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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 - APE 7112B
Association à but non lucratif enregistrée à la
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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Network Functions Virtualisation (NFV).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document specifies the structure and content of the NFV-MANO policy information model. The State-Task design pattern is used in the design of the policy information model. The current version of the present document specifies information elements to support the definition of ECA policies.

NOTE: The information model is designed in a way to flexibly support other policy types, but these are not specified in the current version of the present document.

2 References

2.1 Normative 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 referenced document (including any amendments) applies.

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

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

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

[1] ETSI GS NFV 006: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Architectural Framework Specification".

2.2 Informative 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 referenced document (including any amendments) applies.

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

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] ETSI GR NFV-IFA 041 (V4.1.1): "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Report on enabling autonomous management in NFV-MANO".

[i.2] ETSI GR NFV-IFA 042 (V4.1.1): "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Report on policy information and data models for NFV-MANO".

[i.3] ETSI GS NFV-IFA 013: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Os-Ma-Nfvo reference point - Interface and Information Model Specification".

[i.4] ETSI GS NFV-IFA 005: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Or-Vi reference point - Interface and Information Model Specification".

[i.5] ETSI GS NFV-IFA 006: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Vi-Vnfm reference point - Interface and Information Model Specification".

[i.6] ETSI GS NFV-IFA 007: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Or-Vnfm reference point - Interface and Information Model Specification".

[i.7] ETSI GS NFV-IFA 008: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".

[i.8] ETSI GS NFV-IFA 030: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Multiple Administrative Domain Aspect Interfaces Specification".

[i.9] ETSI GR NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

[i.10] ETSI GS NFV-IFA 040: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements for service interfaces and object model for OS container management and orchestration specification".

[i.11] ETSI GS NFV-SOL 001: "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; NFV descriptors based on TOSCA specification".

[i.12] ETSI GS NFV-IFA 010: "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Functional requirements specification".

[i.13] ISO/IEC 9646-7: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GR NFV 003 [i.9] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GR NFV 003 [i.9] and the following apply.

NOTE: An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in ETSI GR NFV 003 [i.9].

APEX Adaptive Policy EXecution
DSL Domain Specific Language
ECA Event-Condition-Action

4 Overview

4.1 Introduction

Policy is a managed object in the NFV-MANO. According to ETSI GS NFV-IFA 010 [i.12], the NFVO, VNFM and VIM support the capability to parse and enforce NFV-MANO policies. Policies can be used to enable the NFV-MANO to manage and orchestrate managed objects automatically and even autonomously. Intent Management can take advantage of policies to fulfil the intents in several processing steps of the intent handling (e.g. interpretation, decision and actions).

NOTE 1: The details of how to use policies in intent handling processes is out of the scope of the present document. More details can be referred in ETSI GR NFV-IFA 041 [i.1] and ETSI GR NFV-IFA 042 [i.2].

The information elements and attributes defined in the present document are transferred through the policy management interfaces defined in other deliverables. Furthermore, the modelling is capable of conveying the information about policies to cover different use cases, e.g. LCM, FM, etc.

Based on the outcome from the study in the ETSI GR NFV-IFA 042 [i.2], the State-Task design pattern is used in designing the policy information model of the present document. This pattern supports representing different policy expression forms and provides more flexibility and extensibility.

NOTE 2: The impacted deliverables are listed in clause 4.2 of the present document.

4.2 Relationship with other ETSI NFV deliverables

The present document relates to other ETSI NFV deliverables as follows:

- ETSI GS NFV-IFA 013 [i.3] specifies the Os-Ma-nfvo reference point requirements and interfaces including the Policy Management interface, which includes the operations for transferring a new policy; deleting/querying/activating/deactivating an existing policy; and raising policy conflict notifications. Clause 8.8.2 of ETSI GS NFV-IFA 013 [i.3] specifies the information elements related to policy information. The present document specifies the detailed content of a policy which is one of the attributes of the PolicyInfo information element defined in ETSI GS NFV-IFA 013 [i.3].

- ETSI GS NFV-IFA 005 [i.4]: same as ETSI GS NFV-IFA 013 [i.3] but concerning to the Or-Vi reference point.

