



Group Specification

## **Measurement Ontology for IP traffic (MOI); IP traffic measurement ontologies architecture**

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## Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Measurement Ontology for IP traffic (MOI).

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## Introduction

In previous work items the main guidelines of MOI ISG to specify a complete set of vocabulary of classes and relations to describe Internet measurements was defined, supporting QoS parameters and offering privacy protection [1]; moreover, the requirements which characterize an ontology for semantic conceptualization of information related to IP Traffic measurements were identified and also the main problems were analyzed of setting limits to the ontology [2].

Standardizing network measurement parameters, algorithms and protocols is the basis of fair SLA (Service Level Agreement), and hence future business in Telecommunications. Therefore, using a standardized common vocabulary would provide the basis for interoperable service management and network monitoring.

Accordingly, an ontology is an explicit and formal specification of a shared conceptualization, which provides a vocabulary of classes and relations to describe a domain, stressing knowledge sharing and knowledge representation. Such ontology is necessary because it acts as the mediator between traffic monitoring infrastructures.

---

# 1 Scope

The present document provides the high level structure description of an ontology for interfacing and data exchange with IP traffic measurement devices. It is based on preceding work item GS MOI 010 [1] and meets the requirements presented in GS MOI 002 [2].

The different elements in IP traffic measurements will be organized into several ontologies that will be combined in order to obtain the final objective. When available and suitable, standardized classes or ontologies will be used for specific tasks. The provided relationships and hierarchies of the ontology components will derive an organized conceptual model compatible with most precedent ones. They will also take into account the logical dependencies of parameters, key performance indicators, application descriptors, business elements, etc. The resulting high-level description will be flexible enough and well structured in order to allow for successive improvements with coherency. Service supervision, QoS-driven network management and confidentiality constraints will be supported by the architecture.

In addition, a first approach for QoE-driven network management is also introduced in the present document, at this stage focused on QoE monitoring, based on which work is being carried out inside Eureka Celtic Call 8 project IPNQSIS (IP Network Monitoring for Quality of Service Intelligent Support) where different members of ETSI MOI are taking part.

A structure of components or partial ontologies will be set up for modular treatment. It will allow practical mapping of individual modules and import/export operations with such modules. Interoperability of the ontology is an asset of the work performed in MOI so that the results can be used (partially) for other purposes aimed at in Future Internet challenges like support for virtualization and its application for service orchestration or to any tool for self-govern and autonomic systems.

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# 2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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## 2.1 Normative references

The following referenced documents are necessary for the application of the present document.

- [1] ETSI GS MOI 010: "Measurement Ontology for IP traffic (MOI); Report on information models for IP traffic measurement".
- [2] ETSI GS MOI 002: "Measurement Ontology for IP traffic (MOI); Requirements for IP traffic measurement ontologies development".

## 2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] Heiner Stuckenschmidt, Christine Parent, Stefano Spaccapietra, "Modular Ontologies: Concepts, Theories and Techniques for Knowledge Modularization".

- [i.2] Jorge Enrique López de Vergara Méndez, "Integrated Network Management Information Model Specification by Means of the Use of Ontologies and Knowledge Representation Techniques", Ph. D. Thesis, Departamento de Ingeniería de Sistemas Telemáticos, Universidad Politécnica de Madrid. 2003.
- [i.3] Cooperative Association for Internet Data Analysis (CAIDA): "DatCat: Internet Measurement Data Catalog".
- NOTE: Available at <http://www.datcat.org>.
- [i.4] T. McGregor, S. Alcock and D. Karrenberg, "The RI0.PE NCC Internet Measurement Data Repository", Passive and Active Measurement Conference, Zurich, Switzerland, April 7-9 2010.
- [i.5] RIPE Labs: RIPE NCC Data Repository (beta).
- NOTE: Available at <https://labs.ripe.net/datarepository>.
- [i.6] W3C Working Draft 27 September 2006: "Time Ontology in OWL".
- NOTE: Available at <http://www.w3.org/TR/owl-time/>.
- [i.7] DAMN-Time homepage.
- NOTE: Available at <http://www.cs.rochester.edu/~ferguson/daml/>.
- [i.8] The timeline ontology.
- NOTE: Available at <http://motools.sourceforge.net/timeline/timeline.html>.
- [i.9] OWL-Time (formerly DAML-Time).
- NOTE: Available at <http://www.isi.edu/~hobbs/owl-time.html>.
- [i.10] A. Cuadra-Sánchez, M. Cutanda, I. Péres, A. Aurelius, K. Brunnström, J-P Laulajainen, M. Varela, J. López de Vergara: "A global customer experience management architecture", Future Network & Mobile Summit 2012 Conference. 4 - 6 July 2012, Berlin, Germany.
- [i.11] Jeroen van der Ham, Chrysa Papagianni, Jozsef Steger, Peter Matray, Yiannos Kryftis, Paola Grosso and Leonidas Lymberopoulos: "Challenges of an Information Model for Federating Virtualized Infrastructures". In 5th International DMTF Academic Alliance Workshop on Systems and Virtualization Management: Standards and the Cloud, Paris 24 Oct. 2011.
- [i.12] Recommendation ITU-T M.3100: "Generic network information model".
- [i.13] IETF RFC 3393: "IP Packet Delay Variation Metric for IP Performance Metrics (IPPM)".
- [i.14] IETF RFC 2283: "Multiprotocol Extensions for BGP-4".
- [i.15] IETF RFC 5136: "Defining Network Capacity".
- [i.16] IETF RFC 3357: "One-way Loss Pattern Sample Metrics".
- [i.17] IETF RFC 4360: "BGP Extended Communities Attribute".
- [i.18] IETF RFC 1863: "A BGP/IDRP Route Server alternative to a full mesh routing".
- [i.19] IETF RFC 4456: "BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)".
- [i.20] IETF RFC 4893: "BGP Support for Four-octet AS Number Space".
- [i.21] IETF RFC 2679: "A One-way Delay Metric for IPPM".
- [i.22] IETF RFC 1997: "BGP Communities Attribute".
- [i.23] IETF RFC 2681: "A Round-trip Delay Metric for IPPM".
- [i.24] draft-mathis-ippm-model-based-metrics-00: "Model Based Internet Performance Metrics".

### 3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ABAC	Attribute-Based Access Control
AS	Autonomous System
AUP	Acceptable Use Policy
BGP	Border Gateway Protocol
CAIDA	Cooperative Association for Internet Data Analysis
CIM	Common Information Model
CNIT	Consorzio Nazionale Interuniversitario per le Telecomunicazioni
CPU	Central processing unit
CSV	Comma Separated Values
DB	Database
DPA	Destination Point Attribute
ETOMIC	European Traffic Observatory Measurement Infrastructure
ETSI	European Telecommunications Standards Institute
EU	European Union
FCC	Federal Communications Commission
FP7	Seventh Framework Program
GPS	Global Positioning System
HTTP	Hyper-Text Transfer Protocol
ICMP	Internet Control Message Protocol
ICN	Information-Centric Networking
IDMEF	Intrusion Detection Message Exchange Format
IEC	International Electrotechnical Commission
IM	Information Model
IMDC	Internet Measurement Data Catalog
IP	Internet Protocol
IPNQSIS	IP Network Monitoring for QoS Intelligent Support
IPPM	IP Performance Metrics
IQ	Intelligence quotient
IRI	Interception Related Information
ISG	Industrial Specification Group
ITU	International Telecommunication Union
LI	Lawful Interception
LTU	linear transformed unit
MAC	Medium Access Control
MIB	Management Information Base
MOI	Measurement Ontology for IP traffic
MOS	Mean Opinion Score
MRTG	Multi Router Traffic Grapher
NCC	Network Coordination Center
NOVI	Networking innovations Over Virtualized Infrastructures
NTP	Network Time Protocol
OS	Operating System
OSI	Open Systems Interconnection
OWL	Web Ontology Language
PC	Personal Computer
PKI	Public Key Infrastructure
PPS	Pulse per second
PU	Power Unit
QoE	Quality of Experience
QoS	Quality of Service
RBAC	Role-Based Access Control
RDF	Resource Description Framework
RDFS	Resource Description Format Schema
REST	Representational State Transfer
RIPE	Reseaux IP Europeens
RTU	Regular expression Transformed Unit
SI	International System of units (Système International d'unités)

SLA	Service Level Agreement
SMI	Structure of the Management Information
SMR	Semantic Metadata Registry
SNMP	Simple Network Management Protocol
SSH	Secure Shell
TCP	Transmission Control Protocol
TTL	Time-to-live
UDP	User Datagram Protocol
URL	Uniform resource locator
VPN	Virtual Private Network
WADL	Web Application Description Language
WSDL	Web Services Description Language
ZIP	Zone Improvement Plan (postal code)

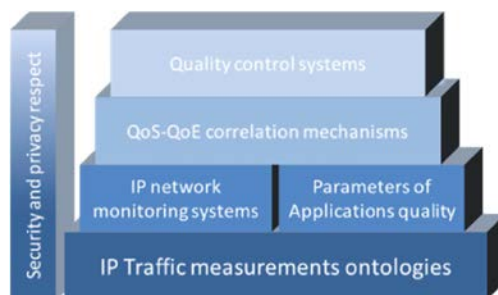
## 4 General Ontology Architecture

### 4.1 Rationality for a modular design

Managing large ontologies is a serious challenge for designers and users. One generic strategy to deal with this problem is modularization, usually known as divide and conquers. In other words, to divide the problem into smaller ontology components called modules [i.1].

Defining the strategy on how knowledge is divided into modules is a fundamental task. This modular strategy may be supported by semantic or syntactic criteria in terms of our goal. Moreover, an important issue is to create an ontology that disassociates ontology components as much as possible, minimizing the coupling between components, increasing the internal cohesion of each component and not overlapping them.

The following figure shows a general hierarchy of the ontologies proposed to be standardized. Given that this is a large task, the present document does not cover all of them. The present document focuses on IP Traffic measurements and anonymization ontologies. Therefore, upper levels will be dealt in future works of the ISG. In particular the Quality of Experience and its relationship with the QoS are defined in the third layer. In order to establish this relation some European initiatives, such as IPNQSIS Celtic project [i.10] are working on correlation models that can be used to map network-level QoS metrics into high-level QoE indicators. These models fit into three categories: statistical models, learning-based models, and deterministic models.

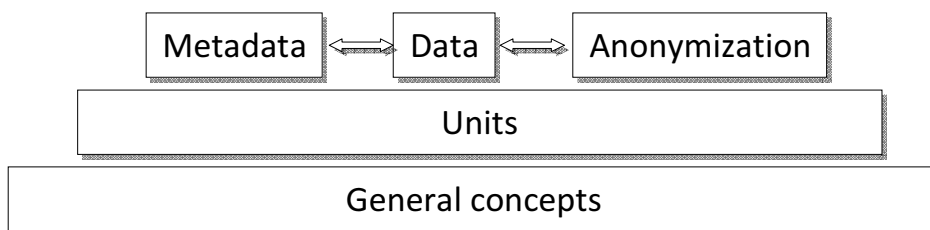


**Figure 1: Ontology hierarchy**



## 4.2 Components

The ontology is divided in the following parts in descending order of abstraction.



**Figure 2: Ontology components**

The General Concepts ontology describes the context concept for network measurement.

The Units Ontology has replaced all the units from the physics field with units from the computer sciences like bit, Byte, bps, IP addresses, etc. Also bearing in mind the final use of the ontology, which is mapping heterogeneous data-sources, different units for different network address representations have been designed. The transformation properties between them are not only numerical factors like in the International System units but are also regular expressions to match and perform the transformation of the unit, ensuring all conversions between units.

The Metadata Ontology describes the information about the measurements. It contains basic information about the measurement: human readable description of the measurement data, its size, a hash of the contents (for data integrity reasons) and a textual description of the creation process as well as other significant information of the data sources. Therefore metadata can describe external repositories but it will be impossible to treat semantically the measurement data referenced unless the data source is mapped to the ontology somehow.

The Data Ontology is divided into two main groups, measurements and concepts. Concepts describe critical information for measurements that couldn't be described as data-type properties in measurement classes such as error, result or utilization. It also describes physical concepts such as a node, segment or port to determine the environment of the measurement.

The Anonymization Ontology represents the "common vocabulary" that shall fit all possible anonymization contexts, i.e. the minimum superset of concepts and/or functionalities that describes the "anonymization of network measurements" domain.

## 4.3 Possible extensions

An important aspect that could be incorporated into the ontology is the support of the federation of virtualized testbeds. Virtualization plays an important role in state of the art network monitoring in at least two ways. First, as a means to build experimental facilities that allow parallel measurement executions (see e.g. the PlanetLab and the Federica system). Second, virtualization constitutes an important paradigm that has an increasing role in reshaping networking technologies themselves, and as such, it becomes more and more important to investigate its effects on the network.

By extending the ontology with the required features, it could assist several important tasks:

- intelligent measurement and monitoring;
- intelligent automatic decision making by enabling "context awareness";
- facilitate the federation of virtualized testbeds.

The difficulty of supporting such objectives lies in the cross-domain nature of these systems. The heterogeneity of the federated networks (including network elements and monitoring tools) poses a major challenge. An important requirement for such an extension would be the construction of a specific module of the ontology. This module should describe not only monitoring tools, but also monitoring tasks (or workflows) to enable the uniform representation of monitoring functionalities in the federated environment.

The monitoring ontology [i.11] developed in EU FP7 NOVI (Networking innovations Over Virtualized Infrastructures) project provides a proper basis for supporting virtualized infrastructures and its elements are worth considering to be included in ETSI MOI ontology as well.

The recent measurements initiatives, e.g. by the FCC or SamKnows", are very much focused on obtaining an edge-based view and user-perspective for assessing the quality of IP networks. Therefore, new interest in metrics arose that are oriented towards the user perspective but which are still objective and focused on the transport layer. An overview on these metrics, e.g. as given in "draft-mathis-ippm-model-based-metrics-00.txt [i.24]".

## 4.4 Information-Centric Networks and statistics collection

Information-Centric Networking (ICN) is emerging as a new network paradigm, in contrast to the current IP (where the network acts as a mediator between users and content *providers*, i.e. hosts on the IP network), which acts as a mediator between end-users and *content*. In other words, network operators replicate popular content close to consumers, connecting users, not to particular hosts, but to particular items of content and drastically with the goal of reducing usage of network resources.

Such kind of in-network caching, as enabled today by off-the-shelf HTTP transparent proxies, requires proxies to perform stateful operations, because the delivery of cached content is based on the connection-oriented TCP. ICN promises to significantly improve efficiency, reliability and scalability of caching, especially for video.

Although ubiquitous in-network caching may be able to optimize network performance, it poses some challenges in terms of monitoring and collection of statistics that are worth reporting in the present document.

One of the problems of transparent caching is the following: the Content Provider is not able to collect statistics anymore. Content Providers do not receive notifications of who is downloading what, since content can be served from several distributed locations.

In traditional networking, Content Providers can always collect information about user requests for content: content is only delivered on receipt of an explicit request. Caching breaks this link, making it difficult for content providers to collect statistics on numbers of users, hits and downloads.

Current transparent caching systems and CDNs try to provide statistics to Content Providers. However, this requires different implementations for different protocols, applications, and types of traffic. Many software companies that provide transparent caching software (+hardware) to network operators try to solve this problem: for example, the caching system relies back to the content originator all the requests (IP, etc.) and just offloads to the network cache the actual delivery of the data pieces. But in the absence of explicit content identifiers, the only way of identifying specific content is by hashing portions of content and returning the hash to the originator. This can significantly degrade analytics.

Native ICNs can improve on this scheme. However, they have their own disadvantages, in particular, the need for a separate signalling channel to relay statistics to content providers. Implementing such a channel can be difficult, even if it operates much slower than at line speed.

Trying to develop a model that is able to capture requirements for correctly monitoring networks which are designed around the information-centric paradigm could be a future important aspect to deal with in the context of this ISG.

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# 5 General Concepts Ontology Architecture

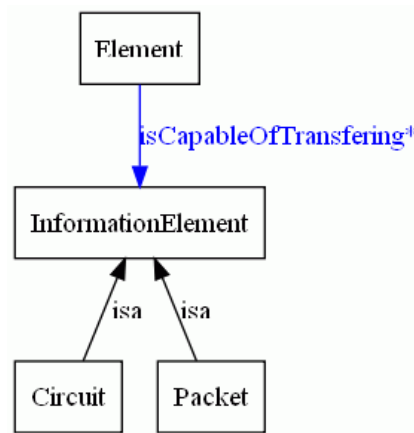
## 5.1 Structure and internal relationships

This clause includes the basic set of concepts that MOI general concepts ontology should contain.

From the point of view of network measurements, a network is a set of Elements transmitting (transferring, sending, communicating, etc.) some bits of information using a predefined set of restrictions. Those restrictions describe either the communication stack (such as the OSI model), its protocols and structure of the elements of information, or the behaviour of the network elements.

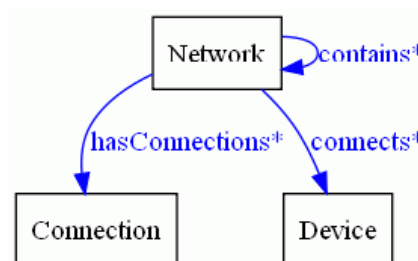
Any measurement described in the Data ontology will refer to the concepts described here as measurements about elements of the network and their capabilities and performance transmitting information elements.

The dictionary describes a "communication network" as a set of interrelated devices which are able to transmit/receive information. A communication network element can transmit certain bits of information called Information Elements, which usually are Packets and Circuits. Notice here that "circuit" is understood as a virtual entity which represents an information element with certain properties.



**Figure 3: InformationElement hierarchy**

Recommendation ITU-T M.3100 [i.12] defines: "The Network object class is a class of managed objects that are collections of interconnected telecommunications and management objects (logical or physical) capable of exchanging information. These objects have one or more common characteristics". From the description, it is obvious that networks contain networks, as we could select a subset of elements from the first network, creating a new network.



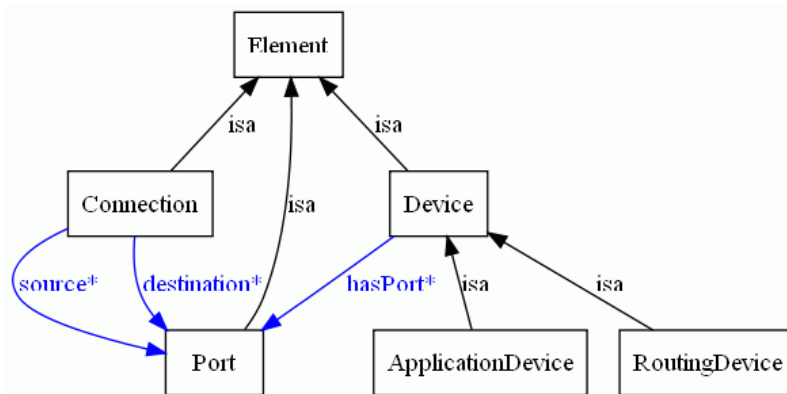
**Figure 4: Network, Connection and Device relationship**

From the point of view of network measurements, information models right now could be circuits or packets:

A circuit (stream, channel, etc.) is a continuous element of information in which the information being transferred does not contain any additional information about the contingencies of its transmission on any network element. Due to the continuous nature of the circuit, the means for transmitting it should preserve temporal continuity, des-duplicity and static time-scale.

A packet is a discrete element of information, usually part of a larger set of information, which has been fragmented for transmission purposes. Although it is not directly implied, the fragmentation might cause some inconsistencies in the order, duplicity, time-scale, etc. in the transmission of a set of packets from the same set of information.

Network elements can be separated logically into three categories: Devices, Ports and Connections.



**Figure 5: Element hierarchy**

Devices are the elements of the network that need to/want to/desire to/must share information with other devices of the network. Ports are either physical or logical entities that represent the start-point/end-point of a communication, i.e. where the communication was started and/or where the information from the communication has to be delivered.

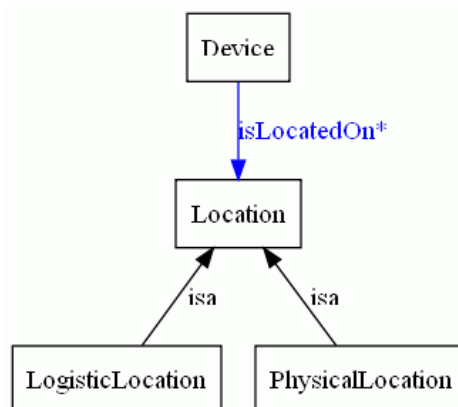
We wanted to make clear the difference between a port and a device, but it is easy to see that devices are only sets of ports that behave in a pre-defined way. This way, we are able to distinguish between two different kinds of devices: Application devices (the producers or consumers of information) and the routing devices (those devices which do not look at the information, only at the means of delivering it from the producers to the consumers).

Lastly, the third Element in a network is the connection. A connection is a physical or logical entity describing that a set of ports is participating in a communication. Here we use the typical names for consumers and producers of information in communication networks: sources and destinations.

Notice that we can define any kind of connection between any set of ports:

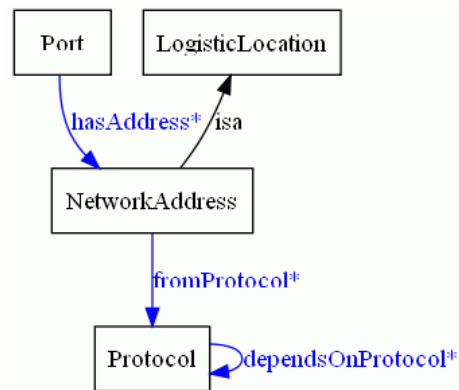
- Unidirectional point to point connection: One port as a source and a different one as a destination.
- Bidirectional point-to-point connection: Two different ports, both as sources and destinations of the connection.
- Point to Multi-point connection: A differentiated port as the source, and a set of ports as the destination.
- Multi-point to point (A network sniffer): The set of sniffed ports as source, and the sniffer as the destination.
- etc.

Devices as entities should be located somewhere, either logically (A virtual router is located inside a PC), or physically (the router is located in some geographical coordinates). We assume that ports from a device are co-located with the device (which is not a very strong assumption).



**Figure 6: Location hierarchy**

One important kind of Logistic Locations is Network Addresses. Network addresses are logistic locations associated to a certain routing protocol. The network address must specify univocally the destination ports for an information element. Notice, that it does not mean that it must be unique, as in point to multi-point communications the destination for the same information element is a set of ports.

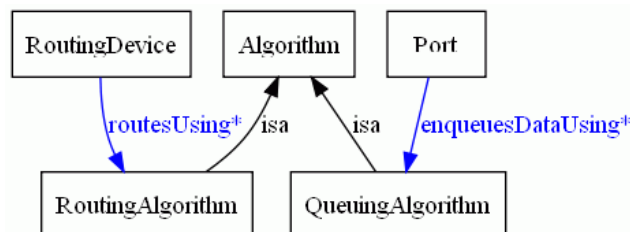


**Figure 7: LogisticLocation and NetworkAddress**

There are several kinds of network address and those are related to the routing protocol which is used to transmit, change and query for network addresses.

It is also important to notice that the transmission of information between devices can be performed in several ways. The formal details on how information elements are transmitted over a network are described in the Communication Protocol.

One important kind of devices in communication networks are those intermediate devices (Routing Devices) which are able to forward the information to their destinations without knowing the full path from source to destination. The mechanism to calculate how a packet must be forwarded is known as the Routing Algorithm.



**Figure 8: RoutingDevices**

Another interesting algorithm which is present in network communications is how ports, and therefore how devices, treat different packets or circuits reaching them. This can be modelled using the Queuing algorithm.

## 5.2 Mappings to external information models

### 5.2.1 Mappings

Other scientific and technical approaches to create an information model for network measurement and monitoring have created useful models. As analyzed in [1] all of them lack a global view of the problem, or cannot take into account different formalizations or legacy systems.

These limitations do not reduce their value and therefore some of their definitions can (should) be used as they already conform to a standard (even if its "de facto"). CIM, MIBs, SMI and MasterMIF represent some of those approaches from the network management scenario but others from QoS, QoE and other topics not covered there, should be included following an integration technique.

As stated in [i.2] such an integration technique between models would create a new model with the currently existing concepts from other information models mainly based on the predominant model (the one which has the largest and most precise definition of concepts). Then, from such a global model it would be possible to import the concepts necessary in MOI adding the necessary facets.

## 5.2.2 External ontologies

The concept of time has already been analyzed by several groups and therefore, creating a new approach is unnecessary. Those approaches are already OWL/RDFS ontologies so direct importation is possible thanks to OWL capabilities. The most representative approach is the one from the World Wide Web Consortium, which was accepted as a working draft in 2006 ([i.6], [i.7], [i.8] and [i.9]).

The time ontology has to be able to represent time instants when events took place (such as when a measurement was performed, an alarm was raised, etc.) or time intervals for events which took a certain amount of time from start to finish.

## 5.3 Formats and units

When sharing, merging and, in general, re-using knowledge from measurements, one important facet of the data is the Unit and the representation form which the data is stored in. From the analysis on [2] about representational issues, it is clear that a part of the general concepts ontology shall handle the relationship between units and their representational issues. Given a Units Ontology powerful enough it could be possible for a machine to find the relation between disparate units and compute the necessary steps to transform from one into the other automatically.

It is important to notice that with numeric units this approach is valid and can be automated easily in terms of 'Factors' and 'Prefixes'. In terms of representation formats, more complex algorithms might be necessary, and their information might not be easy to describe in an ontology (like the transformation from 127.0.0.1 to 2130706433); therefore, some 'external' utility functions would be necessary and shall be defined.

Some efforts have already addressed this issue and have created several ontologies to represent measurement units, mainly for the physics measurement scenario.

As stated in [2] the most appropriate way to represent the unit is creating containers for each individual value from a measurement and adding all the related information in the container. This is what motivates that individual values from network measurements are always represented inside container objects and not only in properties.

# 6 Data ontology

## 6.1 Structure and internal relationships

The data ontology comprises the classes and properties to be able to represent 'any' measurement that has been generated from any measurement tool, infrastructure or researcher. Therefore, as stated in [2] it should be able to wrap measurements that range from plain text-files to complex object-oriented measurements.

Having this in mind we propose a modular approach in which measurement objects are just containers for individual values or measurements. This way we can reproduce the structure of any tabular measurement (for example CSV files). Linking several of those simple objects, complex objects could be created.

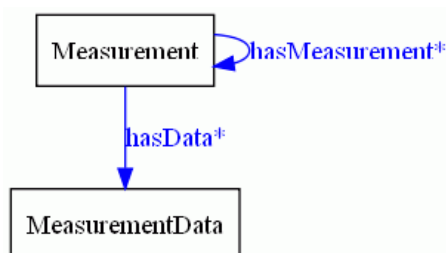
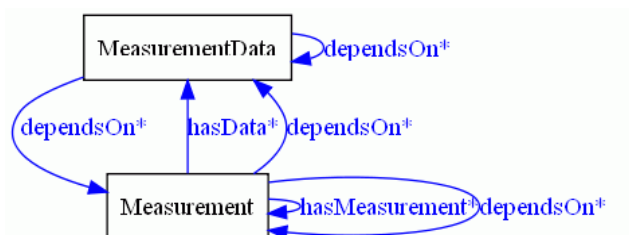


Figure 9: Measurement and MeasurementData relationship (I)

One important aspect that needs to be considered is that sometimes measurements have implicit semantics only known from the documentation, the syntax of the results or the interface. These semantics impose constraints to the values of the measurement such as dependencies on some parts of the ontology.

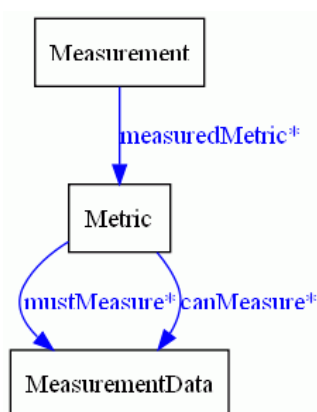


**Figure 10: Measurement and Measurement Data relationships (II)**

With "dependsOn" property we can represent this implicit knowledge into the ontology instances (this way it is easy to create complex measurements such as statistical operators like 'mean of these values').

When referring to the whole object (or row) that is a measurement, usually a higher level of abstraction is used. In those situations, a certain part of the measurement is used to refer to the whole measurement. (e.g. when measuring 'Delay', many values are needed like source IP address, destination IP address, number of Hops and so on, but the whole measurement is referred as a Delay measurement).

Those concepts are known as 'Metrics' and a certain Measurement (all the individual values) are referred as a whole with the Metric's name. This relationship is stated as 'measuredMetric', which states that the measurement has information related to that Metric concept.



**Figure 11: Measurement, Metric and MeasurementData**

In the same manner, when it is stated that a measurement is measuring some Metric, implicitly we are stating that it has a certain set of values for sure and also some other ones with a high probability. `mustMeasure` and `canMeasure` properties state that relation between the abstract and high level concept Metric and the individual and 'real' values in a measurement.

Note that this general structure is valid for quality measurement in a broadened concept beyond QoS. The well defined relationship Measurement-Metric-MeasurementData is also valid for QoE. Furthermore, a fourth basic element can be introduced for feeding QoE in terms of a Metameasurement, with direct downlink to Measurement class. This way QoS Measurements would contribute to QoE Metameasurements in the same way performance Metrics contribute to QoS Measurement.

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## 7 Metadata ontology

### 7.1 Structure and internal relationships

Access to measurement repositories shall be avoided when possible due to the diverse and aggregated huge amounts of different measurements and measurement types. This motivates the division of measurement information between the real data information and the metadata information. The real information can only be found in the original repository (due to scalability issues). The metadata information could be collected from every repository and alleviate them from continuous search requests. The Metadata ontology takes the task of semantically representing the information contained by these metadata.

In order to make a metadata repository as scalable as possible, the metadata objects refer to whole measurement objects. Sometimes they are referred to as "campaigns" of measurements. These metadata objects use the concepts known as Metrics in order to state what has been measured. These metric concepts are defined in the Data ontology. The specific measured object classes (e.g. source IP address, number of hops, etc.) are also stated in the metadata objects in order to extend or restrict those that define a specified metric.

Metadata information that could use classes from the General Concepts ontology does so. For example, time references, physical or logical locations are described by classes from the General Concepts ontology. Logical locations are especially important as they shall describe the way to reach the data repository and the specific measurement data described by the metadata. Different data access methods can be provided, some for human consumption, some for machine use, for example in a web services manner.

Unit's specification for the measured data are also useful in the metadata as long as a unique unit can be specified for the whole measured class. For example, it makes sense to specify that IP addresses are stored in dotted notation, however, it does not provide a scalable solution for a metadata repository to specify for each measured IP address the unit used. Fine-grained metadata information shall be collocated with the data.

Searches from the users to a metadata repository using this metadata ontology could focus on locating data based on their metadata description that would specify what general concept/metric is being measured and what specific data is being collected (or was collected) in a specific measurement. Additional information about the time-span of the campaign would help in restricting the output from the search to a time window of interest. The results would provide human text describing the specifics of the measurement (hardware, software, data formats, availability, etc.), the human contact information for the owner and the physical and logical location of the data.

### 7.2 Mappings to external information models

The metadata ontology facilitates the mapping from other information models used in external repositories describing network measurements. One of the main examples of such a repository was CAIDA's DatCat, that existed from June 2006 to May 2010 [i.3]. DatCat collected metadata about tens of thousands of passive and active traffic measurements. All these measurements were stored by their respective owners and were linked from the repository. The metadata provided the logical location of the measurement data, the contact information of the owner and descriptions on how, where and where they were collected. All these metadata can be represented by properties of the metadata class or instances of classes from the General Concepts ontology referred by a metadata object. No semantic information was stored in DatCat so semantic conversion would not be necessary but it should be added to them.

Another recent effort on traffic measurement collection is the RIPE NCC Data Repository (presently in beta status) [i.4] and [i.5]. However, no structured information repository is available yet.

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## 8 Security and privacy features in the ontologies

Security and privacy in the context of network monitoring consist in the protection of the collected data and the information that can be derived after processing these data. In that respect, it is essential to apply effective policies in order to enforce protection measures. The policies should reflect provisions and impose constraints related to the application of special processing towards data protection (such as encryption, anonymisation, aggregation, etc.), as well as to provide for controlling access to the information.



Drawing from the analysis performed in GS MOI 002 [2], it comes out that a very fundamental concept for privacy is the purpose for which data are processed, which appears often in the requirements, being a core part of lawfulness, as far as a data collection and/or processing activity is concerned. The underlying systems should provide the means for identifying the purpose of each request, in order to allow the collection and processing of data only when said activities are carried out for specified, explicit and legitimate purposes. Moreover, the purpose principle prescribes mechanisms for specifying the compatibility between processing purposes, while also providing for checking whether the processing purposes are consistent with these for which data have been collected. In that respect, the system should also provide the means for defining prevention rules regarding incompatible purposes. In order to achieve the above, the formal description of purposes is deemed necessary, along with their association with data processing activities. Therefore, the Purposes class should be present in the ontology and associated with the security and privacy policies, whereas the hierarchical organization of purposes -by mean of sub-classing or some is a ontological property- is desired for fine-grained modularity.

Typically, policies consist of rules that regulate the actions that some subject is enabled/is not enabled/is obliged to perform to an object. In other words and following the subject-verb-object linguistic metaphor, the ontology should provide the means for specifying rules controlling the execution of some operation by a subject entity to an object entity.

At the bottom line, this implies the need for a Rules ontological class, being the container for the rules. In order to be able to specify different types of rules, at least three Rules sub-classes are deemed necessary: Permissions, Prohibitions and Obligations, reflecting, respectively, provisions that enable, prevent and oblige some entity to execute an action over.

Since the operations are at the core of the rules, an Operations class is necessary, containing all actions that may take place in the context of the application domain. This concerns both simple operations, such as "read", "store", etc., as well as more complex operations, reflecting composite measurements. In this context, operations have to be organized hierarchically, fostering different levels of abstraction, but also following more sophisticated structures, such as AND trees, where child ontological entities are supposed to compose parent elements.

It is not to be neglected that prominent position among the operations is held by the ones that do not concern trivial or complex information processing but are devised for information protection. These include operations representing, among others, encryption, anonymisation, pseudonymisation, obfuscation, filtering and data aggregation functionalities.

Regarding the object part of a rule, intuitively, data and especially their types (since rules are much more meaningful if defined at an abstract semantic level) constitute the main concepts to be considered as objects. Here, a challenge is the definition of the appropriate inheritance patterns, so that an access constraint that is defined at some abstraction level is precisely propagated to other abstraction levels. That is, for instance, a rule imposing some "read" prohibition to an information element should be inferred to apply also for other information elements that contain the object of the rule.

However, objects of rules can also be entities other than only information that constitutes measurement data. In order to effectively protect data, access may be restricted to other classes of objects, such as software systems and machines. Or, obligation rules may be imposed to actions that concern notifications or alerts. Therefore, the Rules ontological class has to be flexible enough, so that it can support a variety of classes to be appointed as the potential objects' domain.

Similarly, various heterogeneous concepts should be possible to represent the subject concept within an access control rule. Especially in network monitoring, actions over information are mostly executed by systems, rather than human entities. In this context, the Role-Based Access Control (RBAC) paradigm, in order to suffice for protecting information, should be conceived as a model that incorporates, as roles, various semantic types of entities. Therefore, there should be a Roles ontological class incorporating abstractly defined concepts such as HumanRoles, Machines, Operations, OperationContainers (meaning containers of functionalities, such as a server), Organizations, etc.

