# ETSI TR 182 022 V2.0.0 (2007-12)

*Technical Report*

.

**Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Architectures for QoS handling**

Reference

DTR/TISPAN-02039-NGN-R2

Keywords

architecture, QoS

*ETSI*

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

***Important notice***

Individual copies of the present document can be downloaded from:
http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services:
http://portal.etsi.org/chaircor/ETSI_support.asp

# Contents

# Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

# Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

# 1 Scope

The present document presents an overall analysis of architectural requirements for QoS reporting and resource monitoring (i.e. QoS handling). This includes analysing management aspects from an architectural perspective (stage 2) as well as taking into account the work on performance and QoS for Next Generation Networks undertaken by STQ.

The area of QoS reporting covers detecting the end-to-end QoS experienced by bearer flows, while the area of resource monitoring covers monitoring the topologies and resources of the transport segments controlled by RACS. Resource monitoring includes detecting the actual usage of these resources.

The present document provides an informative description of the QoS handling tasks that are to be performed. It further describes how different subsystems, common functions or capabilities, and management systems interact in performing these tasks.

Being an informative document providing an overall analysis of QoS handling area it is foreseen to be referenced by the RACS release 2 specification [1] and potentially other specifications impacted by QoS handling, but it only performs a preliminary architectural analysis. New functions or interfaces for QoS Handling will not be part of the normative document of the RACS release 2 specification [1]. The present document does not define or re-define functions or interfaces needed for QoS handling. Instead, such enhancements are expected to be made in normative documents such as the RACS specification, beyond current release.

# 2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
    - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
    - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

## 2.1 Informative references

[1] ETSI ES 282 003: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control Sub-system (RACS); Functional Architecture".

[2] ETSI TS 181 018: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Requirements for QoS in a NGN".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**QoS reporting:** this mechanism identifies the ability for some network elements to collect the values of some QoS metrics of a single service instance

NOTE: Example of QoS metrics could be delay, packet loss, etc.

**resource monitoring:** this mechanism identifies the ability to monitor the topologies and resources of the transport segments controlled by RACS. Resource monitoring includes detecting the actual usage of these resources.

## 3.2 Abbreviations

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

| | |
|---|---|
| AF | Application Function |
| AN | Access Node |
| A-RACF | Access-Resource and Admission Control Function |
| AS | Application Server |
| ATM | Asynchronous Transfer Mode |
| BGF | Border Gateway Function |
| BoD | Bandwidth on Demand |
| CAC | Call Admission Control |
| CDR | Call Detail Record |
| CPE | Customer Premises Equipment |
| IP | Internet Protocol |
| OSS | Operation Support System |
| PCR | Peak Cell Rate |
| QoS | Quality of Service |
| QRC | QoS Reporting Collector |
| QRS | QoS Reporting Source |
| QRU | QoS Reporting User |
| RACS | Resource Admission Control Subsystem |
| RCEF | Resource Control Enforcement Function |
| SNMP | Simple Network Management Protocol |
| SPDF | Service-based Policy Decision Function |
| TRIM | Topology and Resource Information Model |
| TRIS | Topology and Resource Information Specification |
| TRSF | Topology and Resource Storage Function |
| VC | Virtual Circuit |
| VP | Virtual Path |
| x-RACF | Generic-Resource and Admission Control Function |

# 4 Resource Monitoring

RACS provides policy based transport control services to application functions (i.e. QoS control). These services may include policy control, resource reservation, policing, gate control and IP address mediation. Implementing such services RACS needs to hold a logical view of the different transport segments within its control. This view is kept up-to-date and potentially also reflect the actual usage of the network in case traffic sources send at variable rates or in case not all flows are under the control of RACS.

Hence, for RACS to perform resource monitoring it needs functions and reference points to retrieve and store a logical view of the different transport segments within its control. This view is herein described in the form of a logical topology and resource information model (TRIM), which is stored by RACS in the form of a topology and resource information specification (TRIS).

Clause 4.1 discusses the general principles in retrieving, storing and keeping TRIS up-to-date to facilitate efficient resource control by RACS. Clause 4.2 describes the concrete information of TRIS and the mechanisms involved in retrieving, storing and keeping TRIS up-to-date with the transport segments it models.

