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| Technical Specification | |
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# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# Introduction

The current 5G networks brings more operational complexities, and the telecom system need to be able to adapt their operation to the business objectives of the operator as well as expectations of customer, which is driving customer to shift the focus from "how" to "what". An intent driven system will be able to learn the behaviour of networks and services and allows a customer to provide the desired state, without detailed knowledge of how to get to the desired state. Thus, the intent driven management is introduced to reduce the complexity of management without getting into the intricate detail of the underlying network resources.

# 1 Scope

The present document specifies concept, use cases, requirements and solutions for the intent driven management for service or network management.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 28.531: "Management and orchestration; Provisioning".

[3] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[4] 3GPP TS 28.530: "Management and orchestration; Concept, use cases and requirements".

[5] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[6] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM); Integration Reference Point (IRP); Information Service (IS)".

[7] TM Forum IG1253A: "Intent Common Model v1.1.0".

[8] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

[9] 3GPP TS 28.538: "Management and orchestration; Edge Computing Management".

[10] 3GPP TS 28.658: "Telecommunications management; Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP): Information Service (IS)".

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

**intent:** expectations including requirements, goals and constraints given to a 3GPP system, without specifying how to achieve them

## 3.2 Symbols

Void.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

# 4 Concepts and Background

## 4.1 Intent concept

### 4.1.1 Introduction

An intent specifies the expectations including requirements, goals and constraints for a specific service or network management workflow. The intent may provide information on particular objective and possibly some related details. Following are some general concepts for intent:

- An intent is typically understandable by humans, and also needs to be interpreted by the machine without any ambiguity.

- An intent focuses more on describing the "What" needs to be achieved but less on "How" that outcomes should be achieved, The intent expresses the metrics that need to be achieved and not how to achieve them. This not only relieves the burden of the consumer knowing implementation details but also leaves room to allow the producer to explore alternative options and find optimal solutions. Intent describes the properties that allows a satisfactory outcome.

- The expectations expressed by an intent is agnostic to the underlying system implementation, technology and infrastructure. Area can be used as managed object in the expectations expressed by an intent to achieve system implementation, technology and infrastructure agnostic.

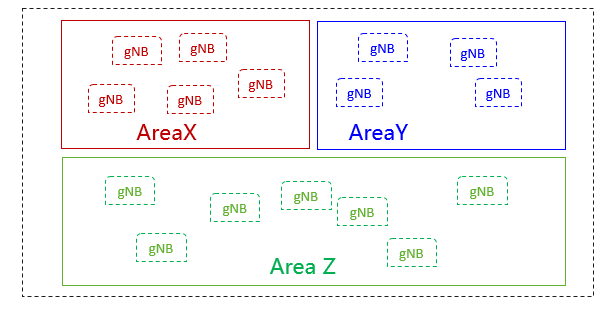


Figure 4.1.1-1

- An intent needs to be quantifiable from network data so that the fulfilment result can be measured and evaluated.

Intent can be categorized based on different user types or different management scenario types.

### 4.1.2 Intent categorizes based on user types

Based on roles related to 5G networks and network slicing management defined in clause 4.8 in 3GPP TS 28.530 [4], different kinds of intents are applicable for different kinds of standardized reference interfaces.

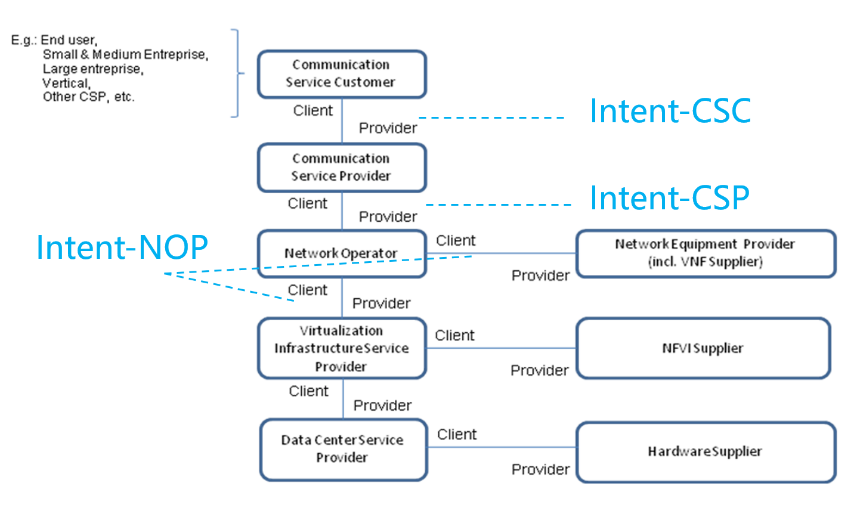


Figure 4.1.2-1: High-level model of different kind of intents expressed by different roles

**- Intent from Communication Service Customer (Intent-CSC):** Intent from Communication Service Customer enables Communication Service Customer (CSC) to express which properties of a communication service the CSC may request from CSP without knowing how to do the detailed management for communication service. For example, Intent-CSC can be 'Enable a V2X communication service for a group of vehicles in certain time'.

**- Intent from Communication Service Provider (Intent-CSP):** Intent from Communication Service Provider enables Communication Service Provider (CSP) to express an intent about what CSP would like to do for network without knowing how to do the detailed management for network. For example, Intent-CSP can be 'Provide a network service supporting V2X communications for highway-417 to support 500 vehicles simultaneously'.

**- Intent from Network Operator (Intent-NOP):** Intent from Network Operator enables Network Operator (NOP) to provide what NOP would like to do for group of network elements (i.e. subnetwork) management and control without knowing how to do the detailed management for the network elements. For example, Intent-NOP can be 'Provide a radio network service to satisfy the specified coverage requirements and UE throughput requirement in certain area'.

### 4.1.3 Intent expectations for different types of management needs

Intent expectations for different types of management needs:

**- Intent expectation for delivering network and service related object:** enables a consumer to express the intent expectation for the object (e.g. network, service, slice) to be delivered by the system. Examples of such intent expectations are:

- "Delivering a radio network in the specified area with specified frequency information, transport information, and radio information (e.g. range of PCI, Cell Id), network capacity and performance information".

- "Delivering a radio service in the specified area with certain service characteristics (e.g. SLS)".

**- Intent expectation for network and service related object performance:** enables a consumer to express the performance objectives of the object (e.g. network, service, slice) to be assured. Examples of such intent expectations are:

- "Ensure the radio network in the specified area meets certain expected RAN UE throughput objectives (e.g. expected average RAN UE DL throughput, expected percentage of UE with the RAN UE DL throughout less than 5 Mbps)".

- "Ensure the radio network in the specified area meets certain expected coverage objectives (e.g. expected coverage ratio, expected average RSRP)".

## 4.2 Intent driven management

### 4.2.1 Support for intent driven management

In intent driven management, the consumer provides its intent to the producer of a set of management services that would be consumed in a specific domain. For example, for the purpose of requesting a radio network with a new coverage, one possible solution (non-intent driven approach) is to use the set of classic MnSs (e.g. provisioning MnS) to decommission a cell and instantiate the cell to a new Node B for the new coverage. The alternative solution (intent driven approach) is to use management service produced by the domain, which may be referred to as the Intent-driven MnS by stating the intent for the radio network for the new coverage, based on the intent, system can trigger actions (e.g. decommission a cell and instantiate the cell to a new Node B) to satisfy received intent. The Intent driven MnS could in principle deployed as a replacement of the deployed classic MnSs for the same network and service management purpose, where the consumer focuses on the 'what' and the producer is concerned about the 'how'.

The producer of an Intent-driven MnS shall allow the consumer to manage the service and / or network resources through the use of intents. The producer shall support the capabilities for intent fulfilment, which include the following:

- The consumer states the intent to be fulfilled (which can be implemented by createMOI operation on the Intent IOC) and the producer receives and acknowledges the receipt of the intent.

- The producer translates the intent to identify the required internal logic needed to fulfil the intent.

- The producer executes the compiled logic to fulfil the intent.

- The producer may report about the fulfilment result of the intent.

### 4.2.2 Intent driven MnS

Introduction of service-based architecture for 5G, in combination with functional model of business roles, exceeds the level of complexity for managing network in different scenarios (including scenarios for design/planning, deployment, maintenance and optimization) both in a single and multivendor network. New/simpler ways of managing are needed.

Actions of an intent driven MnS related to the fulfilment of intents may be categorized as intent deployment and intent assurance. Intent fulfilment refers to the steps taken to satisfy a newly received intent or an update to an existing intent. The goal of intent fulfilment is to bring the network or service's state to satisfy the new or updated intent. The fulfilment of some intents may end at the intent deployment, the case, if the intent's goal simply describes the availability or presence of a network or service. In other cases, the intent's goal describes the assurance requirements for a network or service (e.g. quality of service, end user experience, SLS, etc.) in addition to the need of existence of a network or service. Those intents have their fulfilment tied to the operation of the referred network or service and may require frequent recurring actions to keep those assurance requirements achieved. This part of the intent fulfilment is referred to as intent assurance.

An Intent driven MnS allows its consumer to express intents for managing the network and services and obtain the feedback of intent evaluation result. The Intent-driven MnS producer have the following intent handling capabilities:

- Translate the received intent to executable actions as follows:

- Performing service or network management tasks.

- Identifying, formulating and activating policies for service or network management.

- Evaluate the result/information about the intent fulfilment, including intent deployment (e.g. the intent is initially satisfied or not) and intent assurance (e.g. the intent is continuously satisfied).

Figure 4.2.2-1 shows the model of Intent-driven MnS.



Figure 4.2.2-1: Intent-driven MnS

The intents may be fulfilled by utilizing multiple mechanisms including among others: Rule-based mechanisms, closed loop mechanisms and AI/ML based mechanisms. These mechanisms can be combined in solutions of various complexity, ranging from a simple approach rule-based mechanisms, to more elaborate solutions combining AI/ML, closed loop automation to ensure the fulfilment of intents.

When the intent is created by MnS producer based on MnS consumer’s request, the MnS producer may consume other management services (including non-intent driven MnS and intent driven MnS) to fulfil or satisfy the intent, e.g. creating new assurance closed control loop instance(s) or using assurance closed control loop instance (s) to satisfy the intent. The internal implementation of the intent fulfilment will however not be standardized.

An Intent driven MnS includes the following management capabilities to support intent lifecycle management:

- Create an intent, a MnS Consumer request MnS producer to create a new intent.

- Activate an intent, MnS Consumer request MnS producer to activate an intent when the intent is suspended.

- De-activate an intent, MnS consumer request MnS producer to de-activate an intent for a temporary suspension.

- Delete an intent, MnS Consumer request MnS producer to remove an intent.

- Modify an intent, MnS Consumer request MnS producer to modify the content of the intent (e.g. expectation targets).

- Query an intent, MnS Consumer request MnS producer to return the content and state (e.g. active, inactive) of the intent.

### 4.2.3 Intent translation

The Intent driven MnS producer is the provider of Intent driven MnS and is responsible for deriving activities for networks and services or other intent(s).

The MnS consumer may consume Intent Driven MnS(s) provided by the Intent driven MnS producer(s) or may have the consumer role for non-intent MnS producers.