Going a step beyond and leveraging the Attribute-Based Access Control (ABAC) idea, there might be the case where not all entities falling into a semantic class are subject of the same constraints. As an example, the "age" of some data (i.e. how much time has passed since their collection) may affect their processing; or, as far as the anonymisation operations are concerned, different attributes of the same operation may define different anonymisation strategies albeit sharing a common algorithmic ground. Thus, it is important to consider an Attributes ontological class, appropriately interrelated with the fundamental concepts being subjects, objects and operations that the former perform to the latter. This may imply the need for a set of auxiliary ontological classes that enable the definition of attributes-enhanced entities; therefore, we assume the existence of an EnhancedEntities class enabling the definition of N-are relations between the base concepts and their attributes, as well as an Expression class, devised for the specification of expressions over attributes, such as triples of the form attribute-operator-value.

Security and privacy policies should be also subject of contextual constraints. Apart from typical contextual types, such as temporal, spatial and historical, that are meaningful in several application domains, network monitoring ontologies should be able to incorporate additional types of context, especially events and alerts, the presence of which affects the validity, applicability and consequent enforcement of the policies. Therefore, some Alerts ontological class should serve as the semantic container of the different types of such information structures. Since the area is characterized by standards for the description of the underlying concepts, such as the Intrusion Detection Message Exchange Format (IDMEF), the ontology should be able to reflect the concepts and structures described therein.

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## 9 Assessment of the use cases

In the following section, all use cases presented in GS MOI 002 [2] will be analyzed.

### 9.1 IP networks characterization

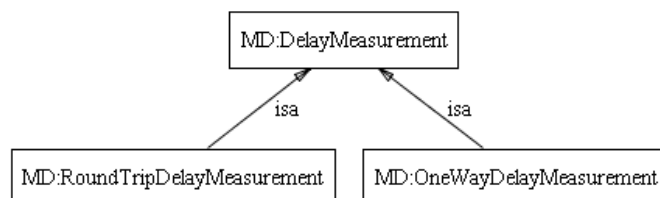
One of the use cases defined in GS MOI 002 [2] was IP networks characterization. In that one, all general concepts of time, address, hops, neighbouring and packet size were presented and also more specific ones related to session parameters, routing, synchronization, etc. In the following points, all concepts related with the ontology will be seen in detail.

- a) End to end routes characterization is supported by the Ontology:
  - There are nodes, AS (autonomous system), source and destination address which are named as MD:NetworkNode, MD:AutonomousSystem, MD:SourceIP (or MD:SourceMacAddress for MAC address) and MD:DestinationIP (or MD:DestinationMacAddress for MAC address).
  - Furthermore, there are different notations for IP address such as IPv4 dotted, integer.
  - Additionally, measurements such as port (MD:NodePort), hop counting (MD:HopCountMeasurement), traceroute (MD:Traceroute), ping (MD:Ping) or Time-To-Live (MD:FinalTtlMeasurement).
- b) Network topological characterization is supported by the Ontology:
  - Ontology has information about different concepts such as topology (MD:Topology), links (MD:Link), paths (MD:Path), etc.
  - Ontology supports the questions presented in GS MOI 002 [2]:
    - Maximum number of hops between two nodes of a given network: The defined ontology has information about the number of hops of a given network thus is possible extract the maximum hops.
    - Number of direct neighbours to a given node: The defined ontology has information about the next hop (MD:NextHop) with the appropriate query.
    - Nodes in a tree.
    - Distribution of paths per length in a given domain.

## 9.2 QoS measurements in IP networks

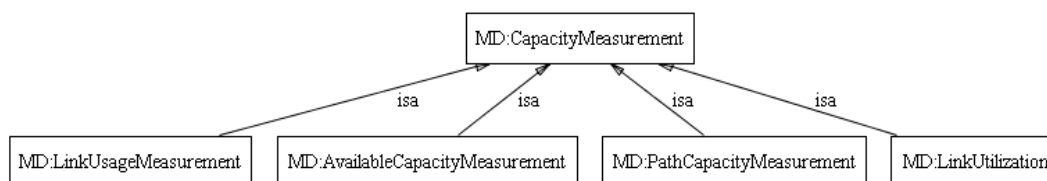
The ontology implements the following use cases defined in DGS/MOI-0002 which is about QoS measurements in IP networks.

- a) Delay and Bandwidth availability monitoring: All of these statistics are subclasses of MD:SimpleMeasurement. MOI includes concepts to give interoperability for determining the delays of packets sent from source host to destination for end to end connection in uplink and downlink direction:



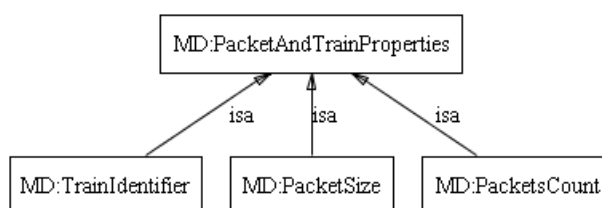
**Figure 12: Delay Measurements**

- Additionally to simple delay measurements there is delay variation (jitter) between two nodes (MD:DelayVariationMeasurement).
- Going further the capacity of links or between two end nodes is also important. Such capacity is represented by the following concepts.



**Figure 13: Capacity Measurements**

- b) Transport quality measuring: MOI includes concepts to give loss rate such as MD:PacketLossRatio, MD:MeanLossBurstSize, MD:ErrorsRate or MD:DiscardRate which can be used to control performance for a given end to end connection. Moreover, there are more concepts in MOI ontology which contain the knowledge about a given train of packets between two nodes (to be used for these measurements).



**Figure 14: Packet train properties**

## 9.3 Traffic Monitoring for Security Applications

One of the main goals of IP traffic analysis is to develop systems to prevent fraud or hacking attacks by detecting anomalies in the traffic pattern or other peculiar user's behaviour. For that reason, one of the use cases specified in GS MOI 002 [2] was traffic monitoring for security applications. To give support to this there are two use cases:

- a) Secure information exchange between nodes.

This task requires to exchange information about the established connections to a given host (a server, for instance) or any other data repository; such information (and the tools to extract it) should deal with concepts like the type of hosts and their roles, for instance: Server, gateway, proxy, router, client. The Device class of the Data Ontology is the correct place to hold such classification. It already provides for a distinction between Routing Devices and Application Devices, and this can be further extended to cope with needed special cases. In parallel, each type of device is to reflect a role per se, or to be matched by a Role.

All role-based security models and the corresponding implementations in ontologies are designed to cover this by default. The approach described above, perfectly fits the task, so that, for instance, Server also becomes a role of a specific machinery.

Furthermore, when such model comprises the definition of Organizations (as proposed in clause 8), such a hierarchy can be used to represent public authorities, public keys providers and various actors in PKIs and PKI chains.

The Operations class hosts all encryption-related operations (like digital signature and signature verification) that are needed to assess correctness of operation of secure channels between two end-points.

- b) Confidentiality of the information exchanged.

Security and privacy policies as described in section 8 are designed to be contextual, including a spatial context. This allows for exchange of information be restricted following spatial constraints such as location in the topology (for instance the target Autonomous System, using the LogisticLocation class) or geolocation (for instance city, country, coordinates, using the PhysicalLocation class), or for Alerts to be triggered when anomalies in the context are detected.

The concept of VPN is easily accommodated by seeing the private network, just like any other Network, as a collection of hosts (Devices) linked by Connections. VPN can then be modelled as an attribute of the Connection class and all connections that are part of the same VPN can be semantically grouped.

Of course, security rules can then be added that forbid or permit hosts to establish the connection if and only if they are marked by specific encryption/characterization patterns, including, for instance, participation in the specific VPN.

## 9.4 Law Enforcement

In the context of network monitoring, law enforcement is generally centred around Lawful Interception (LI), described in GS MOI 002 [2] as "the legally authorized process by which a network operator or service provider grants some law enforcement officials with access to communication data (such as, telephone or VoIP calls, e-mail messages, etc.) of private individuals or organizations". The performance of LI and especially its effectiveness in terms of preventing unauthorized access to the associated infrastructure, to data other than the ones required and to the (lawfully) intercepted data is a complex issue that involves dedicated administrative procedures, as well as special software and/or hardware equipment. The ontology provides the means for reinforcing the LI procedures, mainly regarding two directions

- i) putting in place a semantic information model for intercepted data semantic classification; and
- ii) by providing the mechanisms for the expression of semantic security policies.

More specifically, the current laws, regulations and international standards related with LI are in general adequately detailed regarding the data types that are subject to interception, especially the ones comprising the set of Interception Related Information (IRI). Furthermore, the associated data types are described across different documents (such as ETSI standards), describing the IRI on a case-by-case basis, based on the type of the service in question. Thus, the association of these information elements is typically missing, together with their specific semantics. In this context, GS MOI 002 [2] has stressed the requirement of expressive semantics and data associations, which is an important contribution of the ontology fostering the accurate and effective performance of LI.

On the other hand, both legislation and standardization stress the need for effectively protecting the intercepted data and LI infrastructure and other means from unauthorized access, while putting strict constraints regarding the data types that are to be collected depending on the monitored service and the purpose underlying the interception. In this context, the ontology described here provides the means for the expression of security policies, notably access control rules; in the described approach, the rules are integrated in the ontology, thus essentially part of the semantic definition of data. Moreover, the access control mechanism specified by the described ontology enables the association of the rules with the purpose for accessing data and infrastructures, therefore providing for the association of each access request with the case that enables (or not) the performance of LI. Similarly, the rules are directly associated with contextual parameters, as well as events, such as security alerts, that enable to further refine the permissions, prohibitions and obligations pertaining to the execution of LI. In this context, the ontology provides high expressiveness for the specification of fine-grained, semantic security policies that go far beyond typical role-based access rights definition, while being integrated with the semantic model describing the information. The same mechanisms for incorporating context and events in the rules provides also for the specification of data retention periods.

## Annex A (informative): Ontology files

This annex contains the set of ontologies that have been used as a base for the specifications in the present document.

### A.1 MOMENT Ontology Files

#### A.1.1 General concepts ontology

```
<?xml version="1.0"?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:protege="http://protege.stanford.edu/plugins/owl/protege#"
  xmlns:xsp="http://www.owl-ontologies.com/2005/08/07/xsp.owl#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:owl2xml="http://www.w3.org/2006/12/owl2-xml#"
  xmlns:p1="http://sweet.jpl.nasa.gov/ontology/units.owl#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:swrl="http://www.w3.org/2003/11/swrl#"
  xmlns:swrlb="http://www.w3.org/2003/11/swrlb#"
  xmlns:MGC="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xml:base="http://www.fp7-moment.eu/MomentGeneralConcepts.owl">
  <owl:Ontology rdf:about="">
    <owl:imports rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl"/>
  </owl:Ontology>
  <owl:Class rdf:ID="PhysicalLocation">
    <rdfs:subClassOf>
      <owl:Class rdf:ID="Location"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="WebService">
    <rdfs:subClassOf>
      <owl:Class rdf:ID="InetLocation"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="FTPService">
    <rdfs:subClassOf>
      <owl:Class rdf:about="#InetLocation"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="SqlServer">
    <rdfs:subClassOf>
      <owl:Class rdf:about="#InetLocation"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="Protocol">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >A network communication protocol</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="SQREMSERVICE">
    <rdfs:subClassOf rdf:resource="#WebService"/>
  </owl:Class>
  <owl:Class rdf:about="#InetLocation">
    <rdfs:subClassOf>
      <owl:Class rdf:ID="LogicalLocation"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="RESTService">
    <rdfs:subClassOf rdf:resource="#WebService"/>
  </owl:Class>
  <owl:Class rdf:ID="TimeStamp">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >The unix timeStamp of the measurement</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="TransportProtocol">
    <rdfs:subClassOf rdf:resource="#Protocol"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
```

>Transport Layer is a group of methods and protocols within a layered architecture of network components, within which it is responsible for encapsulating application data blocks into datagrams (packets) suitable for transfer to the network infrastructure for transmission to the destination host, or managing the reverse transaction by abstracting network datagrams and delivering them to an application. Such protocol are also referred to as "transport protocols"</rdfs:comment>

```

</owl:Class>
<owl:Class rdf:ID="SparqlEndpoint">
  <rdfs:subClassOf rdf:resource="#InetLocation"/>
</owl:Class>
<owl:Class rdf:ID="WebResource">
  <rdfs:subClassOf rdf:resource="#InetLocation"/>
</owl:Class>
<owl:Class rdf:ID="SOAPService">
  <rdfs:subClassOf rdf:resource="#WebService"/>
</owl:Class>
<owl:Class rdf:about="#LogicalLocation">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Location"/>
  </rdfs:subClassOf>
  <owl:disjointWith rdf:resource="#PhysicalLocation"/>
</owl:Class>
<owl:Class rdf:ID="ApplicationProtocol">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The application layer protocol of IpIn TCP/IP, the Application Layer contains all protocols and
  methods that fall into the realm of process-to-process communications via an Internet Protocol (IP)
  network using the Transport Layer protocols to establish underlying host-to-host
  connections.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#Protocol"/>
</owl:Class>
<owl:Class rdf:about="#Location">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Location is the place or the position, to place is to determine the position in relation to
  other things.</rdfs:comment>
</owl:Class>
<owl:DatatypeProperty rdf:ID="DBType">
  <rdfs:domain rdf:resource="#SqlServer"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="downloadURL">
  <rdfs:domain rdf:resource="#InetLocation"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="downloadProcedure">
  <rdfs:domain rdf:resource="#InetLocation"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DBName">
  <rdfs:domain rdf:resource="#SqlServer"/>
</owl:DatatypeProperty>
<owl:FunctionalProperty rdf:ID="zipCode">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the zip code used to describe a physical location.</rdfs:comment>
  <rdfs:domain rdf:resource="#PhysicalLocation"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="usesSSL">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#FTPService"/>
        <owl:Class rdf:about="#WebResource"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="longitude">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the longitude coordinate used to describe a physical location.</rdfs:comment>
  <rdfs:domain rdf:resource="#PhysicalLocation"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="country">
  <rdfs:domain rdf:resource="#PhysicalLocation"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Name of the country used to describe a physical location.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>

```

```

</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="protocolNumber">
  <rdfs:domain rdf:resource="#Protocol"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The decimal representation of the protocol number</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="startTime">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The unix time stamp of the starting point of the time interval</rdfs:comment>
  <rdfs:domain rdf:resource="#TimeStamp"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="state">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Name of the state used to describe a physical location.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:domain rdf:resource="#PhysicalLocation"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="endTime">
  <rdfs:domain rdf:resource="#TimeStamp"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >time when a measurement finished</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="transportProtocol">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The transport protocol that the application protocol is using</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
  <rdfs:domain rdf:resource="#ApplicationProtocol"/>
  <rdfs:range rdf:resource="#TransportProtocol"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="WADLurl">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:domain rdf:resource="#RESTService"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="timestamp">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
  <rdfs:domain rdf:resource="#TimeStamp"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="city">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:domain rdf:resource="#PhysicalLocation"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Name of the city used to describe a physical location.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="descriptionURL">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >WADL or WSDL file of the web service</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:domain rdf:resource="#WebService"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="NameID">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The standard name of the protocol</rdfs:comment>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#Location"/>
        <owl:Class rdf:about="#Protocol"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="latitude">
  <rdfs:domain rdf:resource="#PhysicalLocation"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the latitude coordinate used to describe a physical location.</rdfs:comment>

```



```

    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  </owl:FunctionalProperty>
  <owl:FunctionalProperty rdf:ID="sqremeQuery">
    <rdfs:domain rdf:resource="#SQREMEService"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Alfredo Salvador</dc:creator>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Query String to retrieve information for a given MGC:SQUEMEndpoint</rdfs:comment>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  </owl:FunctionalProperty>
  <owl:FunctionalProperty rdf:ID="description">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdfs:domain>
      <owl:Class>
        <owl:unionOf rdf:parseType="Collection">
          <owl:Class rdf:about="#ApplicationProtocol"/>
          <owl:Class rdf:about="#Location"/>
          <owl:Class rdf:about="#TransportProtocol"/>
        </owl:unionOf>
      </owl:Class>
    </rdfs:domain>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >textual description of the position if it's not possible to describe it in terms of logical or
geographical classes</rdfs:comment>
  </owl:FunctionalProperty>
  <owl:FunctionalProperty rdf:ID="WSDLurl">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >URL pointing to the service WSDL</rdfs:comment>
    <rdfs:domain rdf:resource="#SOAPService"/>
  </owl:FunctionalProperty>
  <owl:AnnotationProperty rdf:about="http://purl.org/dc/elements/1.1/creator"/>
  <owl:AllDisjointClasses>
    <owl:members rdf:parseType="Collection">
      <owl:Class rdf:about="#RESTService"/>
      <owl:Class rdf:about="#SOAPService"/>
      <owl:Class rdf:about="#SQREMEService"/>
    </owl:members>
  </owl:AllDisjointClasses>
  <owl:AllDisjointClasses>
    <owl:members rdf:parseType="Collection">
      <owl:Class rdf:about="#FTPService"/>
      <owl:Class rdf:about="#SqlServer"/>
      <owl:Class rdf:about="#WebService"/>
    </owl:members>
  </owl:AllDisjointClasses>
</rdf:RDF>

```

## A.1.2 Units ontology

```

<?xml version="1.0"?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:protege="http://protege.stanford.edu/plugins/owl/protege#"
  xmlns:xsp="http://www.owl-ontologies.com/2005/08/07/xsp.owl#"
  xmlns:MomentUnits="http://www.fp7-moment.eu/MomentUnits.owl#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:swrl="http://www.w3.org/2003/11/swrl#"
  xmlns:swrlb="http://www.w3.org/2003/11/swrlb#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xml:base="http://www.fp7-moment.eu/MomentUnits.owl">
  <owl:Ontology rdf:about="">
    <owl:versionInfo rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >2.0</owl:versionInfo>
  </owl:Ontology>
  <rdfs:Datatype rdf:about="http://www.w3.org/2001/XMLSchema#double"/>
  <rdfs:Datatype rdf:about="http://www.w3.org/2001/XMLSchema#string"/>
  <owl:Class rdf:ID="UnitDerivedByShifting">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >The change of unit is obtained adding a value.</rdfs:comment>
    <rdfs:subClassOf>

```

```

    <owl:Class rdf:ID="UnitDerivedWithoutChangingOfDimension" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Unit">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Also called dimension. Any specified amount of a quantity, by comparison with which any other
quantity of the same kind is measured or estimated.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="BaseUnitOrUnitDerivedtWithoutChangingOfDimension">
  <owl:equivalentClass>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:ID="BaseUnit" />
        <owl:Class rdf:about="#UnitDerivedWithoutChangingOfDimension" />
      </owl:unionOf>
    </owl:Class>
  </owl:equivalentClass>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Class created for convenience</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="unitDerivedByRegexpScaling">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Change of the representation. The change is not performed with a numerical factor, a
regexp.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#UnitDerivedWithoutChangingOfDimension" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="SimpleUnit">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Simple units are modifications of Base units in which the dimension remains unchanged, or all
dimension units are the same (self product)</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:ID="DerivedUnit" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="UnitDerivedByScaling">
  <owl:equivalentClass>
    <owl:restriction>
      <owl:someValuesFrom rdf:resource="#UnitDerivedByScaling" />
      <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Restriction" />
      <owl:onProperty>
        <owl:ObjectProperty rdf:ID="productOf" />
      </owl:onProperty>
    </owl:restriction>
  </owl:equivalentClass>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The change of unit is obtained multiplying a value. Usually in the same scale, the value that
we multiplied to change from one unit to another, is a power of the value that is necessary to
multiply for two consecutive units in the same scale.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:DatatypeProperty rdf:ID="hasScalingNumber" />
      </owl:onProperty>
      <owl:allValuesFrom rdf:resource="http://www.w3.org/2001/XMLSchema#double" />
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:ID="hasPrefix" />
      </owl:onProperty>
      <owl:allValuesFrom>
        <owl:Class rdf:ID="Prefix" />
      </owl:allValuesFrom>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#UnitDerivedWithoutChangingOfDimension" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#Prefix">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:DatatypeProperty rdf:ID="hasValue" />
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>

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    <owl:allValuesFrom rdf:resource="http://www.w3.org/2001/XMLSchema#double"/>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:allValuesFrom rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
    <owl:onProperty>
      <owl:DatatypeProperty rdf:ID="hasSymbol"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Prefixes are scaling factors for units which numerical factor is commonly known and it's not
stated.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="UnitDerivedByRaisingToPower">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Units derived by raising to power are multidimensional units where all dimensions are from the
same unit and measured in the same scale.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#SimpleUnit"/>
</owl:Class>
<owl:Class>
  <owl:equivalentClass>
    <owl:Class rdf:ID="PrefixOrUnit"/>
  </owl:equivalentClass>
  <owl:unionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Prefix"/>
    <owl:Class rdf:about="#Unit"/>
  </owl:unionOf>
</owl:Class>
<owl:Class rdf:about="#DerivedUnit">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Derivated units can be obtained combination some base units, multiplying or adding a base unit
with a number.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#Unit"/>
</owl:Class>
<owl:Class rdf:ID="ComplexUnit">
  <rdfs:subClassOf rdf:resource="#DerivedUnit"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Complex units are units composed by the product of several units, they are multi
dimensional</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#PrefixOrUnit">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Both Prefix or Unit</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#UnitDerivedWithoutChangingOfDimension">
  <rdfs:subClassOf rdf:resource="#SimpleUnit"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>This unit is defined as transformations of the unit but without addition of dimensions such as
scaling, shifting or regexp transformations.</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#BaseUnit">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Base units are defined from physical phenomena constants or in Computer Science units are
common abstract concepts. Those units are defined in an absolute way independent from other
units</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#Unit"/>
</owl:Class>
<owl:ObjectProperty rdf:ID="derivedFromUnit">
  <rdfs:domain rdf:resource="#SimpleUnit"/>
  <rdfs:range rdf:resource="#BaseUnitOrUnitDerivedtWithoutChangingOfDimension"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>This property indicates from what base unit derives a simple derived unit.</rdfs:comment>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="#productOf">
  <rdfs:domain rdf:resource="#ComplexUnit"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>This properties indicates the units that take part in the complex unit.</rdfs:comment>
  <rdfs:range rdf:resource="#Unit"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="#hasPrefix">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>This properties indicates the prefix that the unit has.</rdfs:comment>
  <rdfs:range rdf:resource="#Prefix"/>
  <rdfs:domain rdf:resource="#Unit"/>
</owl:ObjectProperty>
<owl:DatatypeProperty rdf:ID="hasPower">

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<rdfs:domain rdf:resource="#UnitDerivedByRaisingToPower"/>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The value of the exponent of the power expression.</rdfs:comment>
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#double"/>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:about="#hasSymbol">
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Characters used to represent the unit or prefix, for example "m" for meters and G for
"Gigas".</rdfs:comment>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
<rdfs:domain>
<owl:Class>
<owl:unionOf rdf:parseType="Collection">
<owl:Class rdf:about="#PrefixOrUnit"/>
<owl:Class rdf:about="#Unit"/>
</owl:unionOf>
</owl:Class>
</rdfs:domain>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:about="#hasScalingNumber">
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#double"/>
<rdfs:domain rdf:resource="#UnitDerivedByScaling"/>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The value of the number that we have to multiplied to change from the simple unit of the scale
to the unit of the domain.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="hasShiftingNumber">
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The value of the number that we have to add to change from the simple unit of the scale to the
unit of the domain.</rdfs:comment>
<rdfs:domain rdf:resource="#UnitDerivedByShifting"/>
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#double"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:about="#hasValue">
<rdfs:domain rdf:resource="#Prefix"/>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
></rdfs:comment>
</owl:DatatypeProperty>
<owl:FunctionalProperty rdf:ID="matchingRegexp">
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
<rdfs:domain rdf:resource="#unitDerivedByRegexpScaling"/>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>This regexp allow to match the units from this class and group its parts together for further
process</rdfs:comment>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="inverseScalingRegexp">
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>This regexp is the inverse function to de base unit</rdfs:comment>
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
<rdfs:domain rdf:resource="#unitDerivedByRegexpScaling"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="scalingRegexp">
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
<rdfs:domain rdf:resource="#unitDerivedByRegexpScaling"/>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<MomentUnits:UnitDerivedByRaisingToPower rdf:ID="secondToPower3">
<MomentUnits:hasPower rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
>3</MomentUnits:hasPower>
<MomentUnits:derivedFromUnit>
<MomentUnits:BaseUnit rdf:ID="second">
<MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>s</MomentUnits:hasSymbol>
</MomentUnits:BaseUnit>
</MomentUnits:derivedFromUnit>
</MomentUnits:UnitDerivedByRaisingToPower>
<MomentUnits:BaseUnit rdf:ID="hexadecimalMAC"/>
<owl:AnnotationProperty rdf:about="http://www.w3.org/2000/01/rdf-schema#comment"/>
<MomentUnits:UnitDerivedByScaling rdf:ID="GibiByte">
<MomentUnits:derivedFromUnit>
<MomentUnits:UnitDerivedByScaling rdf:ID="Byte">

```

```

<MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
>8</MomentUnits:hasScalingNumber>
<MomentUnits:derivedFromUnit>
  <MomentUnits:BaseUnit rdf:ID="bit">
    <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >b</MomentUnits:hasSymbol>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Bit</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >In computing and telecommunications a bit is a basic unit of information storage and
communication; it is the maximum amount of information that can be stored by a device or other
physical system that can normally exist in only two distinct states. These states are often
interpreted (especially in the storage of numerical data) as the binary digits 0 and 1. They may be
interpreted also as logical values, either "true" or "false"; or two settings of a flag or switch,
either "on" or "off". - wikipedia</rdfs:comment>
  </MomentUnits:BaseUnit>
</MomentUnits:derivedFromUnit>
<MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>B</MomentUnits:hasSymbol>
</MomentUnits:UnitDerivedByScaling>
</MomentUnits:derivedFromUnit>
<MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>GiB</MomentUnits:hasSymbol>
<MomentUnits:hasPrefix>
  <MomentUnits:Prefix rdf:ID="Gibi">
    <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
    >1073741824</MomentUnits:hasValue>
  </MomentUnits:Prefix>
</MomentUnits:hasPrefix>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:Prefix rdf:ID="NoPrefix">
  <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >1</MomentUnits:hasValue>
</MomentUnits:Prefix>
<MomentUnits:UnitDerivedByScaling rdf:ID="microsecond">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >us</MomentUnits:hasSymbol>
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="micro">
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1E-6</MomentUnits:hasValue>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="minute">
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >min</MomentUnits:hasSymbol>
  <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >60</MomentUnits:hasScalingNumber>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="year">
  <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >31556926</MomentUnits:hasScalingNumber>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >year</MomentUnits:hasSymbol>
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="KibiBytepersec">
  <MomentUnits:derivedFromUnit>
    <MomentUnits:ComplexUnit rdf:ID="Bytepersec">
      <MomentUnits:productOf rdf:resource="#Byte"/>
      <MomentUnits:productOf>
        <MomentUnits:UnitDerivedByRaisingToPower rdf:ID="perSecond">
          <MomentUnits:derivedFromUnit rdf:resource="#second"/>
          <MomentUnits:hasPower rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
          >-1</MomentUnits:hasPower>
        </MomentUnits:UnitDerivedByRaisingToPower>
      </MomentUnits:productOf>
      <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >Bps</MomentUnits:hasSymbol>
    </MomentUnits:ComplexUnit>
  </MomentUnits:derivedFromUnit>
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="Kibi">
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1024</MomentUnits:hasValue>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>

```



```

<MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>mac</MomentUnits:hasSymbol>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="Kilobitpersec">
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="kilo">
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1e3</MomentUnits:hasValue>
      <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >k</MomentUnits:hasSymbol>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>
  <MomentUnits:derivedFromUnit>
    <MomentUnits:ComplexUnit rdf:ID="bitpersec">
      <MomentUnits:productOf rdf:resource="#bit"/>
      <MomentUnits:productOf rdf:resource="#perSecond"/>
      <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >Bits per sec</rdfs:label>
    </MomentUnits:ComplexUnit>
  </MomentUnits:derivedFromUnit>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="ppb">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >ppb</MomentUnits:hasSymbol>
  <MomentUnits:derivedFromUnit>
    <MomentUnits:BaseUnit rdf:ID="ratio">
      <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >r</MomentUnits:hasSymbol>
    </MomentUnits:BaseUnit>
  </MomentUnits:derivedFromUnit>
  <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >0.000000001</MomentUnits:hasScalingNumber>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="KibiByte">
  <MomentUnits:derivedFromUnit rdf:resource="#Byte"/>
  <MomentUnits:hasPrefix rdf:resource="#Kibi"/>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >KiB</MomentUnits:hasSymbol>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="percent">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >%</MomentUnits:hasSymbol>
  <MomentUnits:derivedFromUnit rdf:resource="#ratio"/>
  <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >0.01</MomentUnits:hasScalingNumber>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="MebiBytepersec">
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="Mebi">
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1048576</MomentUnits:hasValue>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>
  <MomentUnits:derivedFromUnit rdf:resource="#Bytepersec"/>
</MomentUnits:UnitDerivedByScaling>
<owl:AnnotationProperty rdf:about="http://www.w3.org/2002/07/owl#versionInfo"/>
<MomentUnits:UnitDerivedByScaling rdf:ID="KiloBit">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Kb</MomentUnits:hasSymbol>
  <MomentUnits:hasPrefix rdf:resource="#kilo"/>
  <MomentUnits:derivedFromUnit rdf:resource="#bit"/>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="nanosecond">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >ns</MomentUnits:hasSymbol>
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="nano">
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1E-9</MomentUnits:hasValue>
      <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >n</MomentUnits:hasSymbol>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="GibiBytepersec">
  <MomentUnits:hasPrefix rdf:resource="#Gibi"/>
  <MomentUnits:derivedFromUnit rdf:resource="#Bytepersec"/>

```

```

</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByRaisingToPower rdf:ID="perSecondSquare">
  <MomentUnits:hasPower rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >-2</MomentUnits:hasPower>
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
</MomentUnits:UnitDerivedByRaisingToPower>
<MomentUnits:UnitDerivedByScaling rdf:ID="Gigabitpersec">
  <MomentUnits:derivedFromUnit rdf:resource="#bitpersec"/>
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="giga">
      <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >G</MomentUnits:hasSymbol>
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1e9</MomentUnits:hasValue>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="ppm">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >ppm</MomentUnits:hasSymbol>
  <MomentUnits:derivedFromUnit rdf:resource="#ratio"/>
  <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >0.000001</MomentUnits:hasScalingNumber>
</MomentUnits:UnitDerivedByScaling>
<owl:AnnotationProperty rdf:about="http://www.w3.org/2000/01/rdf-schema#label"/>
<MomentUnits:UnitDerivedByScaling rdf:ID="Megabitpersec">
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="mega">
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1e6</MomentUnits:hasValue>
      <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >M</MomentUnits:hasSymbol>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>
  <MomentUnits:derivedFromUnit rdf:resource="#bitpersec"/>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="decade">
  <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >315569260</MomentUnits:hasScalingNumber>
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >decade</MomentUnits:hasSymbol>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="GigaBit">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Gb</MomentUnits:hasSymbol>
  <MomentUnits:hasPrefix rdf:resource="#giga"/>
  <MomentUnits:derivedFromUnit rdf:resource="#bit"/>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="millennium">
  <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >3.1556926E10</MomentUnits:hasScalingNumber>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >millennium</MomentUnits:hasSymbol>
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByRaisingToPower rdf:ID="secondSquare">
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
  <MomentUnits:hasPower rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >2</MomentUnits:hasPower>
</MomentUnits:UnitDerivedByRaisingToPower>
<MomentUnits:UnitDerivedByScaling rdf:ID="TebiBytepersec">
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="Tebi">
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1099511627776</MomentUnits:hasValue>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>
  <MomentUnits:derivedFromUnit rdf:resource="#Bytepersec"/>
</MomentUnits:UnitDerivedByScaling>
<owl:DeprecatedClass rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
<MomentUnits:Prefix rdf:ID="hecto">
  <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >1e2</MomentUnits:hasValue>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >h</MomentUnits:hasSymbol>
</MomentUnits:Prefix>
<MomentUnits:UnitDerivedByScaling rdf:ID="ppt">

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<MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>ppt</MomentUnits:hasSymbol>
<MomentUnits:derivedFromUnit rdf:resource="#ratio"/>
<MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
>0.000000000001</MomentUnits:hasScalingNumber>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="Terabitpersec">
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="tera">
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1e12</MomentUnits:hasValue>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>
  <MomentUnits:derivedFromUnit rdf:resource="#bitpersec"/>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByRaisingToPower rdf:ID="perSecondToPower3">
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
  <MomentUnits:hasPower rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >-3</MomentUnits:hasPower>
</MomentUnits:UnitDerivedByRaisingToPower>
<MomentUnits:UnitDerivedByScaling rdf:ID="TeraBit">
  <MomentUnits:hasPrefix rdf:resource="#tera"/>
  <MomentUnits:derivedFromUnit rdf:resource="#bit"/>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Tb</MomentUnits:hasSymbol>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="TebiByte">
  <MomentUnits:derivedFromUnit rdf:resource="#Byte"/>
  <MomentUnits:hasPrefix rdf:resource="#Tebi"/>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >TeB</MomentUnits:hasSymbol>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="millisecond">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >ms</MomentUnits:hasSymbol>
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
  <MomentUnits:hasPrefix>
    <MomentUnits:Prefix rdf:ID="milli">
      <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >m</MomentUnits:hasSymbol>
      <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
      >1E-3</MomentUnits:hasValue>
    </MomentUnits:Prefix>
  </MomentUnits:hasPrefix>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:Prefix rdf:ID="deco">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >da</MomentUnits:hasSymbol>
  <MomentUnits:hasValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >10</MomentUnits:hasValue>
</MomentUnits:Prefix>
<MomentUnits:UnitDerivedByScaling rdf:ID="permil">
  <MomentUnits:derivedFromUnit rdf:resource="#ratio"/>
  <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >0.001</MomentUnits:hasScalingNumber>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="MegaBit">
  <MomentUnits:hasPrefix rdf:resource="#mega"/>
  <MomentUnits:derivedFromUnit rdf:resource="#bit"/>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Mb</MomentUnits:hasSymbol>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="century">
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
  <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >3.1556926E09</MomentUnits:hasScalingNumber>
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >century</MomentUnits:hasSymbol>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByScaling rdf:ID="MebiByte">
  <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >MeB</MomentUnits:hasSymbol>
  <MomentUnits:derivedFromUnit rdf:resource="#Byte"/>
  <MomentUnits:hasPrefix rdf:resource="#Mebi"/>
</MomentUnits:UnitDerivedByScaling>
<MomentUnits:UnitDerivedByRaisingToPower rdf:ID="perRadian">
  <MomentUnits:hasPower rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
  >-1</MomentUnits:hasPower>

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<MomentUnits:derivedFromUnit>
  <MomentUnits:BaseUnit rdf:ID="radian">
    <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >rad</MomentUnits:hasSymbol>
  </MomentUnits:BaseUnit>
</MomentUnits:derivedFromUnit>
</MomentUnits:UnitDerivedByRaisingToPower>
<MomentUnits:unitDerivedByRegexpScaling rdf:ID="ipv4dotted">
  <MomentUnits:derivedFromUnit rdf:resource="#ipv4int"/>
  <MomentUnits:scalingRegexp rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >/evalInteger/(25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\. (25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\. (25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\. (25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\. (\g&lt;1&gt;
    &lt;&lt; 24 | (\g&lt;2&gt;) &lt;&lt; 16 | (\g&lt;3&gt;) &lt;&lt; 8 |
    (\g&lt;4&gt;)/</MomentUnits:scalingRegexp>
  <MomentUnits:inverseScalingRegexp rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >/evalIntegerAsString/([0-9]*)/((\g&lt;1&gt;) &amp; (255 &lt;&lt; 24)) &gt;&gt; 24/./([0-9]*)/((\g&lt;1&gt;) &amp; (255 &lt;&lt; 16)) &gt;&gt; 16/./([0-9]*)/((\g&lt;1&gt;) &amp; (255
    &lt;&lt; 8)) &gt;&gt; 8/./([0-9]*)/((\g&lt;1&gt;) &amp; 255//</MomentUnits:inverseScalingRegexp>
  </MomentUnits:unitDerivedByRegexpScaling>
<MomentUnits:UnitDerivedByRaisingToPower rdf:ID="perHour">
  <MomentUnits:hasPower rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
    >-1</MomentUnits:hasPower>
  <MomentUnits:derivedFromUnit>
    <MomentUnits:UnitDerivedByScaling rdf:ID="hour">
      <MomentUnits:hasSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >h</MomentUnits:hasSymbol>
      <MomentUnits:derivedFromUnit rdf:resource="#second"/>
      <MomentUnits:hasScalingNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
        >3600</MomentUnits:hasScalingNumber>
    </MomentUnits:UnitDerivedByScaling>
  </MomentUnits:derivedFromUnit>
</MomentUnits:UnitDerivedByRaisingToPower>
<MomentUnits:UnitDerivedByRaisingToPower rdf:ID="secondToPower4">
  <MomentUnits:hasPower rdf:datatype="http://www.w3.org/2001/XMLSchema#double"
    >4</MomentUnits:hasPower>
  <MomentUnits:derivedFromUnit rdf:resource="#second"/>
</MomentUnits:UnitDerivedByRaisingToPower>
</rdf:RDF>