- ETSI GS NFV-IFA 006 [i.5]: same as ETSI GS NFV-IFA 013 [i.3] but concerning to the Vi-Vnfm reference point.

- ETSI GS NFV-IFA 007 [i.6]: same as ETSI GS NFV-IFA 013 [i.3] but concerning to Or-Vnfm reference point.

- ETSI GS NFV-IFA 008 [i.7]: same as ETSI GS NFV-IFA 013 [i.3] but concerning to the Ve-Vnfm reference point.

- ETSI GS NFV-IFA 030 [i.8]: same as ETSI GS NFV-IFA 013 [i.3] but concerning to the Or-Or reference point. For ETSI GS NFV-IFA 030 [i.8], some exceptions regarding to attributes related to policy management operations are to be considered since the producer and the consumer are two NFVOs. However, the present document is not expected to be impacted or adapted based on these exceptions.

- ETSI GS NFV-IFA 040 [i.10] concerns to OS container management and orchestration, where the modelling and interface standardization of MCIO policies are specified to be following the best-practice of the related open-source communities, hence are out of scope of the present document.

4.3 Conventions

The following notations, defined in ISO/IEC 9646-7 [i.13], are used for the qualifier column of interface information elements:

- M mandatory - the capability is required to be supported;

- O optional - the capability may be supported or not;

- CM conditional mandatory - the capability is required to be supported and is conditional on the support of some condition. This condition shall be specified in the Description column;

- CO conditional optional - the capability may be supported or not and is conditional on the support of some condition. This condition shall be specified in the Description column.

The following notation is used for parameters that represent identifiers, and for attributes that represent identifiers in information elements and notifications:

- If parameters are referring to an identifier of an actual object, their type is "Identifier".

- If an object (information element or notification) contains an attribute that identifies the object, the type of that attribute is "Identifier" and the description states that the attribute is the identifier of that particular notification or information element.

EXAMPLE 1: Identifier "policyId" of the "Policy information element" has type "Identifier" and description "Identifier of this Policy information element".

- If an object (information element or notification) contains an attribute that references another object or objects defined in an ETSI NFV GS, the type of the attribute is "Identifier", followed by the list of objects it references.

EXAMPLE 2: "Identifier (Reference to Vnfc)" or "Identifier (Reference to Vnfc, VirtualLink or VirtualStorage)".

If the type of a parameter or attribute has been marked as "Not specified" in the "Content" column, this means that its specification is part of the protocol design/data model design.

5 Policy information model

5.1 Introduction

According to the recommendations from ETSI GR NFV-IFA 042 [i.2], on the one hand, the design of the policy information model refers to the APEX policy model, which is defined based on the overall idea of "State-Task". On the other hand, according to the actual application recommendations for NFV-MANO, necessary tailoring and extensions are carried out.

Figure 5.1-1 shows the overview of information elements for the policy model.

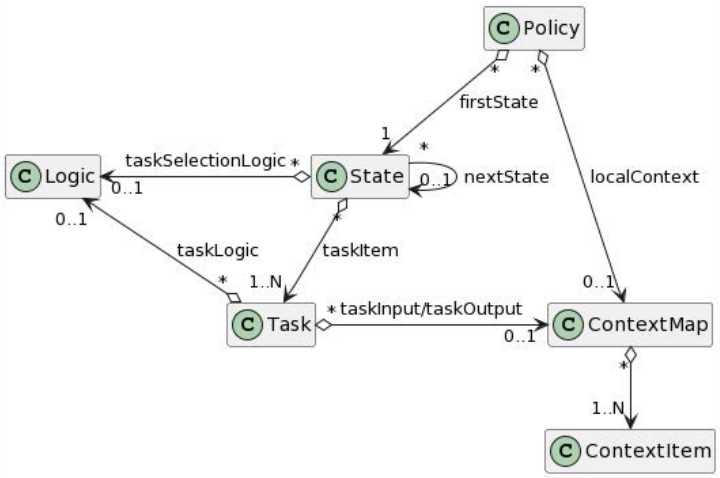

Figure 5.1-1: Overview of information elements for Policy Modelling

The basic information elements include: **Policy,** which consists of at least one state that can subsequently chain to one or more **State**s, and each state is mapped to at least one or several **Task**s. The context between states and tasks is passed through **contextMap**, which is composed of a list of **contextItem**s. The **Logic** contains a piece of executable code in a specified language.