The conflict(s) including conflict between the intent and other intent(s) and/or Non-intent requirements needs to be detected and resolved during the intent translation. Figure 4.2.3-1 illustrate the potential way to satisfy intents originating from CSC:

- Intent-CSC MnS producer provides intent driven MnS for communication services. Intent-CSC MnS producers receive the expressed intent and translate it to Intent-CSP or network requirements, then may consume Intent-CSP MnS(s) or Non-Intent MnS(s) for network to fulfil the intent-CSC.

- Intent-CSP MnS producer provides intent driven MnS for network services. Intent-CSP MnS producers receive the intent and translate it to new Intents for NOP or network element requirements, then may consume Intent-NOP MnS(s) or Non-Intent MnS(s) for NE to fulfil the intent-CSP.

- Intent-NOP MnS producer provides intent driven MnS for network equipment. Intent-NOP MnS Producers receive the expressed intent, and translate it to detailed network element requirements, then takes some internal actions to fulfil the intent-NEP.

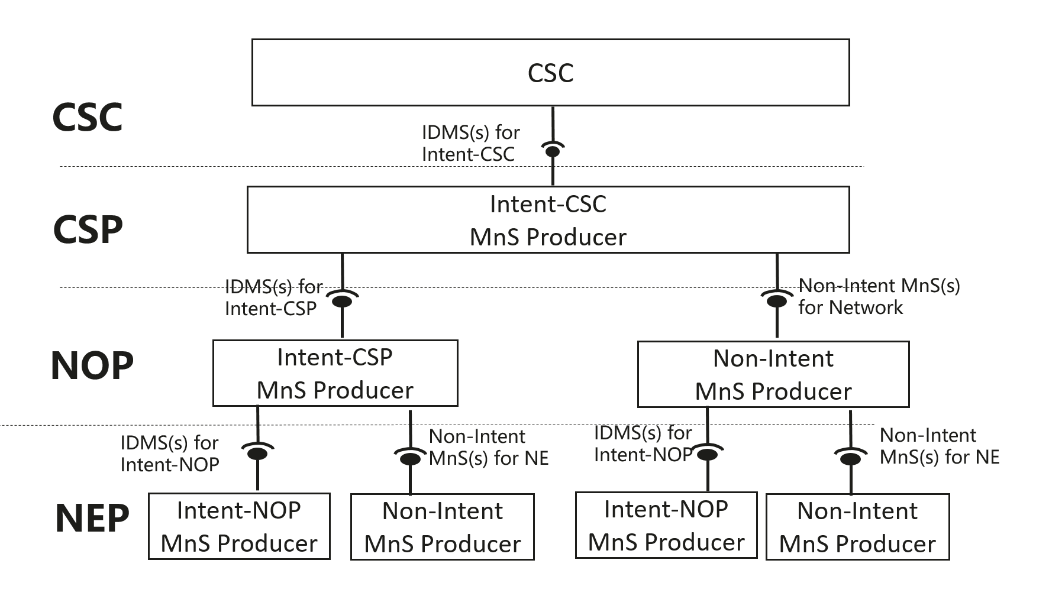


Figure 4.2.3-1: Potential way to satisfy intent-CSC originating from CSC

## 4.3 Intent driven closed-loop

Intent can be used for management and control of closed-loop automation (e.g. intent can be used to specify the goals for the closed-loop), which means the intent can be translated to policies and management tasks that the MnS producer needs to execute for the closed-loop automation. In the intent driven management approach, the mechanisms that the MnS producer using closed-loop automation mechanisms to satisfy the intent is the implementation of the MnS producer and shall not be standardized. The relation of the Intent driven MnS and the closed-loop automation with the Intent driven MnS producer is shown in the figure 4.3-1.

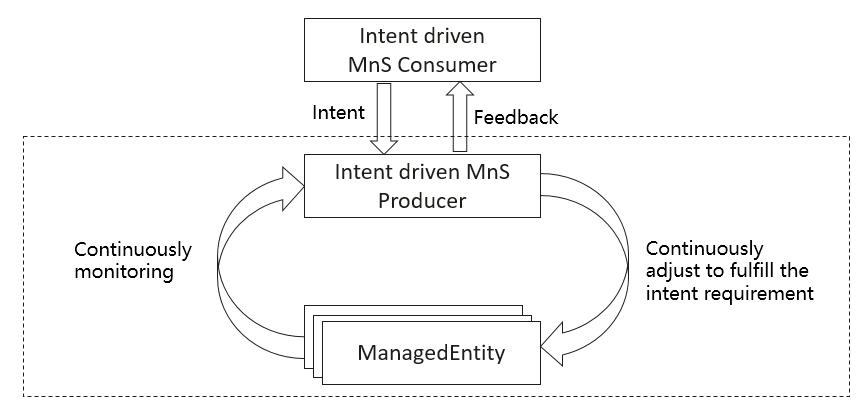


Figure 4.3-1: Intent driven closed-loop

## 4.4 Relation between rule, policy and intent

An intent specifies the expectations including requirements, goals, and constraints for a specific service or network management workflow, while a policy specifies the action(s) to be taken when given condition occurs and rules specifies the explicit or formula logics to be executed. For certain scenarios, policies can be used in conjunction with intents to achieve the autonomous purposes. Figure 4.4-1 describes the relation between rule, policy and intent in the "what-how" view. As it now stands, the telecom systems are mainly focused on "how" and "less what". The current 5G networks brings more operational complexities, and the telecom system need to be able to adapt their operation to the business objectives of the operator as well as expectations of customer, which is driving customer to shift the focus from "how" to "what". The first step towards that shift, has been shift from "Rule based management" to "Policy driven management", with more focus on "how" and less on "what" covering domain specific issues/aspects (an example for policy is when the average throughput is lower than certain threshold, take specified actions). As technologies are evolving and the level of complexity exceeds, the need for an abstraction level description (i.e. Intent) becomes more apparent (an example for intent is the target average throughput for certain area should be assured). An intent driven system will be able to learn the behaviour of networks and services and allows a customer to provide the desired state, without detailed knowledge of how to get to the desired state.

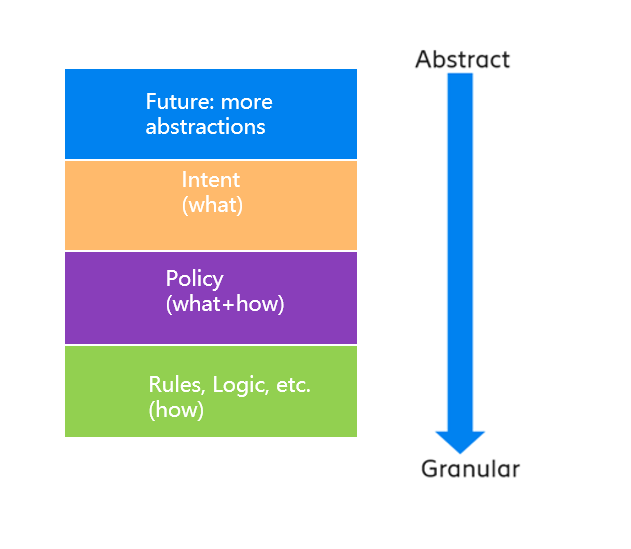


Figure 4.4-1: Relation between rule, policy and intent

## 4.5 General concept of Intent Content

### 4.5.1 Intent Expectation

In the most basic form, a consumer may use an intent to express to the producer the need for:

"an object O with characteristics S".

Where the characteristics S reflect the requirements, goals and contexts for an object.

The object may be a 3GPP managed object like a network slice, subnetwork (e.g. radio network) or other objects like a service. The consumer may desire the same requirements, goals and contexts for multiple objects with the same properties, in which case the intent may be stated for a list of objects as

"objects {O1,O2, …ON} with characteristics S"

However, the consumer may wish to express different requirements, goals and contexts for objects with different properties. It is in that case necessary to distinguish the requirements, goals and contexts to be achieved for each set of objects with the same properties. Correspondingly, the combination of requirements, goals and contexts for each set of objects with the same properties is the Intent Expectation. Also the consumer may wish to distinguish the requirements, goals and contexts for different objects with the same properties, in this case, the combination of requirements, goals and contexts for each object instance may be contained in a separate Intent Expectation or requirements, goals and contexts for the multiple object instances may be combined in a single Intent Expectation.

### 4.5.2 Expectation Targets

For a given intent expectation, the desired characteristics of the object(s) are the expectation targets to be achieved. The expectation targets may include the metrics that characterize the performance of the object(s) or some abstract index that expresses the behaviour of the object(s). A given intent expectation may include multiple expectation targets on the same object or on different objects with the same properties. A consumer may for example require for the Network Slice object(s) that User throughput > 5Mbps and latency < 1ms. The expectation targets may also be context specific, i.e. the intent may require a specific expectation targets given a specific target context. As such with the characteristics as a combination of expectation targets and target contexts, the intent expectation may be stated as:

"ensure that for

Expectation Object O,

Expectation Target\_1 is T\_1, Target Context\_1 is C\_1

….,

Expectation Target\_m is T\_m, Target Context\_k is C\_k;

Each expectation target expresses an aspect of the characteristics of the object under consideration, i.e. it expresses a desired characteristics on a specific object. Each of the object characteristic may be desired to be equivalent to a specific value or constrained to a value or a range of values, e.g. as listed in Table 4.5.2-1. The combination of the name of characteristic (or simply the targetName), the condition constraining the characteristic and the value or value range for the characteristic is the target, i.e. the Expectation Target is the tuple:

Expectation Target = [targetName, condition, value range]

Table 4.5.2-1: Examples of Expectation Targets for different Objects

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Example of Expectation Targets | ExpectationObject | targetName | Condition | Value range |
| example 1 | Network Slice | Coverage area | Is greater than | 40 km radius |
| example 2 | Communication Service | User throughput | Is greater than | 2 Mbps |

### 4.5.3 Expectation Objects

The object (s) for which a given expectation is addressed can be expressed with the object's identifier. This may, however, not always be adequate (e.g. if the consumer does not have or know the identifiers of the object) or may be cumbersome for some intents.

EXAMPLE 1: It may be easier to state "all network slices in city ABC" as opposed to listing the individual network slice. As such it may be easier to identify the objects by stating the object context information that filters and identifies the desired objects.

The objectContext is in form of a context list whose entries are each a tuple (attribute, condition, value range).

EXAMPLE 2: In the case of "all network slices in a city" there is an object context, which is the tuple "location, =, city\_ABC" and "objectType= network slice".

### 4.5.4 Context

Each expectation target may be constrained to only be achieved for a very specific set of conditions as context constraints. The context describes a set of conditions to trigger corresponding management tasks to acheive the expectation targets. For example, the consumer may state that: "ensure that handoverFailureRate < 2 % if Load > 80 %", where the expectation target (HandoverFailureRate < 2 %) is to be achieved only in the context (Load > 80 %). In this example, the producer will perform handover tasks to achieve the expectation target "HandoverFailureRate < 2 %" when observe the context "Load > 80 %".

Similar to the target, the context is also a tuple of < attribute, condition, value range > but where the values having a different semantics.

Although contexts and targets have the same structure, to distinguish between what needs to be achieved and the context which is only to be considered as required conditions, the context has to be explicitly stated separate from the target. For example, if the consumer wishes that the Radio Link Failure rate (RLF) is less than 2 % when the load is more than 50 %. If the context (i.e. load > 50 %) is not explicitly stated/modelled as context, the producer could interpret the request to mean (RLF < 2 % and load > 50 %).