```

## A.1.3 Metadata ontology

```

<?xml version="1.0"?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:MM="http://www.fp7-moment.eu/MomentMetadata.owl#"
  xmlns:protege="http://protege.stanford.edu/plugins/owl/protege#"
  xmlns:xsp="http://www.owl-ontologies.com/2005/08/07/xsp.owl#"
  xmlns:MD="http://www.fp7-moment.eu/MomentData.owl#"
  xmlns:owlassert="http://www.owl-ontologies.com/assert.owl#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:swrl="http://www.w3.org/2003/11/swrl#"
  xmlns:swrlb="http://www.w3.org/2003/11/swrlb#"
  xmlns:MGC="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xml:base="http://www.fp7-moment.eu/MomentMetadata.owl">
  <owl:Ontology rdf:about="">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      ></rdfs:comment>
  </owl:Ontology>
  <rdfs:Class rdf:about="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#PhysicalLocation">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >Physical space that something occupies on the Earth's surface</rdfs:comment>
  </rdfs:Class>
  <rdfs:Class rdf:about="http://www.fp7-moment.eu/MomentData.owl#Metric">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >Metric individuals represent the thing that is being measuring, and all the different values
      that are necessary to obtain, when the metric is being measuring.</rdfs:comment>
  </rdfs:Class>
  <rdfs:Class rdf:about="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#InetLocation">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
      >Logical direction os something.</rdfs:comment>
  </rdfs:Class>
  <rdfs:Class rdf:about="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#TimeStamp"/>
  <rdfs:Class rdf:about="http://www.fp7-moment.eu/MomentData.owl#MeasurementData">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

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>MeasurementData represents individual results of a measurement. As the ontology is designed to
work with D2R it also represents different columns of the database</rdfs:comment>
</rdfs:Class>
<rdfs:Class rdf:about="http://www.w3.org/2000/01/rdf-schema#Property"/>
<rdfs:Class rdf:about="http://www.wiwiss.fu-berlin.de/suhl/bizer/D2RQ/0.1#PropertyBridge"/>
<owl:Class rdf:ID="Document">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Information about Internet measurement data</rdfs:comment>
  <owl:disjointWith>
    <owl:Class rdf:ID="Contact"/>
  </owl:disjointWith>
  <owl:disjointWith>
    <owl:Class rdf:ID="DataFormat"/>
  </owl:disjointWith>
  <owl:disjointWith>
    <owl:Class rdf:ID="DataMetadata"/>
  </owl:disjointWith>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Document</rdfs:label>
</owl:Class>
<owl:Class rdf:about="#Contact">
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Contact</rdfs:label>
  <owl:disjointWith rdf:resource="#Document"/>
  <owl:disjointWith>
    <owl:Class rdf:about="#DataFormat"/>
  </owl:disjointWith>
  <owl:disjointWith>
    <owl:Class rdf:ID="Publication"/>
  </owl:disjointWith>
  <owl:disjointWith>
    <owl:Class rdf:ID="Annotation"/>
  </owl:disjointWith>
  <owl:disjointWith>
    <owl:Class rdf:about="#DataMetadata"/>
  </owl:disjointWith>
  <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://imdc.datcat.org/help/objectTypes#contact</rdfs:isDefinedBy>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Contact objects describe a person or role. Contacts are also used to describe the creators of
data, packages, and other catalogued items, even if those creators do not have SMR logins. For
contacts with logins, the contact's contributor is the contact itself.</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#DataMetadata">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A DataMetadata object describes a dataset contained in a SINGLE file in its most natural
working form, even if the data is not made available directly in that form.
The name of the DataMetadata object is typically, but not necessarily, the same as the filename used
on real-world copies of the data file. However, because copies of the file can have different
filenames, the filename is specified within the Package object if more than one are available, and a
single Data object can describe all the copies of the same data.</rdfs:comment>
  <owl:disjointWith>
    <owl:Class rdf:about="#Annotation"/>
  </owl:disjointWith>
  <owl:disjointWith rdf:resource="#Contact"/>
  <owl:disjointWith rdf:resource="#Document"/>
  <owl:disjointWith>
    <owl:Class rdf:about="#DataFormat"/>
  </owl:disjointWith>
  <owl:disjointWith>
    <owl:Class rdf:about="#Publication"/>
  </owl:disjointWith>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Data Metadata</rdfs:label>
</owl:Class>
<owl:Class rdf:about="#DataFormat">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The two Format types describe file formats used for data files (e.g., pcap) and package files
(e.g., tar-gzip). There also may be Annotation Keys associated with a format, which have the effect
of adding new fields to objects that have that format.</rdfs:comment>
  <owl:disjointWith rdf:resource="#Contact"/>
  <owl:disjointWith>
    <owl:Class rdf:about="#Annotation"/>
  </owl:disjointWith>
  <owl:disjointWith rdf:resource="#DataMetadata"/>
  <owl:disjointWith>
    <owl:Class rdf:about="#Publication"/>
  </owl:disjointWith>

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```

<owl:disjointWith rdf:resource="#Document"/>
<rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Data Format</rdfs:label>
<rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>http://imdc.datcat.org/help/objectTypes#format</rdfs:isDefinedBy>
</owl:Class>
<owl:Class rdf:about="#Annotation">
<rdfs:subClassOf rdf:resource="#Document"/>
<owl:disjointWith rdf:resource="#DataFormat"/>
<owl:disjointWith>
  <owl:Class rdf:about="#Publication"/>
</owl:disjointWith>
<owl:disjointWith rdf:resource="#Contact"/>
<owl:disjointWith rdf:resource="#DataMetadata"/>
<rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>http://imdc.datcat.org/help/objectTypes#annotation</rdfs:isDefinedBy>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>An annotation is an extra piece of information attached to an IMDC object, consisting of an
Annotation Key (described below) and a value. The key defines the range of possible values, how to
interpret them, and who has permission to create and edit annotations. Some annotations act like
extensions to an object's built-in fields; the owner of an object can usually take control over
these annotations even if they were contributed by someone else, in order to maintain the integrity
of the object. Others, such as those with key note, can be created by anyone who wants to attach a
note to an object, and cannot be edited by the object's owner.</rdfs:comment>
<rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Annotation</rdfs:label>
</owl:Class>
<owl:Class rdf:about="#Publication">
<rdfs:subClassOf rdf:resource="#Document"/>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>A Publication describes a scholarly paper, article, or other publication that uses Internet
measurement data. IMDC is not meant to be a catalog of publications, as that service is already
performed by other sites such as Google Scholar and CiteSeer. Rather, the primary purpose of
indexing publications in IMDC is to index the data used by the publications. A Publication object in
IMDC can be thought of as a specialized kind of Collection whose Data contents represent the data
used by the publication. Like a Collection, a Publication may contain other Collection or
Publication objects in order to incorporate their contents.</rdfs:comment>
<owl:disjointWith rdf:resource="#Annotation"/>
<owl:disjointWith rdf:resource="#DataFormat"/>
<owl:disjointWith rdf:resource="#Contact"/>
<owl:disjointWith rdf:resource="#DataMetadata"/>
<rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Publication</rdfs:label>
<rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>http://imdc.datcat.org/help/objectTypes#publication</rdfs:isDefinedBy>
</owl:Class>
<owl:ObjectProperty rdf:ID="hasContributor">
<rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Contributor</rdfs:label>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The contact who contributed the metadata for this object.
Usually it's the user who submitted the data to the SMR or the Contact info from the measurement
infrastructure which made the measurements.</rdfs:comment>
<rdfs:domain rdf:resource="#DataMetadata"/>
<rdfs:range rdf:resource="#Contact"/>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="hasCreator">
<rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Creator</rdfs:label>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The creator of the measurement itself.</rdfs:comment>
<rdfs:range rdf:resource="#Contact"/>
<rdfs:domain>
  <owl:Class>
    <owl:unionOf rdf:parseType="Collection">
      <owl:Class rdf:about="#Annotation"/>
      <owl:Class rdf:about="#DataMetadata"/>
    </owl:unionOf>
  </owl:Class>
</rdfs:domain>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="hasMeasurementData">
<rdfs:range rdf:resource="http://www.fp7-moment.eu/MomentData.owl#MeasurementData"/>
<rdfs:domain rdf:resource="#DataMetadata"/>
<rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Measured Metric Attributes</rdfs:label>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

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    >The metric attributes of the measured metric this measure has data about. The other possible
    attributes are not know as available</rdfs:comment>
  </owl:ObjectProperty>
  <owl:ObjectProperty rdf:ID="hasColumnMapping">
    <rdfs:range rdf:resource="http://www.wiwiss.fu-berlin.de/suhl/bizer/D2RQ/0.1#PropertyBridge"/>
    <rdfs:domain rdf:resource="#DataMetadata"/>
  </owl:ObjectProperty>
  <owl:ObjectProperty rdf:ID="hasObject">
    <rdfs:domain rdf:resource="#Annotation"/>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >is annotating</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >The object to which this Annotation refers.</rdfs:comment>
  </owl:ObjectProperty>
  <owl:ObjectProperty rdf:ID="hasAuthors">
    <rdfs:domain rdf:resource="#Publication"/>
    <rdfs:range rdf:resource="#Contact"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >A list of contacts who wrote the publication</rdfs:comment>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Author</rdfs:label>
  </owl:ObjectProperty>
  <owl:ObjectProperty rdf:about="http://www.wiwiss.fu-berlin.de/suhl/bizer/D2RQ/0.1#property">
    <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Property"/>
    <rdfs:domain rdf:resource="http://www.wiwiss.fu-berlin.de/suhl/bizer/D2RQ/0.1#PropertyBridge"/>
  </owl:ObjectProperty>
  <owl:ObjectProperty rdf:ID="measuredMetric">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >The measured metrics by this measurement. This property points to the instances of Metric which
      best represent the results of the measurements</rdfs:comment>
    <rdfs:range rdf:resource="http://www.fp7-moment.eu/MomentData.owl#Metric"/>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Metrics measured</rdfs:label>
    <rdfs:domain rdf:resource="#DataMetadata"/>
  </owl:ObjectProperty>
  <owl:ObjectProperty rdf:ID="hasFileFormat">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Description of the file format.</rdfs:comment>
    <rdfs:range rdf:resource="#DataFormat"/>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Format</rdfs:label>
    <rdfs:domain rdf:resource="#DataMetadata"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  </owl:ObjectProperty>
  <owl:ObjectProperty rdf:ID="logisticLocation">
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Access Location</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >The access - location</rdfs:comment>
    <rdfs:domain rdf:resource="#DataMetadata"/>
    <rdfs:range rdf:resource="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#InetLocation"/>
  </owl:ObjectProperty>
  <owl:ObjectProperty rdf:ID="timeStamp">
    <rdfs:domain>
      <owl:Class>
        <owl:unionOf rdf:parseType="Collection">
          <owl:Class rdf:about="#DataMetadata"/>
          <owl:Class rdf:about="#Annotation"/>
        </owl:unionOf>
      </owl:Class>
    </rdfs:domain>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Time of measurement</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >The time interval referred in the measurements .</rdfs:comment>
    <rdfs:range rdf:resource="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#TimeStamp"/>
  </owl:ObjectProperty>
  <rdf:Property rdf:about="http://www.fp7-moment.eu/MomentDataV2.owl#isMeasuredIn">
    <rdfs:domain>
      <owl:Class>
        <owl:unionOf rdf:parseType="Collection">
          <rdf:Description rdf:about="http://www.fp7-moment.eu/MomentDataV2.owl#MeasurementData"/>
          <rdfs:Class rdf:about="http://www.wiwiss.fu-
berlin.de/suhl/bizer/D2RQ/0.1#PropertyBridge"/>
        </owl:unionOf>
      </owl:Class>
    </rdfs:domain>
  </rdf:Property>

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<owl:DatatypeProperty rdf:ID="creationProcess">
  <rdfs:domain rdf:resource="#DataMetadata"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A text description of the procedure used to collect the data</rdfs:comment>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Creation process description</rdfs:label>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="publicationDate">
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Publication Date</rdfs:label>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
  <rdfs:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The year and optionally month and day of publication
  Start Time, End Time, Duration</rdfs:comment>
  <rdfs:domain rdf:resource="#Publication"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="url">
  <rdfs:domain rdf:resource="#Publication"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Download URL</rdfs:label>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A URL where the full publication can be found</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="value">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The value of this annotation, with type according to the Annotation Key.</rdfs:comment>
  <rdfs:domain rdf:resource="#Annotation"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value</rdfs:label>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="title">
  <rdfs:domain rdf:resource="#Publication"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Title</rdfs:label>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The publication's full title.</rdfs:comment>
  <rdfs:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="summary">
  <rdfs:domain rdf:resource="#Document"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Summary</rdfs:label>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A medium-length description of this Publication</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="contactInformation">
  <rdfs:domain rdf:resource="#Contact"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The contact information of the Contact Object. This may include telephone number, address,
  email, ZIP, state, country and any other useful information to locate the contact.</rdfs:comment>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Contact Information</rdfs:label>
  <rdfs:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="keyword">
  <rdfs:comment xml:lang="en">A list of words or short phrases that describe important features of
  this object, useful for searching.</rdfs:comment>
  <rdfs:domain rdf:resource="#DataMetadata"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >KeyWord</rdfs:label>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="md5Hash">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The MD5 fingerprint of the datafile, displayed as 32 hexadecimal digits.</rdfs:comment>
  <rdfs:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#DataMetadata"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >MD5 HASH</rdfs:label>

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<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="availability">
  <rdfs:range>
    <owl:DataRange>
      <owl:oneOf rdf:parseType="Resource">
        <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
          >Restricted</rdf:first>
        <rdf:rest rdf:parseType="Resource">
          <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
            >Free</rdf:first>
          <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
        </rdf:rest>
      </owl:oneOf>
    </owl:DataRange>
  </rdfs:range>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Free if anyone may obtain the package without restrictions, or Restricted if obtaining the
    package requires a password or agreement to an AUP or has other restrictions.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#DataMetadadata"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Availability</rdfs:label>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="suffix">
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >File suffix</rdfs:label>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >The suffix of the package</rdfs:comment>
  <rdfs:domain rdf:resource="#DataFormat"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="type">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Contact Type</rdfs:label>
  <rdfs:range>
    <owl:DataRange>
      <owl:oneOf rdf:parseType="Resource">
        <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
          >Person</rdf:first>
        <rdf:rest rdf:parseType="Resource">
          <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
            >Role</rdf:first>
          <rdf:rest rdf:parseType="Resource">
            <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
            <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
              >Institution</rdf:first>
          </rdf:rest>
        </rdf:rest>
      </owl:oneOf>
    </owl:DataRange>
  </rdfs:range>
  <rdfs:domain rdf:resource="#Contact"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >for annotation: If set, Annotations with this Key may only be applied to objects with this
    Object Type. The object type is part of the namespace.</rdfs:comment>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >person if this contact describes an individual person (e.g. Ken Keys), or role if this contact
    describes a job or function independently of the person or people who perform it (e.g. CAIDA Data
    Manager). New accounts are always created with type person, but can be edited later to change their
    type to role.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="platform">
  <rdfs:domain rdf:resource="#DataMetadadata"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Platform</rdfs:label>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >The hardware, software, and OS used to collect the data</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="fileSize">
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Size (Bytes)</rdfs:label>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#DataMetadadata"/>

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        <owl:Class rdf:about="#Document" />
    </owl:unionOf>
</owl:Class>
</rdfs:domain>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The size of the (uncompressed) data file, in bytes</rdfs:comment>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The size of the package file, in bytes</rdfs:comment>
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int" />
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty" />
</owl:DatatypeProperty>
<owl:FunctionalProperty rdf:ID="name">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string" />
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Name</rdfs:label>
    <rdfs:comment xml:lang="en">Added to Contact Object, a contact has a name</rdfs:comment>
    <rdfs:comment xml:lang="en">The object's full name, which will be displayed to other
users.</rdfs:comment>
    <rdfs:domain>
        <owl:Class>
            <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#Contact" />
                <owl:Class rdf:about="#DataMetadata" />
            </owl:unionOf>
        </owl:Class>
    </rdfs:domain>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty" />
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="hasAnnotationKey">
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Annotation Key</rdfs:label>
    <rdfs:domain rdf:resource="#Publication" />
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty" />
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The Annotation Key of this Annotation.</rdfs:comment>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="hasAnnotation">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty" />
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The annotations for the object, information inherited from DATCAT</rdfs:comment>
    <rdfs:range rdf:resource="#Annotation" />
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Annotation</rdfs:label>
    <rdfs:domain rdf:resource="#Annotation" />
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="description">
    <rdfs:comment xml:lang="en">A longer description of the object, displayed only on the object's
detail page</rdfs:comment>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Long description</rdfs:label>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty" />
    <rdfs:domain rdf:resource="#DataMetadata" />
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string" />
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="bibtex">
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>BiBTeX</rdfs:label>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string" />
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The bibtex of the publication</rdfs:comment>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty" />
    <rdfs:domain rdf:resource="#DataMetadata" />
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:about="http://www.wiwiss.fu-berlin.de/suhl/bizer/D2RQ/0.1#column">
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string" />
    <rdfs:domain rdf:resource="http://www.wiwiss.fu-berlin.de/suhl/bizer/D2RQ/0.1#PropertyBridge" />
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty" />
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="venue">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>The name of the conference, journal, magazine, or other venue where the publication was
published.</rdfs:comment>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string" />
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Venue</rdfs:label>
    <rdfs:domain rdf:resource="#Publication" />
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty" />
</owl:FunctionalProperty>

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<owl:FunctionalProperty rdf:ID="abstract">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A much longer description of the object, displayed only on the object's detail
page</rdfs:comment>
  <rdfs:domain rdf:resource="#Publication"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Abstract</rdfs:label>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="shortDescription">
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Description (Short)</rdfs:label>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:domain rdf:resource="#DataMetadata"/>
  <rdfs:comment xml:lang="en">A short (up to 128 characters) description of the object, displayed
in tables containing the object and at the top of the object's detail page</rdfs:comment>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="canContainMultipleFiles">
  <rdfs:domain rdf:resource="#DataFormat"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#DatatypeProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >True if the package can contain multiple files</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Multiple Files</rdfs:label>
</owl:FunctionalProperty>
<owl:FunctionalProperty rdf:ID="geographicLocation">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#ObjectProperty"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Geographic Location (Physical or Political)</rdfs:label>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Geographical location where the measurements were made.</rdfs:comment>
  <rdfs:domain rdf:resource="#DataMetadata"/>
  <rdfs:range rdf:resource="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#PhysicalLocation"/>
</owl:FunctionalProperty>
<rdf:Description rdf:about="http://www.fp7-moment.eu/MomentData.owl#Location">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >An attribute to know where to find something</rdfs:comment>
</rdf:Description>
</rdf:RDF>

```

## A.1.4 Data ontology

```

<?xml version="1.0"?>
<rdf:RDF
  xmlns:protege="http://protege.stanford.edu/plugins/owl/protege#"
  xmlns:xsp="http://www.owl-ontologies.com/2005/08/07/xsp.owl#"
  xmlns:assertion="http://www.owl-ontologies.com/assert.owl#"
  xmlns:MomentUnits="http://www.fp7-moment.eu/MomentUnits.owl#"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:MD="http://www.fp7-moment.eu/MomentDataV2.owl#"
  xmlns:owl2xml="http://www.w3.org/2006/12/owl2-xml#"
  xmlns:Units="http://www.fp7-moment.eu/Units.owl/#"
  xmlns:swrlb="http://www.w3.org/2003/11/swrlb#"
  xmlns:rdfl="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:swrl="http://www.w3.org/2003/11/swrl#"
  xmlns:MomentGeneralConcepts="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#"
  xmlns:Tools="http://www.fp7-moment.eu/tools.owl#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xml:base="http://www.fp7-moment.eu/MomentDataV2.owl">
  <owl:Ontology rdf:about="">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Version 2. This version is incompatible with previous versions.</rdfs:comment>
    <owl:incompatibleWith rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >http://www.fp7-moment.eu/MomentData.owl</owl:incompatibleWith>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Alfredo Salvador Gonzalez</dc:creator>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Alvaro Katsu Tomoyuki</dc:creator>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Jorge E. Lpez de Vergara Mndez</dc:creator>
    <owl:imports rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl"/>

```

```

    <owl:versionInfo rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >v2.0</owl:versionInfo>
  </owl:Ontology>
  <owl:Class rdf:ID="SourceIP">
    <rdfs:subClassOf>
      <owl:Class rdf:ID="NodeIP"/>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:ID="defaultUnit"/>
        </owl:onProperty>
        <owl:hasValue>
          <owl:Thing rdf:about="http://www.fp7-moment.eu/MomentUnits.owl#ipv4int"/>
        </owl:hasValue>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:type>
      <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
    </rdfs:type>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >IP address of the source node</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="MP_Unreach">
    <rdfs:subClassOf>
      <owl:Class rdf:ID="BGPAttributes"/>
    </rdfs:subClassOf>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >This is an optional non-transitive attribute that can be used for the
    purpose of withdrawing multiple unfeasible routes from service.</rdfs:comment>
    <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >http://ietfreport.isoc.org/idref/rfc2283/</rdfs:seeAlso>
  </owl:Class>
  <owl:Class rdf:ID="Path">
    <owl:disjointWith>
      <owl:Class rdf:ID="Topology"/>
    </owl:disjointWith>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >A Path or a Segment in a network is a set of ordered Nodes connected through communication Link
  </rdfs:comment>
    <rdfs:subClassOf>
      <owl:Class rdf:ID="NetworkObject"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="SatelliteCountMeasurement">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Number of Satellites seen by the GPS at the moment of the measurement.</rdfs:comment>
    <rdfs:subClassOf>
      <owl:Class rdf:ID="SimpleMeasurement"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="DelayVariationMeasurement">
    <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >http://www.ietf.org/rfc/rfc3393.txt</rdfs:seeAlso>
    <rdfs:type>
      <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
    </rdfs:type>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#defaultUnit"/>
        </owl:onProperty>
        <owl:hasValue>
          <owl:Thing rdf:about="http://www.fp7-moment.eu/MomentUnits.owl#second"/>
        </owl:hasValue>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
      <owl:Class rdf:about="#SimpleMeasurement"/>
    </rdfs:subClassOf>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >INFORMALLY: The variability over time of the packet latency across a network. A measurement of
    the time difference calculated between a pair of delay measurements.
  </owl:Class>

```

RFC 3393 defines a "IP Packet Delay Variation Metric for IP Performance Metrics (IPPM)" in Section 1.2 as follows:

A definition of the IP Packet Delay Variation (ipdv) can be given for packets inside a stream of packets.

The ipdv of a pair of packets within a stream of packets is defined for a selected pair of packets in the stream going from measurement point MP1 to measurement point MP2.

The ipdv is the difference between the one-way-delay of the selected packets.</rdfs:comment>

```

</owl:Class>
<owl:Class rdf:ID="OutgoingTransferRateMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Average data information that has as source node the node that is being measured per unit of
time.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:ID="TransferRateMeasurement"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="HurstParameterMeasurement">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="MeasurementParameters"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="ClusterID">
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.powerfast.net/bgp/BGP_Nd5.html</rdfs:seeAlso>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Specifies the identifier for the route reflector cluster. Valid values are integers from 0 and
4294967295.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Link">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:ID="hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="DestinationName"/>
      </owl:someValuesFrom>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="DestinationIP"/>
      </owl:someValuesFrom>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="SourceName"/>
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#SourceIP"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="DestinationMacAddress"/>
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
    </owl:Restriction>

```

```

</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom>
      <owl:Class rdf:ID="SourceMacAddress" />
    </owl:someValuesFrom>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData" />
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Class rdf:about="#NetworkObject" />
</rdfs:subClassOf>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>A link is a connection between two of these network devices or nodes</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="MaxMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Maximum Value from a statistical measurement.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:ID="StatisticalMeasurement" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="AddressMeasurement">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="NodeInformation" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="MinMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >minimum Value from a statistical measurement.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#StatisticalMeasurement" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Time">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="GeneralInformation" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="GenericSimpleMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >GenericSimpleMeasurement class represent all the simple measurement that is not represented
in the ontology.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#SimpleMeasurement" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="PathCapacityMeasurement">
  <rdf:type>
    <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing" />
  </rdf:type>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The path capacity of a determinate protocol is the smallest link capacity ("narrow link") of
the links that make up the path.
We define the link capacity,  $C(L,T,I)$ , to be the maximum number of bits of a determinate protocol
that can be transmitted from the source and correctly received by the destination over the link L
during the interval  $[T, T+I]$ , divided by I.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:ID="CapacityMeasurement" />
  </rdfs:subClassOf>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.rfc-editor.org/rfc/rfc5136.txt</rdfs:seeAlso>
</owl:Class>
<owl:Class rdf:about="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#Protocol" />
<owl:Class rdf:about="#MeasurementParameters">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="MeasurementData" />
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Parameters for measurements</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#Timestamp" />
<owl:Class rdf:ID="PINGER">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="Ping" />
  </rdfs:subClassOf>

```

```

    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >A device that periodically emits a signal that can be monitored to permit movement
tracking.</rdfs:comment>
    <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#anyURI"
    >http://ggf.org/ns/nmwg/tools/pinger/2.0</rdfs:isDefinedBy>
  </owl:Class>
  <owl:Class rdf:about="#SourceName">
    <rdfs:subClassOf>
      <owl:Class rdf:ID="NodeName"/>
    </rdfs:subClassOf>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Name or direction of the source node</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="NodeMacAddress">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >MAC address of the node.</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#AddressMeasurement"/>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#defaultUnit"/>
        </owl:onProperty>
        <owl:hasValue>
          <owl:Thing rdf:about="http://www.fp7-moment.eu/MomentUnits.owl#hexadecimalMAC"/>
        </owl:hasValue>
      </owl:Restriction>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:about="#Ping">
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:someValuesFrom>
          <owl:Class rdf:ID="PacketLossMeasurement"/>
        </owl:someValuesFrom>
        <owl:onProperty>
          <owl:ObjectProperty rdf:ID="hasMetricAttributes"/>
        </owl:onProperty>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:someValuesFrom>
          <owl:Class rdf:ID="FinalTtlMeasurement"/>
        </owl:someValuesFrom>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
        </owl:onProperty>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
      <owl:Class rdf:ID="Measurement"/>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:someValuesFrom>
          <owl:Class rdf:ID="RoundTripDelayMeasurement"/>
        </owl:someValuesFrom>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
        </owl:onProperty>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Network tool that measures round-trip time and packet loss sending ICMP "echo-request" packets
and listening for ICMP "echo-response" replies.</rdfs:comment>
    <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#anyURI"
    >http://ggf.org/ns/nmwg/tools/ping/2.0</rdfs:isDefinedBy>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
        </owl:onProperty>
        <owl:someValuesFrom rdf:resource="#SourceIP"/>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty>

```

```

    <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
  </owl:onProperty>
</owl:someValuesFrom>
  <owl:Class rdf:ID="FirstTtlMeasurement"/>
</owl:someValuesFrom>
</owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom>
      <owl:Class rdf:about="#DestinationIP"/>
    </owl:someValuesFrom>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom>
      <owl:Class rdf:ID="Arguments"/>
    </owl:someValuesFrom>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
    </owl:onProperty>
    <owl:someValuesFrom>
      <owl:Class rdf:ID="PacketSize"/>
    </owl:someValuesFrom>
  </owl:Restriction>
</rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="SamplingRate">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >defines the number of samples per second (or per other unit) taken from a continuous signal to
  make a discrete signal</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#SimpleMeasurement"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#PacketLossMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Percentage of losing packets along the data path.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#SimpleMeasurement"/>
  </rdfs:subClassOf>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.ietf.org/rfc/rfc3357.txt</rdfs:seeAlso>
  <rdf:type>
    <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
  </rdf:type>
</owl:Class>
<owl:Class rdf:ID="ExtendedCommunities">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The Extended Communities Attribute is a transitive optional BGP
  attribute, with the Type Code 16. The attribute consists of a set of
  "extended communities"</rdfs:comment>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.rfc-editor.org/rfc/rfc4360.txt</rdfs:seeAlso>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Iperf">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Iperf is a commonly used network testing tool that can create TCP and UDP data streams and
  measure the throughput of a network that is carrying them.</rdfs:comment>
  <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#anyURI"
  >http://ggf.org/ns/nmwg/tools/iperf/2.0/</rdfs:isDefinedBy>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>

```

```

    <owl:ObjectProperty rdf:about="#hasMetricAttributes" />
  </owl:onProperty>
  <owl:someValuesFrom>
    <owl:Class rdf:about="#CapacityMeasurement" />
  </owl:someValuesFrom>
</owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom rdf:resource="#SourceIP" />
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMetricAttributes" />
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMetricAttributes" />
    </owl:onProperty>
    <owl:someValuesFrom>
      <owl:Class rdf:about="#DestinationIP" />
    </owl:someValuesFrom>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Class rdf:about="#Measurement" />
</rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="PauseParameter">
  <rdfs:subClassOf rdf:resource="#MeasurementParameters" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Time between different measurements</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#MeasurementData">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >MeasurementData represents individual results of a measurement. As the ontology is designed to
  work with D2R it also represents different columns of the database</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="NetworkNode">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData" />
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#NodeMacAddress" />
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="NodePort" />
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData" />
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData" />
      </owl:onProperty>
      <owl:someValuesFrom>
        <owl:Class rdf:about="#nodeName" />
      </owl:someValuesFrom>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:about="#NodeIP" />
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData" />
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>