# 4.1 General principles of Resource Monitoring

RACS needs to maintain accurate and current knowledge of resources available in the transport segments within its control and knowledge of which resources will be involved in forwarding individual media flows through these transport segments (i.e. the topology and resource information captured by TRIS). This information is needed by RACS for it to locate all the necessary functional entities and Transport Processing Entities (e.g. SPDF, A-RACF, BGF, RCSF and AN instances), that need to be involved in serving reservation requests issued over Gq'. The A-RACF uses TRIS to perform effective resource admission control for guaranteed forwarding quality of service (QoS).

## 4.1.1 Overview

The topology and resource information is expected to be stored locally by functional entities within RACS. That is, interrogating other functions on a per-request basis may delay the replies to reservation requests made over Gq' and Rq. The information stored locally by each functional entity may not be the complete TRIS for all transport segments controlled by a specific RACS instantiation. An SPDF instance needs only to have access to the information required to serve requests arriving over Gq', while an A-RACF instance only needs to have information to serve requests made over Rq available (i.e. information to interrogate the correct AN and/or RCEF and to perform admission control if guaranteed forwarding QoS is to be offered).

The status of the monitored resources allows the A-RACF to perform resource admission control for the path to protect the involved forwarding resources from overload.

The topology information may be learned by means of a provisioning integration for run-time interaction with OSS system(s) and/or by interacting with network devices.

## 4.1.2 Brief description of scenarios

In annex A of TS 181 018 [2] four scenarios are described that are related to the use of a Resource Monitoring mechanism which will enable a TISPAN NGN to provide an adequate Quality of Service to the media flows.

The following scenarios are derived from the above and illustrate examples where resource monitoring mechanisms are needed to provide accurate and up-to-date network resource and topology information to enable RACS to perform correctly in response to requests for admission control.

### 4.1.2.1 L2 Topology awareness and traffic management options

Scenario A.2 "L2 Topology awareness and traffic management options" [2] describes the case where the RACS has to control an ATM-based access network. Focusing on Connection Admission Control mechanism within an ATM network different approaches can be used. The simplest form among all CAC algorithms, is the so-called Peak Bandwidth Allocation that uses only the knowledge of the PCR parameter to compare against the network available bandwidth and decide whether to accept the configuration of new connection or not. This algorithm ensures that the sum of requested resources and existing connections is bounded by the physical link capacity, but prevents any multiplexing gain among the VC and VP configured into the network. Another approach is to admit new connection allocating a bandwidth between the peak cell rate and the sustained cell rate. As a result, the sum of all the admitted connections' peak cell rates may be greater than the outgoing link capacity.

If a statistical approach is used in the ATM network, RACS is aware of the exact network topology and knows for example the different overbooking factors used in all the interfaces of the various ATM switches. Then, the resource monitoring mechanism allows the RACS to be aware of L2 topology information in order to control an ATM-based access network. In this case the RACS needs to have a map of the network topology, able to model the link that will be affected by the traffic flow and other parameter as VPs and VCs.

Since the RACS is able to control network based on different technology and different deployments, a mechanism is needed in order to retrieve the topology and resource information for different networks and to allow the RACS to know all the information necessary to perform a correct admission control. Moreover, also the topology and resource information model (TRIM) and the topology and resource information (TRIS) maintained by the RACS is independent of the network technology and particular deployments.

NOTE: Further scenarios are possible and contributions are invited.

#### 4.1.2.2 Bandwidth on Demand

Scenario A.4 "Bandwidth on Demand" [2] describes a service offered to a user which allows the user to boost his access bandwidth to a higher level for a limited period of time.

The objective is to study the requirements on the RACS functionalities to deliver such a service. The service would allow users who usually have e.g. 512 Kbps of access bandwidth available to increase this to a higher bandwidth, e.g. 2 Mbps, for a limited period of time.

The service could offer a number of options:

1) Request for increased downstream bandwidth for a specified time. This would allow the user to e.g. download content at a higher rate than normal. In this case only downstream traffic would need to be boosted.

2) Request for increased bi-directional bandwidth for a specified time. This would allow the user to e.g. share content or take part in a video conference and enjoy an improved image and sound quality.