For a given expectation, the specific list of expectation targets may be desired to be achieved for given combined contexts, i.e. besides the expectation targets, an expectation may state a list of contexts which apply to all expectation targets within the intent expectation. Similarly, there may be contexts that apply to all expectations within a given intent. Correspondingly, both Intent expectations and intents should be modelled to only contain the contexts that apply to all the contained sub elements.

# 5 Specification Level Requirements

## 5.1 Use cases

### 5.1.1 Intent containing an expectation for delivering radio network

#### 5.1.1.1 Introduction

This use case describes a scenario where a MnS consumer express intent containing an expectation for delivering a radio network in the specified area to a MnS producer. In this scenario, MnS consumer expresses its intent expectation for delivering a radio network to MnS producer, which may include coverage area information (e.g. geographical areas), radio setting parameter sets (e.g. frequency information, range of gNB Id, range of PCI, range of Cell Id, range of nRTAC), transport setting parameters (including OM transport information (e.g. OMlocalIPaddress, OMremoteIPaddress, OMNextHopInfo) and NG transport information (e.g. list of NGlocalIPaddress, list of NGremoteIPaddress)), and supported network capacity information (e.g. maximum UE number) and network performance information (e.g. UL/DL throughput).

Based on the intent containing an expectation for radio network provisioning received, MnS producer identifies corresponding RAN NEs discovered in the specified coverage area, analyses and generates the configuration parameters (including radio configuration parameters and transport configuration parameters) for each identified RAN NE and corresponding Cells, creates MOI(s) for each RAN NEs and Cells and configure the created MOI(s), and performs verification for configured RAN NEs to enable the radio network in the specified area is successfully delivered and satisfy the received intent.

MnS producer notifies MnS consumer about the fulfilment information of the intent containing an expectation for delivering radio network after the verification is finished.

#### 5.1.1.2 Requirements

**REQ-Intent\_Deploy\_Net-CON-1** The intent driven MnS shall have capability enabling MnS consumer to express intent containing an expectation for delivering a radio network for the specified area to MnS producer.

**REQ-Intent\_Deploy\_Net-CON-2** The intent driven MnS shall have capability enabling MnS consumer to obtain fulfilment information of the intent containing an expectation for delivering a radio network.

### 5.1.2 Intent containing an expectation for delivering a radio service

#### 5.1.2.1 Introduction

This use case describes a scenario where a MnS consumer express intent containing an expectation for delivering radio service (radio network as service) in the specified area to a MnS producer.

In this scenario, MnS consumer expresses its intent containing an expectation for delivering a radio service to MnS producer, which may include coverage area information (e.g. geographical areas), and supported service capacity information (e.g. maxNumberofUEs, activityFactor) and service performance information (e.g. serviceType, dLThptPerUEPerSubnet, uLThptPerUEPerSubnet).

Note: The slice agnostic parameters in RAN SliceProfile can be used for service capacity information and service performance information.

Based on the intent containing an expectation for delivering a radio service received, MnS producer decides to use radio network with slicing or radio network without slicing to support the intent:

- In case of using radio network with slicing, the use case for network slice subnet creation defined in 3GPP TS 28.531 [2] can be reused.

- In case of using radio network without slicing, MnS producer identifies corresponding RAN NEs and cells in the specified coverage area to support the intent, analyses and configure the service specific configuration parameters for corresponding RAN NE and Cells (e.g. RRM policies, supported services).

MnS producer notifies MnS consumer about the fulfilment information of the intent containing an expectation for delivering a radio service after the service configuration is finished.

#### 5.1.2.2 Requirements

**REQ-Intent\_Deploy\_Sev-CON-1** The intent driven MnS shall have capability enabling MnS consumer to express intent containing an expectation for delivering a radio service for the specified area to MnS producer.

**REQ-Intent\_Deploy\_Sev-CON-2** The intent driven MnS shall have capability enabling MnS consumer to obtain fulfilment information of the intent containing an expectation for a service.

### 5.1.3 Intent containing an expectation for delivering a service

#### 5.1.3.1 Introduction

This use case describe a scenario where the MnS consumer, express the intent containing an expectation for delivering a service (e.g. at the edge of the network). The intent expectation for a service includes service type (URLLC, eMBB), service requirements (number of concurrent subscribers and number of concurrent sessions), service availability and the target location.

#### 5.1.3.2 Requirements

**REQ-Intent\_Deploy\_Net-CON-1** The intent driven MnS shall have capability enabling authorized MnS consumer to express intent containing an expectation for delivering a service (e.g. at the edge of the network) to MnS producer.

### 5.1.4 Intent containing an expectation on coverage performance to be assured

#### 5.1.4.1 Introduction

In this scenario, MnS consumer expresses its intent containing an expectation on coverage performances to be assured in the specified areas to NEP, which may include area information (e.g. geographical area), RATs (e.g. NR only, EUTRAN only, or all RATs), coverage targets (e.g. target average RSRP, target weak coverage ratio).

Based on the intent containing an expectation on coverage performance to be assured received, MnS producer collects and analyses corresponding coverage related data (e.g. RSRPs of the serving cell and neighbour cells reported by each UE with anonymous id (e.g. C-RNTI) and location information in the MDT reports)) of corresponding RAN NEs in the specified areas, identifies the potential coverage issues which will impact the coverage targets satisfaction, analyses the identified coverage issue and corresponding solutions, evaluates, decides and adjusts the coverage configuration parameters. The Artificial intelligence or machine learning technologies may be used in above workflow to satisfy the intent, for example, online iteration optimization technologies may be used to selecting the best coverage configuration parameters rapidly.

MnS producer continuously monitors the coverage performance (e.g. weak coverage ratio, average RSRP) for the specified area, and decides whether coverage targets described in the intent is satisfied. If not satisfied, NEP iteratively executes above workflows (including collect, identification, analysis, evaluation, decision and adjustment) to fulfil the coverage targets.

MnS producer may notify MnS consumer about the intent fulfilment information, including coverage performance for the specified area (e.g. weak coverage ratio, coverage hole ratio, average RSRP) which enables MnS consumer to monitor the intent containing an expectation on coverage performance to be assured. MnS consumer may also request to MnS producer to report the intent fulfilment information.

#### 5.1.4.2 Requirements

**REQ-Intent\_Opt\_Cov-CON-1** The intent driven MnS shall have capability enabling MnS consumer to express intent containing an expectation on coverage performance to be assured for the specified area to MnS producer.

**REQ-Intent\_Opt\_Cov-CON-2** The intent driven MnS shall have capability enabling MnS consumer to obtain fulfilment information of the intent containing an expectation on coverage performance to be assured.

### 5.1.5 Intent containing an expectation on radio network performance to be assured

#### 5.1.5.1 Introduction

In this scenario, MnS consumer expresses its intent containing an intent expectation on radio network performance (including RAN UE throughput performance, radio network capacity performance) to be assured to MnS producer, which may include area information (e.g. geographical area), RATs (e.g. NR only, EUTRAN only, or all RATs), radio network performance targets, optional performance scope (e.g. specific service type, specific UE groups).

The radio network performance targets includes the targets in the following target categories based on what radio network performance MnS consumer expected to be assuranced.

- RAN UE throughput targets, for example, target average UL/DL RAN UE throughput, target percentage of UE with low UL/DL RAN UE throughput (e.g. < 5 Mbps), target percentage of UE with high UL/DL RAN UE throughput (e.g. > 50 Mbps).

- Radio network capacity target, for example, target percentage of high UL/DL PRB Load (e.g. < 70%).

Based on the intent containing expectation on radio network performance to be assured received, MnS producer collects and analyses corresponding radio network performance related data (e.g. RAN UE throughput data, number of PRBs used for UL/DL traffic transmission) in the specified areas, identifies the potential radio network performance issues (e.g. low RAN UE throughput for certain areas, high load for certain areas, high UL/DL PRB Load issue)), which will impact radio network performance intent satisfaction, analyses, evaluates, decides and adjusts the radio feature configuration parameters for impacted RAN NEs/Cells in the specified areas. The artificial intelligence or machine learning technologies may be used to select the optimal radio feature configuration parameters set rapidly to satisfy radio network performance targets.

MnS producer continuously monitors the radio network performance (e.g. average UL/DL RAN UE throughput, percentage of UE with low UL/DL RAN UE throughput (e.g. < 5 Mbps), percentage of UE with high UL/DL RAN UE throughput (e.g. > 50 Mbps) , percentage of high UL/DL PRB Load (e.g. < 70%)) for the specified area, and decides whether radio network performance targets is satisfied.

MnS producer may notify MnS consumer about the intent fulfilment information and achieved value for radio network targets, including the RAN UE throughput performance (e.g. average UL/DL RAN UE throughput, percentage of UE with low UL/DL RAN UE throughput, percentage of high UL/DL PRB Load) for the specified area which enables MnS consumer to monitor the intent containing an expectation on radio network performance to be assured.

#### 5.1.5.2 Requirements

**REQ-Intent\_Opt\_Thp-CON-1** The intent driven MnS for radio network shall have capability enabling MnS consumer to express intent containing an expectation on RAN UE throughput performance to be assured for specified area to MnS producer.

**REQ-Intent\_Opt\_Thp-CON-2** The intent driven MnS for radio network shall have capability enabling MnS consumer to obtain fulfilment information of intent containing an expectation on RAN UE throughput performance to be assured.

**REQ-Intent\_Opt\_Capacity-CON-1**: The intent driven MnS for radio network shall have capabilities enabling the MnS consumer to express intent containing an expectation on radio network capacity performance to be assured for the specified area.

**REQ-Intent\_ Op2\_Capacity-CON-2:** The intent driven MnS for radio network shall have capabilities enabling the MnS consumer to obtain intent report information (including fulfilment information and achieved value) for intent containing an expectation on radio network capacity performance to be assured.

Note: the example of radio network capacity performance is target percentage of high UL/DL PRB Load for a specified Geographical area.

### 5.1.6 Intent containing an expectation for end-to-end network optimization

#### 5.1.6.1 Introduction

In this scenario, MnS consumer expresses its intent containing an intent expectation with targets on the whole Network including RAN and Core. The intent may for example be for optimization of the network resources, i.e. the intent expectation captures the objectives for an entity that undertakes optimization for the network. The expectation may be termed as network resources expectation. The network resources expectation targets may express the desired performance optimization outcomes. Depending on the stated targets, the MnS producer may as such configure one or more optimization functions to achieve the desired targets. The network optimization expectation targets may for example be end-to-end KPI targets that the optimization is required to achieve.

The network optimization expectation may include relative prioritizations of the different targets which indicate the relative interests of the intent MnS consumer on the different network attributes.

#### 5.1.6.2 Requirements

**REQ-Intent\_NetOpt-1** The intent driven MnS for end-to-end network shall have capability enabling MnS consumer to express intent containing an expectation with targets on t end-to-end the end-to-end Network including the RAN and core .

**REQ-Intent\_NetOpt-1** The intent driven MnS for end-to-end network shall have capability enabling MnS consumer to express intent containing an expectation with the prioritization of the targets to be achieved.

**REQ-Intent\_ NetOpt-2** The intent driven MnS for end-to-end network shall have capability enabling MnS consumer to obtain fulfilment information of intent containing an expectation with targets on the end-to-end Network.