```

```

<rdfs:subClassOf>
  <owl:Class rdf:about="#NetworkObject" />
</rdfs:subClassOf>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>A point on the network where communications lines interface.
To describe complex nodes such as routers the interface property will represent the multiple
connections the node has and how they are interconnected together</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#StatisticalMeasurement">
  <rdfs:subClassOf rdf:resource="#MeasurementData" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Results from statistical analysis.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="DelayMeasurement">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:hasValue rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl#second" />
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#defaultUnit" />
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#SimpleMeasurement" />
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A measurement of the time required to traverse between two nodes.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="SNMP">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Measurement" />
  </rdfs:subClassOf>
  <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#anyURI"
  >http://ggf.org/ns/nmwg/tools/snmp/2.0</rdfs:isDefinedBy>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >SNMP (Simple Network Management Protocol) information</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#Arguments">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Arguments used to take the measurement</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#MeasurementParameters" />
</owl:Class>
<owl:Class rdf:ID="LatitudeCoordinate">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#NodeInformation" />
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Latitude coordinate where is the object.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="LongitudeCoordinate">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Longitude coordinate where is the object.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#NodeInformation" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Proxy">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#NetworkObject" />
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A server that acts as a go-between for requests from clients seeking resources from other
servers.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="ToolVersion">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="ToolParameters" />
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Version of the tool</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="AsPath">
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://tools.ietf.org/html/draft-ietf-idr-bgp4-21#section-5.1.2</rdfs:seeAlso>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes" />
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

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    >AS_PATH is a well-known mandatory attribute. This attribute identifies the autonomous systems through which routing information carried in this UPDATE message has passed.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="WaitTimeParameter">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Maximum time to wait for reply.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
</owl:Class>
<owl:Class rdf:ID="GenericParameter">
  <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A non specific parameter.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Advertiser">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.ietf.org/rfc/rfc1863.txt#4.1%20ADVERTISER%20Path%20Attribute</rdfs:seeAlso>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >BGP/IDRP Route Server</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="IcmpCode">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="PacketAndTrainProperties"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The ICMP code of the received packet</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="NTP_GPS_Measurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >NTP and GPS measurements some in every node of the ETOMIC system</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#Measurement"/>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="PpsOffset"/>
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#SourceIP"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#SatelliteCountMeasurement"/>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="DagOffset"/>
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="LinkUsageMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The average usage of a link L, Used(L,T,I), is the actual number of bits of a determinate protocol from any source, correctly received over link L during the interval [T, T+I], divided by I.</rdfs:comment>

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<rdf:type>
  <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
</rdf:type>
<rdfs:subClassOf>
  <owl:Class rdf:about="#CapacityMeasurement"/>
</rdfs:subClassOf>
<rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>http://www.rfc-editor.org/rfc/rfc5136.txt</rdfs:seeAlso>
</owl:Class>
<owl:Class rdf:about="http://www.fp7-moment.eu/MomentUnits.owl#Unit"/>
<owl:Class rdf:about="#Measurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Measurement is the class to represent network measurements. A network measurement may measure
multiple metric, like traceroute that measures route and delay.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="NetworkName">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>name of the network where is being measuring.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#GeneralInformation"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#SimpleMeasurement">
  <rdfs:subClassOf rdf:resource="#MeasurementData"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
></rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Duration">
  <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Duration set in advance of the measure.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="P11Parameter">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>StartValue for Kalman filter parameter P11</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
</owl:Class>
<owl:Class rdf:ID="ExporterName">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Name of the exporter</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#GeneralInformation"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="TrainPacketMeasurement">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="PacketIdentifier"/>
      </owl:someValuesFrom>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#PathCapacityMeasurement"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf rdf:resource="#Measurement"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="VarMeasurement"/>
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Obtain available bandwidth and one way delay using packet train information.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Restriction>

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    <owl:someValuesFrom>
      <owl:Class rdf:ID="TrainIdentifier"/>
    </owl:someValuesFrom>
  </owl:onProperty>
  <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
</owl:onProperty>
</owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
    <owl:someValuesFrom>
      <owl:Class rdf:about="#PacketSize"/>
    </owl:someValuesFrom>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
    <owl:someValuesFrom rdf:resource="#MaxMeasurement"/>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
    <owl:someValuesFrom rdf:resource="#MinMeasurement"/>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom>
      <owl:Class rdf:ID="AvailableCapacityMeasurement"/>
    </owl:someValuesFrom>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom>
      <owl:Class rdf:ID="PacketsCount"/>
    </owl:someValuesFrom>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Traceroute">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#PauseParameter"/>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="QueryNumberParameter"/>
      </owl:someValuesFrom>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#WaitTimeParameter"/>
      <owl:onProperty>

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    <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
  </owl:onProperty>
</owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom rdf:resource="#SourceIP"/>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
    <owl:someValuesFrom>
      <owl:Class rdf:about="#FinalTtlMeasurement"/>
    </owl:someValuesFrom>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Traceroute is a network measurement tool to obtain the path between two nodes in a network and
the (one way) delay.</rdfs:comment>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom>
      <owl:Class rdf:ID="HopCountMeasurement"/>
    </owl:someValuesFrom>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom>
      <owl:Class rdf:about="#FirstTtlMeasurement"/>
    </owl:someValuesFrom>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
    <owl:someValuesFrom>
      <owl:Class rdf:about="#RoundTripDelayMeasurement"/>
    </owl:someValuesFrom>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf rdf:resource="#Measurement"/>
<rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#anyURI"
>http://ggf.org/ns/nmwg/tools/traceroute/2.0/</rdfs:isDefinedBy>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom>
      <owl:Class rdf:about="#DestinationIP"/>
    </owl:someValuesFrom>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="Interface">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>One of the interfaces of a Node, usually each of the network adapter of the Node. Each of them
having different addresses.</rdfs:comment>
  <owl:disjointWith rdf:resource="#Path"/>
  <owl:disjointWith>
    <owl:Class rdf:about="#Topology"/>
  </owl:disjointWith>
  <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#anyURI"

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>http://ggf.org/ns/nmwg/topology/2.0#interface</rdfs:isDefinedBy>
<rdfs:subClassOf>
  <owl:Class rdf:about="#NetworkObject"/>
</rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#DestinationMacAddress">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Mac address of the destination node</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:hasValue rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl#hexadecimalMAC"/>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#defaultUnit"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf rdf:resource="#NodeMacAddress"/>
  <rdf:type>
    <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
  </rdf:type>
</owl:Class>
<owl:Class rdf:about="#NodeInformation">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Information about a node or a path of the network.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#MeasurementData"/>
</owl:Class>
<owl:Class rdf:ID="Status">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Special status of a node</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#NodeInformation"/>
</owl:Class>
<owl:Class rdf:ID="OriginatorID">
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.rfc-editor.org/rfc/rfc4456.txt</rdfs:seeAlso>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >ORIGINATOR_ID is a new optional, non-transitive BGP attribute of Type code 9. This attribute
will carry the BGP Identifier of the originator of the route in the local AS</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAtributes"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="PassiveAnomal">
  <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#anyURI"
  >http://ggf.org/ns/nmwg/tools/passiveanomal/2.0/</rdfs:isDefinedBy>
  <rdfs:subClassOf rdf:resource="#Measurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Passive anomal represents pieces of captured traffic which contains anomal data</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="X00Parameter">
  <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >StartValue for Kalman filter parameter x00</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Metric">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Metric individuals represent the thing that is being measuring, and all the different Values
that are necessary to obtain, when the metric is being measuring.</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="http://www.fp7-moment.eu/Units.owl#Unit"/>
<owl:Class rdf:about="#FinalTtlMeasurement">
  <rdf:type>
    <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
  </rdf:type>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >TTL (Time to Live) of the packet at the destination node</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
</owl:Class>
<owl:Class rdf:about="#CapacityMeasurement">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#defaultUnit"/>
      </owl:onProperty>
      <owl:hasValue>
        <owl:Thing rdf:about="http://www.fp7-moment.eu/MomentUnits.owl#bitpersec"/>
      </owl:hasValue>
    </owl:Restriction>
  </rdfs:subClassOf>

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    <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Measurement related with bandwidth. It measures the information pass through a node per unit
of time.</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="DayType">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Indicates the type of day. F if it's holyday or L if it's working day.</rdfs:comment>
    <rdfs:subClassOf>
      <owl:Class rdf:about="#GeneralInformation"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:about="#NetworkObject">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >A object of a Network</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#Measurement"/>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
        </owl:onProperty>
        <owl:someValuesFrom rdf:resource="#Status"/>
      </owl:Restriction>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="As4Path">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >This is an optional transitive attribute that contains the
AS path encoded with 4-octet AS numbers. The AS4_PATH attribute has
the same semantics as the AS_PATH attribute, except that it is
optional transitive, and it carries 4-octet AS numbers</rdfs:comment>
    <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >http://www.armware.dk/RFC/rfc/rfc4893.html</rdfs:seeAlso>
    <rdfs:subClassOf>
      <owl:Class rdf:about="#BGPAttributes"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:about="#PpsOffset">
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#defaultUnit"/>
        </owl:onProperty>
        <owl:hasValue rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl#second"/>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Offset between PPS signal from GPS and NTP clock.</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="StatisticalAnalysis">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Statistical measurements are statistical results derivated from network measurements.
hasMetricAttributes contains the result of the statistical analysis (i.e. mean Value) and
measurementsAnalyzed contains the set of data from where the results are computed.</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#Measurement"/>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:someValuesFrom rdf:resource="#StatisticalMeasurement"/>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#hasMetricAttributes"/>
        </owl:onProperty>
      </owl:Restriction>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="isTTLconstMeasurement">
    <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Boolean measurement indicating if the TTLwas constant during the measurement.</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="GenericEventMeasurement">
    <rdfs:subClassOf>
      <owl:Class rdf:about="#GeneralInformation"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="NlriIp">
    <rdfs:subClassOf>
      <owl:Class rdf:about="#BGPAttributes"/>
    </rdfs:subClassOf>
  </owl:Class>

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</rdfs:subClassOf>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Network Layer Reachability information IP address</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="DestinationPort">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#NodePort" />
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Number of port of the destination node.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="SourcePort">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Number of port of the source node.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#NodePort" />
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#NodeIP">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>IP address of the node</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#AddressMeasurement" />
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#defaultUnit" />
      </owl:onProperty>
      <owl:hasValue rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl#ipv4int" />
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#DagOffset">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#defaultUnit" />
      </owl:onProperty>
      <owl:hasValue rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl#second" />
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf rdf:resource="#SimpleMeasurement" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Offset between system clock (PC) and dag card</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#NodePort">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Port used for the measurement in the Node.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#NodeInformation" />
</owl:Class>
<owl:Class rdf:ID="OneWayDelayMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>A measurement of the time required to traverse one direction between two nodes.

```

RFC2679 defines a "A One-way Delay Metric for IPPM" in Section 3.4 as follows:  
 For a real number  $dT$ ,  $\infty$ ; the \*Type-P-One-way-Delay\* from Src to Dst at T is  $dT$  &lt;&lt; means that Src sent the first bit of a Type-P packet to Dst at wire-time\* T and that Dst received the last bit of that packet at wire-time  $T+dT$ .

&gt;&gt;The \*Type-P-One-way-Delay\* from Src to Dst at T is undefined (informally, infinite) &lt;&lt; means that Src sent the first bit of a Type-P packet to Dst at wire-time T and that Dst did not receive that packet.</rdfs:comment>

```

<rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>RFC2679</rdfs:isDefinedBy>
<rdf:type>
  <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing" />
</rdf:type>
<rdfs:subClassOf rdf:resource="#DelayMeasurement" />
<rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>http://www.ietf.org/rfc/rfc2679.txt</rdfs:seeAlso>
</owl:Class>
<owl:Class rdf:ID="Origin">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>ORIGIN is a well-known mandatory attribute. The ORIGIN attribute is
generated by the speaker that originates the associated routing
information</rdfs:comment>
  <rdfs:subClassOf>

```

```

    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://tools.ietf.org/html/draft-ietf-idr-bgp4-21#section-5.1.1</rdfs:seeAlso>
</owl:Class>
<owl:Class rdf:ID="ClusterList">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >CLUSTER_LIST is a new, optional, non-transitive BGP attribute of Type
  code 10. It is a sequence of CLUSTER_ID values representing the
  reflection path that the route has passed.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.rfc-editor.org/rfc/rfc4456.txt</rdfs:seeAlso>
</owl:Class>
<owl:Class rdf:ID="SequenceIndex">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#GeneralInformation"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="ProbeRateMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Probe rate for the train.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
</owl:Class>
<owl:Class rdf:about="#AvailableCapacityMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Available path capacity is the minimum available link capacity ("tight link") of the links
  along that path.
  AvailCap(P,T,I) = min {1..n} {AvailCap(Ln,T,I)}

```

We define available link capacity as the multiplication of th link capacity with the complement of the link utilization:

```

  AvailCap(L,T,I) = C(L,T,I) * ( 1 - Util(L,T,I) )</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#CapacityMeasurement"/>
  <rdf:type>
    <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
  </rdf:type>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.rfc-editor.org/rfc/rfc5136.txt</rdfs:seeAlso>
</owl:Class>
<owl:Class rdf:ID="NlriMask">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Network Layer Reachability Information subnet IP mask</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#PacketIdentifier">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#PacketAndTrainProperties"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Unique identifier of the packet.</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#TrainIdentifier">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Unique identifier of the train that the packet form part</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#PacketAndTrainProperties"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="P00Parameter">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >StartValue for Kalman filter parameter P00</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
</owl:Class>
<owl:Class rdf:about="#VarMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >variance from a statistical measurement.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#StatisticalMeasurement"/>
</owl:Class>
<owl:Class rdf:about="#DestinationName">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Name or direction of the destination node.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#NodeName"/>

```



```

    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:about="#HopCountMeasurement">
    <rdf:type>
      <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
    </rdf:type>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Number of hops between two different nodes</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
  </owl:Class>
  <owl:Class rdf:ID="X11Parameter">
    <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >StartValue for Kalman filter parameter X11</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="ActiveCentre">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >State wheter observation point is active or not at the current time.</rdfs:comment>
    <rdfs:subClassOf>
      <owl:Class rdf:about="#GeneralInformation"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="StandardDeviationMeasurement">
    <rdfs:subClassOf rdf:resource="#StatisticalMeasurement"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >The standard deviation of the statistical measurement</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:about="#NodeName">
    <rdfs:subClassOf rdf:resource="#NodeInformation"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Name or direction of the node</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="IpIdentifier">
    <rdfs:subClassOf>
      <owl:Class rdf:about="#PacketAndTrainProperties"/>
    </rdfs:subClassOf>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >The IP identifier field from a packet</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:about="#TransferRateMeasurement">
    <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:hasValue rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl#bitpersec"/>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#defaultUnit"/>
        </owl:onProperty>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >The measurement that measured the data information that send or received the node that is
being measured.</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="DiscardsRate">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Rate of discards</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
  </owl:Class>
  <owl:Class rdf:ID="As4Aggregator">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >The AS4_AGGREGATOR
attribute has the same semantics as the AGGREGATOR attribute, except
that it carries a 4-octet AS number</rdfs:comment>
    <rdfs:subClassOf>
      <owl:Class rdf:about="#BGPAttributes"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      ></rdfs:comment>
  </owl:Class>
  <owl:Class rdf:about="#PacketSize">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Size of the packet</rdfs:comment>
    <rdfs:subClassOf>
      <owl:Class rdf:about="#PacketAndTrainProperties"/>
    </rdfs:subClassOf>
  </owl:Class>

```

```

</owl:Class>
<owl:Class rdf:ID="IcmpType">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The ICMP type of the received packet</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#PacketAndTrainProperties"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="GenericInterruptionMeasurement">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#GeneralInformation"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="MeanMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >mean Value from a statistical measurement.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#StatisticalMeasurement"/>
</owl:Class>
<owl:Class rdf:ID="MRTGMeasurement">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#VarMeasurement"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#NetworkName"/>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#MaxMeasurement"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#SamplingRate"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#ExporterName"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="CentreName"/>
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf rdf:resource="#Measurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >MRTG (Multi Router Traffic Grapher) data measured on the acadic Spanish network
  RedIris.</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#Topology">
  <rdfs:subClassOf rdf:resource="#NetworkObject"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Arrangement or mapping of the elements of a network.</rdfs:comment>

```

```

</owl:Class>
<owl:Class rdf:about="#ToolParameters">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The tool used to do the measurement.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
</owl:Class>
<owl:Class rdf:ID="LocalPref">
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://tools.ietf.org/html/draft-ietf-idr-bgp4-21#section-5.1.5</rdfs:seeAlso>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >LOCAL_PREF is a well-known attribute that HAS TO be included in all
  UPDATE messages that a given BGP speaker sends to the other internal
  peers</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="LinkUtilization">
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.rfc-editor.org/rfc/rfc5136.txt</rdfs:seeAlso>
  <rdfs:subClassOf rdf:resource="#CapacityMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >We express usage as a fraction of the overall capacity.
  Util(L,T,I) = ( Used(L,T,I)/C(L,T,I) )
  Thus, the utilization now represents the fraction of the capacity that is being used and is a
  Value between zero (meaning nothing is used) and one (meaning the link is fully saturated).
  Multiplying the utilization by 100 yields the percent utilization of the link</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="MessageType">
  <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Message type indicates the type of a message, like BGP4MP in withdrawn routes of
  RIPE</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="MP_Reach">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >MP_REACH is an optional non-transitive attribute that can be used for the following purposes:

  (a) to advertise a feasible route to a peer

  (b) to permit a router to advertise the Network Layer address of the router that should be
  used as the next hop to the destinations listed in the Network Layer Reachability Information field
  of the MP_NLRI attribute.

  (c) to allow a given router to report some or all of the Subnetwork Points of Attachment
  (SNPAs) that exist within the local system</rdfs:comment>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://ietfreport.isoc.org/idref/rfc2283/</rdfs:seeAlso>
</owl:Class>
<owl:Class rdf:ID="PeerAs">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Autonomous system number of a peer</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="IncomingTransferRateMeasurement">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Data information that has as destination node the node that is being measured per unit of
  time.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#TransferRateMeasurement"/>
</owl:Class>
<owl:Class rdf:about="#FirstTtlMeasurement">
  <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
  <rdfs:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >TTL (Time to Live) of the package in the source node</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#DestinationIP">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >IP address of the destination node</rdfs:comment>
  <rdfs:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>

```

```

    <owl:ObjectProperty rdf:about="#defaultUnit"/>
  </owl:onProperty>
  <owl:hasValue rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl#ipv4int"/>
</owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf rdf:resource="#NodeIP"/>
</owl:Class>
<owl:Class rdf:ID="ErrorsRate">
  <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Rate of errors</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
</owl:Class>
<owl:Class rdf:ID="Community">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#BGPAttributes"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A community is a group of destinations which share some common property</rdfs:comment>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://www.rfc-editor.org/rfc/rfc1997.txt</rdfs:seeAlso>
</owl:Class>
<owl:Class rdf:about="#BGPAttributes">
  <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
</owl:Class>
<owl:Class rdf:about="#CentreName">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Name of the centre (institute, university, ...) where data have been captured.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#GeneralInformation"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#GeneralInformation">
  <rdfs:subClassOf rdf:resource="#MeasurementData"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Information of a centre of measurement like name, direction, telephone ...</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="MOSMeasurement">
  <rdfs:subClassOf rdf:resource="#SimpleMeasurement"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >MOS (Mean Opinion Score) provides a numerical measure of the quality of human speech at the
  destination end of the circuit.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="NextHop">
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://tools.ietf.org/html/draft-ietf-idr-bgp4-21#section-5.1.3</rdfs:seeAlso>
  <rdfs:subClassOf rdf:resource="#BGPAttributes"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The NEXT_HOP is a well-known mandatory attribute that defines the IP address of the router that
  SHOULD be used as the next hop to the destinations listed in the UPDATE message</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="Aggregator">
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://tools.ietf.org/html/draft-ietf-idr-bgp4-21#section-5.1.7</rdfs:seeAlso>
  <rdfs:subClassOf rdf:resource="#BGPAttributes"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >AGGREGATOR is an optional transitive attribute which MAY be included
  in updates which are formed by aggregation</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="AtomicAggregate">
  <rdfs:subClassOf rdf:resource="#BGPAttributes"/>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://tools.ietf.org/html/draft-ietf-idr-bgp4-21#section-5.1.6</rdfs:seeAlso>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >ATOMIC_AGGREGATE is a well-known discretionary attribute.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="CentreIdentifier">
  <rdfs:subClassOf rdf:resource="#GeneralInformation"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Unique Identifier for a centre</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="DPA">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Destination Point Attribute for BGP</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#BGPAttributes"/>
</owl:Class>
<owl:Class rdf:ID="Type">

```

```

    <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
  </owl:Class>
  <owl:Class rdf:ID="TrafficMeasurement">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Measures incoming and outgoing traffic.</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#Measurement"/>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
        </owl:onProperty>
        <owl:someValuesFrom rdf:resource="#IncomingTransferRateMeasurement"/>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#hasMeasurementData"/>
        </owl:onProperty>
        <owl:someValuesFrom rdf:resource="#OutgoingTransferRateMeasurement"/>
      </owl:Restriction>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:about="#QueryNumberParameter">
    <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Number of times to send a query for a given hop</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:about="#PacketAndTrainProperties">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >A packet is a formatted block of data carried over a network.
    A train is a collection of packets.</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#MeasurementParameters"/>
  </owl:Class>
  <owl:Class rdf:about="#RoundTripDelayMeasurement">
    <rdfs:subClassOf rdf:resource="#DelayMeasurement"/>
    <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >RFC2681</rdfs:isDefinedBy>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >INFORMALLY: Time it takes for a packet to reach from a sourceNode to a destinationNode and back
    again.

RFC2681 defines a "Round-trip Delay Metric for IPPM" in Section 2.4 as follows:
  For a real number dT, &gt;&gt;the *Type-P-Round-trip-Delay* from Src to Dst
  at T is dT&lt;&lt; means that Src sent the first bit of a Type-P packet to
  Dst at wire-time* T, that Dst received that packet, then immediately
  sent a Type-P packet back to Src, and that Src received the last bit
  of that packet at wire-time T+dT.

&gt;&gt;The *Type-P-Round-trip-Delay* from Src to Dst at T is undefined
  (informally, infinite)&lt;&lt; means that Src sent the first bit of a
  Type-P packet to Dst at wire-time T and that (either Dst did not
  receive the packet, Dst did not send a Type-P packet in response, or)
  Src did not receive that response packet.

&gt;&gt;The *Type-P-Round-trip-Delay* between Src and Dst at T&lt;&lt; means
  either the *Type-P-Round-trip-Delay* from Src to Dst at T or the
  *Type-P-Round-trip-Delay* from Dst to Src at T. When this notion is
  used, it is understood to be specifically ambiguous which host acts
  as Src and which as Dst. {Comment: This ambiguity will usually be a
  small price to pay for being able to have one measurement, launched
  from either Src or Dst, rather than having two measurements.}</rdfs:comment>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >http://www.ietf.org/rfc/rfc2681.txt</rdfs:seeAlso>
  </owl:Class>
  <owl:Class rdf:about="#SourceMacAddress">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Mac address of the source node</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#NodeMacAddress"/>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:hasValue rdf:resource="http://www.fp7-moment.eu/MomentUnits.owl#hexadecimalMAC"/>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#defaultUnit"/>
        </owl:onProperty>
      </owl:Restriction>
    </rdfs:subClassOf>
  </owl:Class>

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    </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#PacketsCount">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Number of packet in a train.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#PacketAndTrainProperties"/>
</owl:Class>
<owl:Class rdf:ID="MultiExit">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The MULTI_EXIT_DISC is an optional non-transitive attribute which is
  intended to be used on external (inter-AS) links to discriminate
  among multiple exit or entry points to the same neighboring AS</rdfs:comment>
  <rdfs:seeAlso rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://tools.ietf.org/html/draft-ietf-idr-bgp4-21#section-5.1.4</rdfs:seeAlso>
  <rdfs:subClassOf rdf:resource="#BGPAttributes"/>
</owl:Class>
<owl:ObjectProperty rdf:ID="hasNetworkNode">
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#Interface"/>
        <owl:Class rdf:about="#Proxy"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Nodes that are related with the network object</rdfs:comment>
  <rdfs:range rdf:resource="#NetworkNode"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="packetProtocol">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The protocol of the packets used to perform the measurement</rdfs:comment>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#Measurement"/>
        <owl:Class rdf:about="#TrafficMeasurement"/>
        <owl:Class rdf:about="#TrainPacketMeasurement"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#Protocol"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="canBeCalculatedFrom">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Simpler metrics allow to determine complex ones by the combination of their results or adding
  more attributes.</rdfs:comment>
  <rdfs:domain rdf:resource="#Metric"/>
  <rdfs:range rdf:resource="#Metric"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="hasLink">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The Hop or Link between two network nodes</rdfs:comment>
  <rdfs:range rdf:resource="#Link"/>
  <rdfs:domain rdf:resource="#Path"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="DataType">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Form of representation of the data.</rdfs:comment>
  <rdfs:domain rdf:resource="#MeasurementData"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="timestamp">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#Timestamp"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#MRTGMeasurement"/>
        <owl:Class rdf:about="#Measurement"/>
        <owl:Class rdf:about="#TrafficMeasurement"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The time when the measurement was measured on the network</rdfs:comment>
</owl:ObjectProperty>

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<owl:ObjectProperty rdf:ID="isMeasuredIn">
  <rdfs:range>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="http://www.fp7-moment.eu/MomentUnits.owl#Unit"/>
        <owl:Class rdf:about="http://www.fp7-moment.eu/Units.owl/#Unit"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:range>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >The units of measure in which is measured the result.</rdfs:comment>
  <rdfs:domain rdf:resource="#MeasurementData"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="event">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#PassiveAnomal"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="measuresMetric">
  <rdfs:range rdf:resource="#Metric"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Metrics that are measured by a measure .</rdfs:comment>
  <rdfs:domain rdf:resource="#Measurement"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="CreatedTimestamp">
  <rdfs:range rdf:resource="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#Timestamp"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#NetworkNode"/>
        <owl:Class rdf:about="#ToolParameters"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Timestamp with the date of creation.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="measurementsAnalyzed">
  <rdfs:domain rdf:resource="#StatisticalAnalysis"/>
  <rdfs:range rdf:resource="#SimpleMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >The measurements used to perform the statistical analysis</rdfs:comment>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="#hasMetricAttributes">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >The metric attributes relationed with a metric, the individual results of each measurement
    attribute ( column in the database case )</rdfs:comment>
  <rdfs:range rdf:resource="#MeasurementData"/>
  <rdfs:domain rdf:resource="#Metric"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="ModifiedTimestamp">
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#NetworkNode"/>
        <owl:Class rdf:about="#ToolParameters"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Timestamp with the date of the last modification.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.fp7-moment.eu/MomentGeneralConcepts.owl#Timestamp"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="hasSegment">
  <rdfs:range rdf:resource="#Path"/>
  <rdfs:domain rdf:resource="#Topology"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >A topology is composed of any number of segments that should be specified here</rdfs:comment>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="isStatisticalMeasurementOf">
  <rdfs:range rdf:resource="#SimpleMeasurement"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#StatisticalMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >The measure associated with the statistical measurement.</rdfs:comment>
</owl:ObjectProperty>

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<owl:ObjectProperty rdf:about="#hasMeasurementData">
  <rdfs:domain rdf:resource="#Measurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Different data which can be obtained from the measurement. Those Values determine the metrics
  measured and stated in :measuresMetric property</rdfs:comment>
  <rdfs:range rdf:resource="#MeasurementData"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="hasPath">
  <rdfs:range rdf:resource="#Path"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A path is a sequence of Nodes connected with hops or links. The order is not stated because is
  easy to compute given the first and the last node.</rdfs:comment>
  <rdfs:domain rdf:resource="#Traceroute"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="#defaultUnit">
  <rdfs:domain rdf:resource="#MeasurementData"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The default unit is the unit in which a measure should be represented.</rdfs:comment>
  <rdfs:range>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="http://www.fp7-moment.eu/MomentUnits.owl#Unit"/>
        <owl:Class rdf:about="http://www.fp7-moment.eu/Units.owl/#Unit"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:range>
</owl:ObjectProperty>
<owl:DatatypeProperty rdf:ID="index">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >MD:result
  Key for the result if it is numeric.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#Interface"/>
        <owl:Class rdf:about="#MeasurementData"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="OriginValue">
  <rdfs:domain rdf:resource="#Origin"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="StatisticalMeasurementValue">
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:ID="MeasurementDataValue"/>
  </rdfs:subPropertyOf>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="LinkUtilizationValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the fraction of the capacity that is being used.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#double"/>
  <rdfs:domain rdf:resource="#LinkUtilization"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NextHopValue">
  <rdfs:domain rdf:resource="#NextHop"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NodeInformationValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementDataValue"/>
  </rdfs:subPropertyOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Values about a node information.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="TransferRateMeasurementValue">
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:ID="SimpleMeasurementValue"/>
  </rdfs:subPropertyOf>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NodeNameValue">

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<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Name or direction of the node</rdfs:comment>
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
<rdfs:domain rdf:resource="#NodeName"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="StatusValue">
  <rdfs:domain rdf:resource="#Status"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Value of the special status of a node</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="AtomicAggregateValue">
  <rdfs:domain rdf:resource="#AtomicAggregate"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="SourceNameValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Name or direction of the source node.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#SourceName"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NodePortValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Port used for the measurement in the Node.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
  <rdfs:domain rdf:resource="#NodePort"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="MeanMeasurementValue">
  <rdfs:domain rdf:resource="#MeanMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>mean Value from a statistical measurement.</rdfs:comment>
  <rdfs:subPropertyOf rdf:resource="#StatisticalMeasurementValue"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ExporterNameValue">
  <rdfs:domain rdf:resource="#ExporterName"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Name of the exporter. (Uses in DIOR)</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="CommunityValue">
  <rdfs:domain rdf:resource="#Community"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="AggregatorValue">
  <rdfs:domain rdf:resource="#Aggregator"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="PacketIdentifierValue">
  <rdfs:domain rdf:resource="#PacketIdentifier"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Value of the packet's identifier</rdfs:comment>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:ID="PacketAndTrainPropertiesValue"/>
  </rdfs:subPropertyOf>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="SamplingRateValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#SamplingRate"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Defines the number of samples per second taken from a continuous signal to make a discrete
signal</rdfs:comment>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#SimpleMeasurementValue"/>
  </rdfs:subPropertyOf>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="CentreIdentifierValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Unique Identifier for a centre</rdfs:comment>
  <rdfs:domain rdf:resource="#CentreIdentifier"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ResultType">

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<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>Type of result</rdfs:comment>
<rdfs:domain rdf:resource="#GenericSimpleMeasurement" />
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string" />
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty" />
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="SNMPVersion">
  <rdfs:range>
    <owl:DataRange>
      <owl:oneOf rdf:parseType="Resource">
        <rdf:rest rdf:parseType="Resource">
          <rdf:rest rdf:parseType="Resource">
            <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
            >v3</rdf:first>
            <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil" />
          </rdf:rest>
          <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
          >v2</rdf:first>
        </rdf:rest>
        <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >v1</rdf:first>
      </owl:oneOf>
    </owl:DataRange>
  </rdfs:range>
  <rdfs:domain rdf:resource="#SNMP" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  ></rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty" />
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="type">
  <rdfs:domain rdf:resource="#PassiveAnomal" />
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DagOffsetValue">
  <rdfs:domain rdf:resource="#DagOffset" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the offset between system clock (PC) and dag card</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty" />
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementDataValue" />
  </rdfs:subPropertyOf>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ToolVersionValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The version of the tool</rdfs:comment>
  <rdfs:domain rdf:resource="#ToolVersion" />
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string" />
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="id">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty" />
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Measurements: If the measurement has a unique identifier in the data source where it is held,
it should be stated here. This will allow an easier identification of the measurements in their
datasources.</rdfs:comment>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#Measurement" />
        <owl:Class rdf:about="#MeasurementData" />
        <owl:Class rdf:about="#NetworkObject" />
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="FirstTtlMeasurementValue">
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementDataValue" />
  </rdfs:subPropertyOf>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty" />
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the TTL in the source node</rdfs:comment>
  <rdfs:domain rdf:resource="#FirstTtlMeasurement" />
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ClusterListValue">
  <rdfs:domain rdf:resource="#ClusterList" />
</owl:DatatypeProperty>

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<owl:DatatypeProperty rdf:ID="WaitTimeParameterValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value for the maximum time to wait for reply.</rdfs:comment>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:ID="MeasurementParametersValue"/>
  </rdfs:subPropertyOf>
  <rdfs:domain rdf:resource="#WaitTimeParameter"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="PathCapacityMeasurementValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of Capacity</rdfs:comment>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementDataValue"/>
  </rdfs:subPropertyOf>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdfs:domain rdf:resource="#PathCapacityMeasurement"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="PpsOffsetValue">
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementDataValue"/>
  </rdfs:subPropertyOf>
  <rdfs:domain rdf:resource="#PpsOffset"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the offset between PPS signal from GPS and NTP clock</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="GenericInterruptionMeasurementValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#GenericInterruptionMeasurement"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="PacketsCountValue">
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#PacketAndTrainPropertiesValue"/>
  </rdfs:subPropertyOf>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >number of packets in a train.</rdfs:comment>
  <rdfs:domain rdf:resource="#PacketsCount"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NodeMacAddressValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the Mac Address of the node.</rdfs:comment>
  <rdfs:domain rdf:resource="#NodeMacAddress"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DayTypeValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Indicates the type of day. F if it's holyday or L if it's working day.</rdfs:comment>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#DayType"/>
        <owl:Class rdf:about="#MRTGMeasurement"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
  <rdfs:range>
    <owl:DataRange>
      <owl:oneOf rdf:parseType="Resource">
        <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
        >F</rdf:first>
        <rdf:rest rdf:parseType="Resource">
          <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
          <rdf:first rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
          >L</rdf:first>
        </rdf:rest>
      </owl:oneOf>
    </owl:DataRange>
  </rdfs:range>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="IqrIpd">
  <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://ggf.org/ns/nmwg/tools/pinger/2.0</rdfs:isDefinedBy>

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    <rdfs:domain rdf:resource="#PingER"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="MessageTypeValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the type of message</rdfs:comment>
  <rdfs:domain rdf:resource="#MessageType"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NlriIpValue">
  <rdfs:domain rdf:resource="#NlriIp"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the Network Layer Reachability Information Ip address</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="LocalPrefValue">
  <rdfs:domain rdf:resource="#LocalPref"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="AsPathValue">
  <rdfs:domain rdf:resource="#AsPath"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >AsPath value.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="RoundTripDelayMeasurementValue">
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#SimpleMeasurementValue"/>
  </rdfs:subPropertyOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The numerical value related to the round trip delay measurement.</rdfs:comment>
  <rdfs:domain rdf:resource="#RoundTripDelayMeasurement"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="PacketSizeValue">
  <rdfs:domain rdf:resource="#PacketSize"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#PacketAndTrainPropertiesValue"/>
  </rdfs:subPropertyOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Size of the packet.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="OneWayDelayMeasurementValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#OneWayDelayMeasurement"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The numerical value related to the one way delay measurement.</rdfs:comment>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#SimpleMeasurementValue"/>
  </rdfs:subPropertyOf>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ArgumentsValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the arguments.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#Arguments"/>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementParametersValue"/>
  </rdfs:subPropertyOf>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NodeIPValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#NodeIP"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the IP of the Node</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DestinationMacAddressValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:subPropertyOf rdf:resource="#NodeInformationValue"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of Mac Address in the destination node</rdfs:comment>
  <rdfs:domain rdf:resource="#DestinationMacAddress"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="description">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

```

>Description of the concept, process, etc used.