The relations between these information elements include: The policy specifies the first state, and each state specifies the next state, which can flexibly be connected into a series of states. Each state uses taskSelectionLogic to determine which task (if there is more than one task) to execute with input context. Each task specifies its taskLogic via Logic, and its input/output as taskInput/taskOutput via contextMap.

For example, an ECA policy consists of three states, which correspond to event triggering, condition evaluation, action decision & execution, respectively.

The rest of clause 5 defines information elements used in the policy management interfaces defined in the reference point specifications.

Definitions of information elements used in the interfaces defined in the ETSI ISG NFV specifications can also be referenced.

The specification of the following information elements is part of the protocol design:

- String.
- Integer.
- Identifier.
- Enum.
- Version.

5.2 Policy information element

5.2.1 Description

This information element provides the content related information of a policy.

5.2.2 Attributes

The Policy information element shall follow the indications provided in table 5.2.2-1.

Table 5.2.2-1: Attributes of the Policy information element

Attribute	Qualifier	Cardinality	Content	Description
policyVersion	M	1	Version	The version of the policy.
policyFunctionDescription	M	1	String	Describes the function that the policy is expected to accomplish (e.g. scaling, healing, energy saving).
policyFlavour	M	1	Enum	The representation format adopted by the policy. VALUES: • ECA
targetType	M	1	Enum	The application target that the policy applies to. VALUES: • COMMON: the policy applies to multiple managed object instances. • SPECIFIC: the policy applies to a specific managed object instance. See note 1.
targetObjectType	M	1	Enum	The managed object type that the policy applies to. VALUES: • NS • VNF • VNFC • VR • VL • NFVI • NFV-MANO • See note 3 and note 4.
targetObjectId	M	0..N	Identifier	The identifiers of the managed object(s) that the policy applies to. See note 1 and note 5.
priority	M	1	Integer	A non-negative integer which indicates the priority of the policy to be considered when policy conflicts occur. A value of "0" corresponds to the highest priority.
firstState	M	1	State	The first state for policy execution. For instance, in the case of an ECA policy, the first state is the "event" state.

Attribute	Qualifier	Cardinality	Content	Description
globalContext	M	0..1	ContextMap	Declarations of policy's system global context to be used during the policy execution. Context-awareness of the policy can relate to the actual execution of the policy. For instance, it can include system variables/service interface related to event/condition/action access interfaces/parameters/permissions that are used when the ECA policy is executed. See note 2.
localContext	M	0..1	ContextMap	Declarations of policy's local context to be used during the policy execution.

NOTE 1: If the value of the attribute targetObjectType is SPECIFIC, the attribute targetObjectId shall be present.
NOTE 2: The specific modelling of the global context (i.e. the events triggering and actions as a result of the policy execution) is out of scope of the present document.
NOTE 3: The value "VR" applies to all kinds of virtualised resources, multi-site connectivity services and containerized workloads which can constitute other NFV managed objects such as NS, VNF, VNFC and VL.
NOTE 4: NFV-MANO encompasses managed object types regarding NFV-MANO functional blocks and functions.
NOTE 5: Cardinality "0" is applicable for the attribute targetObjectId, when the policy applies to non-identifiable managed objects and the value of the attribute targetType is COMMON.

5.3 Information elements related to State

5.3.1 Introduction

The clauses below define the information elements related to the State.

5.3.2 State information element

5.3.2.1 Description

This information element provides details of a state item included in a policy.

For example, typically an ECA policy consists of three states, which correspond to event triggering, condition evaluation, and action decision & execution, respectively.

5.3.2.2 Attributes

The State information element shall follow the indications provided in table 5.3.2.2-1.

Table 5.3.2.2-1: Attributes of the State information element

Attribute	Qualifier	Cardinality	Content	Description
stateType	M	1	Enum	The type of the state item. The types that can be selected are based on the policy flavour format adopted by the policy. VALUES: • EVENT • CONDITION • ACTION See note 1.
taskItem	M	1..N	Task	List of task items composing the state item.
taskSelectionLogic	M	1	Logic	The logic to select and execute different task items composing the state item to fulfil the policy function. See note 2.
nextState	M	0..1	State	Describes the next state to be executed.