3) Request for increased bandwidth for a specific service which would only affect the traffic associated with that service, e.g. a "Video Boost" service.

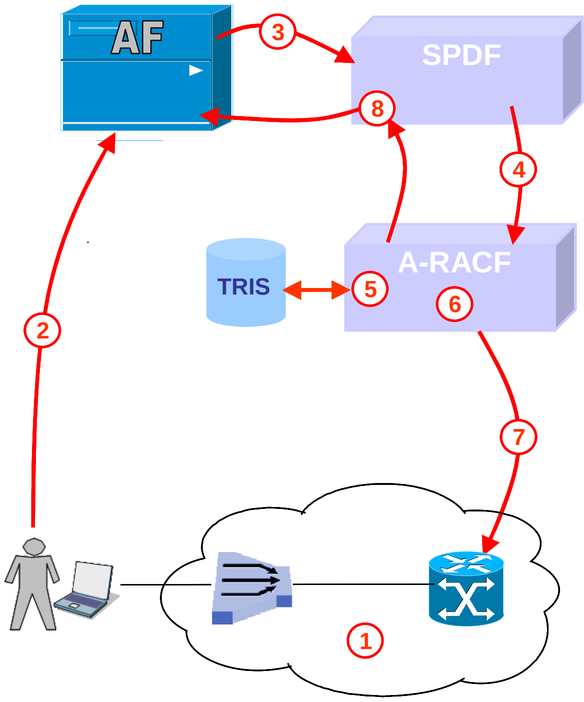
4) Request for increased bandwidth for some specific content.

Note that any of the options above (time based, service based and content based) could be combined.

The traffic affected by a bandwidth change may be all of the traffic to/from a particular subscriber or only a specific subset related to the given service requested. For example, in option 3) above only the video traffic would benefit from the newly available bandwidth. Also, depending on the service requested, bandwidth changes may have an impact on upstream and/or downstream traffic.

Bandwidth rates and the services to which they apply may be explicitly requested by the user or the user may request pre-defined policies. The request could be performed through a web portal. When explicitly requesting a bandwidth rate, the user includes sufficient information to identify the traffic that should be boosted. When requesting a pre-defined policy, the user minimally indicates the policy s/he wants to activate. In this last scenario the user/web portal may be unaware of the specific bandwidth change that RACS will apply in the network since RACS will hide this information.

Figure 1 represents an example of a possible realization of this service.




1. We assume the User CPE Network Session is already established and that the user policy can be applied. There may or may not be a default policy applied
2. A User logs into the Portal and selects to activate the BoD Service
3. The portal forwards the request onto the SPDF (includes User Identifier and BoD Profile to apply)
4. SPDF uses the User IP address or numeric identifier to map the request to an A-RACF
5. Admission Control Policy in the A-RACF uses TRIS information to determine whether there are sufficient resources to admit the request (assume yes)
6. A new network policy set is constructed for this request.
7. BoD Policy Rule is applied to the RCEF and/or AN
8. A-RACF gives positive request response to SPDF which forwards confirmation to user through the Portal

**Figure 1: Bandwidth-on-Demand Scenario**

The sequence of operations is as follows:

- The user logs on to a web portal and selects the BoD service.
- The Web Portal forwards the request to the SPDF including a user identifier (e.g. IP address or numeric identifier) plus an indication of quantity for bandwidth boost (this may be explicitly indicated in the request, or it is possible to reference pre-defined BoD classes).
- The SPDF uses the user identifier to map the request to an appropriate A-RACF.
- The A-RACF accesses information from the TRIS, if needed via TRSF, to determine whether there are sufficient network bandwidth resources to admit the request (we assume there are).
- A new policy set is constructed and applied in the network for the user according to the quantity of bandwidth requested.
- A positive response is forwarded to the user.
- If the Admission Control fails, the user is notified, and no upgrade is configured.

This scenario illustrates the need for current topology and resource information to be available to RACS to allow accurate allocation of resources for new requests. The topology and resource information is maintained in the form of the TRIS as discussed in clause 4.2.2. Implementation of the storage medium for TRIS and its location are for further study but are discussed in annex F to [1].