### 5.1.7 Intent containing an expectation for RAN energy saving

#### 5.1.7.1 Introduction

Operators are aiming at decreasing power consumption in 5G networks to lower their operational expense with energy saving management solutions. Energy saving is achieved by executing the energy saving actions with suitable parameter configurations, e.g. energy saving state switch, start time and end time, the energy saving thresholds. However, the various combinations of energy saving actions can lead to conflicts. For example, different energy saving actions may be contradictory, or the energy saving actions may conflict with other activities (e.g. network optimization actions). Moreover, it is not straightforward to evaluate the influence on service experience (e.g. UL/DL RAN UE throughput, latency) of energy saving actions beforehand, which makes it difficult to balance the energy saving effect and service experience, for example the energy saving actions may deteriorate the service experience. To avoid affecting the service experience, MnS consumer may express energy saving target with the maximum value of RAN energy consumption in intent expectation, and MnS producer is able to choose an optimal value of RAN energy consumption to save energy as much as possible in the context to satisfy the service experience.

As clause 4.1.1 described, an intent focuses more on describing the "What" needs to be achieved but less on "How" that outcomes should be achieved, which not only relieves the burden of the consumer knowing implementation details but also leaves room to allow the producer to explore alternative options and find optimal solutions. So, introducing the intent approach for energy saving, which can enable the 3GPP management system to analyse and select the optimal balance between the energy saving effect and service experience by utilizing some intelligence mechanisms. In intent driven approach, a MnS consumer expresses intent expectation for RAN energy saving in the specified area (e.g. geographical area) to a MnS producer, which may include the RAN energy saving target (e.g. the maximum value of target RAN energy consumption, reduction radio of energy consumption) and service experience (e.g. RAN UE throughput, latency), as well as the frequencies and RATs to be considered for energy saving. Some contexts for RAN energy saving (e.g. RAN energy saving allowed time (e.g., 1:00 am-5:00 am), RAN energy saving trigger event (e.g. PRB load ratio < 50%)) also can be specified by MnS consumer to provide the conditions to allow corresponding energy saving actions to be triggered to satisfy the energy saving targets. MnS producer analyses and determines the optimal RAN energy saving solution (i.e. a set of energy saving actions) to satisfy MnS consumer's intent expectation for RAN energy saving.MnS producer continuously monitors the RAN energy saving performance (e.g. RAN energy consumption, RAN energy efficiency) and service experience performance (e.g. target average UL/DL RAN UE throughput, target) for the specified area, and decides whether RAN energy saving target is satisfied.

MnS producer may report the intent fulfilment information and achieved value for RAN energy saving targets (e.g. RAN energy consumption, RAN energy efficiency) for the specified area to MnS consumer which enables MnS consumer to monitor the intent containing an expectation for RAN energy saving.

#### 5.1.7.2 Requirements

**REQ-Intent\_Opt\_EnergySaving-1:** The intent driven MnS for radio network shall have capabilites enabling MnS consumer to express intent containing an expectation for RAN energy saving for the specified area to MnS producer.

**REQ-Intent\_ Opt\_EnergySaving -2:** The intent driven MnS for radio network shall have capabilites enabling MnS consumer to obtain intent report information (i.e. fulfilment information, achieved value for corresponding targets) of the intent containing an expectation for RAN energy saving.

### 5.1.8 Intent containing an expectation for 5GC network

#### 5.1.8.1 Introduction

This use case describes a scenario where a MnS consumer express intent containing an expectation related to 5GC network to a MnS producer. In this scenario, MnS consumer expresses its intent expectation which may include location information (e.g. geographic location, data center), type of the network (e.g. toB), included 5GC NF list (e.g. NF types information, range of NF instance ID), PLMN information, supported APN information, transport related parameters (e.g. list of related end point addresses information), and target network capacity information (e.g. number of PDU session of network, number of registered subscribers, UL/DL throughput)

Based on the intent containing an expectation related for 5GC network as received, the intent MnS producer decides whether to deploy a new 5GC network in the specified location or to reconfigure an existing 5GC network. If a new 5GC network is to be delivered, the intent MnS producer generates network configuration parameters (including 5GC network/NFs configuration parameters and transport network configuration parameters). If an existing 5GC network is to be reconfigured, the intent MnS producer identifies the potential 5GC performace issues (e.g. low performance because of high load ) for the existing 5GC network, modifies the 5GC NF configuration parameters if needed to satisfy the performance expectation targets (this may also trigger scaling procedure by interworking with ETSI NFV MANO). Multiple interactions between the Intent MnS consumer and the Intent MnS producer may be needed based on the intent management capabilities (e.g. intent translation and intent feasibility check) provided by intent MnS producer.

The Intent MnS producer continuously monitors the 5GC performance (e.g. mean number of registered UE, mean number of created PDU session), and decides whether 5GC related expectation is satisfied.If the 5GC related expectation is not satisfied, the intent MnS producer identifies the potential 5GC performace issues and modifies the 5GC NF configuration parameters if needed to satisfy the performance expectation targets.

On a regular basis, MnS producer notifies MnS consumer about the fulfilment information of the intent.

#### 5.1.8.2 Requirements

**REQ-Intent\_5GC\_Net-CON-1** The intent driven MnS shall have capability enabling MnS consumer to express intent containing an expectation for delivering a 5GC network for the specified area to MnS producer.

**REQ-Intent\_5GC\_Net-CON-2** The intent driven MnS shall have capability enabling MnS consumer to obtain fulfilment information of the intent containing an expectation for delivering a 5GC network.

**REQ-Intent\_5GC\_Net-CON-3** The intent driven MnS shall have capability enabling MnS consumer to express intent containing an expectation on 5GC network performance to be assured to the Intent MnS producer.

**REQ-Intent\_5GC\_Net-CON-4** The intent driven MnS shall have capability enabling MnS consumer to obtain fulfilment information of the intent containing an expectation on 5GC network performance to be assured.

## 5.2 Generic requirements for intent driven MnS

**REQ-Intent\_Driven\_MnS-CON-1** The intent driven MnS shall have capability enabling MnS consumer to request MnS producer to create a new Intent instance.

**REQ-Intent\_Driven\_MnS-CON-2** The intent driven MnS shall have capability enabling MnS consumer to request MnS producer to remove an Intent instance.

**REQ-Intent\_Driven\_MnS-CON-3** The intent driven MnS shall have capability enabling MnS producer to report intent fulfilment information.

**REQ-Intent\_Driven\_MnS-CON-4** The intent driven MnS shall have capability enabling MnS consumer to request MnS producer to modify an existing Intent instance.

**REQ-Intent\_Driven\_MnS-CON-5** The intent driven MnS shall have capability enabling MnS consumer to query intent instance information from MnS producer.

## 5.3 Generic use case for intent driven management

### 5.3.1 Intent handling capability obtaining

#### 5.3.1.1 Introduction

Clause 4.2.2 described that an Intent-driven MnS producer has the following capabilities:fulfil the received intent and report the result/information about the intent fulfilment, and clause 6.2.2 defined different scenario specific intent expectations with different ExpectationObjects and ExpectationTargets to support different use cases. In a network, multiple intent handling functions may be deployed to support different kinds of intents. Different intent handling functions may be deployed to support different intent expectation object domains, e.g. intent handling function A is deployed to handle the radio network related intents, intent handling function B is deployed to handle the 5GC network related intents, while intent handling function C is deployed to handle the service related intents. Or different intent handling functions are deployed to support different areas of the same intent expectation object domain, e.g. intent handling function D is deployed to support to handle the intent for radio network in Area#1, while intent handling function E is deployed to support to handle the intent for radio network in Area#2.

Before MnS consumer expresses the intent expectation targets and expectation objects to MnS producer, MnS consumer may want to know what expectation targets and expectation objects can be supported by MnS producer. Based on such supported expectation targets information and expectation objects information, the MnS consumer may use such information to select the proper intent handling function to express the intent.

#### 5.3.1.2 Requirements

**REQ-IHCO-CON-1** The intent driven MnS shall have capabilities enabling an MnS consumer to obtain intent handling capabilities from the MnS producer.

### 5.3.2 Intent report

#### 5.3.2.1 Introduction

The Fulfilment information (including the intentFulfilmentInfo, expectationFulfilmentInfo and targetFulfilmentInfo) are defined for the MnS consumer to monitor the intent fulfilment information. The intent report also can contain the current and optional predicted value for performance indicated by corresponding expectation targets (e.g. WeakRSRPRatio for the weakRSRPRatioTarget, Average UL RAN UE Throughput for aveULRANUEThptTarget), which can be used by MnS consumer to validate whether the intent is really fulfilled and to evaluate whether the intent (especially for expectation targets) needs to be updated if needed (improve the target value when corresponding target is fulfilled or reduce the target value when corresponding target is not fulfilled or not fulfilled with the reason of target confliction). Besides, intent conflict information and intent fulfilment feasibility check information which send by MnS producer to MnS consumer is another type of intent report information. So, following are the four types of information needs to be monitored by MnS consumer:

- Intent Fulfilment information, which represents the properties of a specific fulfilment information for an aspect of the intent (i.e. either an expectation, a target or the whole intent), including fulfilment status and achieved values for targets.

- Intent conflict information, which represents conflict type (i.e., intent conflict, expectation conflict and target conflict) and possible solution recommendation to address the conflicts.

- Intent fulfilment feasibility check information, which indicates that the intent is feasible or infeasible. Intent fulfilment feasibility check information is provided after MnS producer automatically performs feasibility check when receive the intent creation and modification request from MnS consumer.

Different MnS consumer may have different requirements for intent report (e.g. Some MnS consumer may want to have corresponding performance value information while others do not want. Different MnS consumer may want to calculate or monitor the performance value in different period).

#### 5.3.2.2 Requirements

**REQ-Intent\_Driven\_MnS\_Report-1:** The intent driven MnS shall have the capability to enable the MnS consumer to request intent report information.

**REQ-Intent\_Driven\_MnS\_Report-2:** The intent driven MnS shall have the capability to enable the MnS consumer to obtain intent report information with intent fulfilment information (including fulfilment status and achieved values for targets).

**REQ-Intent\_Driven\_MnS\_Report-3:** The intent driven MnS shall have the capability to enable the MnS consumer to obtain intent report information with intent conflict information.

**REQ-Intent\_Driven\_MnS\_Report-4:** The intent driven MnS shall have the capability to enable the MnS consumer to obtain intent report information with intent fulfilment feasibility check information.

**REQ-Intent\_Driven\_MnS\_Report-5:** The intent driven MnS shall have capability enabling MnS consumer to specify the content of the report.

**REQ-Intent\_Driven\_MnS\_Report-6:** The intent driven MnS shall have capability enabling MnS consumer to configure the frequency of the intent reporting.

**REQ-Intent\_Driven\_MnS\_Report-7:** The intent driven MnS shall have the capability enabling MnS consumers to receive reports, with different content and intervals according to its specified requirements.

### 5.3.3 Intent fulfilment feasibility check

#### 5.3.3.1 Introduction

This capbility can be used to assist MnS consumer to generate the suitable intent information. MnS producer automatically conducts feasibility check to determine whether the intent instance is feasible including check the satisfaction of intent fulfilment and potential conflicts between one or more intent instances, when it receives the intent instance creation or modification request from MnS consumer, then notifies MnS consumer the result of feasibility check. . If the result of intent fulfilment feasibility check is feasible, the MnS producer performs the service or network management tasks to satisfiy the intent instance. In case the result of intent fulfilment feasibility check is infeasible, MnS producer notifies the Mns consumer the reason of infeasibilty and corresponding recommendations, then the MnS comsumer update the intent information.