NOTE 1: Currently, only ECA format is specified in the present document version. Therefore, the values of types enumerated are derived from this format only. An ECA policy shall contain at least one state of Event type and one state of Action type.
NOTE 2: The task item selection logic is used to determine which of the task items included in a state are to be executed.

5.4 Information elements related to Task

5.4.1 Introduction

The clauses below define the information elements related to the Task.

5.4.2 Task information element

5.4.2.1 Description

This information element provides details of a task item included in a state.

For example, an ECA policy consists of three states, and each state contains a task which correspond to event triggering, condition evaluation, and action decision & execution, respectively.

5.4.2.2 Attributes

The Task information element shall follow the indications provided in table 5.4.2.2-1.

Table 5.4.2.2-1: Attributes of the Task information element

Attribute	Qualifier	Cardinality	Content	Description
taskType	M	1	Enum	The type of task. VALUES: • EVENT-TASK • CONDITION-TASK • ACTION-TASK See note 1.
taskInput	M	0..1	ContextMap	The input for the task execution. See note 2.
taskLogic	M	0..1	Logic	The logic for the task. See note 2.
taskOutput	M	0..1	ContextMap	The output of the task execution. See note 2.
NOTE 1: Currently, only ECA format is specified in the present document version. Therefore, the values of types enumerated are derived from this format only. An ECA state of type "EVENT" shall contain at least one task of "EVENT-TASK" type, an ECA state of type "CONDITION" shall contain at least one task of "CONDITION-TASK" type, and an ECA state of type "ACTION" shall contain at least one task of "ACTION-TASK" type. NOTE 2: At least of one of the attributes shall be present depending on the taskType.				

5.5 Information elements related to Context

5.5.1 Introduction

The clauses below define the information elements related to the Context.

For example, an ECA policy consists of three states, and each state contains a task which correspond to event triggering, condition evaluation, and action decision & execution, respectively. The context between tasks (in the name of taskInput and taskOutput) is passed through a list of **ContextItem**s which are grouped into a **ContextMap**.

5.5.2 ContextItem information element

5.5.2.1 Description

This information element provides details of a Context item included in a ContextMap.

5.5.2.2 Attributes

The ContextItem information element shall follow the indications provided in table 5.5.2.2-1.

Table 5.5.2.2-1: Attributes of the ContextItem information element

Attribute	Qualifier	Cardinality	Content	Description
contextItemName	M	1	String	Name or identification of the ContextItem.
contextDescription	M	1	String	Description about the ContextItem, e.g. to provide information about the purpose or use of the context.
contextItemAccess	M	0..1	String	It provides information about how to access or send the data or related interface operations contained in the ContextItem, e.g. a unique resource identifier for a piece of data, or a local access address for a registered interface operation. The attribute shall support referring to interfaces and its operations (including request, response and notification message contents), runtime information (including metrics and alarms information) and descriptors information used, produced, and/or consumed by functional blocks and functions defined by the NFV-MANO architectural framework specified in ETSI GS NFV 006 [1] and specifications referenced therein, as well as to other policies.
contextItemParams	M	0..1	Not specified	Parameters and values for the ContextItem. The data modelling of this attribute shall support the definition of parameters and their values, possibly formed as an array of key value pairs.

5.5.3 ContextMap information element

5.5.3.1 Description

This information element provides details of a ContextMap.

5.5.3.2 Attributes

The ContextMap information element shall follow the indications provided in table 5.5.3.2-1.

Table 5.5.3.2-1: Attributes of the ContextMap information element

Attribute	Qualifier	Cardinality	Content	Description
mapName	M	1	String	Name or identification of the ContextMap.
contextItem	M	1..N	ContextItem	List of context items that are grouped in the ContextMap.

5.6 Information elements related to Logic

5.6.1 Logic information element

5.6.1.1 Description

This information element defines the logic included in a state or task. The Logic provides the capability to define the code and/or scripts to be executed by its container object (i.e. State or Task).