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A textual, human-readable description which defines the concept.</rdfs:comment>
<rdfs:domain>
  <owl:Class>
    <owl:unionOf rdf:parseType="Collection">
      <owl:Class rdf:about="#Measurement"/>
      <owl:Class rdf:about="#NetworkObject"/>
      <owl:Class rdf:about="#ToolParameters"/>
    </owl:unionOf>
  </owl:Class>
</rdfs:domain>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="HopCountMeasurementValue">
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementDataValue"/>
  </rdfs:subPropertyOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Number of hop between two different nodes</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#HopCountMeasurement"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="TimeValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#Time"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:about="#PacketAndTrainPropertiesValue">
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementDataValue"/>
  </rdfs:subPropertyOf>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ExtendedCommunitiesValue">
  <rdfs:domain rdf:resource="#ExtendedCommunities"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="FinalTtlMeasurementValue">
  <rdfs:domain rdf:resource="#FinalTtlMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the TTL in the destination node</rdfs:comment>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementDataValue"/>
  </rdfs:subPropertyOf>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="SatelliteCountMeasurementValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#SimpleMeasurementValue"/>
  </rdfs:subPropertyOf>
  <rdfs:domain rdf:resource="#SatelliteCountMeasurement"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="Name">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >MD:Result :
Key for the result if it is a string</rdfs:comment>
<rdfs:domain>
  <owl:Class>
    <owl:unionOf rdf:parseType="Collection">
      <owl:Class rdf:about="#GenericParameter"/>
      <owl:Class rdf:about="#GenericSimpleMeasurement"/>
      <owl:Class rdf:about="#NetworkObject"/>
      <owl:Class rdf:about="#SNMP"/>
      <owl:Class rdf:about="#ToolParameters"/>
    </owl:unionOf>
  </owl:Class>
</rdfs:domain>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="SourceMacAddressValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of Mac address in the source node.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#SourceMacAddress"/>
  <rdfs:subPropertyOf rdf:resource="#NodeInformationValue"/>

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</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="TrainIdentifierValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Unique identifier of the train that the packet form part</rdfs:comment>
  <rdfs:subPropertyOf rdf:resource="#PacketAndTrainPropertiesValue"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#TrainIdentifier"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="MaxMeasurementValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#MaxMeasurement"/>
  <rdfs:subPropertyOf rdf:resource="#StatisticalMeasurementValue"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:about="#MeasurementDataValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The value related to a measurement. Should be the property of a MeasurementData (or one of its
  subclasses) instance and other details as unit and datatype should be present</rdfs:comment>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#GenericSimpleMeasurement"/>
        <owl:Class rdf:about="#MeasurementData"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="needsSelector">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Indicate if it need a selector (True) or not (False)</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#GenericSimpleMeasurement"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="SNMPCommunity">
  <rdfs:domain rdf:resource="#SNMP"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="seqNum">
  <rdfs:domain rdf:resource="#PingER"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="MinMeasurementValue">
  <rdfs:subPropertyOf rdf:resource="#StatisticalMeasurementValue"/>
  <rdfs:domain rdf:resource="#MinMeasurement"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="P11ParameterValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of P11 parameter</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementParametersValue"/>
  </rdfs:subPropertyOf>
  <rdfs:domain rdf:resource="#P11Parameter"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="CapacityMeasurementValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#double"/>
  <rdfs:domain rdf:resource="#CapacityMeasurement"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ClusterIDValue">
  <rdfs:domain rdf:resource="#ClusterID"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="LongitudeCoordinateValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Longitude coordinate where the object is.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#LongitudeCoordinate"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="IpIdentifierValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the IP identifier field from received packet</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:domain rdf:resource="#IpIdentifier"/>
</owl:DatatypeProperty>

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<owl:DatatypeProperty rdf:ID="PathUsageMeasurementValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of throughput</rdfs:comment>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#SimpleMeasurementValue"/>
  </rdfs:subPropertyOf>
  <rdfs:domain rdf:resource="#LinkUsageMeasurement"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ActiveCentreValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
  <rdfs:domain rdf:resource="#ActiveCentre"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >State wheter observation point is active or not at the current time.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="P00ParameterValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of P00 parameter.</rdfs:comment>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementParametersValue"/>
  </rdfs:subPropertyOf>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdfs:domain rdf:resource="#P00Parameter"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DestinationPortValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Number of the destination port in a network conexion.</rdfs:comment>
  <rdfs:subPropertyOf rdf:resource="#NodeInformationValue"/>
  <rdfs:domain rdf:resource="#DestinationPort"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:about="#SimpleMeasurementValue">
  <rdfs:subPropertyOf rdf:resource="#MeasurementDataValue"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="Startum">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  ></rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdfs:domain rdf:resource="#NetworkNode"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="X11ParameterValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of X11 parameter.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementParametersValue"/>
  </rdfs:subPropertyOf>
  <rdfs:domain rdf:resource="#X11Parameter"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="authrealm">
  <rdfs:domain rdf:resource="#Interface"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="LatitudeCoordinateValue">
  <rdfs:domain rdf:resource="#LatitudeCoordinate"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Latitude coordinate where the object is.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="AdvertiserValue">
  <rdfs:domain rdf:resource="#Advertiser"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="classOfService">
  <rdfs:domain rdf:resource="#Interface"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >a 3 bit field within an Ethernet frame header when using 802.1Q tagging</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NlriMaskValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#NlriMask"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Network Layer Reachability Information mask</rdfs:comment>

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</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="isToolResult">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Indicate if the result was generated by a tool (True) or not (False)</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#GenericSimpleMeasurement"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="PacketLossMeasurementValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdfs:subPropertyOf rdf:resource="#SimpleMeasurementValue"/>
  <rdfs:domain rdf:resource="#PacketLossMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the percentage of losing packets.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="MultiExitValue">
  <rdfs:domain rdf:resource="#MultiExit"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="IcmpCodeValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the ICMP code of the received packet.</rdfs:comment>
  <rdfs:domain rdf:resource="#IcmpCode"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DPValue">
  <rdfs:domain rdf:resource="#DPA"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="clp">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Count of packet lost</rdfs:comment>
  <rdfs:domain rdf:resource="#PingER"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:isDefinedBy rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >http://ggf.org/ns/nmwg/tools/pinger/2.0</rdfs:isDefinedBy>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="IcmpTypeValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the ICMP type of the received packet</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdfs:domain rdf:resource="#IcmpType"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DelayVariationMeasurementValue">
  <rdfs:subPropertyOf rdf:resource="#MeasurementDataValue"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#DelayVariationMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the delay variation</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="seqIndex">
  <rdfs:domain rdf:resource="#Ping"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="isTTLconstMeasurementValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Is Value is True if is constant or False if not</rdfs:comment>
  <rdfs:domain rdf:resource="#isTTLconstMeasurement"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DestinationIPValue">
  <rdfs:subPropertyOf rdf:resource="#NodeInformationValue"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >IP of the destination node.</rdfs:comment>
  <rdfs:domain rdf:resource="#DestinationIP"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="VarMeasurementValue">
  <rdfs:subPropertyOf rdf:resource="#StatisticalMeasurementValue"/>
  <rdfs:domain rdf:resource="#VarMeasurement"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >variance from a statistical measurement.</rdfs:comment>

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</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="SequenceIndexValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
  <rdfs:domain rdf:resource="#SequenceIndex"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="AvailableCapacityMeasurementValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdfs:domain rdf:resource="#AvailableCapacityMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Bandwidth's Value</rdfs:comment>
  <rdfs:subPropertyOf rdf:resource="#SimpleMeasurementValue"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="CentreNameValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:domain rdf:resource="#CentreName"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Name of the centre (institute, university, ...) where data have been captured.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="SourceIPValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#SourceIP"/>
  <rdfs:subPropertyOf rdf:resource="#NodeInformationValue"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of the IP of the source node</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="MP_ReachValue">
  <rdfs:domain rdf:resource="#MP_Reach"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ErrorsRateValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
  <rdfs:domain rdf:resource="#ErrorsRate"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Number of errors per second</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="QueryNumberParameterValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Number of times to send a query for a given hop</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#QueryNumberParameter"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="X00ParameterValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of X00 parameter.</rdfs:comment>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementParametersValue"/>
  </rdfs:subPropertyOf>
  <rdfs:domain rdf:resource="#X00Parameter"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="NetworkNameValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:domain rdf:resource="#NetworkName"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >name of the network where is being measuring. (uses in DIOR)</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="isRequired">
  <rdfs:domain rdf:resource="#MeasurementParameters"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Indicate if a parameter is required (True) or optional (False)</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="HurstParameterMeasurementValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#HurstParameterMeasurement"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#float"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="GenericEventMeasurementValue">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#GenericEventMeasurement"/>
</owl:DatatypeProperty>

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<owl:DatatypeProperty rdf:ID="TOS">
  <rdfs:domain rdf:resource="#Ping"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Type of Service</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="As4PathValue">
  <rdfs:domain rdf:resource="#As4Path"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="Alias">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >SNMP Alias</rdfs:comment>
  <rdfs:domain rdf:resource="#SNMP"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="ProbeRateMeasurementValue">
  <rdfs:subPropertyOf rdf:resource="#SimpleMeasurementValue"/>
  <rdfs:domain rdf:resource="#ProbeRateMeasurement"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="PauseParameterValue">
  <rdfs:domain rdf:resource="#PauseParameter"/>
  <rdfs:subPropertyOf>
    <owl:DatatypeProperty rdf:about="#MeasurementParametersValue"/>
  </rdfs:subPropertyOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Time between different measurements</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="MOSMeasurementValue">
  <rdfs:subPropertyOf rdf:resource="#SimpleMeasurementValue"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#MOSMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of MOS.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="hostName">
  <rdfs:domain rdf:resource="#Interface"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="OID">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#SNMP"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Object identifier for SNMP Values</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DurationValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Value of duration set in advance of the measure.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#Duration"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="PeerAsValue">
  <rdfs:domain rdf:resource="#PeerAs"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Autonomous system number of a peer</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="isConditionable">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Indicate if it is containable (True) or not (False)</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#GenericSimpleMeasurement"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="IncomingTransferRateMeasurementValue">
  <rdfs:domain rdf:resource="#IncomingTransferRateMeasurement"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdfs:subPropertyOf rdf:resource="#TransferRateMeasurementValue"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Information per time that comes to the measured node.</rdfs:comment>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="DestinationNameValue">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

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>Name or direction of the destination node.</rdfs:comment>
<rdfs:domain rdf:resource="#DestinationName"/>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="direction">
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#Interface"/>
        <owl:Class rdf:about="#MRTGMeasurement"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="As4AggregatorValue">
  <rdfs:domain rdf:resource="#As4Aggregator"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="deadline">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >the point in time at which something has to be completed</rdfs:comment>
  <rdfs:domain rdf:resource="#Ping"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="SourcePortValue">
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="#SourcePort"/>
  <rdfs:subPropertyOf rdf:resource="#NodeInformationValue"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="MP_UnreachValue">
  <rdfs:domain rdf:resource="#MP_Unreach"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="OriginatorIDValue">
  <rdfs:domain rdf:resource="#OriginatorID"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="capacity">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The interface capacity in MBytes/sec</rdfs:comment>
  <rdfs:domain rdf:resource="#Interface"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="OutgoingTransferRateMeasurementValue">
  <rdfs:domain rdf:resource="#OutgoingTransferRateMeasurement"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Information per time that go out from the measured node.</rdfs:comment>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#decimal"/>
  <rdfs:subPropertyOf rdf:resource="#TransferRateMeasurementValue"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:about="#MeasurementParametersValue">
  <rdfs:domain rdf:resource="#GenericParameter"/>
  <rdfs:subPropertyOf rdf:resource="#MeasurementDataValue"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
</owl:DatatypeProperty>
<owl:Thing rdf:ID="AvailableBandwidthMetric">
  <rdf:type rdf:resource="#Metric"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >AvailableBandwidth</rdfs:label>
  <MD:hasMetricAttributes rdf:resource="#AvailableCapacityMeasurement"/>
  <MD:hasMetricAttributes rdf:resource="#SourceIP"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Bandwidth that is not use.</rdfs:comment>
</owl:Thing>
<owl:AnnotationProperty rdf:about="http://purl.org/dc/elements/1.1/creator"/>
<MD:Metric rdf:ID="ThroughputMetric">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <MD:hasMetricAttributes rdf:resource="#DestinationIP"/>
  <MD:hasMetricAttributes rdf:resource="#LinkUsageMeasurement"/>
  <MD:hasMetricAttributes rdf:resource="#SourceIP"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Average rate of successful message delivery over a net connection</rdfs:comment>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Throughput</rdfs:label>
</MD:Metric>
<MD:Metric rdf:ID="RouteMetric">
  <MD:hasMetricAttributes rdf:resource="#FinalTtlMeasurement"/>
  <MD:hasMetricAttributes rdf:resource="#DestinationIP"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Route</rdfs:label>

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<MD:hasMetricAttributes rdf:resource="#FirstTtlMeasurement"/>
<MD:canBeCalculatedFrom>
  <MD:Metric rdf:ID="HopMetric">
    <MD:hasMetricAttributes rdf:resource="#DestinationIP"/>
    <MD:hasMetricAttributes rdf:resource="#DestinationMacAddress"/>
    <MD:hasMetricAttributes rdf:resource="#SourceIP"/>
    <MD:hasMetricAttributes rdf:resource="#SourceMacAddress"/>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >HopMetric</rdfs:label>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Two neighboring nodes</rdfs:comment>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  </MD:Metric>
</MD:canBeCalculatedFrom>
<MD:hasMetricAttributes rdf:resource="#HopCountMeasurement"/>
<rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
<MD:hasMetricAttributes rdf:resource="#SourceMacAddress"/>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
  >Path that follows a package from the source node to the destination node</rdfs:comment>
<MD:hasMetricAttributes rdf:resource="#SourceIP"/>
<MD:hasMetricAttributes rdf:resource="#DestinationMacAddress"/>
</MD:Metric>
<MD:Metric rdf:ID="MOSMetric">
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >MOS</rdfs:label>
  <MD:hasMetricAttributes rdf:resource="#DestinationIP"/>
  <MD:hasMetricAttributes rdf:resource="#MOSMeasurement"/>
  <MD:hasMetricAttributes rdf:resource="#SourceIP"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >MOS (Mean Opinion Score) provides a numerical measure of the quality of human speech at the
    destination end of the circuit.</rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
</MD:Metric>
<owl:Thing rdf:ID="PathCapacityMetric">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >The path capacity of a determinate protocol is the smallest link capacity of the links that
    make up the path.
    We define the link capacity,  $C(L,T,I)$ , to be the maximum number of bits of a determinate protocol
    that can be transmitted from the source and correctly received by the destination over the link L
    during the interval  $[T, T+I]$ , divided by I.</rdfs:comment>
  <MD:hasMetricAttributes rdf:resource="#DestinationIP"/>
  <MD:hasMetricAttributes rdf:resource="#PathCapacityMeasurement"/>
  <MD:hasMetricAttributes rdf:resource="#SourceIP"/>
  <rdf:type rdf:resource="#Metric"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Capacity</rdfs:label>
</owl:Thing>
<MD:Metric rdf:ID="PacketLossMetric">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Percentage of losing packets along the data path.</rdfs:comment>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >PacketLoss</rdfs:label>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <MD:hasMetricAttributes rdf:resource="#DestinationIP"/>
  <MD:hasMetricAttributes rdf:resource="#PacketLossMeasurement"/>
  <MD:hasMetricAttributes rdf:resource="#SourceIP"/>
</MD:Metric>
<MD:Metric rdf:ID="ErrorMetric">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <MD:hasMetricAttributes rdf:resource="#ErrorsRate"/>
  <MD:hasMetricAttributes>
    <owl:Thing rdf:ID="NodeIp"/>
  </MD:hasMetricAttributes>
</MD:Metric>
<MD:Metric rdf:ID="DelayVariationMetric">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <MD:canBeCalculatedFrom>
    <owl:Thing rdf:ID="OneWayDelayMetric">
      <MD:hasMetricAttributes rdf:resource="#DestinationIP"/>
      <MD:hasMetricAttributes rdf:resource="#OneWayDelayMeasurement"/>
      <MD:hasMetricAttributes rdf:resource="#SourceIP"/>
      <MD:canBeCalculatedFrom rdf:resource="#DelayVariationMetric"/>
      <rdf:type rdf:resource="#Metric"/>
      <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
        >OneTripDelay</rdfs:label>
      <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
        >Time it takes for a packet to reach from the sourceNode to the
        destinationNode.</rdfs:comment>
    </owl:Thing>
  </MD:canBeCalculatedFrom>

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    </owl:Thing>
  </MD:canBeCalculatedFrom>
  <MD:canBeCalculatedFrom>
    <MD:Metric rdf:ID="RoundTripDelayMetric">
      <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
      <MD:canBeCalculatedFrom rdf:resource="#DelayVariationMetric"/>
      <MD:hasMetricAttributes rdf:resource="#DestinationIP"/>
      <MD:hasMetricAttributes rdf:resource="#RoundTripDelayMeasurement"/>
      <MD:hasMetricAttributes rdf:resource="#SourceIP"/>
      <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
        >RoundTripDelay</rdfs:label>
      <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
        >Time it takes for a packet to reach from a sourceNode to a destinationNode and back
again.</rdfs:comment>
    </MD:Metric>
  </MD:canBeCalculatedFrom>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >The variability over time of the packet latency across a network.</rdfs:comment>
  <MD:hasMetricAttributes rdf:resource="#DelayVariationMeasurement"/>
  <MD:hasMetricAttributes rdf:resource="#DestinationIP"/>
  <MD:hasMetricAttributes rdf:resource="#SourceIP"/>
  <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >DelayVariation</rdfs:label>
</MD:Metric>
</rdf:RDF>

```

## A.1.5 Anonymization ontology

```

<?xml version="1.0"?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:protege="http://protege.stanford.edu/plugins/owl/protege#"
  xmlns:xsp="http://www.owl-ontologies.com/2005/08/07/xsp.owl#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:owl2xml="http://www.w3.org/2006/12/owl2-xml#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:swrl="http://www.w3.org/2003/11/swrl#"
  xmlns:anonymization="http://www.fp7-moment.eu/anonymization.owl#"
  xmlns:swrlb="http://www.w3.org/2003/11/swrlb#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xml:base="http://www.fp7-moment.eu/anonymization.owl">
  <owl:Ontology rdf:about="">
    <dc:publisher rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >MOMENT FP7 EU project</dc:publisher>
    <dc:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Vincenzo Failla</dc:contributor>
    <dc:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Nicola Blefari-Melazzi</dc:contributor>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >This is a model to support anonymization and obfuscation of Internet traffic
measurements</rdfs:comment>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Giuseppe Tropea</dc:creator>
  </owl:Ontology>
  <owl:Class rdf:ID="StringScrambleBackend">
    <rdfs:subClassOf>
      <owl:Class rdf:ID="AlgorithmicBackends"/>
    </rdfs:subClassOf>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Substitute characters with other characters</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="PRISM_ANONYMIZATIONBACKEND">
    <rdfs:subClassOf>
      <owl:Class rdf:ID="ExternalBackends"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="StrongObfuscationBackend">
    <rdfs:subClassOf>
      <owl:Class rdf:ID="AnonymizationBackend"/>
    </rdfs:subClassOf>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >This backend is configured so that all of its targets are completely randomized.</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:ID="LightObfuscationBackend">
    <rdfs:subClassOf>

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    <owl:Class rdf:about="#AnonymizationBackend"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >This backend is configured so that it tries to preserve structure of data as much as possible,
  by using byte masks to preserve prefixes when randomizing data or by offsetting data. Payloads, if
  present, are MD5 hashed.</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="MeasurementSetScope">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="PrivacyScope"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="LATITUDE_ANONYMIZATIONTARGET">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="AnonymizationTarget"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Geographic information about latitude of the data generator or the information
  piece</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="AnonymizationStrategy">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The strategy is a link between a set of anonymization targets and the backend to use in order
  to anonymize them</rdfs:comment>
  <owl:equivalentClass>
    <owl:Class>
      <owl:intersectionOf rdf:parseType="Collection">
        <owl:Restriction>
          <owl:allValuesFrom>
            <owl:Class rdf:about="#AnonymizationBackend"/>
          </owl:allValuesFrom>
          <owl:onProperty>
            <owl:ObjectProperty rdf:ID="hasAnonymizationBackend"/>
          </owl:onProperty>
        </owl:Restriction>
        <owl:Restriction>
          <owl:onProperty>
            <owl:ObjectProperty rdf:about="#hasAnonymizationBackend"/>
          </owl:onProperty>
          <owl:someValuesFrom>
            <owl:Class rdf:about="#AnonymizationBackend"/>
          </owl:someValuesFrom>
        </owl:Restriction>
        <owl:Restriction>
          <owl:onProperty>
            <owl:ObjectProperty rdf:ID="hasAnonymizationTarget"/>
          </owl:onProperty>
          <owl:allValuesFrom>
            <owl:Class rdf:about="#AnonymizationTarget"/>
          </owl:allValuesFrom>
        </owl:Restriction>
        <owl:Restriction>
          <owl:onProperty>
            <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
          </owl:onProperty>
          <owl:someValuesFrom>
            <owl:Class rdf:about="#AnonymizationTarget"/>
          </owl:someValuesFrom>
        </owl:Restriction>
      </owl:intersectionOf>
    </owl:Class>
  </owl:equivalentClass>
</owl:Class>
<owl:Class rdf:ID="PolicyObject">
  <owl:equivalentClass>
    <owl:Class>
      <owl:intersectionOf rdf:parseType="Collection">
        <owl:Restriction>
          <owl:onProperty>
            <owl:ObjectProperty rdf:ID="isValidForUsagePurpose"/>
          </owl:onProperty>
          <owl:someValuesFrom>
            <owl:Class rdf:ID="UsagePurpose"/>
          </owl:someValuesFrom>
        </owl:Restriction>
        <owl:Restriction>
          <owl:someValuesFrom>
            <owl:Class rdf:ID="UserRole"/>
          </owl:someValuesFrom>
        </owl:Restriction>
      </owl:intersectionOf>
    </owl:Class>
  </owl:equivalentClass>

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        </owl:someValuesFrom>
        <owl:onProperty>
          <owl:ObjectProperty rdf:ID="isValidForUserRole"/>
        </owl:onProperty>
      </owl:Restriction>
    </owl:intersectionOf>
  </owl:Class>
</owl:equivalentClass>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>N-ary relation between the user context. i.e.: the UserRole and UsagePurpose, and the
obfuscation strategy to be used when a user with such a role and such a usage purpose is requesting
the data</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="PAYLOADS_ANONYMIZATIONTARGET">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Extra information carried inside the data traces not related to the measurement
itself</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#AnonymizationTarget"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="AAPI_ANONYMIZATIONBACKEND">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#ExternalBackends"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="MeasurementScope">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#PrivacyScope"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="BRO_ANONYMIZATIONBACKEND">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#ExternalBackends"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="BUSINESS_USERROLE">
  <rdfs:subClassOf rdf:resource="#UserRole"/>
</owl:Class>
<owl:Class rdf:ID="RESEARCHER_USERROLE">
  <rdfs:subClassOf rdf:resource="#UserRole"/>
</owl:Class>
<owl:Class rdf:ID="NetworkAnalysisPolicies">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="StrongStrategies"/>
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:ID="hasAnonymizationStrategy"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <owl:equivalentClass>
    <owl:Class>
      <owl:intersectionOf rdf:parseType="Collection">
        <owl:Class rdf:ID="BusinessPolicies"/>
        <owl:Restriction>
          <owl:onProperty>
            <owl:ObjectProperty rdf:about="#isValidForUsagePurpose"/>
          </owl:onProperty>
          <owl:someValuesFrom>
            <owl:Class>
              <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:ID="NETWORK_PERFORMANCE_USAGEPURPOSE"/>
                <owl:Class rdf:ID="NETWORK_TOMOGRAPHY_USAGEPURPOSE"/>
              </owl:unionOf>
            </owl:Class>
          </owl:someValuesFrom>
        </owl:Restriction>
      </owl:intersectionOf>
    </owl:Class>
  </owl:equivalentClass>
</owl:Class>
<owl:Class rdf:ID="DEANONYMIZATION_USAGEPURPOSE">
  <rdfs:subClassOf rdf:resource="#UsagePurpose"/>
</owl:Class>
<owl:Class rdf:ID="StrongAgeingPrivacy">

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<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom>
      <owl:Class rdf:ID="DATE_ANONYMIZATIONTARGET"/>
    </owl:someValuesFrom>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Class rdf:about="#StrongStrategies"/>
</rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="STUDY_HOST_CHARACTERISTICS">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="CLASSIFY_TRAFFIC_USAGEPURPOSE"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="DataAge">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Represents the aging of the data collection. This class is covered by a value partition that
    covers all possible semantic values of data aging.</rdfs:comment>
  <owl:equivalentClass>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <owl:Class rdf:ID="NEW_DATAAGE"/>
        <owl:Class rdf:ID="OLD_DATAAGE"/>
        <owl:Class rdf:ID="RECENT_DATAAGE"/>
        <owl:Class rdf:ID="UNINFLUENTIAL_DATAAGE"/>
      </owl:unionOf>
    </owl:Class>
  </owl:equivalentClass>
</owl:Class>
<owl:Class rdf:ID="PACKET_TIMESTAMPS_ANONYMIZATIONTARGET">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#AnonymizationTarget"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Timing information associated with the data trace</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="MediumObfuscationBackend">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >This backend is configured so as to employ perturbation algorithms on the privacy data.
    Payloads, if present, are MD5 hashed.</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#AnonymizationBackend"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="NO_PROFIT_USERROLE">
  <rdfs:subClassOf rdf:resource="#UserRole"/>
</owl:Class>
<owl:Class rdf:ID="ALL_USERROLE">
  <rdfs:subClassOf rdf:resource="#UserRole"/>
</owl:Class>
<owl:Class rdf:ID="BIT_FIELD_ANONYMIZATIONTARGET">
  <rdfs:subClassOf>
    <owl:Class rdf:ID="GENERIC_ANONYMIZATIONTARGET"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="http://www.w3.org/2002/07/owl#Thing"/>
<owl:Class rdf:about="#BusinessPolicies">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
    >Policies related to profit users</rdfs:comment>
  <owl:equivalentClass>
    <owl:Class>
      <owl:intersectionOf rdf:parseType="Collection">
        <owl:Restriction>
          <owl:onProperty>
            <owl:ObjectProperty rdf:about="#isValidForUserRole"/>
          </owl:onProperty>
          <owl:someValuesFrom>
            <owl:Class>
              <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#BUSINESS_USERROLE"/>
                <owl:Class rdf:ID="NETWORK_OPERATOR_USERROLE"/>
                <owl:Class rdf:ID="NETWORK_PROVIDER_USERROLE"/>
              </owl:unionOf>
            </owl:Class>
          </owl:someValuesFrom>
        </owl:Restriction>
      </owl:intersectionOf>
    </owl:Class>
  </owl:equivalentClass>

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        </owl:Class>
        </owl:someValuesFrom>
    </owl:Restriction>
    <owl:Class rdf:about="#PolicyObject"/>
</owl:intersectionOf>
</owl:Class>
</owl:equivalentClass>
</owl:Class>
<owl:Class rdf:ID="LONGITUDE_ANONYMIZATIONTARGET">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Geographic information about longitude of the data generator or the information
piece</rdfs:comment>
    <rdfs:subClassOf>
        <owl:Class rdf:about="#AnonymizationTarget"/>
    </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="LightAgeingPrivacy">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Age of data is taken into account</rdfs:comment>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty>
                <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
            </owl:onProperty>
            <owl:someValuesFrom>
                <owl:Class rdf:about="#DATE_ANONYMIZATIONTARGET"/>
            </owl:someValuesFrom>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Class rdf:ID="LightStrategies"/>
    </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="RESPONSIVENESS_USAGEPURPOSE">
    <rdfs:subClassOf>
        <owl:Class rdf:about="#NETWORK_PERFORMANCE_USAGEPURPOSE"/>
    </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#NETWORK_OPERATOR_USERROLE">
    <rdfs:subClassOf rdf:resource="#UserRole"/>
</owl:Class>
<owl:Class rdf:ID="MarketingPolicies">
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty>
                <owl:ObjectProperty rdf:about="#hasAnonymizationStrategy"/>
            </owl:onProperty>
            <owl:someValuesFrom>
                <owl:Class rdf:ID="LightFullPrivacy"/>
            </owl:someValuesFrom>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >Gather and analyze traffic measurements in order to understand trends in market</rdfs:comment>
    <owl:equivalentClass>
        <owl:Class>
            <owl:intersectionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#BusinessPolicies"/>
                <owl:Restriction>
                    <owl:onProperty>
                        <owl:ObjectProperty rdf:about="#isValidForUsagePurpose"/>
                    </owl:onProperty>
                    <owl:someValuesFrom>
                        <owl:Class>
                            <owl:unionOf rdf:parseType="Collection">
                                <owl:Class rdf:about="#CLASSIFY_TRAFFIC_USAGEPURPOSE"/>
                                <owl:Class rdf:ID="AGGREGATE_TRAFFIC_TYPES"/>
                            </owl:unionOf>
                        </owl:Class>
                    </owl:someValuesFrom>
                </owl:Restriction>
            </owl:intersectionOf>
        </owl:Class>
    </owl:equivalentClass>
</owl:Class>
<owl:Class rdf:about="#CLASSIFY_TRAFFIC_USAGEPURPOSE">
    <rdfs:subClassOf rdf:resource="#UsagePurpose"/>
</owl:Class>

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<owl:Class rdf:ID="StrongFullPrivacy">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
      </owl:onProperty>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="IDENTIFIER_ANONYMIZATIONTARGET"/>
      </owl:someValuesFrom>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="PORT_ANONYMIZATIONTARGET"/>
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#PAYLOADS_ANONYMIZATIONTARGET"/>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#LONGITUDE_ANONYMIZATIONTARGET"/>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#LATITUDE_ANONYMIZATIONTARGET"/>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#PACKET_TIMESTAMPS_ANONYMIZATIONTARGET"/>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >All privacy indicators affected</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#AGGREGATE_TRAFFIC_TYPES">
  <rdfs:subClassOf rdf:resource="#CLASSIFY_TRAFFIC_USAGEPURPOSE"/>
  <owl:disjointWith rdf:resource="#STUDY_HOST_CHARACTERISTICS"/>
</owl:Class>
<owl:Class rdf:ID="ADDRESSES_ANONYMIZATIONTARGET">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#AnonymizationTarget"/>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >An identifier of a node in the space of network addresses. Generally an IP
address</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="RESEARCH_UNIT_MEMBER">
  <rdfs:subClassOf rdf:resource="#RESEARCHER_USERROLE"/>
</owl:Class>
<owl:Class rdf:about="#AnonymizationBackend">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The software/configuration algorithms used to perform the real obfuscation of
data</rdfs:comment>

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</owl:Class>
<owl:Class rdf:ID="RandomizeBackend">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Randomize the bytes representing the data value, preserving some of them via a byte
mask</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Class rdf:about="#AlgorithmicBackends"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="TCPDPRIV_ANONYMIZATIONBACKEND">
  <rdfs:subClassOf>
    <owl:Class rdf:about="#ExternalBackends"/>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="NoProfitPolicies">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationStrategy"/>
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#LightAgeingPrivacy"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Policies related to non-profit users</rdfs:comment>
  <owl:equivalentClass>
    <owl:Class>
      <owl:intersectionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#PolicyObject"/>
        <owl:Restriction>
          <owl:someValuesFrom>
            <owl:Class>
              <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#RESEARCHER_USERROLE"/>
                <owl:Class rdf:about="#NO_PROFIT_USERROLE"/>
              </owl:unionOf>
            </owl:Class>
          </owl:someValuesFrom>
        </owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#isValidForUserRole"/>
        </owl:onProperty>
      </owl:intersectionOf>
    </owl:Class>
  </owl:equivalentClass>
</owl:Class>
<owl:Class rdf:ID="SelfDefencePolicies">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom>
        <owl:Class rdf:ID="SecurityStrategy"/>
      </owl:someValuesFrom>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationStrategy"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <owl:equivalentClass>
    <owl:Class>
      <owl:intersectionOf rdf:parseType="Collection">
        <owl:Class rdf:about="#BusinessPolicies"/>
        <owl:Restriction>
          <owl:someValuesFrom>
            <owl:Class rdf:ID="INFERRING_SECURITY_ATTACKS_USAGEPURPOSE"/>
          </owl:someValuesFrom>
          <owl:onProperty>
            <owl:ObjectProperty rdf:about="#isValidForUsagePurpose"/>
          </owl:onProperty>
        </owl:Restriction>
      </owl:intersectionOf>
    </owl:Class>
  </owl:equivalentClass>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Analysis of traffic data in order to detect intrusions and attacks to own private
network</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#IDENTIFIER_ANONYMIZATIONTARGET">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"

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    >Unique ID of a piece of information</rdfs:comment>
    <rdfs:subClassOf>
      <owl:Class rdf:about="#AnonymizationTarget"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:ID="TEXT_ANONYMIZATIONTARGET">
    <rdfs:subClassOf>
      <owl:Class rdf:about="#GENERIC_ANONYMIZATIONTARGET"/>
    </rdfs:subClassOf>
  </owl:Class>
  <owl:Class rdf:about="#AnonymizationTarget">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >The taxonomy of possible data fields to obfuscate</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:about="#GENERIC_ANONYMIZATIONTARGET">
    <rdfs:subClassOf rdf:resource="#AnonymizationTarget"/>
  </owl:Class>
  <owl:Class rdf:about="#PORT_ANONYMIZATIONTARGET">
    <rdfs:subClassOf rdf:resource="#AnonymizationTarget"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >An identifier of a service endpoint in the space of network services. Generally an IP port
number.</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:about="#ExternalBackends">
    <rdfs:subClassOf rdf:resource="#AnonymizationBackend"/>
  </owl:Class>
  <owl:Class rdf:ID="FULL_PROFESSOR_USERROLE">
    <rdfs:subClassOf rdf:resource="#RESEARCHER_USERROLE"/>
  </owl:Class>
  <owl:Class rdf:about="#OLD_DATAAGE">
    <rdfs:subClassOf rdf:resource="#DataAge"/>
    <owl:disjointWith>
      <owl:Class rdf:about="#RECENT_DATAAGE"/>
    </owl:disjointWith>
    <owl:disjointWith>
      <owl:Class rdf:about="#UNINFLUENTIAL_DATAAGE"/>
    </owl:disjointWith>
  </owl:Class>
  <owl:Class rdf:ID="PHD_STUDENT_USERROLE">
    <rdfs:subClassOf rdf:resource="#RESEARCHER_USERROLE"/>
  </owl:Class>
  <owl:Class rdf:about="#UNINFLUENTIAL_DATAAGE">
    <rdfs:subClassOf rdf:resource="#DataAge"/>
  </owl:Class>
  <owl:Class rdf:about="#AlgorithmicBackends">
    <rdfs:subClassOf rdf:resource="#AnonymizationBackend"/>
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Specific algorithms</rdfs:comment>
  </owl:Class>
  <owl:Class rdf:about="#NEW_DATAAGE">
    <owl:disjointWith rdf:resource="#OLD_DATAAGE"/>
    <owl:disjointWith>
      <owl:Class rdf:about="#RECENT_DATAAGE"/>
    </owl:disjointWith>
    <owl:disjointWith rdf:resource="#UNINFLUENTIAL_DATAAGE"/>
    <rdfs:subClassOf rdf:resource="#DataAge"/>
  </owl:Class>
  <owl:Class rdf:ID="BOOLEAN_ANONYMIZATIONTARGET">
    <rdfs:subClassOf rdf:resource="#GENERIC_ANONYMIZATIONTARGET"/>
  </owl:Class>
  <owl:Class rdf:about="#SecurityStrategy">
    <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
      >Address, Latitude and Longitude are masked but not randomized, all other info is left
untouched</rdfs:comment>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:someValuesFrom rdf:resource="#IDENTIFIER_ANONYMIZATIONTARGET"/>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
        </owl:onProperty>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:someValuesFrom rdf:resource="#MediumObfuscationBackend"/>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#hasAnonymizationBackend"/>
        </owl:onProperty>
      </owl:Restriction>
    </rdfs:subClassOf>
  </owl:Class>

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    </owl:Restriction>
  </rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom rdf:resource="#LONGITUDE_ANONYMIZATIONTARGET"/>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom rdf:resource="#LATITUDE_ANONYMIZATIONTARGET"/>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasAnonymizationTarget"/>
    </owl:onProperty>
    <owl:someValuesFrom rdf:resource="#ADDRESSES_ANONYMIZATIONTARGET"/>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf rdf:resource="#AnonymizationStrategy"/>
</owl:Class>
<owl:Class rdf:ID="TRAFFIC_TYPE_ANONYMIZATIONTARGET">
  <rdfs:subClassOf rdf:resource="#AnonymizationTarget"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >A literal identifier of the type of traffic carried inside the data traces.</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#PrivacyScope">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:ID="hasDataAge"/>
      </owl:onProperty>
      <owl:cardinality rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"
      >1</owl:cardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasDataAge"/>
    </owl:onProperty>
    <owl:someValuesFrom rdf:resource="#DataAge"/>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:allValuesFrom rdf:resource="#DataAge"/>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasDataAge"/>
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Indicates whether the policy applies to all measurements of the collection or
not</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="PerturbationBackend">
  <rdfs:subClassOf rdf:resource="#AlgorithmicBackends"/>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Perturbate data by adding or subtracting a random amount calculated as a fraction of the data
value</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#RECENT_DATAAGE">
  <rdfs:subClassOf rdf:resource="#DataAge"/>
  <owl:disjointWith rdf:resource="#UNINFLUENTIAL_DATAAGE"/>
</owl:Class>
<owl:Class rdf:about="#INFERRING_SECURITY_ATTACKS_USAGEPURPOSE">
  <rdfs:subClassOf rdf:resource="#UsagePurpose"/>
</owl:Class>
<owl:Class rdf:ID="NETWORK_THROUGHPUT_USAGEPURPOSE">