#### 5.3.3.2 Requirements

**REQ-Intent\_Driven\_MnS- Fesibilitycheck -Y:** The intent-driven MnS producer shall have capability to inform the authorized MnS consumer about the result of intent fulfilment feasibility check, including feasible or infeasible.

**REQ-Intent\_Driven\_MnS- Fesibilitycheck -Z:** The intent-driven MnS producer shall have capability to inform the authorized MnS consumer about the infeasible reason and corresponding recommendations if the result of intent fulfilment feasibility check is unfeasible.

# 6 Stage 2 definition for Intent Driven Management

## 6.1 Management operation for Intent (MnS component type A)

The operations (e.g. createMOI operations) and notifications (e.g. notifyMOIcreation) of generic provisioning MnS defined in 3GPP TS 28.532 [3] can be used for intent lifecycle management. The intent can be treated as object instance. Following is the IS to support intent lifecycle management

Table 6.1-1: IS to support intent lifecycle management

|  |  |
| --- | --- |
| intent lifecycle management | IS operation |
| Create an intent | createMOI operation |
| Delete an intent | deleteMOI operation |
| Modify an intent | modifyMOIAttributes operation |
| Query an intent | getMOIAttributes operation |

## 6.2 Information model definition for Intent (MnS component typeB)

### 6.2.1 Generic Information model definition

#### 6.2.1.1 Class diagram

##### 6.2.1.1.1 Relationship



NOTE: The model for IntentReport is not addressed in the present document.

Figure 6.2.1.1.1-1: Relationship UML diagram for intent

##### 6.2.1.1.2 Inheritance

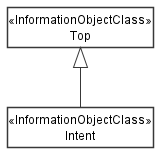


Figure 6.2.1.1.2-1: Inheritance UML diagram for intent

#### 6.2.1.2 Class definition

##### 6.2.1.2.1 Intent <<IOC>>

6.2.1.2.1.1 Definition

This IOC represents the properties of an Intent driven management information between MnS consumer and MnS producer.

The Intent IOC contains one or multiple IntentExpectation(s) which includes MnS consumer's requirements, goals and contexts given to a 3GPP system*.*

The Intent IOC includes the attribute objectClass and objectInstance from the TOP IOC. The value of attribute objectClass is "Intent" and the value of attribute objectInstance is the DN of the instance of Intent IOC.

6.2.1.2.1.2 Attributes

The Intent IOC includes attributes inherited fromTOP IOC (defined in 3GPP TS 28.622 [6]) and the following attributes.

Table 6.2.1.2.1.2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| intentExpectations | M | T | T | F | F |
| userLabel | M | T | T | F | F |
| intentContexts | O | T | T | F | F |
| intentFulfilmentinfo | M | T | F | F | T |

6.2.1.2.1.3 Attribute constraints

None.

###### 6.2.1.2.1.4 Notifications

The common notifications defined in clause 6.2.1.5 are valid for this IOC, without exceptions or additions.

#### 6.2.1.3 DataType definition

##### 6.2.1.3.1 IntentExpectation <<dataType>>

6.2.1.3.1.1 Definition

IntentExpectation <<dataType>>represents MnS consumer's requirements, goals and contexts given to a 3GPP system*.*

6.2.1.3.1.2 Attributes

The IntentExpectation includes the following attributes.

Table 6.2.1.3.1.2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| expectationId | M | T | T | T | T |
| expectationVerb | O | T | T | T | F |
| expectationObject | M | T | T | F | F |
| expectationTargets | M | T | T | F | F |
| expectationContexts | O | T | T | F | F |
| expectationfulfilmentInfo | O | T | F | F | T |
| NOTE: The scenario/requirements-specific IntentExpectations are defined utilizing the constructs of this generic IntentExpectation model. | | | | | |

6.2.1.3.1.3 Attribute constraints

None.

###### 6.2.1.3.1.4 Notifications

The notifications specified for the IOC using this <<dataType>> for its attribute(s), shall be applicable.

##### 6.2.1.3.2 ExpectationObject <<dataType>>

6.2.1.3.2.1 Definition

The ExpectationObject <<dataType>> represents the Object to which the IntentExpectation should apply.

6.2.1.3.2.2 Attributes

The ExpectationObject includes the following attributes.

Table 6.2.1.3.2.2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| objectType | CM | T | T | F | F |
| objectInstance | CM | T | T | F | F |
| objectContexts | O | T | T | F | F |

6.2.1.3.2.3 Attribute constraints

Table 6.2.1.3.2.3-1

|  |  |
| --- | --- |
| Name | Definition |
| objectType  Support Qualifier | Condition: The intent expectation is not for a specific object instance or MnS consumer have no knowledge of the DN of this specific object instance. |
| objectInstance  Support Qualifier | Condition: The intent expectation is for a specific object instance and MnS consumer have the knowledge of the DN of this specific object instance. |

##### 6.2.1.3.3 ExpectationTarget <<dataType>>

6.2.1.3.3.1 Definition

The ExpectationTarget <<dataType>> represents the targets of the IntentExpectation that are required to be achieved.

6.2.1.3.3.2 Attributes

The ExpectationTarget includes the following attributes.

Table 6.2.1.3.3.2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| targetName | M | T | T | F | T |
| targetCondition | M | T | T | F | F |
| targetValueRange | M | T | T | F | F |
| targetContexts | O | T | T | F | F |
| targetfulfilmentInfo | O | T | F | F | T |

6.2.1.3.3.3 Attribute constraints

None.

###### 6.2.1.3.3.4 Notifications

The notifications specified for the IOC using this <<dataType>> for its attribute(s), shall be applicable.

##### 6.2.1.3.4 Context <<dataType>>

6.2.1.3.4.1 Definition

The Context <<dataType>> represents the properties of a context. A context describes the condition. The context may apply to the intent, the intent expectation, the intent targets or to the object.

6.2.1.3.4.2 Attributes

The Context includes the following attributes.

Table 6.2.1.3.4.2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| contextAttribute | M | T | T | F | F |
| contextCondition | M | T | T | F | F |
| contextValueRange | M | T | T | F | F |

6.2.1.3.4.3 Attribute constraints

None.

##### 6.2.1.3.5 FulfilmentInfo << dataType >>

6.2.1.3.5.1 Definition

This dataType represents the properties of a specific fulfilment information for an aspect of the intent (i.e. either an expectation, a target or the whole intent). The fulfilment information describes the MnS producer's assessment of the degree to which a specific aspect of the intent is being fulfilled. The MnS consumer may however assess the fulfilment differently e.g. the MnS consumer may evaluate the delivered outcome or network state to compute its fulfilment satisfaction.

The fulfilmentStatus field indicates whether the intent is being fulfilled or not being fulfilled. The possible values of the fulfilment include:

- NOTFULFILLED: This is the default status for any aspect of the intent and the fulfilmentStatus remains as "NOTFULFILLED" until the MnS producer is satisfied that the actions undertaken meet the requirements as stated by the MnS consumer.

- FULFILLED: This is the status if the MnS producer considers that the intent, expectation or target is being fulfilled as desired by the MnS consumer that created the intent. The consumer may provide a fulfilment satisfaction report that either confirms the fulfilment or describes its evaluation the fulfilment.

The degree of fulfilment of an intent with the NOTFULFILLED status may have multiple explanations and related states. These different progress states and conditions are recorded in the notFulfilledState field. The possible values of the notFulfilledState include:

- ACKNOWLEDGED: this is the default status and is the initial notFulfilledState right after the intent has been received.

- COMPLIANT: this is the state after the feasibility check has been run for the intent and the intent accepted as being compliant for fulfilment.

- DEGRADED: this is the state if an intent that was previously fulfilled but after a period of observation it is found not be meeting the initially stated requirements.

- SUSPENDED: this is the state if the MnS producer decides to suspect the fulfilment of the intent, expectation or target for whatever reason. This notFulfilledState shall be supported by a reason such as the event(s) that were observed when fulfilment was attempted.

- TERMINATED: This state is registered if the respective aspect of the intent (i.e. either an expectation, a target or the whole intent) shall not be considered for fulfilment e.g. when an authorized MnS consumer sends an indication terminating the specific aspect of the intent. For instance, if the MnS consumer sends an update of the intent in which a particular target is eliminated, then that target shall be marked as cancelled.

- FULFILMENTFAILED: This is the state when the MnS producer decides that the intent, expectation or target cannot be fulfilled. This state shall be supported by a reason such as the event(s) that were observed when fulfilment was attempted.

For some scenarios (in particular for the "SUSPENDED" and the "FULFILMENTFAILED" notFulfilledStates), the notFulfilledState should be supported by extra information describing or related to the state. This extra information is recorded into the notFulfilledReasons field.

6.2.1.3.5.2 Attributes

The FulfilmentInfo includes the following attributes.

Table 6.2.1.3.5.2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| fulfilmentStatus | M | T | F | F | T |
| notFulfilledState | CM | T | F | F | T |
| notFulfilledReasons | CO | T | F | F | T |

6.2.1.3.5.3 Attribute constraints

Table 6.2.1.3.5.3-1

|  |  |
| --- | --- |
| Name | Definition |
| notFulfilledState  Support Qualifier | Condition: when FulfilmentInfo is implemented for IntentFulfilmentInfo |
| notFulfilledReasons  Support Qualifier | Condition: when FulfillmentInfo is implemented for IntentFulfilmentInfo |

###### 6.2.1.3.5.4 Notifications

The notifications specified for the IOC using this <<dataType>> for its attribute(s), shall be applicable.