5.6.1.2 Attributes

The Logic information element shall follow the indications provided in table 5.6.1.2-1.

Table 5.6.1.2-1: Attributes of the Logic information element

Attribute	Qualifier	Cardinality	Content	Description
logicName	M	1	String	Name or identification of the Logic.
logicDsl	M	1	String	Defines the Domain Specific Language (DSL) of logic that is provided. Types of scripts could include bash, python, etc. The DSL shall support intrinsic functions (such as wait, loop, date), relational operators (such as greater, greater than, equal to, etc.), logic/bitwise operators (such as AND, OR, XOR, NOT), basic arithmetic operations (such as addition, subtraction, multiply, etc.), and execution control/decision statements (such as if-else, for loops, etc.) to enable the control of the policy execution and to perform operations on expressions related to states, tasks and context (such as those defined for events, conditions, and actions in the case of an ECA policy).
logicCode	M	1	Not Specified	Includes the implementation of logic (written in a DSL as specified by logicDsl) or a reference to a file or artifact providing the implementation of the logic.

Annex A (informative): Examples

A.1 Policy model in descriptors

As an example of the policy model application, the simple auto-scaling policy used in ETSI GS NFV-SOL 001 [i.11], clause A.1.5.2 as shown in figure A.1-1.

```
    - auto_scale:
        type: tosca.policies.nfv.VnfIndicator
        properties:
          source: vnf
        triggers:
          scale_out:
            event: tosca.interfaces.nfv.VnfIndicator.utilization # full name of a
notification in the VnfIndicator interface
            condition:
              - utilization_vnf_indicator: [ { greater_or_equal: 60.0 } ]
              - call_proc_scale_level: [ { less_than: 3 } ]
            action:
              - call_operation:
                  operation: Vnflcm.scale
                  inputs:
                    type:
                      value: scale_out
                    aspect:
                      value: call_proc
                    number_of_steps:
                      value: 1 # optional
```

Figure A.1-1: Illustrative example of auto-scaling policy (from ETSI GS NFV-SOL 001 [i.11])

A.2 Illustrative policy modelling example

A.2.1 Modelling overview

As an example of a simple ECA policy, the information elements used in modelling the exemplary policy, their relations and key attributes are shown in figure A.2.1-1.