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<rdfs:subClassOf>
  <owl:Class rdf:about="#NETWORK_PERFORMANCE_USAGEPURPOSE" />
</rdfs:subClassOf>
<owl:disjointWith rdf:resource="#RESPONSIVENESS_USAGEPURPOSE" />
</owl:Class>
<owl:Class rdf:about="#LightStrategies">
  <rdfs:subClassOf rdf:resource="#AnonymizationStrategy" />
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget" />
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#ADDRESSES_ANONYMIZATIONTARGET" />
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#LightObfuscationBackend" />
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationBackend" />
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Addresses are prefix-preserved</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="GENERIC_USAGEPURPOSE">
  <rdfs:subClassOf rdf:resource="#UsagePurpose" />
</owl:Class>
<owl:Class rdf:ID="ASSOCIATE_PROFESSOR_USERROLE">
  <rdfs:subClassOf rdf:resource="#RESEARCHER_USERROLE" />
</owl:Class>
<owl:Class rdf:ID="HashingBackend">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Calculate MD5 hash of the value</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#AlgorithmicBackends" />
</owl:Class>
<owl:Class rdf:about="#NETWORK_TOMOGRAPHY_USAGEPURPOSE">
  <rdfs:subClassOf rdf:resource="#UsagePurpose" />
</owl:Class>
<owl:Class rdf:about="#DATE_ANONYMIZATIONTARGET">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >The date this piece of data refers to (date the measurement was taken)</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#AnonymizationTarget" />
</owl:Class>
<owl:Class rdf:about="#NETWORK_PROVIDER_USERROLE">
  <rdfs:subClassOf rdf:resource="#UserRole" />
</owl:Class>
<owl:Class rdf:ID="OTHER_ANONYMIZATIONBACKEND">
  <rdfs:subClassOf rdf:resource="#ExternalBackends" />
</owl:Class>
<owl:Class rdf:ID="InfrastructureScope">
  <rdfs:subClassOf rdf:resource="#PrivacyScope" />
</owl:Class>
<owl:Class rdf:about="#LightFullPrivacy">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >All privacy indicators involved</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#IDENTIFIER_ANONYMIZATIONTARGET" />
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget" />
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget" />
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#PORT_ANONYMIZATIONTARGET" />
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget" />
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>

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    <owl:someValuesFrom rdf:resource="#PAYLOADS_ANONYMIZATIONTARGET" />
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom rdf:resource="#LONGITUDE_ANONYMIZATIONTARGET" />
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasAnonymizationTarget" />
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:someValuesFrom rdf:resource="#LATITUDE_ANONYMIZATIONTARGET" />
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasAnonymizationTarget" />
    </owl:onProperty>
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf>
  <owl:Restriction>
    <owl:onProperty>
      <owl:ObjectProperty rdf:about="#hasAnonymizationTarget" />
    </owl:onProperty>
    <owl:someValuesFrom rdf:resource="#PACKET_TIMESTAMPS_ANONYMIZATIONTARGET" />
  </owl:Restriction>
</rdfs:subClassOf>
<rdfs:subClassOf rdf:resource="#LightStrategies" />
</owl:Class>
<owl:Class rdf:ID="OffsetShiftBackend">
  <rdfs:subClassOf rdf:resource="#AlgorithmicBackends" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Add a fixed amount to all values, thus preserving size of delta intervals (i.e. preserving
temporal or spatial relationships)</rdfs:comment>
</owl:Class>
<owl:Class rdf:ID="INSPECT_TRAFFIC_USAGEPURPOSE">
  <rdfs:subClassOf rdf:resource="#UsagePurpose" />
</owl:Class>
<owl:Class rdf:ID="NUMBER_ANONYMIZATIONTARGET">
  <rdfs:subClassOf rdf:resource="#GENERIC_ANONYMIZATIONTARGET" />
</owl:Class>
<owl:Class rdf:ID="AcceptableUsePolicy">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >An human language readable output document describing to the user the obfuscation techniques
employed on the data he/she is getting from the system</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="#NETWORK_PERFORMANCE_USAGEPURPOSE">
  <rdfs:subClassOf rdf:resource="#UsagePurpose" />
</owl:Class>
<owl:Class rdf:about="#StrongStrategies">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Addresses are completely randomized</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#AnonymizationStrategy" />
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationTarget" />
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#ADDRESSES_ANONYMIZATIONTARGET" />
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasAnonymizationBackend" />
      </owl:onProperty>
      <owl:someValuesFrom rdf:resource="#StrongObfuscationBackend" />
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="AggressivePolicies">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
  >Analysis of traffic data for potentially malicious purposes, like inferring private information
about users, deanonymization, traffic inspection</rdfs:comment>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:someValuesFrom rdf:resource="#StrongFullPrivacy" />
    </owl:Restriction>
  </owl:Restriction>

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```

    <owl:ObjectProperty rdf:about="#hasAnonymizationStrategy" />
  </owl:onProperty>
</owl:Restriction>
</rdfs:subClassOf>
<owl:equivalentClass>
  <owl:Class>
    <owl:intersectionOf rdf:parseType="Collection">
      <owl:Class rdf:about="#BusinessPolicies" />
      <owl:Restriction>
        <owl:onProperty>
          <owl:ObjectProperty rdf:about="#isValidForUsagePurpose" />
        </owl:onProperty>
        <owl:someValuesFrom>
          <owl:Class>
            <owl:unionOf rdf:parseType="Collection">
              <owl:Class rdf:about="#DEANONYMIZATION_USAGEPURPOSE" />
              <owl:Class rdf:about="#INSPECT_TRAFFIC_USAGEPURPOSE" />
            </owl:unionOf>
          </owl:Class>
        </owl:someValuesFrom>
      </owl:Restriction>
    </owl:intersectionOf>
  </owl:Class>
</owl:equivalentClass>
</owl:Class>
<owl:ObjectProperty rdf:about="#hasDataAge">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty" />
  <rdfs:range rdf:resource="#DataAge" />
  <rdfs:domain rdf:resource="#PrivacyScope" />
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="hasAcceptableUsePolicy">
  <rdfs:domain rdf:resource="#PolicyObject" />
  <rdfs:range rdf:resource="#AcceptableUsePolicy" />
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="#hasAnonymizationStrategy">
  <rdfs:range rdf:resource="#AnonymizationStrategy" />
  <rdfs:domain rdf:resource="#PolicyObject" />
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="#hasAnonymizationBackend">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty" />
  <rdfs:range rdf:resource="#AnonymizationBackend" />
  <rdfs:domain rdf:resource="#AnonymizationStrategy" />
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID="isAppliedToPrivacyScope">
  <rdfs:range rdf:resource="#PrivacyScope" />
  <rdfs:domain rdf:resource="#PolicyObject" />
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="#isValidForUserRole">
  <rdfs:range rdf:resource="#UserRole" />
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="#isValidForUsagePurpose">
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >The function isValidForUsagePurpose should not be made functional, since for a given individual
(i.e. for a given PolicyObject instance), multiple UsagePurposes are possible.</rdfs:comment>
  <rdfs:range rdf:resource="#UsagePurpose" />
</owl:ObjectProperty>
<owl:ObjectProperty rdf:about="#hasAnonymizationTarget">
  <rdfs:domain rdf:resource="#AnonymizationStrategy" />
  <rdfs:range rdf:resource="#AnonymizationTarget" />
  <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >The function hasAnonymizationTarget should not be made functional, since for a given individual
(i.e. for a given AnonymizationStrategy instance), multiple AnonymizationTargets are
possible.</rdfs:comment>
</owl:ObjectProperty>
<owl:AnnotationProperty rdf:about="http://purl.org/dc/elements/1.1/publisher" />
<owl:AnnotationProperty rdf:about="http://purl.org/dc/elements/1.1/creator" />
<owl:AnnotationProperty rdf:about="http://purl.org/dc/elements/1.1/contributor" />
</rdf:RDF>

```



## A.2 Novi Ontology Files

### A.2.1 main ontology

```

<?xml version="1.0"?>

<!DOCTYPE rdf:RDF [
  <!ENTITY fp7-novi "http://fp7-novi.eu/" >
  <!ENTITY unit "http://fp7-novi.eu/unit.owl#" >
  <!ENTITY owl "http://www.w3.org/2002/07/owl#" >
  <!ENTITY swrl "http://www.w3.org/2003/11/swrl#" >
  <!ENTITY swrlb "http://www.w3.org/2003/11/swrlb#" >
  <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
  <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
  <!ENTITY ont "http://www.co-ode.org/ontologies/ont.owl#" >
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
  <!ENTITY protege "http://protege.stanford.edu/plugins/owl/protege#" >
  <!ENTITY xsp "http://www.owl-ontologies.com/2005/08/07/xsp.owl#" >
]

<rdf:RDF xmlns="&fp7-novi;im.owl#"
  xml:base="&fp7-novi;im.owl"
  xmlns:protege="http://protege.stanford.edu/plugins/owl/protege#"
  xmlns:xsp="http://www.owl-ontologies.com/2005/08/07/xsp.owl#"
  xmlns:fp7-novi="http://fp7-novi.eu/"
  xmlns:unit="&fp7-novi;unit.owl#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:swrl="http://www.w3.org/2003/11/swrl#"
  xmlns:ont="http://www.co-ode.org/ontologies/ont.owl#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:swrlb="http://www.w3.org/2003/11/swrlb#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">

  <!--
  //////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
  //
  // Annotation properties
  //
  //////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
  -->

  <!--
  //////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
  //
  // Datatypes
  //
  //////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
  -->

  <!--
  //////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
  //
  // Object Properties
  //
  //////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
  -->

  <!-- http://fp7-novi.eu/im.owl#connectedTo -->

  <owl:ObjectProperty rdf:about="&fp7-novi;im.owl#connectedTo">
    <rdfs:domain>
      <owl:Class>
        <owl:unionOf rdf:parseType="Collection">
          <rdf:Description rdf:about="&fp7-novi;im.owl#Interface"/>
          <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
        </owl:unionOf>
      </owl:Class>
    </rdfs:domain>
    <rdfs:range>
      <owl:Class>
        <owl:unionOf rdf:parseType="Collection">
          <rdf:Description rdf:about="&fp7-novi;im.owl#Interface"/>
          <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
        </owl:unionOf>
      </owl:Class>
    </rdfs:range>
  </owl:ObjectProperty>

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        </owl:unionOf>
      </owl:Class>
    </rdfs:range>
  </owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#contains -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#contains">
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Resource"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Group"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Path"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasComponent -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasComponent">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Node"/>
  <rdfs:range rdf:resource="&fp7-novi;im.owl#NodeComponent"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasIPv4Address -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasIPv4Address">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Interface"/>
  <rdfs:range rdf:resource="&fp7-novi;unit.owl#IPAddress"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasInboundInterface -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasInboundInterface">
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Interface"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Node"/>
  <owl:inverseOf rdf:resource="&fp7-novi;im.owl#isInboundInterfaceOf"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasLifetime -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasLifetime">
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Lifetime"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Group"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Resource"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasLoginIPv4Address -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasLoginIPv4Address">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="&fp7-novi;unit.owl#IPAddress"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginComponent"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginService"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

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    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasOutboundInterface -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasOutboundInterface">
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Interface"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Node"/>
  <owl:inverseOf rdf:resource="&fp7-novi;im.owl#isOutboundInterfaceOf"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasPrivateSinkAddress -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasPrivateSinkAddress">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#NSwitch"/>
  <rdfs:range rdf:resource="&fp7-novi;unit.owl#IPAddress"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasPrivateSourceAddress -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasPrivateSourceAddress">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#NSwitch"/>
  <rdfs:range rdf:resource="&fp7-novi;unit.owl#IPAddress"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasService -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasService">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Node"/>
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Service"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasSink -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasSink">
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Interface"/>
  <owl:inverseOf rdf:resource="&fp7-novi;im.owl#isSink"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Link"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Path"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#hasSource -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#hasSource">
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Interface"/>
  <owl:inverseOf rdf:resource="&fp7-novi;im.owl#isSource"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Link"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Path"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#implementedBy -->

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<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#implementedBy">
  <owl:inverseOf rdf:resource="&fp7-novi;im.owl#implements"/>
  <rdfs:range>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Interface"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:range>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Interface"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#implements -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#implements">
  <rdfs:range>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Interface"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:range>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Interface"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#inPath -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#inPath">
  <rdfs:comment>Should be reconsidered.</rdfs:comment>
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Path"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#NetworkElement"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#isContainedIn -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#isContainedIn">
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Group"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Resource"/>
  <owl:inverseOf rdf:resource="&fp7-novi;im.owl#contains"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#isInboundInterfaceOf -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#isInboundInterfaceOf">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Interface"/>
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Node"/>

```

```

</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#isOutboundInterfaceOf -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#isOutboundInterfaceOf">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Interface"/>
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Node"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#isSink -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#isSink">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Interface"/>
  <rdfs:range>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Link"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Path"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:range>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#isSource -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#isSource">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Interface"/>
  <rdfs:range>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Link"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Path"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:range>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#locatedAt -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#locatedAt">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Location"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Service"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#next -->
<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#next">
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#NetworkElement"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
  <rdfs:range>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#NetworkElement"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#Node"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:range>
</owl:ObjectProperty>

```

```

        </owl:unionOf>
      </owl:Class>
    </rdfs:range>
  </owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#provisionedBy -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#provisionedBy">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Link"/>
  <rdfs:range>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdfs:Description rdf:about="&fp7-novi;im.owl#Link"/>
        <rdfs:Description rdf:about="&fp7-novi;im.owl#Path"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:range>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/im.owl#switchedTo -->

<owl:ObjectProperty rdf:about="&fp7-novi;im.owl#switchedTo">
  <rdfs:range rdf:resource="&fp7-novi;im.owl#Interface"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Interface"/>
</owl:ObjectProperty>

<!--
//
// Data properties
//
-->

<!-- http://fp7-novi.eu/im.owl#canFederate -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#canFederate">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Interface"/>
  <rdfs:range rdf:resource="&xsd:boolean"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#diskImage -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#diskImage">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#VirtualNode"/>
  <rdfs:range rdf:resource="&xsd:anyURI"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#endTime -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#endTime">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Lifetime"/>
  <rdfs:range rdf:resource="&xsd;dateTime"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#exclusive -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#exclusive">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Resource"/>

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    <rdfs:range rdf:resource="&xsd:boolean" />
  </owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hardwareType -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hardwareType">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Node" />
  <rdfs:range rdf:resource="&xsd:string" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasAvailableCapacity -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasAvailableCapacity">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#NetworkElement" />
  <rdfs:range rdf:resource="&xsd:float" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasAvailableCores -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasAvailableCores">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#CPU" />
  <rdfs:range rdf:resource="&xsd:integer" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasAvailableLogicalRouters -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasAvailableLogicalRouters">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Node" />
  <rdfs:range rdf:resource="&xsd:int" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasAvailableMemorySize -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasAvailableMemorySize">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Memory" />
  <rdfs:range rdf:resource="&xsd:float" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasAvailableStorageSize -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasAvailableStorageSize">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Storage" />
  <rdfs:range rdf:resource="&xsd:float" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasCPUSpeed -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasCPUSpeed">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#CPU" />
  <rdfs:range rdf:resource="&xsd:float" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasCapacity -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasCapacity">

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    <rdf:type rdf:resource="&owl;FunctionalProperty"/>
    <rdfs:domain rdf:resource="&fp7-novi;im.owl#NetworkElement"/>
    <rdfs:range rdf:resource="&xsd;float"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasCores -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasCores">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#CPU"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
  <rdfs:subPropertyOf rdf:resource="&owl;topDataProperty"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasGREtunnelID -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasGREtunnelID">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#NSwitch"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasLogicalRouters -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasLogicalRouters">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Node"/>
  <rdfs:range rdf:resource="&xsd;int"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasLoginProtocol -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasLoginProtocol">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:comment>values are for example SSHv1, SSHv2, Telnet, etc.</rdfs:comment>
  <rdfs:range rdf:resource="&xsd;string"/>
  <rdfs:domain>
    <owl:Class>
      <unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginComponent"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginService"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasMemorySize -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasMemorySize">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Memory"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasName -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasName">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasNetmask -->

<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasNetmask">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>

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    <rdfs:domain rdf:resource="&fp7-novi;im.owl#Interface"/>
    <rdfs:range rdf:resource="&xsd:string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasOS -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasOS">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#VirtualNode"/>
  <rdfs:range rdf:resource="&xsd:string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasStorageSize -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasStorageSize">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Storage"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasVLANID -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasVLANID">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#NSwitch"/>
  <rdfs:range rdf:resource="&xsd:string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasVXLANID -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasVXLANID">
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#NSwitch"/>
  <rdfs:range rdf:resource="&xsd:string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasVendor -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasVendor">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#VirtualNode"/>
  <rdfs:range rdf:resource="&xsd:string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hasVirtualizationEnvironment -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hasVirtualizationEnvironment">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#VirtualNode"/>
  <rdfs:range rdf:resource="&xsd:string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hostname -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hostname">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Node"/>
  <rdfs:range rdf:resource="&xsd:string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#hrn -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#hrn">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>

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    <rdfs:domain rdf:resource="&fp7-novi;im.owl#Node" />
    <rdfs:range rdf:resource="&xsd:string" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#id -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#id">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:range rdf:resource="&xsd:anyURI" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#latitude -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#latitude">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Location" />
  <rdfs:range rdf:resource="&xsd;float" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#longitude -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#longitude">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Location" />
  <rdfs:range rdf:resource="&xsd;float" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#startTime -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#startTime">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#Lifetime" />
  <rdfs:range rdf:resource="&xsd;dateTime" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/im.owl#virtualRole -->
<owl:DatatypeProperty rdf:about="&fp7-novi;im.owl#virtualRole">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:domain rdf:resource="&fp7-novi;im.owl#VirtualNode" />
  <rdfs:range rdf:resource="&xsd:string" />
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/unit.owl#hasValue -->
<owl:DatatypeProperty rdf:about="&fp7-novi;unit.owl#hasValue">
  <rdfs:domain rdf:resource="&fp7-novi;unit.owl#IPAddress" />
  <rdfs:range rdf:resource="&xsd:string" />
</owl:DatatypeProperty>

<!-- http://www.co-ode.org/ontologies/ont.owl#hasLoginPassword -->
<owl:DatatypeProperty rdf:about="&ont;hasLoginPassword">
  <rdf:type rdf:resource="&owl;FunctionalProperty" />
  <rdfs:range rdf:resource="&xsd:string" />
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginComponent" />
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginService" />
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>

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<!-- http://www.co-ode.org/ontologies/ont.owl#hasLoginPort -->
<owl:DatatypeProperty rdf:about="&ont;hasLoginPort">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:comment>initially will be always port 22</rdfs:comment>
  <rdfs:range rdf:resource="&xsd:int"/>
  <rdfs:subPropertyOf rdf:resource="&owl;topDataProperty"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginComponent"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginService"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>

<!-- http://www.co-ode.org/ontologies/ont.owl#hasLoginUsername -->
<owl:DatatypeProperty rdf:about="&ont;hasLoginUsername">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="&xsd:string"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginComponent"/>
        <rdf:Description rdf:about="&fp7-novi;im.owl#LoginService"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>

<!--
//
// Classes
//
-->

<!-- http://fp7-novi.eu/im.owl#BidirectionalInterface -->
<owl:Class rdf:about="&fp7-novi;im.owl#BidirectionalInterface">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Group"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#BidirectionalLink -->
<owl:Class rdf:about="&fp7-novi;im.owl#BidirectionalLink">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Group"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#CPU -->
<owl:Class rdf:about="&fp7-novi;im.owl#CPU">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#NodeComponent"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#DiskImage -->
<owl:Class rdf:about="&fp7-novi;im.owl#DiskImage">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#NodeComponent"/>

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</owl:Class>

<!-- http://fp7-novi.eu/im.owl#Group -->
<owl:Class rdf:about="&fp7-novi;im.owl#Group"/>

<!-- http://fp7-novi.eu/im.owl#Interface -->
<owl:Class rdf:about="&fp7-novi;im.owl#Interface">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#NetworkElement"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#Lifetime -->
<owl:Class rdf:about="&fp7-novi;im.owl#Lifetime"/>

<!-- http://fp7-novi.eu/im.owl#Link -->
<owl:Class rdf:about="&fp7-novi;im.owl#Link">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#NetworkElement"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#Location -->
<owl:Class rdf:about="&fp7-novi;im.owl#Location"/>

<!-- http://fp7-novi.eu/im.owl#LoginComponent -->
<owl:Class rdf:about="&fp7-novi;im.owl#LoginComponent">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#NodeComponent"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#LoginService -->
<owl:Class rdf:about="&fp7-novi;im.owl#LoginService">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Service"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#Memory -->
<owl:Class rdf:about="&fp7-novi;im.owl#Memory">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#NodeComponent"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#MemoryService -->
<owl:Class rdf:about="&fp7-novi;im.owl#MemoryService">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Service"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#NSwitch -->
<owl:Class rdf:about="&fp7-novi;im.owl#NSwitch">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Link"/>
</owl:Class>
```

```
<!-- http://fp7-novi.eu/im.owl#NSwitchService -->
<owl:Class rdf:about="&fp7-novi;im.owl#NSwitchService">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Service"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#NetworkElement -->
<owl:Class rdf:about="&fp7-novi;im.owl#NetworkElement">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Resource"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#Node -->
<owl:Class rdf:about="&fp7-novi;im.owl#Node">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Resource"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#NodeComponent -->
<owl:Class rdf:about="&fp7-novi;im.owl#NodeComponent">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Resource"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#Path -->
<owl:Class rdf:about="&fp7-novi;im.owl#Path">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#NetworkElement"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#Platform -->
<owl:Class rdf:about="&fp7-novi;im.owl#Platform">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Group"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#ProcessingService -->
<owl:Class rdf:about="&fp7-novi;im.owl#ProcessingService">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Service"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#Reservation -->
<owl:Class rdf:about="&fp7-novi;im.owl#Reservation">
  <rdfs:subClassOf rdf:resource="&fp7-novi;im.owl#Group"/>
</owl:Class>

<!-- http://fp7-novi.eu/im.owl#Resource -->
<owl:Class rdf:about="&fp7-novi;im.owl#Resource"/>

<!-- http://fp7-novi.eu/im.owl#Service -->
<owl:Class rdf:about="&fp7-novi;im.owl#Service"/>

<!-- http://fp7-novi.eu/im.owl#Storage -->
```



## A.2.2 Monitoring event ontology

```

<?xml version="1.0"?>

<!DOCTYPE Ontology [
  <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
  <!ENTITY xml "http://www.w3.org/XML/1998/namespace" >
  <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
]>

<Ontology xmlns="http://www.w3.org/2002/07/owl#"
  xml:base="http://fp7-novi.eu/monitoring_event.owl"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:xml="http://www.w3.org/XML/1998/namespace"
  ontologyIRI="http://fp7-novi.eu/monitoring_event.owl">
  <Prefix name="" IRI="http://www.w3.org/2002/07/owl#" />
  <Prefix name="im" IRI="http://fp7-novi.eu/im.owl#" />
  <Prefix name="owl" IRI="http://www.w3.org/2002/07/owl#" />
  <Prefix name="rdf" IRI="http://www.w3.org/1999/02/22-rdf-syntax-ns#" />
  <Prefix name="xsd" IRI="http://www.w3.org/2001/XMLSchema#" />
  <Prefix name="rdfs" IRI="http://www.w3.org/2000/01/rdf-schema#" />
  <Prefix name="monitoring_event" IRI="http://fp7-novi.eu/monitoring_event.owl#" />
  <Import>http://fp7-novi.eu/monitoring_query.owl</Import>
  <Import>http://fp7-novi.eu/monitoring_task.owl</Import>
  <Import>http://fp7-novi.eu/monitoring_features.owl#</Import>
  <Annotation>
    <AnnotationProperty abbreviatedIRI="rdfs:comment" />
    <Literal datatypeIRI="xsd:string">Part of the NOVI Information Model (IM). Defines and
classifies concepts that are necessary to describe monitoring services, their parameterization and
the representation of the results.</Literal>
  </Annotation>
  <Annotation>
    <AnnotationProperty IRI="#author" />
    <Literal datatypeIRI="xsd:string">Matray, Pater (matray@complex.elte.hu)</Literal>
  </Annotation>
  <Annotation>
    <AnnotationProperty IRI="#author" />
    <Literal datatypeIRI="xsd:string">Stager, Jazsef (steger@complex.elte.hu)</Literal>
  </Annotation>
  <Declaration>
    <Class IRI="#ConditionalNotSatisfiedEvent" />
  </Declaration>
  <Declaration>
    <Class IRI="#MonitorEvent" />
  </Declaration>
  <Declaration>
    <Class IRI="#MonitorEventAtMeasurementStage" />
  </Declaration>
  <Declaration>
    <Class IRI="#NoToolConfiguredToMeasureFeature" />
  </Declaration>
  <Declaration>
    <Class IRI="#SamplesMissingEvent" />
  </Declaration>
  <Declaration>
    <Class IRI="#ToolUnavailableEvent" />
  </Declaration>
  <Declaration>
    <DataProperty IRI="#message" />
  </Declaration>
  <Declaration>
    <NamedIndividual IRI="#DB" />
  </Declaration>
  <Declaration>
    <NamedIndividual IRI="#Float" />
  </Declaration>
  <Declaration>
    <NamedIndividual IRI="#Integer" />
  </Declaration>
  <Declaration>
    <NamedIndividual IRI="#REST" />
  </Declaration>

```

```

<Declaration>
  <NamedIndividual IRI="#SOAPClient" />
</Declaration>
<Declaration>
  <NamedIndividual IRI="#SSH" />
</Declaration>
<Declaration>
  <NamedIndividual IRI="#Slice" />
</Declaration>
<Declaration>
  <NamedIndividual IRI="#String" />
</Declaration>
<Declaration>
  <NamedIndividual IRI="#Substrate" />
</Declaration>
<Declaration>
  <NamedIndividual IRI="#UsernamePassword" />
</Declaration>
<Declaration>
  <NamedIndividual IRI="#UsernameRSAKey" />
</Declaration>
<Declaration>
  <AnnotationProperty IRI="#author" />
</Declaration>
<SubClassOf>
  <Class IRI="#ConditionalNotSatisfiedEvent" />
  <Class IRI="#MonitorEvent" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#MonitorEventAtMeasurementStage" />
  <Class IRI="#MonitorEvent" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#MonitorEventAtMeasurementStage" />
  <ObjectExactCardinality cardinality="1" />
  <ObjectProperty IRI="http://fp7-novi.eu/monitoring_features.owl#hasFeature" />
  <Class IRI="http://fp7-novi.eu/monitoring_features.owl#MonitoredFeature" />
  </ObjectExactCardinality>
</SubClassOf>
<SubClassOf>
  <Class IRI="#MonitorEventAtMeasurementStage" />
  <ObjectExactCardinality cardinality="1" />
  <ObjectProperty IRI="http://fp7-novi.eu/monitoring_query.owl#hasResource" />
  <Class abbreviatedIRI="im:Resource" />
  </ObjectExactCardinality>
</SubClassOf>
<SubClassOf>
  <Class IRI="#MonitorEventAtMeasurementStage" />
  <DataMaxCardinality cardinality="1" />
  <DataProperty IRI="#message" />
  <Datatype abbreviatedIRI="xsd:string" />
  </DataMaxCardinality>
</SubClassOf>
<SubClassOf>
  <Class IRI="#NoToolConfiguredToMeasureFeature" />
  <Class IRI="#MonitorEventAtMeasurementStage" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#SamplesMissingEvent" />
  <Class IRI="#MonitorEventAtMeasurementStage" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#ToolUnavailableEvent" />
  <Class IRI="#MonitorEventAtMeasurementStage" />
</SubClassOf>
<FunctionalDataProperty>
  <DataProperty IRI="#message" />
</FunctionalDataProperty>
<DataPropertyRange>
  <DataProperty IRI="#message" />
  <Datatype abbreviatedIRI="xsd:string" />
</DataPropertyRange>
</Ontology>

```



## A.2.3 Monitoring features ontology

```

<?xml version="1.0"?>

<!DOCTYPE rdf:RDF [
  <!ENTITY unit "http://fp7-novi.eu/unit.owl#" >
  <!ENTITY owl "http://www.w3.org/2002/07/owl#" >
  <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
  <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
  <!ENTITY monitoring_features "http://fp7-novi.eu/monitoring_features.owl#" >
  <!ENTITY monitoring_parameter "http://fp7-novi.eu/monitoring_parameter.owl#" >
]>

<rdf:RDF xmlns="http://fp7-novi.eu/monitoring_features.owl#"
  xml:base="http://fp7-novi.eu/monitoring_features.owl"
  xmlns:unit="http://fp7-novi.eu/unit.owl#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:monitoring_features="http://fp7-novi.eu/monitoring_features.owl#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:monitoring_parameter="http://fp7-novi.eu/monitoring_parameter.owl#">
  <owl:Ontology rdf:about="http://fp7-novi.eu/monitoring_features.owl#">
    <owl:imports rdf:resource="http://fp7-novi.eu/im.owl"/>
    <owl:imports rdf:resource="http://fp7-novi.eu/monitoring_parameter.owl"/>
    <owl:imports rdf:resource="http://fp7-novi.eu/unit.owl"/>
  </owl:Ontology>

  <!--
  ////////////////////////////////////////////////////
  //
  // Annotation properties
  //
  ////////////////////////////////////////////////////
  -->

  <owl:AnnotationProperty rdf:about="&monitoring_parameter;hasDimension"/>
  <owl:AnnotationProperty rdf:about="&monitoring_features;imports"/>
  <owl:AnnotationProperty rdf:about="&monitoring_parameter;hasPrefix"/>
  <owl:AnnotationProperty rdf:about="&monitoring_parameter;hasUnit"/>

  <!--
  ////////////////////////////////////////////////////
  //
  // Datatypes
  //
  ////////////////////////////////////////////////////
  -->

  <!--
  ////////////////////////////////////////////////////
  //
  // Object Properties
  //
  ////////////////////////////////////////////////////
  -->

  <!-- http://fp7-novi.eu/monitoring_features.owl#hasFeature -->
  <owl:ObjectProperty rdf:about="&monitoring_features;hasFeature">
    <rdfs:range rdf:resource="&monitoring_features;MonitoredFeature"/>
  </owl:ObjectProperty>

```

```

<!-- http://fp7-novi.eu/monitoring_features.owl#hasResourceType -->
<owl:ObjectProperty rdf:about="&monitoring_features;hasResourceType">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_features;MonitoredFeature"/>
  <rdfs:range rdf:resource="&monitoring_features;ResourceType"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_features.owl#obligatoryParameter -->
<owl:ObjectProperty rdf:about="&monitoring_features;obligatoryParameter">
  <rdfs:range rdf:resource="&monitoring_parameter;Parameter"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_features.owl#optionalParameter -->
<owl:ObjectProperty rdf:about="&monitoring_features;optionalParameter">
  <rdfs:range rdf:resource="&monitoring_parameter;Parameter"/>
</owl:ObjectProperty>

<!--
//
// Data properties
//
//
//
-->

<!-- http://fp7-novi.eu/monitoring_features.owl#featureName -->
<owl:DatatypeProperty rdf:about="&monitoring_features;featureName">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_features;MonitoredFeature"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</owl:DatatypeProperty>

<!--
//
// Classes
//
//
//
-->

<!-- http://fp7-novi.eu/monitoring_features.owl#BandwidthFeature -->
<owl:Class rdf:about="&monitoring_features;BandwidthFeature">
  <rdfs:subClassOf rdf:resource="&monitoring_features;MonitoredFeature"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_features.owl#DelayFeature -->
<owl:Class rdf:about="&monitoring_features;DelayFeature">
  <rdfs:subClassOf rdf:resource="&monitoring_features;MonitoredFeature"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_features.owl#FeatureMonitoringParameter -->
<owl:Class rdf:about="&monitoring_features;FeatureMonitoringParameter">

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    <rdfs:subClassOf rdf:resource="&monitoring_parameter;Parameter"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_features.owl#MemoryFeature -->
<owl:Class rdf:about="&monitoring_features;MemoryFeature">
  <rdfs:subClassOf rdf:resource="&monitoring_features;MonitoredFeature"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_features.owl#MiscFeature -->
<owl:Class rdf:about="&monitoring_features;MiscFeature">
  <rdfs:subClassOf rdf:resource="&monitoring_features;MonitoredFeature"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_features.owl#MonitoredFeature -->
<owl:Class rdf:about="&monitoring_features;MonitoredFeature">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_features;featureName"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      <owl:onDataRange rdf:resource="&xsd:string"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_features.owl#ProcessorFeature -->
<owl:Class rdf:about="&monitoring_features;ProcessorFeature">
  <rdfs:subClassOf rdf:resource="&monitoring_features;MonitoredFeature"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_features.owl#ResourceType -->
<owl:Class rdf:about="&monitoring_features;ResourceType">
  <rdfs:subClassOf rdf:resource="&owl;Thing"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_features.owl#StorageFeature -->
<owl:Class rdf:about="&monitoring_features;StorageFeature">
  <rdfs:subClassOf rdf:resource="&monitoring_features;MonitoredFeature"/>
</owl:Class>

<!--
////////////////////////////////////
//
// Individuals
//
////////////////////////////////////
-->

<!-- http://fp7-novi.eu/monitoring_features.owl#Address -->
<owl:NamedIndividual rdf:about="&monitoring_features;Address">
  <rdf:type rdf:resource="&monitoring_features;MiscFeature"/>
  <rdf:type rdf:resource="&unit;IPAddress"/>
</owl:NamedIndividual>

```

```

<!-- http://fp7-novi.eu/monitoring_features.owl#AvailableBandwidth -->
<owl:NamedIndividual rdf:about="&monitoring_features;AvailableBandwidth">
  <rdf:type rdf:resource="&monitoring_features;BandwidthFeature"/>
  <rdf:type rdf:resource="&unit;InformationRate"/>
  <featureName>Available Bandwidth</featureName>
  <hasResourceType rdf:resource="&monitoring_features;PathResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#AvailableMemory -->
<owl:NamedIndividual rdf:about="&monitoring_features;AvailableMemory">
  <rdf:type rdf:resource="&monitoring_features;MemoryFeature"/>
  <rdf:type rdf:resource="&unit;InformationSize"/>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#CPUClockRate -->
<owl:NamedIndividual rdf:about="&monitoring_features;CPUClockRate">
  <rdf:type rdf:resource="&monitoring_features;ProcessorFeature"/>
  <rdf:type rdf:resource="&unit;Frequency"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#CPUCoreTemperature -->
<owl:NamedIndividual rdf:about="&monitoring_features;CPUCoreTemperature">
  <rdf:type rdf:resource="&monitoring_features;ProcessorFeature"/>
  <rdf:type rdf:resource="&unit;Temperature"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#CPUCores -->
<owl:NamedIndividual rdf:about="&monitoring_features;CPUCores">
  <rdf:type rdf:resource="&monitoring_features;ProcessorFeature"/>
  <rdf:type rdf:resource="&unit;Countable"/>
  <featureName>kprocCores</featureName>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#CPUUtilization -->
<owl:NamedIndividual rdf:about="&monitoring_features;CPUUtilization">
  <rdf:type rdf:resource="&monitoring_features;ProcessorFeature"/>
  <rdf:type rdf:resource="&unit;Utilization"/>
  <featureName>CPUUtilization</featureName>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#CPULoad -->
<owl:NamedIndividual rdf:about="&monitoring_features;CPULoad">
  <rdf:type rdf:resource="&monitoring_features;ProcessorFeature"/>
  <rdf:type rdf:resource="&unit;Countable"/>
  <featureName>CPULoad</featureName>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#ConsumedBandwidth -->
<owl:NamedIndividual rdf:about="&monitoring_features;ConsumedBandwidth">
  <rdf:type rdf:resource="&monitoring_features;BandwidthFeature"/>
  <rdf:type rdf:resource="&unit;InformationRate"/>
</owl:NamedIndividual>

```