#### 6.2.1.4 Attribute definition

Table 6.2.1.4-1

| Attribute Name | Documentation and Allowed Values | Properties |
| --- | --- | --- |
| userLabel | A user-friendly (and user assignable) name of the intent.  allowedValues: Not Applicable | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| intentExpectations | It describes the expectations including requirements, goals and contexts (including constraints and filter information) given to a 3GPP system. It states the list of specific outcomes desired to be realized for expectation object(s).  allowedValues: Not Applicable | type: IntentExpectation  multiplicity: 1..\*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: False |
| intentFulfilmentInfo | It describes status of fulfilment of an intent and the related reasons for that status.  allowedValues: Not Applicable | type: FulfilmentInfo  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| expectationFulfilmentInfo | It describes status of fulfilment of an intentExpectation and the related reasons for that status.  allowedValues: Not Applicable | type: FulfilmentInfo  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| targetFulfilmentInfo | It describes status of fulfilment of an expectationTarget and the related reasons for that status.  allowedValues: Not Applicable | type: FulfilmentInfo  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| fulfilmentStatus | It describes the current status of the intent fulfilment result, which is configured by MnS producer and can be read by MnS consumer.  allowedValues: "FULFILLED", "NOT\_FULFILLED" | type: ENUM  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| notFulfilledState | It describes the current progress of or the reason for not achieving fulfilment for the intent, intentExpectation or expectationTarget. It is configured/written by MnS producer and can be read by MnS consumer.  allowedValues: "ACKNOWLEDGED", "COMPLIANT", "DEGRADED", "SUSPENDED", "TERMINATED" "FULFILMENTFAILED" | type: ENUM  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| notFulfilledReasons | It describes the reasons/observations related to the specific noted notFulfilledState  allowedValues: Not Applicable | type: String  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: False |
| intentContexts | It describes the list of IntentContext(s) which represents the constraints and conditions that should apply for the entire intent even if there may be specific contexts defined for specific parts of the intent.  allowedValues: triple of (attribute, condition, value range) | type: Context  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: False |
| expectationId | A user-friendly (and user assignable) name of the intentExpectation.  allowedValues: Not Applicable | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| expectationVerb | It describes the characteristic of the intentExpectation and is the property that describes the types of intentExpectations. Examples of verbs and their related types of expectation are  Deliver: DeliveryIntentExpectation, e.g. Deliver a RAN network, Service, Slice, function  Ensure: AssuranceintentExpectation, e.g. Ensure the performance targets values  allowedValues: DELIVER, ENSURE | type: String  multiplicity: 1  isOrdered:N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| expectationObject | It describes the expectation objects to which the IntentExpectation should apply.  allowedValues: Not Applicable | type: ExpectationObject  multiplicity: 1  isOrdered:N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| objectType | It describes the type of expectation object of the IntentExpectation that are required to be applied on. It can be class name of the managed object.  allowedValues: see scenario specific Intent Expectation | type: Enum  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| objectInstance | It describes a specific object instance (e.g. instance of managed object) to which the intentExpectation should apply.  allowedValues: Not Applicable | type: DN  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: False |
| objectContexts | It describes the list of ObjectContext(s) which represents the constraints and conditions to be used as filter information to identify the object(s) to which a given intentExpectation should apply. Note there may be other constraints and conditions defined either for the entire intent, for the specific intentExpectation or for the expectationTarget of the considered intentExpectation.  The concrete ObjectContext depends on the ExpectationObject, which is defined in clause 6.2.2. All the concrete ObjectContexts follow the common structure of ObjectContext | type: Context  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: False |
| expectationTarget | It describes the list of ExpectationTarget(s) which represent specific outcomes on the metrics that characterize the performance of the object(s) or some abstract index that expresses the behavior of the object(s) that are desired to be realized for a given intentExpectation.  The concrete ExpectationTarget depends on the ExpectationObject, which is defined in clause 6.2.2. All the concrete ExpectationTargets follow the common structure of ExpectationTarget | type: ExpectationTarget  multiplicity: 1..\*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: False |
| expectationContexts | It describes the list of context(s) which represents the constraints and conditions that should apply for a specific intentExpectation.  Note there may be other constraints and conditions defined for the entire intent or for specific parts of the intentExpectation.  allowedValues: depends on Expectation Object in the IntentExpectation | type: Context  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: False |
| targetName | It describes the name of the Expectation of the expectation target which represents specific outcomes on the metrics that characterize the performance of the object(s) or some abstract index that expresses the behavior of the object(s) that are desired to be realized for a given intentExpectation.allowedValues: depends on ExpectationObject in the IntentExpectation | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| targetCondition | It expresses the limits within which the targetName is allowed/supposed to be.  allowedValues: IS\_EQUAL\_TO", "IS\_LESS\_THAN", "IS\_GREATER\_THAN", "IS\_WITHIN\_RANGE", "IS\_OUTSIDE\_RANGE", "IS\_ONE\_OF", "IS EQUAL TO OR LESS THAN”, "IS EQUAL TO OR GREATER THAN", "IS NOT ONE OF","IS\_ALL\_OF" | type: Enum  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: "is equal to"  isNullable: False |
| targetValueRange | It describes the range of values that applicable to the targetName and the targetCondition.  allowedValues: depends on the targetCondition.  The value will be a single real number when the targetCondition is either "IS\_EQUAL\_TO", "IS\_LESS\_THAN", "IS\_GREATER\_THAN", "IS EQUAL TO OR LESS THAN", "IS EQUAL TO OR GREATER THAN”  The value will be a pair of real numbers when the targetCondition is either "IS\_WITHIN\_RANGE", "IS\_OUTSIDE\_RANGE"  The value will be a list when the targetCondition is "IS\_ONE\_OF", "IS NOT ONE OF","IS\_ALL\_OF"See NOTE 1. | type: Real  multiplicity: 1..\*  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| targetContexts | It describes the list of constraints and conditions that should apply for a specific expectationTarget. Note there may be other constraints and conditions defined for the entire intent or the intentExpectation.  allowedValues: Not Applicable | type: Context  multiplicity: \*  isOrdered: False  isUnique: True  defaultValue: None  isNullable: False |
| contextAttribute | It describes a specific attribute of or related to the object or to characteristics thereof (e.g. its control parameter, gauge, counter, KPI, weighted metric, etc) to which the expectation should apply or an attribute related to the operating conditions of the object (such as weather conditions, load conditions, etc). | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| contextCondition | It expresses the limits within which the ContextAttribute is allowed/supposed to be  allowedValues: "IS\_EQUAL\_TO", "IS\_LESS\_THAN", "IS\_GREATER\_THAN", "IS\_WITHIN\_RANGE", "IS\_OUTSIDE\_RANGE, "IS\_ONE\_OF", "IS EQUAL TO OR LESS THAN", "IS EQUAL TO OR GREATER THAN", "IS NOT ONE OF","IS\_ALL\_OF" | type: Enum  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: "is equal to"  isNullable: False |
| contextValueRange | It describes the range of values that applicable to the ContextAttribute and the ContextCondition.  AllowedValue: depends on the contextCondition  The value will be a single real number when the contextCondition is either "IS\_EQUAL\_TO", "IS\_LESS\_THAN", "IS\_GREATER\_THAN", "IS EQUAL TO OR LESS THAN", "IS EQUAL TO OR GREATER THAN"  The value will be a pair of real numbers when the contextCondition is either "IS\_WITHIN\_RANGE", "IS\_OUTSIDE\_RANGE"  The value will be a list when the contextCondition is "IS\_ONE\_OF", "IS NOT ONE OF","IS\_ALL\_OF".  See NOTE 1. | type: Real  multiplicity: 1..\*  isOrdered: False  isUnique: True  defaultValue: Null  isNullable: True |
| Note 1: For "IS\_ALL\_OF", the value shall be an match of the entire list. | | |

#### 6.2.1.5 Common notifications

##### 6.2.1.5.1 Configuration notifications

This clause presents a list of notifications, defined in TS 28.532 [3], that an MnS consumer may receive. The notification header attribute objectClass/objectInstance shall capture the DN of an instance of a class defined in the present document.

Table 6.2.1.5.1-1

| Name | Qualifier | Notes |
| --- | --- | --- |
| notifyMOICreation | O | -- |
| notifyMOIDeletion | O | -- |
| notifyMOIAttributeValueChanges | O | -- |

### 6.2.2 Scenario specific IntentExpectation definition

#### 6.2.2.1 Scenario specific IntentExpectation definition

##### 6.2.2.1.1 Radio Network Expectation

6.2.2.1.1.1 Definition

Radio Network Expectation is an IntentExpectation which can be used to represent MnS consumer's expectations for radio network (RAN SubNetwork) delivering and performance assurance.

The Radio Network Expectation is defined by utilizing the construct of the generic IntentExpectation <<dataType>> with set of allowed values and concrete dataTypes specified.

Following are the specific allowed values when implemented the IntentExpectation for Radio Network Expectation.

Table 6.2.2.1.1.1-1

|  |  |
| --- | --- |
| Attribute Name | Allowed Values |
| objectType (CM) | RAN SubNetwork |
| objectInstance (CM) | DN of the RAN SubNetwork |

NOTE: Following are the qualifier description for attribute "objectType" and "objectInstance":

- In case of the intent expectation is not for a specific RAN SubNetwork instance or/and MnS consumer have no knowledge of the DN of this RAN SubNetwork instance, the attribute "objectType" needs to be specified.

- In case of the intent expectation is for a specific RAN SubNetwork instance and MnS consumer have the knowledge of the DN of this RAN SubNetwork instance, the attribute "objectInstance" needs to specified.

6.2.2.1.1.2 ObjectContexts

Following provides the concrete ObjectContexts for Radio Network Expectation based on the common structure of ObjectContext. The properties of the attributes in the following table should be same with properties of ObjectContexts defined in clause 6.2.1.3.

Table 6.2.2.1.1.2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| coverageAreaPolygonContext | O | T | T | F | F |
| coverageTACContext | O | T | T | F | F |
| pLMNContext | O | T | T | F | F |
| nRFqBandContext | O | T | T | F | F |
| rATContext | O | T | T | F | F |

6.2.2.1.1.3 ExpectationTargets

Following provides the concrete ExpectationTargets for Radio Network Expectation based on the common structure of ExpectationTarget. The properties of the attributes in the following table should be same with properties of ExpectationTargets defined in clause 6.2.1.3.

Table 6.2.2.1.1.3-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| weakRSRPRatioTarget | O | T | T | F | F |
| lowSINRRatioTarget | O | T | T | F | F |
| aveULRANUEThptTarget | O | T | T | F | F |
| aveDLRANUEthptTarget | O | T | T | F | F |
| lowULRANUEThptRatioTarget | O | T | T | F | F |
| lowDLRANUEThptRatioTarget | O | T | T | F | F |

##### 6.2.2.1.2 Edge Service Support Expectation

6.2.2.1.2.1 Definition

Edge Service Support Expectation is an IntentExpectation which can be used to represent MnS consumer's expectations for edge service deployment.

The Edge Service Support Expectation is defined utilizing the constructs of the generic IntentExpectation <<dataType>> with set of allowed values and concrete dataTypes specified.

Following are the specific allowed values when implemented the IntentExpectation for Edge Service Support Expectation.

Table 6.2.2.1.2.1-1

|  |  |
| --- | --- |
| Attribute | Allowed Values |
| ObjectType (CM) | EdgeServiceSupport |
| objectInstance (CM) | DN of the EdgeServiceSupport |

NOTE: Following are the qualifier description for attribute "objectType" and "objectInstance":

- In case of the intent expectation is not for a specific service instance or/and MnS consumer have no knowledge of the DN of this service instance, the attribute "objectType" needs to be specified.

- In case of the intent expectation is for a specific service instance and MnS consumer have the knowledge of the DN of this service instance, the attribute "objectInstance" needs to be specified.

6.2.2.1.2.2 ObjectContexts

Following provides the concrete ObjectContexts for Edge Service Support Expectation based on the common structure of ObjectContext. The properties of the attributes in the following table should be same with properties of ObjectContexts defined in clause 6.2.1.3.

Table 6.2.2.1.2.2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| edgeIdenfiticationIdContext | CM | T | T | F | F |
| edgeIdenfiticationLocContext | CM | T | T | F | F |
| coverageAreaTAContext | CM | T | T | F | F |

NOTE: Following are the qualifier description for attribute "edgeIdentificationId" and " edgeIdentificationLoc":

- In case of the Service deployment is needed at a particular edge data network, the attribute " edgeIdentificationId " needs to be specified.

- In case of the Service deployment is needed at a particular location, the attribute "edgeIdentificationLoc" needs to be specified.

6.2.2.1.2.3 ExpectationTargets

Following provides the concrete ExpectationTargets for Edge Service Support Expectation based on the common structure of ExpectationTarget. The attribute properties defined in the table below should be same with the properties defined for ExpectationTargets in clause 6.2.1.3.