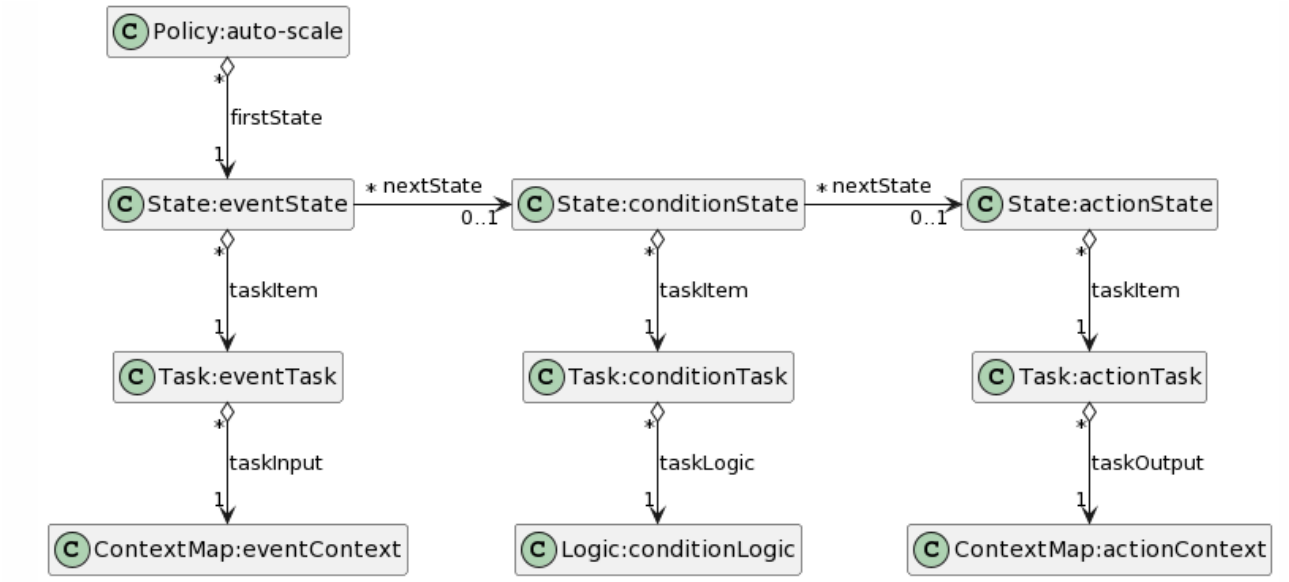

Figure A.2.1-1: Modelling overview

A.2.2 Information elements and values of the example

More specifically, the detailed attributes for each involved information elements are as follows.

- Policy

Attributes	Value
policyFunctionDescription	auto_scale
policyFlavour	ECA
targetObjectType	VNF
targettype	SPECIFIC
targetObjectID	NULL
firstState	EventState
globalContext	vnfindicator.utilization
localContext	NULL

- EventState

Attributes	Value
stateType	EVENT
taskItem	EventTask
taskSelectionLogic	NULL
nextState	ConditionState

- ConditionState

Attributes	Value
stateType	CONDITION
taskItem	ConditionTask
taskSelectionLogic	NULL
nextState	ActionState

- ActionState

Attributes	Value
stateType	ACTION
taskItem	ActionTask
taskSelectionLogic	NULL
nextState	NULL

- EventTask

Attributes	Value
taskType	EVENT-TASK
taskInput	vnfIndicator.utilization
taskLogic	NULL
taskOutput	NextState

- ConditionTask

Attributes	Value
taskType	CONDITION-TASK
taskInput	NULL
taskLogic	ConditionLogic
taskOutput	NextState

- ActionTask

Attributes	Value
taskType	ACTION-TASK
taskInput	NULL
taskLogic	NULL
taskOutput	ScaleContextMap

- ConditionLogic

Attributes	Value
logicDsl	Python
logicCode	"(utilization_vnf_indicator>=60) and (call_proc_scale_level<3)"

- ScaleContextMap

Attributes	Value
contextMapName	ScaleContextMap
contextItem	ScaleContextItem

- ScaleContextItem

Attributes	Value
contextItemName	scale
contextItemAccess	Vnflcm.scale
contextItemParams	"type:scale_out;aspect:call_proc;number_of_steps:1"

Annex B (informative): Change History

Date	Version	Information about changes
March 2022	0.0.1	Implementation of skeleton approved in IFA#275: NFVIFA(22)000150
April 2022	0.0.2	Implementations of approved contributions approved in IFA#277: NFVIFA(22)000206r1 Implementations of approved contributions approved in IFA#278: NFVIFA(22)000207r1 NFVIFA(22)000208r1 Implementations of approved contributions approved in IFA#279: NFVIFA(22)000205r2 NFVIFA(22)000222
June 2022	0.0.3	Implementations of approved contributions approved in IFA#287: NFVIFA(22)000333r3 NFVIFA(22)000334r2 NFVIFA(22)000335r1 NFVIFA(22)000348r3 Implementations of approved contributions approved in IFA#289: NFVIFA(22)000336r3 NFVIFA(22)000337r4 NFVIFA(22)000347r2 NFVIFA(22)000382r1 NFVIFA(22)000383r1 NFVIFA(22)000385r1
July 2022	0.0.4	Minor Update
August 2022	0.0.5	Implementations of approved contributions approved in IFA#289: NFVIFA(22)000384r2 Implementations of approved contributions approved in IFA#291: NFVIFA(22)000411 NFVIFA(22)000410r1 NFVIFA(22)000409r1 NFVIFA(22)000408r1 NFVIFA(22)000406r1 NFVIFA(22)000407r2
October 2022	0.0.6	Implementations of approved contributions approved in IFA#304: NFVIFA(22)000743 NFVIFA(22)000744 NFVIFA(22)000745 NFVIFA(22)000746 Implementations of approved contributions approved in IFA#306: NFVIFA(22)000740r1 NFVIFA(22)000776
November 2022	0.0.7	Implementations of approved contributions approved in IFA#308: NFVIFA(22)000783r1

History

Document history		
V4.4.1	January 2023	Publication