## 4.1.3 Preferred functional properties

The topology and resource information maintained by RACS (i.e. TRIS) should be independent of the network technology and particular deployments. That is, the actual information stored by RACS may differ between different network technologies and deployments, but the information model used to maintain the required knowledge should be the same for all network technologies and deployments.

Although TRIS is network technology and deployment independent the protocols used to retrieve resource topology and state information can be network technology specific. For example, a protocol used to retrieve the information may have different profiles or parameters to support specific network technologies.

Interfaces for retrieving topology and resource information should support both push and pull. That is, entities communicating topology and resource information to RACS should be able to push information at any time and without delay. RACS should also be able of explicitly pull information from such entities at any time and without delay. For example, a change in topology of the transport network may result in a notification that there are no resources available.

## 4.2 Mechanisms for Resource Monitoring

RACS needs mechanisms to retrieve and store TRIS. This includes mechanism to keep TRIS up-to-date. Moreover, RACS needs mechanisms to distribute subsets of it for usage in different RACS functional entities. Before discussing these mechanisms the type of information to maintain in TRIS and the principles of the information model of TRIS need to be however defined. Clauses 4.2.1 and 4.2.2 provide this definition and these principles. Thereafter, the mechanisms involved in retrieving, storing and distributing TRIS are described in clause 4.2.3.

### 4.2.1 Type of information to be monitored

The resource monitoring mechanisms of RACS are to maintain a topology and resource information specification (TRIS) following the topology and resource information model (TRIM).

TRIM can conceptually be separated into five levels:

1) *Physical Topology*: Device and interface entities of the physical network topology (i.e. the transport segments controlled by RACS) are represented at the first level of TRIM (i.e. *network topology information*). This includes the connections between entities (i.e. connections between interfaces and between interfaces and devices). Entities represented are routers, switches or any other network nodes and network interfaces (physical or logical). At minimum, all contention points should be represented to support meaningful resource admission control. Whether a represented entity is in operation or not is modelled.

2) *Logical Topology*: that describes logical pipes and entry points. The map between physical and logical topology can be maintained by RACS or outside RACS (e.g. in the OSS system) depending on the deployment scenario

3) At the third level of TRIM, *routing information* that describes the connectivity through the topology modelled at the first and the second levels is represented. This information allows identification of the set of device and interface entities traversed by media flows between each transport segment edge-points.

4) *Resource information* is represented at the fourth level. This information may model a hierarchy of resources to accurately describe how capacity is shared at network devices or interfaces between traffic classes. It may further include measurement results for the actual usage of the resources. Each resource is mapped to a device or interface entity represented at the first level of TRIM and/or a logical pipes represented at the second level of TRIM.

5) *Selection Information:* constitutes the fifth level of TRIM. This information allow requests issued over Gq' to be routed to the correct functional entities within RACS.

### 4.2.2 Principles of the information specification

As mentioned above, TRIS needs to be both accurate and up-to-date with the transport segments it models. This clause discusses what parts of TRIS that can be expected to be dynamic and what parts that are likely to be more static over time. The time-scales at which dynamic information may change depends on network technology and configuration. Time-scales are therefore not specifically discussed herein.

The topology information at the first level of TRIS constitutes bootstrap information needed by RACS to interact with individual network devices (i.e. the addresses to network devices are needed). Although the physical topology may not change individual network devices and/or interfaces may be taken out of service for failure, maintenance or other reasons. Hence, the first level information of TRIS can be considered partly static and potentially partly dynamic.

The logical topology information at the second level of TRIS can be considered static and retrieved by OSS systems or interacting with network devices.

The source of the routing information at the third level of TRIS may be implicit in the sense that the routing algorithm is known (e.g. shortest path first) or explicit in the form of complete hop-by-hop source routes. In case the source of the routing information is implicit it will change if re-routing occurs due to changes in the network routing topology (e.g. caused by that network devices and/or interfaces are taken out of service). In case the source of the routing information is explicit it will change if the explicit information is updated. Hence, the second level information of TRIS is potentially dynamic as well.

The resource information at the fourth level of TRIS may consist of information on provisioned resources only (including the potential dynamic state of those resources), or a combination of provisioned resources and measurement results for those resources. In the former case the resource information can be considered static, while in the latter case the measured part of the information is typically dynamic.