Table 6.2.2.1.2.3-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| dlThptPerUETarget | O | T | T | F | F |
| UlThptPerUETarget | O | T | T | F | F |
| dLLatencyTarget | O | T | T | F | F |
| uLLatencyTarget | O | T | T | F | F |
| maxNumberofUEsTarget | O | T | T | F | F |
| activityFactorTarget | O | T | T | F | F |
| uESpeedTarget | O | T | T | F | F |

6.2.2.1.2.4 ExpectationContexts

Following provides the concrete ExpectationContexts for Service Deployment Expectation based on the common structure of ExpectationContext. The attribute properties defined in the table below should be same with the properties defined for ExpectationContexts in clause 6.2.1.3.

Table 6.2.2.1.2.4-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute Name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| serviceStartTimeContext | O | T | T | F | F |
| serviceEndTimeContext | O | T | T | F | F |
| uEMobilityLevelContext | O | T | T | F | F |
| resourceSharingLevelContext | O | T | T | F | F |

#### 6.2.2.2 Attribute definition

Table 6.2.2.2-1

| Attribute Name | Documentation and Allowed Values | Properties |
| --- | --- | --- |
| coverageAreaPolygonContext | It describes the coverage areas for the RAN SubNetwork that the intent expectation is applied in the form of polygon.  CoverageAreaPolygonContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "coverageAreaPolygon"  - contextCondition: "IS\_ALL\_OF"  - contextValueRange: a list of CoverageArea defined in 3GPP TS 28.541 [5] | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| coverageTACContext | It describes the coverage areas for the RAN SubNetwork that the intent expectation is applied in the form of TAC.  CoverageTACContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "coverageTAC"  - contextCondition: "IS\_ALL\_OF"  - contextValueRange: a list of nRTAC defined in 3GPP TS 28.541 [5] | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| plMNContext | It describes the PLMN(s) supported by the RAN SubNetwork that the intent expectation is applied.  PLMNContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "pLMN"  - contextCondition: "IS\_ALL\_OF"  - contextValueRange: a list of PLMNId defined in TS 28. 658 [10] | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| nRFqBandContext | It describes the nRFqBands supported by the RAN SubNetwork that the intent expectation is applied.  nRFqBandContext is a Context including attributes: contextAtrribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "nRFqBand"  - contextCondition: "IS\_ALL\_OF"  - contextValueRange: a list of NRFqBand expressed as string. Valid frequency band values are specified in clause 5.4.2 in 3GPP TS 38.104 [8] | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| rATContext | It describes the RAT supported by the RAN SubNetwork that the intent expectation is applied.  RATContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "rAT"  - contextCondition: "IS\_ALL\_OF"  - contextValueRange: a list of ENUM with allowed value: UTRAN, EUTRAN and NR | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| weakRSRPRatioTarget | It describes the downlink weak coverage ratio target for the RAN SubNetwork that the intent expectation is applied.  WeakRSRPRatioTarget is an ExpectationTarget including attributes: targetName, targetCondition,targetValueRange and targetContext.  Following are the allowed values:  - targetName: "weakRSRPRatio"  - targetCondition: "IS\_LESS\_THAN"  - targetValueRange: integer with allowed value [0,100]  - targetContext: WeakRSRPContext | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| WeakRSRPRatioTarget.weakRSRPContext | It describes the threshold for downlink weak RSRP of the RAN SubNetwork that the intent expectation is applied.  WeakRSRPContext is a Context including attributes: contextAtrribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "weakRSRPThreshold"  - contextCondition: "IS\_LESS\_THAN"  - contextValueRange: Float | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| LowSINRRatioTarget | It describes the low SINR ratio target for the RAN SubNetwork that the intent expectation is applied.  LowSINRRatioTarget is an ExpectationTarget including attributes: targetName, targetCondition,targetValueRange and targetContxt.  Following are the allowed values:  - targetName: "lowSINRRatio"  - targetCondition: "IS\_LESS\_THAN"  - targetValueRange: integer with allowed value [0,100]  - targetContext: LowSINRContext | type:ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| LowSINRRatioTarget.lowSINRContext | It describes the threshold for low SINR for RAN SubNetwork that the intent expectation is applied.  LowSINRContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "lowSINRThreshold"  - contextCondition: "IS\_LESS\_THAN"  - contextValueRange: integer | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| aveULRANUEThptTarget | It describes the average UL RAN UE throughput target for RAN SubNetwork that the intent expectation is applied.  AveULRANUEThptTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange.  Following are the allowed values:  - targetName: "aveULRANUEThpt"  - targetCondition: "IS\_GREATER\_THAN"  - targetValueRange: integer | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| aveDLRANUEThptTarget | It describes the average DL RAN UE throughput target for RAN SubNetwork that the intent expectation is applied.  AveDLRANUEThptTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange.  Following are the allowed values:  - targetName: "aveDLRANUEThpt"  - targetCondition: "IS\_GREATER\_THAN"  - targetValueRange: integer | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| lowULRANUEThptRatioTarget | It describes the low UL RAN UE throughput ratio target for the RAN SubNetwork that the intent expectation is applied.  LowULRANUEThptRatioTarget is an ExpectationTarget including attributes: targetName, targetCondition,targetValueRange and targetContext.  Following are the allowed values:  - targetName: "lowULRANUEThptRatio"  - targetCondition: "IS\_LESS\_THAN"  - targetValueRange: integer with allowed value [0,100]  - targetContext: LowULRANUEThptContext | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| LowULRANUEThptRatioTarget.lowULRANUEThptContext | It describes the threshold for the low UL RAN UE throughput of the RAN SubNetwork that the intent expectation is applied  LowULRANUEThptContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "lowULRANUEThptThreshold"  - contextCondition: "IS\_LESS\_THAN"  - contextValueRange: Float | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| lowDLRANUEThptRatioTarget | It describes the low DL RAN UE throughput ratio target for the RAN SubNetwork that the intent expectation is applied.  LowDLRANUEThptRatioTarget is an ExpectationTarget including attributes: targetName, targetCondition,targetValueRange and targetContext.  Following are the allowed values:  - targetName: "lowDLRANUEThptRatio"  - targetCondition: "IS\_LESS\_THAN "  - targetValueRange: integer with allowed value [0,100]  - targetContext: LowDLRANUEThptContext | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| owDLRANUEThptRatioTarget.lowDLRANUEThptContext | It describes the threshold for the low DL RAN UE throughput of the RAN SubNetwork that the intent expectation is applied.  LowDLRANUEThptContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "lowDLRANUEThptThreshold"  - contextCondition: "IS\_LESS\_THAN"  - contextValueRange: Float | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| serviceStartTimeContext | This describes the start time at which the service shall be available. This contributes to the selection of the appropriate edge data network to be used for service deployment.  Following are the allowed values:  - contextAttribute: "serviceStartTime"  - contextCondition: "IS\_EQUAL\_TO"  - contextValueRange: start time stamp | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| serviceEndTimeContext | This describes the end time after which the service shall not be available. This contributes to the selection of the appropriate edge data network to be used for service deployment.  Following are the allowed values:  - contextAttribute: "serviceEndTime"  - contextCondition: "IS\_EQUAL\_TO"  - contextValueRange: end time stamp | type:Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| edgeIdentificationIdContextt | This identifies the edge network where the service need to be deployed. This should be used when the edge identification is known to the consumer  Following are the allowed values:  - contextAttribute: "edgeIdentificationId"  - contextCondition: "IS\_EQUAL\_TO"  - contextValueRange: EDNidentifier as defined in 3GPP TS 28.538 [9] | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| edgeIdentificationLocContext | This identifies the location where the service need to be deployed. This should be used when the edge identification is not known to the consumer  Following are the allowed values:  - contextAttribute: "edgeIdentificationLoc"  - contextCondition: "IS\_EQUAL\_TO"  - contextValueRange: geographical target location. This will take a form of either single latitude & longitude or a TAI | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| coverageAreaTAContext | It describes Tracking Coverage Areas for service supporting that the intent expectation is applied.  coverageAreaTAContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "coverageAreaTA"  - contextCondition: "IS\_ALL\_OF"  - contextValueRange: a list of Tracking Coverage Areas, coverageAreaTAList in clause 6.3.1 in 3GPP TS 28.541[5] | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| dlThptPerUETarget | It describes the DL throughput target by the per UE for the service Supporting that the intent expectation is applied.  DLThptperUETarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange:  - targetName: "DLThptperUE"  - targetCondition: "IS\_GREATER\_THAN"  - targetValueRange: dlThptPerUE defined in clause 6.3.1 of 3GPP TS 28.541 [5] | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| UlThptPerUETarget | It describes the UL throughput target by the per UE for the service Supporting that the intent expectation is applied.  ULThptperUETarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange.  - targetName: "ulThptperUE"  - targetCondition: "IS\_GREATER\_THAN"  - targetValueRange: uLThptPerUE defined in clause 6.3.1 of 3GPP TS 28.541 [5] | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| dLLatencyTarget | It describes the DL latency target for the service Supporting that the intent expectation is applied.  DLLatencyTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange.  - targetName: "dLLatency"  - targetCondition: "IS\_LESS\_THAN"  - targetValueRange: dLLatency defined in clause 6.3.1 of 3GPP TS 28.541 [5] | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| uLLatencyTarget | It describes the UL latency target for the service Supporting that the intent expectation is applied.  uLLatencyTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange.  - targetName: "uLLatency"  - targetCondition: "IS\_LESS\_THAN"  - targetValueRange: ULLatency defined in clause 6.3.1 of 3GPP TS 28.541 [5] | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| maxNumberofUEsTarget | It describes the maximum number of UEs for service supporting that the intent expectation is applied.  maxNumberofUEsContext is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange.  Following are the allowed values:  - targetName: "maxNumberofUEs"  - targetCondition: " IS\_LESS\_THAN"  - targetValueRange: maxNumberofUEs in clause 6.3.1 in 3GPP TS 28.541 [5] | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| activityFactorTarget | It describes the percentage value of the amount of simultaneous active UEs to the total number of UEs where active means the UEs are exchanging data with the network for service supporting that the intent expectation is applied.  activityFactorTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange.  Following are the allowed values:  - targetName: " activityFactor "  - targetCondition: " IS\_EQUAL\_TO"  - targetValueRange: activityFactor in clause 6.3.1 in 3GPP TS 28.541 [5] | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| uESpeedTarget | It describes the maximum speed (in km/hour) supported  for service supporting that the intent expectation is applied.  uESpeedTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange.  Following are the allowed values:  - targetName: "uESpeed"  - targetCondition: " IS\_LESS\_THAN"  - targetValueRange: uESpeed in clause 6.3.1 in 3GPP TS 28.541 [5] | type: ExpectationTarget  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| uEMobilityLevelContext | It describes the mobility level of UE for service supporting that the intent expectation is applied.  uEMobilityLevelContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: " uEMobilityLevel "  - contextCondition: "IS\_WITHIN\_RANGE"  - contextValueRange: uEMobilityLevel in clause 6.3.1 in 3GPP TS 28.541 [5] | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |
| resourceSharingLevelContext | It describes the resource sharing level for service supporting that the intent expectation is applied.  resourceSharingLevelContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange.  Following are the allowed values:  - contextAttribute: "resourceSharingLevel"  - contextCondition: "IS\_WITHIN\_RANGE"  - contextValueRange: resourceSharingLevel in clause 6.3.1 in 3GPP TS 28.541 [5] | type: Context  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: None  isNullable: True |

## 6.3 Procedures for intent management

### 6.3.1 Introduction

This clause describes the procedures for intent management.