```

<!-- http://fp7-novi.eu/monitoring_features.owl#DiskQuota -->
<owl:NamedIndividual rdf:about="&monitoring_features;DiskQuota">
  <rdf:type rdf:resource="&monitoring_features;StorageFeature"/>
  <rdf:type rdf:resource="&unit;InformationSize"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#FreeDiskSpace -->
<owl:NamedIndividual rdf:about="&monitoring_features;FreeDiskSpace">
  <rdf:type rdf:resource="&monitoring_features;StorageFeature"/>
  <rdf:type rdf:resource="&unit;InformationSize"/>
  <featureName>Free Disk Space</featureName>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
  <obligatoryParameter rdf:resource="&monitoring_features;PFM_FilesystemFolder"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#FreeMemory -->
<owl:NamedIndividual rdf:about="&monitoring_features;FreeMemory">
  <rdf:type rdf:resource="&monitoring_features;MemoryFeature"/>
  <rdf:type rdf:resource="&unit;InformationSize"/>
  <featureName>Free Memory</featureName>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#MemoryUtilization -->
<owl:NamedIndividual rdf:about="&monitoring_features;MemoryUtilization">
  <rdf:type rdf:resource="&monitoring_features;MemoryFeature"/>
  <rdf:type rdf:resource="&unit;InformationUtilization"/>
  <featureName>MemoryUtilization</featureName>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#NodeResource -->
<owl:NamedIndividual rdf:about="&monitoring_features;NodeResource">
  <rdf:type rdf:resource="&monitoring_features;ResourceType"/>
  <hasFeature rdf:resource="&monitoring_features;AvailableMemory"/>
  <hasFeature rdf:resource="&monitoring_features;MemoryUtilization"/>
  <hasFeature rdf:resource="&monitoring_features;CPUClockRate"/>
  <hasFeature rdf:resource="&monitoring_features;CPUCoreTemperature"/>
  <hasFeature rdf:resource="&monitoring_features;CPUCores"/>
  <hasFeature rdf:resource="&monitoring_features;CPULoad"/>
  <hasFeature rdf:resource="&monitoring_features;CPUUtilization"/>
  <hasFeature rdf:resource="&monitoring_features;DiskQuota"/>
  <hasFeature rdf:resource="&monitoring_features;FreeDiskSpace"/>
  <hasFeature rdf:resource="&monitoring_features;FreeMemory"/>
  <hasFeature rdf:resource="&monitoring_features;SwappedMemory"/>
  <hasFeature rdf:resource="&monitoring_features;Uptime"/>
  <hasFeature rdf:resource="&monitoring_features;UsedDiskSpace"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#OnewayDelay -->
<owl:NamedIndividual rdf:about="&monitoring_features;OnewayDelay">
  <rdf:type rdf:resource="&monitoring_features;DelayFeature"/>
  <rdf:type rdf:resource="&unit;TimeInterval"/>
  <featureName>Oneway Delay</featureName>
  <optionalParameter rdf:resource="&monitoring_features;PFM_Count"/>
  <optionalParameter rdf:resource="&monitoring_features;PFM_Delay"/>
  <optionalParameter rdf:resource="&monitoring_features;PFM_DestinationPort"/>
  <optionalParameter rdf:resource="&monitoring_features;PFM_PacketSize"/>
  <optionalParameter rdf:resource="&monitoring_features;PFM_SourcePort"/>
  <hasResourceType rdf:resource="&monitoring_features;PathResource"/>

```

```

</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_Count -->
<owl:NamedIndividual rdf:about="&monitoring_features;PFM_Count">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;Countable"/>
  <monitoring_parameter:paramName>Count</monitoring_parameter:paramName>
  <unit:hasValue>5</unit:hasValue>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;Integer"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_Delay -->
<owl:NamedIndividual rdf:about="&monitoring_features;PFM_Delay">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;TimeInterval"/>
  <unit:hasValue>200</unit:hasValue>
  <monitoring_parameter:paramName>Delay</monitoring_parameter:paramName>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;Integer"/>
  <unit:hasPrefix rdf:resource="&unit;milli"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_DestinationNode -->
<owl:NamedIndividual rdf:about="&monitoring_features;PFM_DestinationNode">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;NameOfSomething"/>
  <unit:hasValue>planetlab2-novi.lab.netmode.ece.ntua.gr</unit:hasValue>
  <monitoring_parameter:paramName>Destination</monitoring_parameter:paramName>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;String"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_DestinationPort -->
<owl:NamedIndividual rdf:about="&monitoring_features;PFM_DestinationPort">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;Cardinal"/>
  <unit:hasValue>7777</unit:hasValue>
  <monitoring_parameter:paramName>DestinationPort</monitoring_parameter:paramName>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;Integer"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_FilesystemFolder -->
<owl:NamedIndividual rdf:about="&monitoring_features;PFM_FilesystemFolder">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;NameOfSomething"/>
  <monitoring_parameter:paramName>Directory</monitoring_parameter:paramName>
  <unit:hasValue>/</unit:hasValue>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;String"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_NetworkInterface -->
<owl:NamedIndividual rdf:about="&monitoring_features;PFM_NetworkInterface">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;NameOfSomething"/>
  <unit:hasValue>novi</unit:hasValue>
  <monitoring_parameter:paramName>NetworkInterface</monitoring_parameter:paramName>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;String"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_PacketSize -->

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```

<owl:NamedIndividual rdf:about="&monitoring_features;PFM_PacketSize">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;InformationSize"/>
  <unit:hasValue>64</unit:hasValue>
  <monitoring_parameter:paramName>PacketSize</monitoring_parameter:paramName>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;Integer"/>
  <unit:hasUnit rdf:resource="&unit;Byte"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_SourceNode -->
<owl:NamedIndividual rdf:about="&monitoring_features;PFM_SourceNode">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;NameOfSomething"/>
  <monitoring_parameter:paramName>Source</monitoring_parameter:paramName>
  <unit:hasValue>novilab.elte.hu</unit:hasValue>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;String"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_SourcePort -->
<owl:NamedIndividual rdf:about="&monitoring_features;PFM_SourcePort">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;Cardinal"/>
  <monitoring_parameter:paramName>SourcePort</monitoring_parameter:paramName>
  <unit:hasValue>7777</unit:hasValue>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;Integer"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PFM_TimeToLive -->
<owl:NamedIndividual rdf:about="&monitoring_features;PFM_TimeToLive">
  <rdf:type rdf:resource="&monitoring_features;FeatureMonitoringParameter"/>
  <rdf:type rdf:resource="&unit;Countable"/>
  <unit:hasValue>32</unit:hasValue>
  <monitoring_parameter:paramName>TimeToLive</monitoring_parameter:paramName>
  <monitoring_parameter:hasType rdf:resource="&monitoring_parameter;Integer"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PacketSize -->
<owl:NamedIndividual rdf:about="&monitoring_features;PacketSize">
  <rdf:type rdf:resource="&monitoring_features;MiscFeature"/>
  <rdf:type rdf:resource="&unit;InformationSize"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PacketlossRatio -->
<owl:NamedIndividual rdf:about="&monitoring_features;PacketlossRatio">
  <rdf:type rdf:resource="&monitoring_features;MiscFeature"/>
  <rdf:type rdf:resource="&unit;InformationLossRatio"/>
  <featureName>Packet loss ratio</featureName>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#PathResource -->
<owl:NamedIndividual rdf:about="&monitoring_features;PathResource">
  <rdf:type rdf:resource="&monitoring_features;ResourceType"/>
  <hasFeature rdf:resource="&monitoring_features;AvailableBandwidth"/>
  <hasFeature rdf:resource="&monitoring_features;ConsumedBandwidth"/>
  <hasFeature rdf:resource="&monitoring_features;OnewayDelay"/>
  <hasFeature rdf:resource="&monitoring_features;PacketlossRatio"/>
  <hasFeature rdf:resource="&monitoring_features;RoundtripDelay"/>
</owl:NamedIndividual>

```

```

<!-- http://fp7-novi.eu/monitoring_features.owl#RoundtripDelay -->
<owl:NamedIndividual rdf:about="&monitoring_features;RoundtripDelay">
  <rdf:type rdf:resource="&monitoring_features;DelayFeature"/>
  <rdf:type rdf:resource="&unit;TimeInterval"/>
  <featureName>Round Trip Delay</featureName>
  <optionalParameter rdf:resource="&monitoring_features;PFM_Count"/>
  <optionalParameter rdf:resource="&monitoring_features;PFM_Delay"/>
  <optionalParameter rdf:resource="&monitoring_features;PFM_NetworkInterface"/>
  <optionalParameter rdf:resource="&monitoring_features;PFM_PacketSize"/>
  <optionalParameter rdf:resource="&monitoring_features;PFM_TimeToLive"/>
  <hasResourceType rdf:resource="&monitoring_features;PathResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#SwappedMemory -->
<owl:NamedIndividual rdf:about="&monitoring_features;SwappedMemory">
  <rdf:type rdf:resource="&monitoring_features;MemoryFeature"/>
  <rdf:type rdf:resource="&unit;InformationSize"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#TimeToLive -->
<owl:NamedIndividual rdf:about="&monitoring_features;TimeToLive">
  <rdf:type rdf:resource="&monitoring_features;MiscFeature"/>
  <rdf:type rdf:resource="&unit;Countable"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#Uptime -->
<owl:NamedIndividual rdf:about="&monitoring_features;Uptime">
  <rdf:type rdf:resource="&monitoring_features;MiscFeature"/>
  <rdf:type rdf:resource="&unit;TimeInterval"/>
  <featureName>Uptime</featureName>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#UsedDiskSpace -->
<owl:NamedIndividual rdf:about="&monitoring_features;UsedDiskSpace">
  <rdf:type rdf:resource="&monitoring_features;StorageFeature"/>
  <rdf:type rdf:resource="&unit;InformationSize"/>
  <featureName>Used Disk Space</featureName>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
  <obligatoryParameter rdf:resource="&monitoring_features;PFM_FileSystemFolder"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_features.owl#UsedMemory -->
<owl:NamedIndividual rdf:about="&monitoring_features;UsedMemory">
  <rdf:type rdf:resource="&monitoring_features;MemoryFeature"/>
  <rdf:type rdf:resource="&unit;InformationSize"/>
  <featureName>Used Memory</featureName>
  <hasResourceType rdf:resource="&monitoring_features;NodeResource"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#fraction -->
<owl:NamedIndividual rdf:about="&unit;fraction"/>
<rdf:Description>
  <imports rdf:resource="http://fp7-novi.eu/unit.owl"/>
</rdf:Description>
</rdf:RDF>

```



## A.2.4 Monitoring parameters ontology

```

<?xml version="1.0"?>

<!DOCTYPE Ontology [
  <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
  <!ENTITY xml "http://www.w3.org/XML/1998/namespace" >
  <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
]>

<Ontology xmlns="http://www.w3.org/2002/07/owl#"
  xml:base="http://fp7-novi.eu/monitoring_parameter.owl#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:xml="http://www.w3.org/XML/1998/namespace"
  ontologyIRI="http://fp7-novi.eu/monitoring_parameter.owl">
  <Prefix name="" IRI="http://www.w3.org/2002/07/owl#" />
  <Prefix name="im" IRI="http://fp7-novi.eu/im.owl#" />
  <Prefix name="owl" IRI="http://www.w3.org/2002/07/owl#" />
  <Prefix name="rdf" IRI="http://www.w3.org/1999/02/22-rdf-syntax-ns#" />
  <Prefix name="xsd" IRI="http://www.w3.org/2001/XMLSchema#" />
  <Prefix name="rdfs" IRI="http://www.w3.org/2000/01/rdf-schema#" />
  <Prefix name="monitoring_parameter" IRI="http://fp7-novi.eu/monitoring_parameter.owl#" />
  <Import>http://fp7-novi.eu/unit.owl</Import>
  <Annotation>
    <AnnotationProperty abbreviatedIRI="rdfs:comment" />
    <Literal datatypeIRI="&xsd:string">Part of the NOVI Information Model (IM). Defines and
classifies concepts that are necessary to describe monitoring services, their parametrization and
the representation of the results.</Literal>
  </Annotation>
  <Annotation>
    <AnnotationProperty IRI="#author" />
    <Literal datatypeIRI="&xsd:string">MÃ;tray, PÃ;ter (matray@complex.elte.hu)</Literal>
  </Annotation>
  <Annotation>
    <AnnotationProperty IRI="#author" />
    <Literal datatypeIRI="&xsd:string">StÃ;ger, JÃ;zsef (steger@complex.elte.hu)</Literal>
  </Annotation>
  <Declaration>
    <Class IRI="#ParamValueType" />
  </Declaration>
  <Declaration>
    <Class IRI="#Parameter" />
  </Declaration>
  <Declaration>
    <ObjectProperty IRI="#hasParameter" />
  </Declaration>
  <Declaration>
    <ObjectProperty IRI="#hasType" />
  </Declaration>
  <Declaration>
    <DataProperty IRI="#paramName" />
  </Declaration>
  <Declaration>
    <NamedIndividual IRI="#Bool" />
  </Declaration>
  <Declaration>
    <NamedIndividual IRI="#Float" />
  </Declaration>
  <Declaration>
    <NamedIndividual IRI="#Integer" />
  </Declaration>
  <Declaration>
    <NamedIndividual IRI="#String" />
  </Declaration>
  <Declaration>
    <AnnotationProperty IRI="#author" />
  </Declaration>
  <SubClassOf>
    <Class IRI="#Parameter" />
    <ObjectExactCardinality cardinality="1">
      <ObjectProperty IRI="#hasType" />
      <Class IRI="#ParamValueType" />
    </ObjectExactCardinality>
  </SubClassOf>

```

```

    </ObjectExactCardinality>
  </SubClassOf>
</SubClassOf>
  <Class IRI="#Parameter"/>
  <DataExactCardinality cardinality="1">
    <DataProperty IRI="#paramName"/>
  </DataExactCardinality>
</SubClassOf>
</ClassAssertion>
  <Class IRI="#ParamValueType"/>
  <NamedIndividual IRI="#Bool"/>
</ClassAssertion>
</ClassAssertion>
  <Class IRI="#ParamValueType"/>
  <NamedIndividual IRI="#Float"/>
</ClassAssertion>
</ClassAssertion>
  <Class IRI="#ParamValueType"/>
  <NamedIndividual IRI="#Integer"/>
</ClassAssertion>
</ClassAssertion>
  <Class IRI="#ParamValueType"/>
  <NamedIndividual IRI="#String"/>
</ClassAssertion>
</FunctionalObjectProperty>
  <ObjectProperty IRI="#hasType"/>
</FunctionalObjectProperty>
</ObjectPropertyDomain>
  <ObjectProperty IRI="#hasType"/>
  <Class IRI="#Parameter"/>
</ObjectPropertyDomain>
</ObjectPropertyRange>
  <ObjectProperty IRI="#hasParameter"/>
  <Class IRI="#Parameter"/>
</ObjectPropertyRange>
</ObjectPropertyRange>
  <ObjectProperty IRI="#hasType"/>
  <Class IRI="#ParamValueType"/>
</ObjectPropertyRange>
</DataPropertyDomain>
  <DataProperty IRI="#paramName"/>
  <Class IRI="#Parameter"/>
</DataPropertyDomain>
</DataPropertyRange>
  <DataProperty IRI="#paramName"/>
  <Datatype abbreviatedIRI="xsd:string"/>
</DataPropertyRange>
</Ontology>

```

## A.2.5 Monitoring query ontology

```

<?xml version="1.0"?>

<!DOCTYPE Ontology [
  <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
  <!ENTITY xml "http://www.w3.org/XML/1998/namespace" >
  <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
]>

<Ontology xmlns="http://www.w3.org/2002/07/owl#"
  xml:base="http://fp7-novi.eu/monitoring_query.owl"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:xml="http://www.w3.org/XML/1998/namespace"
  ontologyIRI="http://fp7-novi.eu/monitoring_query.owl">
  <Prefix name="" IRI="http://www.w3.org/2002/07/owl#" />
  <Prefix name="im" IRI="http://fp7-novi.eu/im.owl#" />
  <Prefix name="owl" IRI="http://www.w3.org/2002/07/owl#" />
  <Prefix name="rdf" IRI="http://www.w3.org/1999/02/22-rdf-syntax-ns#" />
  <Prefix name="xsd" IRI="http://www.w3.org/2001/XMLSchema#" />
  <Prefix name="rdfs" IRI="http://www.w3.org/2000/01/rdf-schema#" />
  <Prefix name="monitoring_query" IRI="http://fp7-novi.eu/monitoring_query.owl#" />

```

```

<Import>http://fp7-novi.eu/monitoring_parameter.owl</Import>
<Import>http://fp7-novi.eu/monitoring_stat.owl</Import>
<Import>http://fp7-novi.eu/im.owl</Import>
<Import>http://fp7-novi.eu/monitoring_features.owl#</Import>
<Annotation>
  <AnnotationProperty IRI="#author"/>
  <Literal datatypeIRI="xsd:string">M̃;tray, P̃@ter (matray@complex.elte.hu)</Literal>
</Annotation>
<Annotation>
  <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
  <Literal datatypeIRI="xsd:string">Part of the NOVI Information Model (IM). Defines and
classifies concepts that are necessary to describe monitoring services, their parametrization and
the representation of the results.</Literal>
</Annotation>
<Annotation>
  <AnnotationProperty IRI="#author"/>
  <Literal datatypeIRI="xsd:string">St̃@ger, J̃zsef (steger@complex.elte.hu)</Literal>
</Annotation>
<Declaration>
  <Class IRI="#BatchQuery"/>
</Declaration>
<Declaration>
  <Class IRI="#BundleQuery"/>
</Declaration>
<Declaration>
  <Class IRI="#DataFormatter"/>
</Declaration>
<Declaration>
  <Class IRI="#MonitorQuery"/>
</Declaration>
<Declaration>
  <Class IRI="#MonitorQueryDefinitionPart"/>
</Declaration>
<Declaration>
  <Class IRI="#QueryParameter"/>
</Declaration>
<Declaration>
  <ObjectProperty IRI="#hasFormatter"/>
</Declaration>
<Declaration>
  <ObjectProperty IRI="#hasProcessid"/>
</Declaration>
<Declaration>
  <ObjectProperty IRI="#hasResource"/>
</Declaration>
<Declaration>
  <NamedIndividual IRI="#Formatter_CSV"/>
</Declaration>
<Declaration>
  <NamedIndividual IRI="#Formatter_JSON"/>
</Declaration>
<Declaration>
  <NamedIndividual IRI="#UnmodifiedExtractOfFeatureSamples"/>
</Declaration>
<Declaration>
  <AnnotationProperty IRI="#author"/>
</Declaration>
<SubClassOf>
  <Class IRI="#BatchQuery"/>
  <Class IRI="#MonitorQuery"/>
</SubClassOf>
<SubClassOf>
  <Class IRI="#BatchQuery"/>
  <ObjectSomeValuesFrom>
    <ObjectProperty IRI="http://fp7-novi.eu/monitoring_parameter.owl#hasParameter"/>
    <Class IRI="#QueryParameter"/>
  </ObjectSomeValuesFrom>
</SubClassOf>
<SubClassOf>
  <Class IRI="#BatchQuery"/>
  <ObjectMinCardinality cardinality="1">
    <ObjectProperty IRI="#hasResource"/>
    <Class abbreviatedIRI="im:Resource"/>
  </ObjectMinCardinality>
</SubClassOf>
<SubClassOf>
  <Class IRI="#BundleQuery"/>
  <Class IRI="#MonitorQuery"/>

```

```

</SubClassOf>
<SubClassOf>
  <Class IRI="#BundleQuery" />
  <ObjectSomeValuesFrom>
    <ObjectProperty IRI="http://fp7-novi.eu/monitoring_parameter.owl#hasParameter" />
    <Class IRI="#QueryParameter" />
  </ObjectSomeValuesFrom>
</SubClassOf>
<SubClassOf>
  <Class IRI="#BundleQuery" />
  <ObjectExactCardinality cardinality="1">
    <ObjectProperty IRI="#hasResource" />
    <Class abbreviatedIRI="im:Resource" />
  </ObjectExactCardinality>
</SubClassOf>
<SubClassOf>
  <Class IRI="#DataFormatter" />
  <Class IRI="#MonitorQueryDefinitionPart" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#MonitorQuery" />
  <ObjectExactCardinality cardinality="1">
    <ObjectProperty IRI="http://fp7-novi.eu/monitoring_features.owl#hasFeature" />
    <Class IRI="http://fp7-novi.eu/monitoring_features.owl#MonitoredFeature" />
  </ObjectExactCardinality>
</SubClassOf>
<SubClassOf>
  <Class IRI="#MonitorQuery" />
  <ObjectExactCardinality cardinality="1">
    <ObjectProperty IRI="#hasFormatter" />
    <Class IRI="#DataFormatter" />
  </ObjectExactCardinality>
</SubClassOf>
<SubClassOf>
  <Class IRI="#MonitorQuery" />
  <ObjectExactCardinality cardinality="1">
    <ObjectProperty IRI="http://fp7-novi.eu/monitoring_stat.owl#hasSample" />
    <Class IRI="http://fp7-novi.eu/monitoring_stat.owl#Sample" />
  </ObjectExactCardinality>
</SubClassOf>
<SubClassOf>
  <Class IRI="#ProcessIdentifier" />
  <Class IRI="#MonitorQueryDefinitionPart" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#ProcessIdentifier" />
  <Class IRI="#MonitoringServiceResponse" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#QueryParameter" />
  <Class IRI="http://fp7-novi.eu/monitoring_parameter.owl#Parameter" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#QueryParameter" />
  <Class IRI="#MonitorQueryDefinitionPart" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#SampleManipulationIdentifier" />
  <Class IRI="#MonitorQueryDefinitionPart" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#SampleManipulationIdentifier" />
  <Class IRI="#MonitoringServiceResponse" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#SampleManipulationQuery" />
  <Class IRI="#MonitorQuery" />
</SubClassOf>
<SubClassOf>
  <Class IRI="#SampleManipulationQuery" />
  <ObjectExactCardinality cardinality="1">
    <ObjectProperty IRI="#hasProcessid" />
    <Class IRI="#ProcessIdentifier" />
  </ObjectExactCardinality>
</SubClassOf>
<SubClassOf>
  <Class IRI="http://fp7-novi.eu/monitoring_stat.owl#Sample" />
  <Class IRI="#MonitorQueryDefinitionPart" />

```

```

</SubClassOf>
<ClassAssertion>
  <Class IRI="#DataFormatter"/>
  <NamedIndividual IRI="#Formatter_CSV"/>
</ClassAssertion>
<ClassAssertion>
  <Class IRI="#DataFormatter"/>
  <NamedIndividual IRI="#Formatter_JSON"/>
</ClassAssertion>
<ClassAssertion>
  <Class IRI="http://fp7-novi.eu/monitoring_stat.owl#Sample"/>
  <NamedIndividual IRI="#UnmodifiedExtractOfFeatureSamples"/>
</ClassAssertion>
<FunctionalObjectProperty>
  <ObjectProperty IRI="#hasFormatter"/>
</FunctionalObjectProperty>
<FunctionalObjectProperty>
  <ObjectProperty IRI="#hasProcessid"/>
</FunctionalObjectProperty>
<FunctionalObjectProperty>
  <ObjectProperty IRI="#hasResource"/>
</FunctionalObjectProperty>
<ObjectPropertyDomain>
  <ObjectProperty IRI="#hasFormatter"/>
  <Class IRI="#BundleQuery"/>
</ObjectPropertyDomain>
<ObjectPropertyRange>
  <ObjectProperty IRI="#hasFormatter"/>
  <Class IRI="#DataFormatter"/>
</ObjectPropertyRange>
<ObjectPropertyRange>
  <ObjectProperty IRI="#hasProcessid"/>
  <Class IRI="#ProcessIdentifier"/>
</ObjectPropertyRange>
<ObjectPropertyRange>
  <ObjectProperty IRI="#hasResource"/>
  <Class abbreviatedIRI="im:Resource"/>
</ObjectPropertyRange>
<AnnotationAssertion>
  <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
  <IRI>#hasResource</IRI>
  <Literal datatypeIRI="&rdf;PlainLiteral">here it links to the core ontology</Literal>
</AnnotationAssertion>
</Ontology>

```

## A.2.6 Monitoring stat ontology

```

<?xml version="1.0"?>

<!DOCTYPE rdf:RDF [
  <!ENTITY unit "http://fp7-novi.eu/unit.owl#" >
  <!ENTITY owl "http://www.w3.org/2002/07/owl#" >
  <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
  <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
  <!ENTITY monitoring_parameter "http://fp7-novi.eu/monitoring_parameter.owl#" >
]>

<rdf:RDF xmlns="http://fp7-novi.eu/monitoring_stat.owl#"
  xml:base="http://fp7-novi.eu/monitoring_stat.owl"
  xmlns:unit="http://fp7-novi.eu/unit.owl#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:monitoring_parameter="http://fp7-novi.eu/monitoring_parameter.owl#">
  <owl:Ontology rdf:about="http://fp7-novi.eu/monitoring_stat.owl">
    <owl:imports rdf:resource="http://fp7-novi.eu/monitoring_parameter.owl"/>
    <owl:imports rdf:resource="http://fp7-novi.eu/unit.owl"/>
  </owl:Ontology>

  <!--

```

```
////////////////////////////////////
//
// Annotation properties
//
////////////////////////////////////
-->

<!--
////////////////////////////////////
//
// Datatypes
//
////////////////////////////////////
-->

<!--
////////////////////////////////////
//
// Object Properties
//
////////////////////////////////////
-->

<!-- http://fp7-novi.eu/monitoring_stat.owl#generatorOperation -->

<owl:ObjectProperty rdf:about="http://fp7-novi.eu/monitoring_stat.owl#generatorOperation">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#ReducedSample"/>
  <rdfs:range rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#SampleOperator"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_stat.owl#hasCondition -->

<owl:ObjectProperty rdf:about="http://fp7-novi.eu/monitoring_stat.owl#hasCondition">
  <rdfs:range rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Condition"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_stat.owl#hasSample -->

<owl:ObjectProperty rdf:about="http://fp7-novi.eu/monitoring_stat.owl#hasSample">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Sample"/>
</owl:ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_stat.owl#hasSampleSource -->

<owl:ObjectProperty rdf:about="http://fp7-novi.eu/monitoring_stat.owl#hasSampleSource">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Sample"/>
  <rdfs:domain rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#SampleOperator"/>
</owl:ObjectProperty>

<!--
////////////////////////////////////
//
// Classes
//
////////////////////////////////////
-->
```

```

<!-- http://fp7-novi.eu/monitoring_stat.owl#Aggregator -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Aggregator">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#SampleOperator"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#AndExpression -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#AndExpression">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Condition"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#hasCondition"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Condition"/>
      <owl:minQualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">2</owl:minQualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Average -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Average">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Aggregator"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Condition -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Condition"/>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Head -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Head">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#IndexResampler"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_parameter;hasParameter"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#SOP_head"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#IndexResampler -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#IndexResampler">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Resampler"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#IsNotnegative -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#IsNotnegative">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Condition"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#hasSample"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Sample"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

```

<!-- http://fp7-novi.eu/monitoring_stat.owl#IsPositive -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#IsPositive">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Condition"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#hasSample"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Sample"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#LargerThan -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#LargerThan">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#ValueSampler"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Maximum -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Maximum">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Aggregator"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Minimum -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Minimum">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Aggregator"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#NotLargerThan -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#NotLargerThan">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#ValueSampler"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#NotSmallerThan -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#NotSmallerThan">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#ValueSampler"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#OrExpression -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#OrExpression">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Condition"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#hasCondition"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Condition"/>
      <owl:minQualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">2</owl:minQualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Order -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Order">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#IndexResampler"/>

```



```

    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty rdf:resource="&monitoring_parameter;hasParameter"/>
        <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#SOP_order"/>
        <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
        </owl:Restriction>
      </rdfs:subClassOf>
    </owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Percentile -->

<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Percentile">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Aggregator"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_parameter;hasParameter"/>
      <owl:onClass rdf:resource="http://fp7-
novi.eu/monitoring_stat.owl#SampleOperatorParameter"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      </owl:Restriction>
    </rdfs:subClassOf>
  </owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#ReducedSample -->

<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#ReducedSample">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Sample"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-
novi.eu/monitoring_stat.owl#generatorOperation"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#SampleOperator"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:comment>Samples represented by this class is generated by some means of reduction of
the input, such as the calculation various aggregates or resampling of the source of
data.</rdfs:comment>
  </owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Resampler -->

<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Resampler">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#SampleOperator"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#SOP_head -->

<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#SOP_head">
  <rdfs:subClassOf rdf:resource="http://fp7-
novi.eu/monitoring_stat.owl#SampleOperatorParameter"/>
  <rdfs:subClassOf rdf:resource="&unit;Countable"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_parameter;paramName"/>
      <owl:hasValue>head</owl:hasValue>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_parameter;hasType"/>
      <owl:hasValue rdf:resource="&monitoring_parameter;Integer"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

```

<!-- http://fp7-novi.eu/monitoring_stat.owl#SOP_order -->

<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#SOP_order">
  <rdfs:subClassOf rdf:resource="http://fp7-
novi.eu/monitoring_stat.owl#SampleOperatorParameter"/>
  <rdfs:subClassOf rdf:resource="&unit;Boolean"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_parameter;hasType"/>
      <owl:hasValue rdf:resource="&monitoring_parameter;Bool"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_parameter;paramName"/>
      <owl:hasValue>ascending</owl:hasValue>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#SOP_tail -->

<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#SOP_tail">
  <rdfs:subClassOf rdf:resource="http://fp7-
novi.eu/monitoring_stat.owl#SampleOperatorParameter"/>
  <rdfs:subClassOf rdf:resource="&unit;Countable"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_parameter;paramName"/>
      <owl:hasValue>tail</owl:hasValue>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_parameter;hasType"/>
      <owl:hasValue rdf:resource="&monitoring_parameter;Integer"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Sample -->

<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Sample">
  <rdfs:comment>This class represent samples of the same dimension, One can apply various
transformation on the samples to yield new samples. Subclasses of Sample indicate how the Sample
individual was generated: either by reduction or unification.</rdfs:comment>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#SampleOperator -->

<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#SampleOperator">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-
novi.eu/monitoring_stat.owl#hasSampleSource"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Sample"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment>This class represent a transformation, which can be applied on both a sample
series or a TransformedSample</rdfs:comment>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#SampleOperatorParameter -->

<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#SampleOperatorParameter">
  <rdfs:subClassOf rdf:resource="&monitoring_parameter;Parameter"/>
</owl:Class>

```

```

<!-- http://fp7-novi.eu/monitoring_stat.owl#Shuffle -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Shuffle">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#IndexResampler"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#SmallerThan -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#SmallerThan">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#ValueSampler"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Tail -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Tail">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#IndexResampler"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&monitoring_parameter;hasParameter"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#SOP_tail"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#UnionOfSamples -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#UnionOfSamples">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Sample"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#hasSample"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Sample"/>
      <owl:minQualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">2</owl:minQualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment>Samples of compatible type (matching dimension) can be unified. This class
represent them.</rdfs:comment>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#ValueSampler -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#ValueSampler">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Resampler"/>
</owl:Class>

<!-- http://fp7-novi.eu/monitoring_stat.owl#Variance -->
<owl:Class rdf:about="http://fp7-novi.eu/monitoring_stat.owl#Variance">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/monitoring_stat.owl#Aggregator"/>
</owl:Class>

<!--
//
// Individuals
//
-->

```



```

<!--
//
// Datatypes
//
//
-->

<!--
//
// Object Properties
//
//
-->

<!-- http://fp7-novi.eu/monitoring_task.owl#MonitoringTaskProperty -->
<ObjectProperty rdf:about="&monitoring_task;MonitoringTaskProperty">
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:range rdf:resource="&monitoring_task;MonitoringTaskDefinitionPart"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasAuthenticationType -->
<ObjectProperty rdf:about="&monitoring_task;hasAuthenticationType">
  <rdfs:range rdf:resource="&monitoring_task;AuthenticationType"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasColumn -->
<ObjectProperty rdf:about="&monitoring_task;hasColumn">
  <rdfs:range rdf:resource="&monitoring_task;Column"/>
  <rdfs:domain rdf:resource="&monitoring_task;OutputTableFormat"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasDriver -->
<ObjectProperty rdf:about="&monitoring_task;hasDriver">
  <rdfs:range rdf:resource="&monitoring_task;Driver"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasExecutionParameter -->
<ObjectProperty rdf:about="&monitoring_task;hasExecutionParameter">
  <rdfs:range rdf:resource="&monitoring_task;ExecutionParameter"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasHookParameter -->
<ObjectProperty rdf:about="&monitoring_task;hasHookParameter">
  <rdfs:range rdf:resource="&monitoring_task;HookParameter"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
  <rdfs:domain rdf:resource="&monitoring_task;PreHook"/>
</ObjectProperty>

```

```

<!-- http://fp7-novi.eu/monitoring_task.owl#hasMonitoredFeature -->
<ObjectProperty rdf:about="&monitoring_task;hasMonitoredFeature">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="&monitoring_features;MonitoredFeature"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoredFeatureColumn"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasMonitoringDomain -->
<ObjectProperty rdf:about="&monitoring_task;hasMonitoringDomain">
  <rdfs:range rdf:resource="&monitoring_task;MonitoringDomain"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasOutputTableFormat -->
<ObjectProperty rdf:about="&monitoring_task;hasOutputTableFormat">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
  <rdfs:range rdf:resource="&monitoring_task;OutputTableFormat"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasPostHook -->
<ObjectProperty rdf:about="&monitoring_task;hasPostHook">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
  <rdfs:range rdf:resource="&monitoring_task;PostHook"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasPreHook -->
<ObjectProperty rdf:about="&monitoring_task;hasPreHook">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
  <rdfs:range rdf:resource="&monitoring_task;PreHook"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasRetrieveHook -->
<ObjectProperty rdf:about="&monitoring_task;hasRetrieveHook">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
  <rdfs:range rdf:resource="&monitoring_task;RetrieveHook"/>
</ObjectProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#hasStartHook -->
<ObjectProperty rdf:about="&monitoring_task;hasStartHook">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
  <rdfs:range rdf:resource="&monitoring_task;StartHook"/>
</ObjectProperty>

```

```

<!-- http://fp7-novi.eu/monitoring_task.owl#hasStopHook -->
<ObjectProperty rdf:about="&monitoring_task;hasStopHook">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_task;MonitoringTask"/>
  <rdfs:subPropertyOf rdf:resource="&monitoring_task;MonitoringTaskProperty"/>
  <rdfs:range rdf:resource="&monitoring_task;StopHook"/>
</ObjectProperty>

<!--
//
// Data properties
//
-->

<!-- http://fp7-novi.eu/monitoring_task.owl#hookCode -->
<DatatypeProperty rdf:about="&monitoring_task;hookCode">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_task;Hook"/>
  <rdfs:range rdf:resource="&xsd:string"/>
</DatatypeProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#name -->
<DatatypeProperty rdf:about="&monitoring_task;name">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:range rdf:resource="&xsd:string"/>
  <rdfs:domain>
    <Class>
      <unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&monitoring_task;Column"/>
        <rdf:Description rdf:about="&monitoring_task;MonitoringTask"/>
        <rdf:Description rdf:about="&monitoring_task;OutputTableFormat"/>
      </unionOf>
    </Class>
  </rdfs:domain>
</DatatypeProperty>