The selection information of the fifth level corresponds typically to the static configuration of RACS. The static configuration of selection information is out of the scope of the present document.

RACS keeps a record of currently accepted reservations and the amount of forwarding resources reserved for each device and interface entity modelled by TRIS. The resource admission control process involves to compare the requested amount of resources for each device and interface entity along the path of the media flow(s) of the request with the resource information and records of accepted reservations.

### 4.2.3 Sources of information

Topology and resource information needed to populate TRIS is communicated to RACS by potentially multiple sources including network devices of the transport segments controlled by RACS and external systems such as an OSS. Parts of the complete information set of TRIS are likely to be stored in each internal functional entities of RACS for performance reasons (i.e. interrogating externally located functions on a per-request basis would delay the replies to reservation requests made over Gq' and Rq).

For the above-mentioned reasons RACS needs the capability to retrieve topology and resource information from multiple sources and if needed to distribute it to different internal functional entities. Furthermore, as some information sources may be centralized there is a potential need for communicating topology and resource information using a single point of contact to RACS. For example, a network database and/or inventory of an OSS are commonly centralized entities. Measurement systems providing input to the fourth level resource information of TRIS may not be aware of the internal structure of RACS and would therefore also benefit from a single point of contact to RACS (i.e. understanding how end-to-end measurements maps to transport segments controlled by different A-RACF instances requires awareness of the internal structure of RACS).

Correlating information from different sources (e.g. a network database or inventory, different network devices, and one or more measurement systems) may require access to the complete TRIS. Hence, although parts of it are likely to be locally stored in individual functional entities of RACS, storing the complete TRIS within RACS in addition to the distributed storage should be supported by the architecture.

NOTE: Topology and resource information can be communicated to the A-RACF and the SPDF via provisioning interfaces although those are not defined in release 1. However, in order to ensure that the resource management is correct at all times these functions may also need information directly from network nodes of the transport segments it is controlling. RACS release 1 does not support this kind of resource monitoring.

The RAC function as of ITU-T (which corresponds to RACS) has a reference point towards the underlying network over which topology and resource information can be captured (i.e. the Rc reference point). There is ongoing work within ITU-T sg11 to define stage 3 protocols for Rc (i.e. based on SNMP and COPS respectively).

# 5 QoS Reporting

In addition to performing resource monitoring RACS may retrieve QoS reporting information from an external QoS reporting collector function or subsystem. It should be noted that while topology and resource monitoring information may include measurement results for traffic aggregates, the QoS reporting information typically includes measurement results for individual media flows.

QoS reporting information can be used by RACS in the process of performing resource admission control, be correlated with topology and resource information kept by RACS for further reporting to other systems, or a combination of both.

## 5.1 General principles of QoS Reporting

RACS can benefit from having access to QoS measurements performed by an external QoS reporting collector function or subsystem. For example, RACS can correlate retrieved QoS reporting information with TRIS to identify potential points of overload in the transport segments under its control. By this, A-RACF instances may use the QoS reporting information to adapt the resource admission control strategy.

### 5.1.1 Overview

When retrieving QoS reporting information, RACS may initiate a process to correlate the retrieved information with TRIS and the amount of forwarding resources reserved for each device and interface entity modelled by TRIS. By that, RACS may identify potential points of overload in the transport segments it controls. This information can be used to update the resource information for impacted device and interface entities to adapt the resource admission control strategy for future reservation requests, pre-empt selected existing reservations, or a combination of both.

RACS may also inform an external system such as an OSS of potential points of overload. Such an external system may for example use the obtained information for fault, accounting and/or performance management (e.g. to validate that the intended level of QoS is delivered to media flows).

### 5.1.2 Brief description of scenarios

In annex A of TS 181 018 [2] some scenarios are described that are related to the QoS reporting mechanisms.

Scenario A.1 "Use of sophisticated Admission Control Algorithms" [2] describes the case in which the RACS has to manage variable bit-rate flows. In this scenario we suppose that the traffic flows have the same peak bandwidth but different characteristic of burstiness and average bandwidth. Using a deterministic approach based on the peak bandwidth the waste of bandwidth could be very large.

Then, a QoS reporting mechanism is needed to implement on the RACS admission control algorithms more sophisticated than a simple deterministic scheme. If the RACS has the possibility to know the QoS parameters related to each admitted media flow, it can use an admission control mechanism that allow to optimize the usage of resources. For example the RACS can use a statistical admission control algorithm instead of a deterministic one, it can use an algorithm that allows overbooking of the network resources and it can control the quality perceived by the media flows. If the feedbacks of the QoS metrics for the bearer flows indicate a degradation, the RACS can deny all the requests or act on the existing flows until an acceptable level of quality is reached.

Scenario A.3 "Coexistence of managed and un-managed traffic" [2] describes a case where the RACS receives reservation requests only for a subset of the traffic entering the network. Situations exist where the presence of un-managed traffic may impact the performance of the higher priority flows managed by the RACS. The example is an ATM access network where over all the links un-managed traffic can be present participating in the creation of congestion situation in which the managed traffic is discarded although irrespectively of the information available at the RACS level.

According to this scenario, QoS Reporting mechanism could help RACS to be informed of the un-managed traffic entering the network and react accordingly. As soon as QoS reports degrade, RACS for example lower the available bandwidth.

Since the RACS is able to control network based on different technologies and in different deployment scenarios, a mechanism is needed to allow the RACS to have QoS reporting data from heterogeneous sources; the data can be formatted in different format.

### 5.1.3 Preferred functional properties

QoS reporting information may origin from network end-points (i.e. end-to-end measurements) or individual network devices (i.e. device measurements). End-to-end measurements may need to be correlated with the complete TRIS (i.e. the topology and resource information covers the complete path of the measurements). Hence, in case the information origins from network end-points it may not be possible to relate the information to a specific transport segment controlled by a single A-RACF instance. Hence, it needed to communicate QoS reporting information to RACS using a single point of contact.

## 5.2 QoS Reporting framework

The following picture describes the proposed framework for QoS reporting. It is a three level solution, where the three layers are represented by:

- Sources of QoS Reporting data (QoS Reporting Sources, QRS).
- QoS Reporting Collector (QRC) function acting as a mediation element.
- Users of QoS Reporting data (QoS Reporting Users, QRU).

The use of a three level architecture instead of a set of interfaces going directly from the QRSs to the QRUs has the following advantages:

- The QRC collects the QoS data from the lower layer, elaborates and distributes them according to the needs of each QRU.
- The QRC performs protocol adaptation from different QRSs toward different QRUs.
- The presence of a QRC allows the QRSs not to have a number of direct interfaces towards the QRUs.

Further, the presence of a mediation layer introduces more flexibility for managing dynamically QRSs and QRUs.

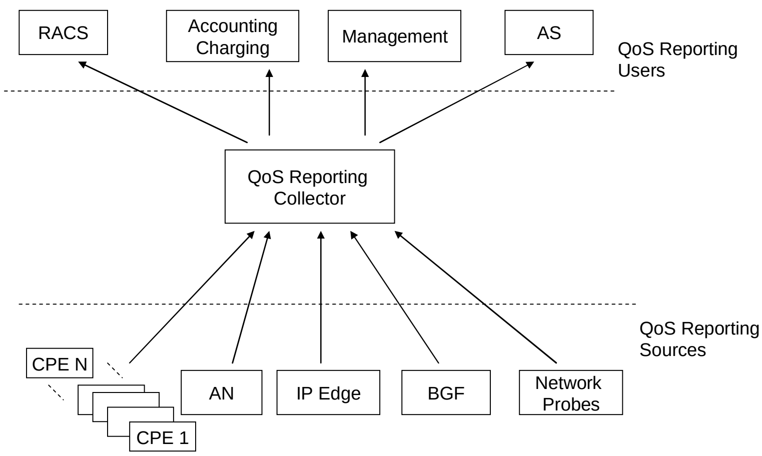



**Figure 2**

### 5.2.1 QoS Reporting Sources

According to the TS 181 018 [2], the sources of QoS measurement information should be:

- CPE/Home Gateway.
- Border Gateway Function.
- Network probes.

In addition it should be possible to have also other information sources such as Access Nodes, IP edge nodes, etc.