<!-- http://fp7-novi.eu/monitoring_task.owl#sequenceNumber -->
<DatatypeProperty rdf:about="&monitoring_task;sequenceNumber">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="&monitoring_task;Column"/>
</DatatypeProperty>

<!--
//
// Classes
//
-->

<!-- http://fp7-novi.eu/monitoring_task.owl#AuthenticationType -->
<Class rdf:about="&monitoring_task;AuthenticationType">
  <rdfs:subClassOf rdf:resource="&monitoring_task;MonitoringTaskDefinitionPart"/>
</Class>

```

```

<!-- http://fp7-novi.eu/monitoring_task.owl#Column -->
<Class rdf:about="&monitoring_task;Column">
  <rdfs:subClassOf>
    <Restriction>
      <onProperty rdf:resource="&monitoring_task;sequenceNumber"/>
      <qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</qualifiedCardinality>
      <onDataRange rdf:resource="&xsd:int"/>
    </Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <Restriction>
      <onProperty rdf:resource="&monitoring_task;name"/>
      <qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</qualifiedCardinality>
      <onDataRange rdf:resource="&xsd:string"/>
    </Restriction>
  </rdfs:subClassOf>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#Driver -->
<Class rdf:about="&monitoring_task;Driver">
  <rdfs:subClassOf rdf:resource="&monitoring_task;MonitoringTaskDefinitionPart"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#ExecutionParameter -->
<Class rdf:about="&monitoring_task;ExecutionParameter">
  <rdfs:subClassOf rdf:resource="&monitoring_parameter;Parameter"/>
  <rdfs:subClassOf rdf:resource="&monitoring_task;MonitoringParameter"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#Hook -->
<Class rdf:about="&monitoring_task;Hook">
  <rdfs:subClassOf rdf:resource="&monitoring_task;MonitoringTaskDefinitionPart"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#HookParameter -->
<Class rdf:about="&monitoring_task;HookParameter">
  <rdfs:subClassOf rdf:resource="&monitoring_parameter;Parameter"/>
  <rdfs:subClassOf rdf:resource="&monitoring_task;MonitoringParameter"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#MiscColumn -->
<Class rdf:about="&monitoring_task;MiscColumn">
  <rdfs:subClassOf rdf:resource="&monitoring_task;Column"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#MonitoredFeatureColumn -->
<Class rdf:about="&monitoring_task;MonitoredFeatureColumn">
  <rdfs:subClassOf rdf:resource="&monitoring_task;Column"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#MonitoringDomain -->
<Class rdf:about="&monitoring_task;MonitoringDomain">
  <rdfs:subClassOf rdf:resource="&monitoring_task;MonitoringTaskDefinitionPart"/>
</Class>

```



```

<!-- http://fp7-novi.eu/monitoring_task.owl#MonitoringParameter -->
<Class rdf:about="&monitoring_task;MonitoringParameter">
  <rdfs:subClassOf rdf:resource="&monitoring_task;MonitoringTaskDefinitionPart"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#MonitoringTask -->
<Class rdf:about="&monitoring_task;MonitoringTask">
  <rdfs:subClassOf>
    <Restriction>
      <onProperty rdf:resource="&monitoring_task;hasRetrieveHook"/>
      <onClass rdf:resource="&monitoring_task;RetrieveHook"/>
      <qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</qualifiedCardinality>
    </Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <Restriction>
      <onProperty rdf:resource="&monitoring_task;hasMonitoringDomain"/>
      <someValuesFrom rdf:resource="&monitoring_task;MonitoringDomain"/>
    </Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <Restriction>
      <onProperty rdf:resource="&monitoring_task;hasAuthenticationType"/>
      <onClass rdf:resource="&monitoring_task;AuthenticationType"/>
      <qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</qualifiedCardinality>
    </Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <Restriction>
      <onProperty rdf:resource="&monitoring_task;hasDriver"/>
      <onClass rdf:resource="&monitoring_task;Driver"/>
      <qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</qualifiedCardinality>
    </Restriction>
  </rdfs:subClassOf>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#MonitoringTaskDefinitionPart -->
<Class rdf:about="&monitoring_task;MonitoringTaskDefinitionPart"/>

<!-- http://fp7-novi.eu/monitoring_task.owl#OutputTableFormat -->
<Class rdf:about="&monitoring_task;OutputTableFormat">
  <rdfs:subClassOf rdf:resource="&monitoring_task;MonitoringTaskDefinitionPart"/>
  <rdfs:subClassOf>
    <Restriction>
      <onProperty rdf:resource="&monitoring_task;name"/>
      <qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</qualifiedCardinality>
      <onDataRange rdf:resource="&xsd:string"/>
    </Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <Restriction>
      <onProperty rdf:resource="&monitoring_task;hasColumn"/>
      <someValuesFrom rdf:resource="&monitoring_task;Column"/>
    </Restriction>
  </rdfs:subClassOf>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#PostHook -->

```

```

<Class rdf:about="&monitoring_task;PostHook">
  <rdfs:subClassOf rdf:resource="&monitoring_task;Hook"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#PreHook -->
<Class rdf:about="&monitoring_task;PreHook">
  <rdfs:subClassOf rdf:resource="&monitoring_task;Hook"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#RetrieveHook -->
<Class rdf:about="&monitoring_task;RetrieveHook">
  <rdfs:subClassOf rdf:resource="&monitoring_task;Hook"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#StartHook -->
<Class rdf:about="&monitoring_task;StartHook">
  <rdfs:subClassOf rdf:resource="&monitoring_task;Hook"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#StopHook -->
<Class rdf:about="&monitoring_task;StopHook">
  <rdfs:subClassOf rdf:resource="&monitoring_task;Hook"/>
</Class>

<!-- http://fp7-novi.eu/monitoring_task.owl#TabularColumn -->
<Class rdf:about="&monitoring_task;TabularColumn">
  <rdfs:subClassOf rdf:resource="&monitoring_task;Column"/>
  <rdfs:subClassOf>
    <Restriction>
      <onProperty rdf:resource="&monitoring_task;hasOutputTableFormat"/>
      <onClass rdf:resource="&monitoring_task;OutputTableFormat"/>
      <qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</qualifiedCardinality>
    </Restriction>
  </rdfs:subClassOf>
</Class>

<!--
////////////////////////////////////
//
// Individuals
//
////////////////////////////////////
-->

<!-- http://fp7-novi.eu/monitoring_task.owl#DB -->
<NamedIndividual rdf:about="&monitoring_task;DB">
  <rdf:type rdf:resource="&monitoring_task;Driver"/>
</NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_task.owl#REST -->
<NamedIndividual rdf:about="&monitoring_task;REST">
  <rdf:type rdf:resource="&monitoring_task;Driver"/>
</NamedIndividual>

```

```

<!-- http://fp7-novi.eu/monitoring_task.owl#SOAPClient -->
<NamedIndividual rdf:about="&monitoring_task;SOAPClient">
  <rdf:type rdf:resource="&monitoring_task;Driver"/>
</NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_task.owl#SSH -->
<NamedIndividual rdf:about="&monitoring_task;SSH">
  <rdf:type rdf:resource="&monitoring_task;Driver"/>
</NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_task.owl#Slice -->
<NamedIndividual rdf:about="&monitoring_task;Slice">
  <rdf:type rdf:resource="&monitoring_task;MonitoringDomain"/>
</NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_task.owl#Substrate -->
<NamedIndividual rdf:about="&monitoring_task;Substrate">
  <rdf:type rdf:resource="&monitoring_task;MonitoringDomain"/>
</NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_task.owl#UsernamePassword -->
<NamedIndividual rdf:about="&monitoring_task;UsernamePassword">
  <rdf:type rdf:resource="&monitoring_task;AuthenticationType"/>
</NamedIndividual>

<!-- http://fp7-novi.eu/monitoring_task.owl#UsernameRSAKey -->
<NamedIndividual rdf:about="&monitoring_task;UsernameRSAKey">
  <rdf:type rdf:resource="&monitoring_task;AuthenticationType"/>
</NamedIndividual>
</rdf:RDF>

```

## A.2.8 Unit ontology

```

<?xml version="1.0"?>

<!DOCTYPE rdf:RDF [
  <!ENTITY owl "http://www.w3.org/2002/07/owl#" >
  <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
  <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
]>

<rdf:RDF xmlns="http://fp7-novi.eu/unit.owl#"
  xml:base="http://fp7-novi.eu/unit.owl"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
  <owl:Ontology rdf:about="http://fp7-novi.eu/unit.owl"/>

```

```

<!--
//
// Annotation properties
//
//
-->

```

```

<!--
//
// Datatypes
//
//
-->

```

```

<!--
//
// Object Properties
//
//
-->

```

```

<!-- http://fp7-novi.eu/unit.owl#defaultUnit -->

```

```

<owl:ObjectProperty rdf:about="http://fp7-novi.eu/unit.owl#defaultUnit">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="http://fp7-novi.eu/unit.owl#Dimension"/>
  <rdfs:range rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
</owl:ObjectProperty>

```

```

<!-- http://fp7-novi.eu/unit.owl#derivedFrom -->

```

```

<owl:ObjectProperty rdf:about="http://fp7-novi.eu/unit.owl#derivedFrom"/>

```

```

<!-- http://fp7-novi.eu/unit.owl#hasPrefix -->

```

```

<owl:ObjectProperty rdf:about="http://fp7-novi.eu/unit.owl#hasPrefix">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="http://fp7-novi.eu/unit.owl#Prefix"/>
</owl:ObjectProperty>

```

```

<!-- http://fp7-novi.eu/unit.owl#hasUnit -->

```

```

<owl:ObjectProperty rdf:about="http://fp7-novi.eu/unit.owl#hasUnit">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
</owl:ObjectProperty>

```

```

<!-- http://fp7-novi.eu/unit.owl#possiblePrefix -->

```

```

<owl:ObjectProperty rdf:about="http://fp7-novi.eu/unit.owl#possiblePrefix">
  <rdfs:range rdf:resource="http://fp7-novi.eu/unit.owl#Prefix"/>
  <rdfs:domain rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
</owl:ObjectProperty>

```

```

<!--
// Data properties
//
-->

<!-- http://fp7-novi.eu/unit.owl#base -->

<owl:DatatypeProperty rdf:about="http://fp7-novi.eu/unit.owl#base">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="http://fp7-novi.eu/unit.owl#Prefix"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/unit.owl#exponent -->

<owl:DatatypeProperty rdf:about="http://fp7-novi.eu/unit.owl#exponent">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#PowerDimension"/>
        <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#PowerUnit"/>
        <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#Prefix"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/unit.owl#forwardExpression -->

<owl:DatatypeProperty rdf:about="http://fp7-novi.eu/unit.owl#forwardExpression">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:subPropertyOf rdf:resource="http://fp7-novi.eu/unit.owl#regexp"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/unit.owl#hasValue -->

<owl:DatatypeProperty rdf:about="http://fp7-novi.eu/unit.owl#hasValue"/>

<!-- http://fp7-novi.eu/unit.owl#inverseExpression -->

<owl:DatatypeProperty rdf:about="http://fp7-novi.eu/unit.owl#inverseExpression">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:subPropertyOf rdf:resource="http://fp7-novi.eu/unit.owl#regexp"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/unit.owl#offset -->

<owl:DatatypeProperty rdf:about="http://fp7-novi.eu/unit.owl#offset">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <rdfs:range rdf:resource="&xsd;double"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/unit.owl#regexp -->

<owl:DatatypeProperty rdf:about="http://fp7-novi.eu/unit.owl#regexp">
  <rdfs:comment>An abstraction of any arbitrary function that can be expressed by regular
expressions. The format can be of the following two forms:

```

- I. /evalInteger/expression/operation/
- II. /evalIntegerAsString/expression/operation/separator/[...],

where [...] stands for a series of operation/separator/ with n repetition.

&quot;expression&quot;: is a regular expression, which contains grouping enclosed by parenthesis, like &quot;([0-9]\*)&quot;. These groups are referenced by &quot;\g<1?>&quot; within the operation field, where question mark represents the sequence number of the group referenced, starting with 1.

&quot;operation&quot;: is a mathematical form that may contain operations understood by eval method. For instance: &quot;+, -, \*, /, &gt;&gt;&quot;, etc.

&quot;separator&quot;: is the piece of string to be appended to the result of an evaluation, which is already transformed a string.

An example:

Given a function that maps: {apple1 |-&gt; 10, apple2 |-&gt; 20, ...} can be expressed as follows:

```
/evalInteger/alma([0-9]*)/10*(\g<1&gt;)/
```

Another example:

Given a function that maps: { 11 |-&gt; 1d2u, 32 |-&gt; 3d4u, ...} can be expressed as follows:

```
/evalIntegerAsString/([0-9])([0-9])(\g<1&gt;)/d/2*(\g<2&gt;)/u/</rdfs:comment>
  <rdfs:domain rdf:resource="http://fp7-novi.eu/unit.owl#RegexpTransformedUnit"/>
  <rdfs:range rdf:resource="&xsd:string"/>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/unit.owl#scale -->
<owl:DatatypeProperty rdf:about="http://fp7-novi.eu/unit.owl#scale">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="&xsd:double"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
        <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#Prefix"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>

<!-- http://fp7-novi.eu/unit.owl#symbol -->
<owl:DatatypeProperty rdf:about="http://fp7-novi.eu/unit.owl#symbol">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:range rdf:resource="&xsd:string"/>
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#Prefix"/>
        <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#Unit"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:DatatypeProperty>

<!--
////////////////////////////////////
//
// Classes
//
////////////////////////////////////
-->
```

```

<!-- http://fp7-novi.eu/unit.owl#BaseDimension -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#BaseDimension">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#Dimension"/>
  <owl:disjointWith rdf:resource="http://fp7-novi.eu/unit.owl#DerivedDimension"/>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#BaseUnit -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#BaseUnit">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
  <rdfs:comment>Base units are the simplest unit forms, independent of each other, and they
are the profound building blocks for derived units.</rdfs:comment>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#BinaryPrefix -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#BinaryPrefix">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#Prefix"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#base"/>
      <owl:hasValue rdf:datatype="&xsd;integer">2</owl:hasValue>
    </owl:Restriction>
  </rdfs:subClassOf>
  <owl:disjointWith rdf:resource="http://fp7-novi.eu/unit.owl#DecimalPrefix"/>
  <rdfs:comment>In computing, a binary prefix is a specifier or mnemonic that is prepended to
the units of digital information, the bit and the byte, to indicate multiplication by a power of 2.
In practice the powers used are multiples of 10, so the prefixes denote powers of 1024 = 2^10.

Starting in about 1998, a number of standards and trade organizations approved standards and
recommendations for a new set of binary prefixes, proposed earlier by the International
Electrotechnical Commission (IEC), that would refer unambiguously to powers of 1024. According to
these, the SI prefixes would only be used in the decimal sense, even when referring to data storage
capacities: kilobyte and megabyte would denote one thousand bytes and one million bytes respectively
(consistent with SI), while new terms such as kibibyte, mebibyte and gibibyte, abbreviated KiB, MiB,
and GiB, would denote 1024 bytes, 1048576 bytes, and 1073741824 bytes respectively.</rdfs:comment>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#Boolean -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Boolean">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#BaseDimension"/>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#Cardinal -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Cardinal">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#BaseDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#NominalLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#unitless"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#Countable -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Countable">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#BaseDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#piece"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

```

    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

```

<!-- http://fp7-novi.eu/unit.owl#DecimalPrefix -->

```

```

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#DecimalPrefix">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#Prefix"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#base"/>
      <owl:hasValue rdf:datatype="&xsd;integer">10</owl:hasValue>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment>A prefix that precedes a basic unit of measure to indicate a decadic multiple
or fraction of the unit.

```

The prefix kilo-, for example, may be added to gram to indicate multiplication by one thousand; one kilogram is equal to one thousand grams (1 km = 1000 m). The prefix centi-, likewise, may be added to metre to indicate division by one hundred; one centimetre is equal to one hundredth of a metre (1 cm = 0.01 m).</rdfs:comment>

```

</owl:Class>

```

```

<!-- http://fp7-novi.eu/unit.owl#DerivedDimension -->

```

```

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#DerivedDimension">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#Dimension"/>
</owl:Class>

```

```

<!-- http://fp7-novi.eu/unit.owl#DifferenceDimension -->

```

```

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#DifferenceDimension">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#DerivedDimension"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#IntervalLevel"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">2</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

```

<!-- http://fp7-novi.eu/unit.owl#Dimension -->

```

```

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Dimension">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#hasValue"/>
      <owl:maxCardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:maxCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#hasUnit"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
      <owl:maxQualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:maxQualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#hasPrefix"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#Prefix"/>
      <owl:maxQualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:maxQualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>

```



```

    <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
    <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
    <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment>Numbers are meaningless for the physicist without the correct use of units. It
makes no sense to say "the distance from my house to school is two", unless we follow that
statement with "miles" or "kilometers", or whichever unit makes the statement
true.

```

We will distinguish between dimension, the abstract quality of a measurement without scale (ie., length), and unit, the quality of a number which specifies a previously agreed upon scale (ie., meters). While dimensional arguments are of primary importance in understanding the qualitative behavior of systems, the use of units are necessary for the predictions we seek.

```

<!-- http://fp7-novi.eu/unit.owl#Frequency -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Frequency">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#PowerDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#TimeInterval"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#persecond"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#exponent"/>
      <owl:hasValue rdf:datatype="&xsd;integer">-1</owl:hasValue>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#GeoPosition -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#GeoPosition">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#BaseDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#NominalLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#radian"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#IPAddress -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#IPAddress">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#BaseDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#NominalLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#ipv4dotted"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

```

<!-- http://fp7-novi.eu/unit.owl#InformationLossRatio -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#InformationLossRatio">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#InformationSize"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      </owl:Restriction>
    </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#unitless"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#InformationRate -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#InformationRate">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#ProductDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#Frequency"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      </owl:Restriction>
    </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#InformationSize"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      </owl:Restriction>
    </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#bitpersecond"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#InformationSize -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#InformationSize">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#BaseDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#bit"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#InformationUtilization -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#InformationUtilization">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#InformationSize"/>

```

```

        <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
            <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#unitless"/>
        </owl:Restriction>
    </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#IntervalLevel -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#IntervalLevel">
    <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#OrdinalLevel"/>
    <rdfs:comment>Quantitative attributes are all measurable on interval scales, as any
difference between the levels of an attribute can be multiplied by any real number to exceed or
equal another difference. A highly familiar example of interval scale measurement is temperature
with the Celsius scale. In this particular scale, the unit of measurement is 1/100 of the
temperature difference between the freezing and boiling points of water under a pressure of 1
atmosphere. The &quot;zero point&quot; on an interval scale is arbitrary; and negative values can be
used. The formal mathematical term is an affine space (in this case an affine line). Variables
measured at the interval level are called &quot;interval variables&quot; or sometimes &quot;scaled
variables&quot; as they have units of measurement.

Ratios between numbers on the scale are not meaningful, so operations such as multiplication and
division cannot be carried out directly. But ratios of differences can be expressed; for example,
one difference can be twice another.

The central tendency of a variable measured at the interval level can be represented by its mode,
its median, or its arithmetic mean. Statistical dispersion can be measured in most of the usual
ways, which just involved differences or averaging, such as range, interquartile range, and standard
deviation. Since one cannot divide, one cannot define measures that require a ratio, such as
studentized range or coefficient of variation. More subtly, while one can define moments about the
origin, only central moments are useful, since the choice of origin is arbitrary and not meaningful.
One can define standardized moments, since ratios of differences are meaningful, but one cannot
define coefficient of variation, since the mean is a moment about the origin, unlike the standard
deviation, which is (the square root of) a central moment.</rdfs:comment>
    </owl:Class>

<!-- http://fp7-novi.eu/unit.owl#LinearTransformedUnit -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#LinearTransformedUnit">
    <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#UnaryUnit"/>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#offset"/>
            <owl:maxQualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:maxQualifiedCardinality>
            <owl:onDataRange rdf:resource="&xsd;double"/>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#scale"/>
            <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
            <owl:onDataRange rdf:resource="&xsd;double"/>
        </owl:Restriction>
    </rdfs:subClassOf>
    <rdfs:comment>LTU = scale * U + offset,
where LTU stands for the linear transformed unit derived from U.</rdfs:comment>
    </owl:Class>

<!-- http://fp7-novi.eu/unit.owl#MeasurementLevel -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#MeasurementLevel">
    <rdfs:comment>The &quot;levels of measurement&quot; or scales of measure are expressions
that typically refer to the theory of scale types developed by the psychologist Stanley Smith
Stevens. Stevens proposed his theory in a 1946 Science article titled &quot;On the theory of scales

```

of measurement". In that article, Stevens claimed that all measurement in science was conducted using four different types of scales that he called "nominal", "ordinal", "interval" and "ratio".</rdfs:comment>

```
</owl:Class>
```

```
<!-- http://fp7-novi.eu/unit.owl#N_aryUnit -->
```

```
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#N_aryUnit">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
  <rdfs:comment>N-ary units are derived from more than one unit.</rdfs:comment>
</owl:Class>
```

```
<!-- http://fp7-novi.eu/unit.owl#NameOfSomething -->
```

```
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#NameOfSomething">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#BaseDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#NominalLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#unitless"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```

```
<!-- http://fp7-novi.eu/unit.owl#NominalLevel -->
```

```
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#NominalLevel">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#MeasurementLevel"/>
  <rdfs:comment>At the nominal scale, i.e. for a nominal category, one uses labels; for
example, rocks can be generally categorized as igneous, sedimentary and metamorphic. For this scale,
some valid operations are equivalence and set membership. Nominal measures offer names or labels for
certain characteristics.
```

Variables assessed on a nominal scale are called categorical variables. We can use a simple example of a nominal category: the destination port of an IP packet captured. For instance, looking at the destination port values we might find one or more of IP packets with a value 7777. In this scenario 7777 is their label. We can only check whether two packets's destination ports have the same label (equivalence) or whether a given label is in on a certain list of labels (set membership), but it is impossible to say which label is greater or less than another (comparison) or to measure the difference between two labels.

Given a set of destination port numbers, we can describe the set by its most common label (the mode), but cannot provide an "average label" or even the "middle label" among all the names. However, if we decide to sort our labels numerically (or to sort them by how many times they appear in a measurement log), we will begin to turn this nominal scale into an ordinal scale.</rdfs:comment>

```
</owl:Class>
```

```
<!-- http://fp7-novi.eu/unit.owl#OrdinalLevel -->
```

```
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#OrdinalLevel">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#NominalLevel"/>
  <rdfs:comment>Rank-ordering data simply puts the data on an ordinal scale. Ordinal
measurements describe order, but not relative size or degree of difference between the items
measured. In this scale type, the numbers assigned to objects or events represent the rank order
(1st, 2nd, 3rd, etc.) of the entities assessed. An example of an ordinal scale is the result of a
horse race, which says only which horses arrived first, second, or third but include no information
about race times.
```

When using an ordinal scale, the central tendency of a group of items can be described by using the group's mode (or most common item) or its median (the middle-ranked item), but the mean (or average) cannot be defined. Thus it is an error to write that an IQ of 160 is just as different from an IQ of 130 as an IQ of 100 is different from an IQ of 70.</rdfs:comment>

```
</owl:Class>
```

```
<!-- http://fp7-novi.eu/unit.owl#PointInTime -->
```

```

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#PointInTime">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#BaseDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#IntervalLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#unixtimestamp"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#PowerDimension -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#PowerDimension">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#DerivedDimension"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#exponent"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      <owl:onDataRange rdf:resource="&xsd;integer"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#PowerUnit -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#PowerUnit">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#UnaryUnit"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#exponent"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      <owl:onDataRange rdf:resource="&xsd;integer"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment>PU = U^exponent,
where PU power unit is derived from U unit.</rdfs:comment>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#Prefix -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Prefix">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#exponent"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      <owl:onDataRange rdf:resource="&xsd;integer"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#base"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      <owl:onDataRange rdf:resource="&xsd;integer"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment>A metric prefix or SI prefix is a unit prefix that precedes a basic unit of
measure to indicate a decadic multiple or fraction or binary multiple of the unit. Each prefix has a
unique symbol that is prepended to the unit symbol.

```

The use of multiple prefixes are disallowed.</rdfs:comment>  
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#Probability -->

```
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Probability">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#unitless"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#Countable"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```

<!-- http://fp7-novi.eu/unit.owl#ProductDimension -->

```
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#ProductDimension">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#DerivedDimension"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass>
        <owl:Class>
          <owl:unionOf rdf:parseType="Collection">
            <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#BaseDimension"/>
            <rdf:Description rdf:about="http://fp7-
novi.eu/unit.owl#PowerDimension"/>
          </owl:unionOf>
        </owl:Class>
      </owl:onClass>
      <owl:minQualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">2</owl:minQualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```

<!-- http://fp7-novi.eu/unit.owl#ProductUnit -->

```
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#ProductUnit">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#N_aryUnit"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
      <owl:minQualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">2</owl:minQualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment>ProdU = U1 * U2 [... * Ui],
where ProdU product unit is derived from multiplying units Ui.</rdfs:comment>
</owl:Class>
```

<!-- http://fp7-novi.eu/unit.owl#RatioDimension -->

```
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#RatioDimension">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#DerivedDimension"/>
  <rdfs:subClassOf>
    <owl:Restriction>
```

```

    <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
    <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
    <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#RatioLevel -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#RatioLevel">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#IntervalLevel"/>
  <rdfs:comment>Most measurement in the physical sciences and engineering is done on ratio
scales. Mass, length, time, plane angle, energy and electric charge are examples of physical
measures that are ratio scales. The scale type takes its name from the fact that measurement is the
estimation of the ratio between a magnitude of a continuous quantity and a unit magnitude of the
same kind (Michell, 1997, 1999). Informally, the distinguishing feature of a ratio scale is the
possession of a zero value. For example, the Kelvin temperature scale has a non-arbitrary zero point
of absolute zero, which is denoted 0K and is equal to -273.15 degrees Celsius. This zero point is
accuracy representing the particles that compose matter at this temperature having zero kinetic
energy.

All statistical measures can be used for a variable measured at the ratio level, as all necessary
mathematical operations are defined. The central tendency of a variable measured at the ratio level
can be represented by, in addition to its mode, its median, or its arithmetic mean, also its
geometric mean or harmonic mean. In addition to the measures of statistical dispersion defined for
interval variables, such as range and standard deviation, for ratio variables one can also define
measures that require a ratio, such as studentized range or coefficient of variation.</rdfs:comment>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#RegexpTransformedUnit -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#RegexpTransformedUnit">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#UnaryUnit"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#forwardExpression"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      <owl:onDataRange rdf:resource="&xsd:string"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#inverseExpression"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
      <owl:onDataRange rdf:resource="&xsd:string"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment>This kind of unit is a made-up unary type. The idea behind is that most of the
complex functions can be represented as a series of operations based on regular expressions.

RTU = Forward(U)
U = Inverse(RTU)</rdfs:comment>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#Temperature -->

<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Temperature">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#BaseDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#kelvin"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

```

<!-- http://fp7-novi.eu/unit.owl#TimeInterval -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#TimeInterval">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#DifferenceDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#PointInTime"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">2</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#second"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#UnaryUnit -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#UnaryUnit">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#Unit"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:comment>Unary unit is a derivative of a single unit.</rdfs:comment>
</owl:Class>

<!-- http://fp7-novi.eu/unit.owl#Unit -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Unit"/>

<!-- http://fp7-novi.eu/unit.owl#Utilization -->
<owl:Class rdf:about="http://fp7-novi.eu/unit.owl#Utilization">
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioDimension"/>
  <rdfs:subClassOf rdf:resource="http://fp7-novi.eu/unit.owl#RatioLevel"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#derivedFrom"/>
      <owl:onClass rdf:resource="http://fp7-novi.eu/unit.owl#Countable"/>
      <owl:qualifiedCardinality
rdf:datatype="&xsd;nonNegativeInteger">1</owl:qualifiedCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://fp7-novi.eu/unit.owl#defaultUnit"/>
      <owl:hasValue rdf:resource="http://fp7-novi.eu/unit.owl#unitless"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

<!--
//
// Individuals
//
//
-->

```



```

<!-- http://fp7-novi.eu/unit.owl#Byte -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#Byte">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <scale>8</scale>
  <symbol>B</symbol>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#Gibi"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#Kibi"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#Mebi"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#Tebi"/>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#bit"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#giga"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#kilo"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#mega"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#Bytepersecond -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#Bytepersecond">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <scale>8</scale>
  <symbol>Bps</symbol>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#bitpersecond"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#giga"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#kilo"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#mega"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#Gibi -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#Gibi">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BinaryPrefix"/>
  <exponent>30</exponent>
  <base>2</base>
  <symbol>Gi</symbol>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#Kibi -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#Kibi">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BinaryPrefix"/>
  <symbol>K</symbol>
  <exponent>10</exponent>
  <base>2</base>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#Mebi -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#Mebi">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BinaryPrefix"/>
  <base>2</base>
  <exponent>20</exponent>
  <symbol>Mi</symbol>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#Tebi -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#Tebi">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BinaryPrefix"/>
  <base>2</base>
  <symbol>Ti</symbol>
  <exponent>40</exponent>
</owl:NamedIndividual>

```

```

<!-- http://fp7-novi.eu/unit.owl#bit -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#bit">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BaseUnit"/>
  <symbol>bit</symbol>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#giga"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#kilo"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#mega"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#bitpersecond -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#bitpersecond">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#ProductUnit"/>
  <symbol>bps</symbol>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#bit"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#giga"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#kilo"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#mega"/>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#persecond"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#celsius -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#celsius">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <offset>273.15</offset>
  <scale>1</scale>
  <symbol>C</symbol>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#kelvin"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#day -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#day">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <scale>86400</scale>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#second"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#deco -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#deco">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#DecimalPrefix"/>
  <symbol>da</symbol>
  <exponent>1</exponent>
  <base>10</base>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#dozen -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#dozen">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <symbol>dozen</symbol>
  <scale>12</scale>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#piece"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#fraction -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#fraction">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BaseUnit"/>
  <symbol></symbol>
</owl:NamedIndividual>

```



```

    <forwardExpression>/evalIntegerAsString/([0-9]*)/hex(((\g&lt;1&gt;) &amp;
0xFFFF0000000000000000000000000000) &gt;&gt; 112)/:/hex(((\g&lt;1&gt;) &amp;
0xFFFF0000000000000000000000000000) &gt;&gt; 96)/:/hex(((\g&lt;1&gt;) &amp; 0xFFFF0000000000000000000000000000)
&gt;&gt; 80)/:/hex(((\g&lt;1&gt;) &amp; 0xFFFF00000000000000000000) &gt;&gt; 64)/:/hex(((\g&lt;1&gt;)
&amp; 0xFFFF000000000000) &gt;&gt; 48)/:/hex(((\g&lt;1&gt;) &amp; 0xFFFF00000000) &gt;&gt;
32)/:/hex(((\g&lt;1&gt;) &amp; 0xFFFF0000) &gt;&gt; 16)/:/hex(((\g&lt;1&gt;) &amp;
0xFFFF))/</forwardExpression>
    <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#ipv6dotted"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#kelvin -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#kelvin">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BaseUnit"/>
  <symbol>K</symbol>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#kilo -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#kilo">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#DecimalPrefix"/>
  <base>10</base>
  <symbol>k</symbol>
  <exponent>3</exponent>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#mega -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#mega">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#DecimalPrefix"/>
  <base>10</base>
  <exponent>6</exponent>
  <symbol>M</symbol>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#micro -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#micro">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#DecimalPrefix"/>
  <exponent>-6</exponent>
  <base>10</base>
  <symbol>mu</symbol>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#milli -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#milli">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#DecimalPrefix"/>
  <symbol>m</symbol>
  <base>10</base>
  <exponent>-3</exponent>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#minute -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#minute">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <symbol>min</symbol>
  <scale>60</scale>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#second"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#month -->

```

```

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#month">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <scale>1814400</scale>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#second"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#nano -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#nano">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#DecimalPrefix"/>
  <exponent>-9</exponent>
  <symbol>n</symbol>
  <base>10</base>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#percent -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#percent">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <scale>100</scale>
  <symbol>%</symbol>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#fraction"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#permil -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#permil">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <scale>1000</scale>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#fraction"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#persecond -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#persecond">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#PowerUnit"/>
  <symbol>Hz</symbol>
  <exponent>-1</exponent>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#giga"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#kilo"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#mega"/>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#second"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#pico -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#pico">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#DecimalPrefix"/>
  <symbol>p</symbol>
  <exponent>-12</exponent>
  <base>10</base>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#piece -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#piece">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BaseUnit"/>
  <symbol>(1)</symbol>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#radian -->

<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#radian">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BaseUnit"/>

```

```

</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#second -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#second">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BaseUnit"/>
  <symbol>s</symbol>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#micro"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#milli"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#nano"/>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#pico"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#tera -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#tera">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#DecimalPrefix"/>
  <exponent>12</exponent>
  <symbol>T</symbol>
  <base>10</base>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#unitless -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#unitless">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BaseUnit"/>
  <symbol></symbol>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#unixtimestamp -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#unixtimestamp">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#BaseUnit"/>
  <symbol>s</symbol>
  <possiblePrefix rdf:resource="http://fp7-novi.eu/unit.owl#nano"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#week -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#week">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <scale>604800</scale>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#second"/>
</owl:NamedIndividual>

<!-- http://fp7-novi.eu/unit.owl#year -->
<owl:NamedIndividual rdf:about="http://fp7-novi.eu/unit.owl#year">
  <rdf:type rdf:resource="http://fp7-novi.eu/unit.owl#LinearTransformedUnit"/>
  <scale>6622560000</scale>
  <derivedFrom rdf:resource="http://fp7-novi.eu/unit.owl#second"/>
</owl:NamedIndividual>

<!--
//
// General axioms
//
//
-->

<rdf:Description>
  <rdf:type rdf:resource="&owl;AllDisjointClasses"/>
  <owl:members rdf:parseType="Collection">

```

```

    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#BaseUnit" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#N_aryUnit" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#UnaryUnit" />
  </owl:members>
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  <rdf:type rdf:resource="&owl:AllDisjointClasses" />
  <owl:members rdf:parseType="Collection">
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#DifferenceDimension" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#PowerDimension" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#ProductDimension" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#RatioDimension" />
  </owl:members>
</rdf:Description>
<rdf:Description>
  <rdf:type rdf:resource="&owl:AllDisjointClasses" />
  <owl:members rdf:parseType="Collection">
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#Cardinal" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#Countable" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#GeoPosition" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#IPAddress" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#InformationSize" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#NameOfSomething" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#PointInTime" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#Temperature" />
  </owl:members>
</rdf:Description>
<rdf:Description>
  <rdf:type rdf:resource="&owl:AllDisjointClasses" />
  <owl:members rdf:parseType="Collection">
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#LinearTransformedUnit" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#PowerUnit" />
    <rdf:Description rdf:about="http://fp7-novi.eu/unit.owl#RegexTransformedUnit" />
  </owl:members>
</rdf:Description>
</rdf:RDF>

```

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## Annex B (informative): Authors & contributors

The following people have contributed to the present document:

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## History

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