Optionally the QRS may have capability to register itself with QRC to bind a certain flow with itself. Upon successful setup of a connection, the QRS may send to the QRC a QRS_ID and all the information needed to identify the monitored flow, e.g. source IP, destination IP, source port number, destination port number and protocol.

### 5.2.2 QoS Reporting Users

The Users of the QoS Reporting information could be:

- control elements such as RACS, that uses the QoS Reporting Information for admission control purposes and also to integrate the network view of the TRIS;
- management elements such as fault management, for detecting and managing fault conditions;
- accounting systems to allow the definition of CDRs containing also QoS information;
- service elements such as Application Server that can offer services that make use of the QoS reporting information.

### 5.2.3 QoS Reporting Collector

This is the mediation element between the transport layer, which provides information about the QoS provided for the single service instance, and the functional blocks that need such data: the QoS reporting users. This element performs the functions described in the following.

**Collection of data coming from the QRSs:** These data come from a large set of network elements, including customer devices, probes, BGF and so on.

**Delivering of QoS reports to the QRUs:** The collected data have to be sent to the interested QRU.

**Protocol/Format Mediation:** Each QRU is supposed to send data according its own protocol and format, rather than to conform a given protocol, this is due to the high heterogeneity of the sources. The same holds for the QRUs, who may need its own specific format. Protocol/Format mediation is then in charge of the QRC.

**Data elaboration:** The QoS reports gathered from the QRSs may be large and very detailed; a QRU may need only a subset of the report. For example, RACS will be interested in being informed about QoS threshold violations, whereas Accounting block will need QoS data to enhance its Charging Data Records (CDR). The QoS report collector will therefore perform data elaboration functions such as:

- data filter;
- data aggregation;
- data correlation.

and any other elaboration should be necessary to fulfil the QoS reporting service towards the QRUs.

**Event Management:** The most flexible way to manage a number of QRUs is the support of events. Any QRU interested in a QoS report subscribes itself to the QoS Reporting service with the QRC. Then the QRC will maintain a subscription register of the QoS data users interested in QoS reporting data.

**QRS Registration optional:** For those QRS that are able to register itself with a QRC, the QRC stores the information of QRS ID and related flow information. Upon the reception of the reporting request, the QRC will identify all relevant QRSs along the flow path based on the above information.

# 6 Overall QoS architecture

The overall solution described in the present document for QoS handling (i.e. resource monitoring and QoS reporting) presumes that RACS will interact with other subsystems or functions using interfaces not specified in RACS R1 and R2. Firstly, as illustrated in figure 3, a new interface, "A" to a QoS Reporting collector function or subsystem that can provide RACS with QoS reporting information is needed. Besides RACS the "A" reference point is used to provide QoS Reporting information to OSS and other QoS Reporting Users Associated with this will be the Users of this information as described in clause 5.2.2. The QoS Reporting Collector (clause 5.2.3) obtains information from QoS Reporting sources in the network (clause 5.2.1) via reference point "C".

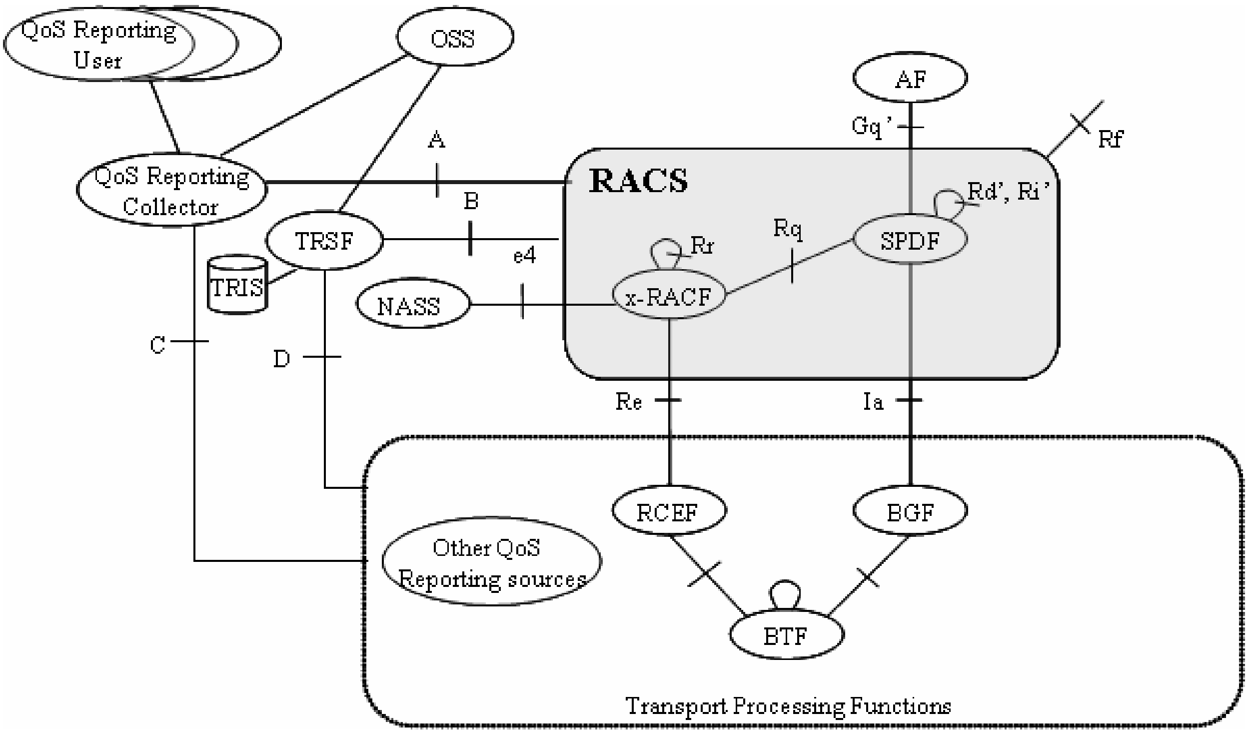



**Figure 3: Overall solution for QoS handling and the relation to RACS**

A further interface, "B" provides RACS with up to date resource monitoring information from the TRSF, which holds the information in the form of the TRIS as described in clause 4.2. Dynamic resource monitoring information is obtained via interface "D" between the TRSF and the network. Both the TRSF and the QoS Reporting Collector may also obtain information from an OSS system. Note that in the above diagram the TRSF and QoS Reporting Collector functions are represented as stand-alone entities as for Release 2 it has not been defined whether they are internal or external to RACS.

# 7 Relationship between Resource Monitoring and QoS Reporting

Referring to the Overall QoS architecture described in clause 6, it is clear that there are some architectural analogies between the Resource Monitoring system and the QoS Reporting system:

- Both systems communicate with the transport processing functions: the Resource Monitoring system in order to retrieve Resource Monitoring data and QoS Reporting system to retrieve QoS Reporting data.
- Both systems communicate with the RACS (if deployed as stand-alone entities): the Resource Monitoring system in order to provide Resource Monitoring data to the RACS and QoS Reporting system to provide QoS Reporting data to the RACS.

- Both systems have an interface toward the OSSs: the Resource Monitoring system in order to retrieve the TRIS information from the OSSs and the QoS Reporting system to provide the QoS Reporting data to the OSSs.
- Both could be deployed as functionalities internal or external to the RACS.

According to this, in the following some points are highlighted for further exploring and integration in the RACS architecture (not for Release 2) and in general in the Overall NGN Architecture:

- The transport processing functions (or at least some of them) play the role of both QoS Reporting Sources and Resource Monitoring Information Sources. Interfaces C and D are described in the present document as specific of the given network entities and both QRC and TSRF support mediation of the specific protocols. Then, synergies may be explored for interfaces C and D, up to letting them collapse into a single interface.
- Different is the situation for the two interfaces towards the OSS. Interface "A" is an interface from QRC to OSSs, used for feeding the OSSs with reporting data. The other one is an interface from OSS to TRSF, used for feeding the TRSF with topology data. Then they will probably be different interfaces.
- Similarities can be found on the functionalities of QRC and TRSF, that may be defined as a single functional entity.

# History

| Document history | | |
|---|---|---|
| V2.0.0 | December 2007 | Publication |
| | | |
| | | |
| | | |
| | | |