### 6.3.2 Create an intent

Figure 6.3.2-1 illustrates the procedure for create a new intent.



Figure 6.3.2-1: Procedure for create an intent

1. MnS Consumer sends a request to create an intent instance (see createMOI operation defined in TS 28.532 [3]) to MnS Producer with intent information for the new intent to be created. The detailed intent information see attributes (attribute which "isWritable" property is "True") of the concrete intent IOC defined in clause 6.2.

2. Based on the received request, the MnS Producer creates the concrete intent instance (i.e. instance of intent IOC) and configure the new created intent MOI with the received intent information.

3. MnS Producer sends a response (see createMOI operation defined in TS 28.532[3]) to the MnS Consumer with attribute "objectInstance" of the created intent instance.

4. Based on the created intent instance, MnS Producer performs the feasibility check of the intent instance. MnS Producer can perform the feasibility check and get the results based on latest statistics of network or service performance metrics, historical experience (e.g. experience based feasible value range or threshold of performance gain), current operating status including network resource utilization and availability, prediction results based on network simulation system, and predefined checking rules or policies.

NOTE 1: Whether to perform the feasibility check can be determined according to the feasibility check enabling policy (e.g. enforce to perform feasibility check in any case, enforce to perform feasibility check in specific cases, not to perform feasibility check in specific cases, not to perform feasibility check in any case). And the feasibility check enabling policy can be predefined/configured in the MnS Producer or sent with the intent creation request from the MnS Consumer.

NOTE 2: No sequence restriction for above step 3 and step 4.

In case the feasibility check result is 'feasible', following step 5a-step8 are executed::

5a. Based on the created intent, MnS Producer identifies the MOI for managed entities (e.g. ManagedElement, ManagedFunction) and derives one or more executable management tasks (including deployment and configuration parameters) for these managed entities, then MnS producer deploys or configures corresponding managed entities with deployment and configuration parameters to satisfy the intent instance.

6. During the execution of the intent, MnS Producer continuously monitors intent fulfilment information.

7. MnS Producer analyses and adjusts the managed entities to ensure the intent is continuously satisfied.

8. MnS Producer should notify (see notifyMOIAttributeValueChanges notification) MnS Consumer about attribute "objectInstance" of intent instance and the intent fulfilment information (see intentFulfilmentinfo, expectationfulfilmentInfo and targetfulfilmentInfo defined in clause 6.2).

In case the feasibility check result is 'infeasible', following step 5b is executed.

5b. MnS Producer notifies MnS consumer about infeasib le for the created intent instance. The reasons why the feasibility check result is infeasible (e.g. invalid intent expression, the intent conflict) and corresponding recommendations also can be included in the notification.

### 6.3.3 Modify an intent

Figure 6.3.3-1 illustrates the procedure for modify an existing intent.



Figure 6.3.3-1: Procedure for modify an intent

1. MnS Consumer sends a request to modify an intent instance (see modifyMOIAttributes operation defined in TS 28.532 [3]) to MnS Producer with 'objectInstance' of the intent MOI and intent information to be modified. The detailed intent information see attributes (attributes which "isWritable" property is "True") of the concrete intent IOC defined in clause 6.2.

2. Based on the received request, MnS Producer modify the intent instance with received intent information which is required to be modified.

3. MnS Producer sends a response (see modifyMOIAttributes operation defined in TS 28.532 [3]) to the MnS consumer with the attribute 'objectInstance' of the modified intent instance and the intent information which is modified.

4. Based on the received request, MnS Producer performs the feasibility check of the modified intent instance. Whether to perform the feasibility check can be determined according to the feasibility check enabling policy.

In case the feasibility check result is 'feasible', following step 5a-step8 is performed:

5a. MnS Producer derives one or more executable management tasks for these managed entities, then MnS producer deploys or configures corresponding managed entities to satisfy the modified intent instance.

6. During the execution of the intent, MnS producer continuously tracks intent fulfilment information.

7. MnS producer analyses and adjusts the managed entities to ensure the intent is continuously satisfied.

8. MnS Producer should notify (see notifyMOIAttributeValueChanges notification defined in TS 28.532 [3]) MnS Consumer about attribute "objectInstance" of the modified intent instance and the intent fulfilment information for the modified intent instance.

In case the feasibility check result is 'infeasible', following step 5b is executed:

5b. MnS Producer notifies MnS consumer about infeasible information for the modified intent instance. The reasons why the feasibility check result is infeasible (e.g. invalid intent expression, the intent conflict) and corresponding recommendations also can be included in the notification

### 6.3.4 Delete an intent

Figure 6.3.4-1 illustrates the procedure for deleting an existing intent.



Figure 6.3.4-1: Procedure for delete an intent

1. MnS Consumer sends a request to delete an intent instance (see deleteMOI operation defined in TS 28.532[3]) to MnS Producer with 'objectInstance' of the intent MOI.

2. Based on the request, MnS Producer deletes the intent MOI.

3. MnS Producer sends response (see deleteMOI operation defined in TS 28.532 [3]) to the MnS consumer with status (OperationSucceeded or OperationFailed) and 'objectInstance' of the deleted intent MOI.

### 6.3.5 Query an intent

Figure 6.3.5-1 illustrates the procedure for query an intent.



Figure 6.3.5-1: Procedure for query an intent

1. MnS Consumer sends a request to query an intent instance (see getMOIAttributes operation defined in TS 28.532[3]) to MnS Producer with 'objectInstance' of the existing intent MOI and list of attribute names of intent IOC. The list of attribute names identifies the attributes to be returned by this operation.

2. Based on the request, the MnS Producer queries the concrete intent MOI.

3. MnS Producer sends a response (see getMOIAttributes operation defined in TS 28.532[3]) to the MnS consumer with 'objectClass', 'objectInstance', and list of [Attribute,Value] which is defined in clause 6.2.

# 7 Stage 3 definition for Intent Driven Management

## 7.1 RESTful HTTP-based solution set

he RESTful HTTP-based solution set for generic provisioning management service is defined in clause 12.1.1 in 3GPP TS 28.532 [3]. Corresponding className is Intent. Following is the SS to support intent lifecycle management based on Table 12.1.1.1.1-1 in TS 28.532 [3].

Table 7.1-1: SS to support intent lifecycle management

|  |  |  |  |
| --- | --- | --- | --- |
| intent lifecycle management | IS operation | HTTP Method | Resource URI |
| Create an intent | createMOI operation | PUT | {MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{intent}={id} |
| Delete an intent | deleteMOI operation | DELETE | {MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{intent}={id} |
| Modify an intent | modifyMOIAttributes operation | PUT  PATCH | {MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{intent}={id} |
| Query an intent | getMOIAttributes operation | GET | {MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{intent}={id} |

## 7.2 OpenAPI specification

### 7.2.1 OpenAPI document "TS28532\_ProvMnS.yaml"

OpenAPI definition of the provisioning MnS which includes the provisioning MnS operations and the provisioning MnS notifications see clause A.1.1 in 3GPP TS 28.532 [3].

### 7.2.2 OpenAPI document "TS28312\_IntentNrm.yaml"

openapi: 3.0.1

info:

title: Intent NRM

version: 18.0.0

description: >-

OAS 3.0.1 definition of the Intent NRM

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externalDocs:

description: 3GPP TS 28.312; Intent driven management services for mobile networks

url: http://www.3gpp.org/ftp/Specs/archive/28\_series/28.312/

paths: {}

components:

schemas:

#-------Definition of generic IOCs ----------#

SubNetwork-Single:

allOf:

- $ref: 'TS28623\_GenericNrm.yaml#/components/schemas/Top'

- type: object

properties:

attributes:

$ref: 'TS28623\_GenericNrm.yaml#/components/schemas/SubNetwork-Attr'

- $ref: 'TS28623\_GenericNrm.yaml#/components/schemas/SubNetwork-ncO'

- type: object

properties:

SubNetwork:

$ref: '#/components/schemas/SubNetwork-Multiple'

Intent:

$ref: '#/components/schemas/Intent-Multiple'

Intent-Single:

allOf:

- $ref: 'TS28623\_GenericNrm.yaml#/components/schemas/Top'

- type: object

properties:

userLabel:

type: string

intentExpectations:

type: array

items:

type: object

oneOf:

- $ref: "#/components/schemas/IntentExpectation"

- $ref: "TS28312\_IntentExpectations.yaml#/components/schemas/RadioNetworkExpectation"

- $ref: "TS28312\_IntentExpectations.yaml#/components/schemas/ServiceSupportExpectation"

intentContexts:

type: array

items:

$ref: "#/components/schemas/IntentContext"

intentFulfilmentInfo:

$ref: "#/components/schemas/FulfilmentInfo"

#-------Definition of generic IOCs ----------#

#-------Definition of the generic IntentExpectation dataType ----------#

IntentExpectation:

description: >-

This data type is the "IntentExpectation" data type without specialisations

type: object

properties:

expectationId:

type: string

expectationVerb:

$ref: "#/components/schemas/ExpectationVerb"

expectationObjects:

type: array

items:

$ref: "#/components/schemas/ExpectationObject"

expectationTargets:

type: array

items:

$ref: "#/components/schemas/ExpectationTarget"

expectationContexts:

type: array

items:

$ref: "#/components/schemas/ExpectationContext"

expectationfulfilmentInfo:

$ref: "#/components/schemas/FulfilmentInfo"

required:

- expectationId

#-------Definition of the generic IntentExpectation dataType ----------#

#-------Definition of the generic ExpectationObject dataType ----------#

ExpectationObject:

description: >-

This data type is the "ExpectationObject" data type without specialisations

type: object

properties:

objectType:

type: string

enum:

- RAN\_SubNetwork #value for Radio Network Expectation--#

- Service\_Support #value for Service Support Expectation--#

- TBD #-This will be added based on defined scenario specfic intent expectation-#

objectInstance:

$ref: "TS28623\_ComDefs.yaml#/components/schemas/Dn"

objectContexts:

type: array

items:

$ref: "#/components/schemas/ObjectContext"

#-------Definition of the generic ExpectationObject dataType ----------#

#-------Definition of the generic dataType --------------#

Condition:

type: string

enum:

- IS\_EQUAL\_TO

- IS\_LESS\_THAN

- IS\_GREATER\_THAN

- IS\_WITHIN\_RANGE

- IS\_OUTSIDE\_RANGE

- IS\_ONE\_OF

- IS\_NOT\_ONE\_OF

- IS\_EQUAL\_TO\_OR\_LESS\_THAN

- IS\_EQUAL\_TO\_OR\_GREATER\_THAN

- IS\_ALL\_OF

FulfilStatus:

type: string

readOnly: true

enum:

- FULFILLED

- NOT\_FULFILLED

NotFulfilledState:

type: string

readOnly: true

enum:

- ACKNOWLEDGED

- COMPLIANT

- DEGRADED

- SUSPENDED

- TERMINATED

- FULFILMENTFAILED

FulfilmentInfo:

type: object

properties:

fulfilStatus:

$ref: "#/components/schemas/FulfilStatus"

notFullfilledState:

description: ->

An attribute which is used when FulfilmentInfo is implemented for IntentFulfilmentInfo

$ref: "#/components/schemas/NotFulfilledState"

notFulfilledReasons:

description: ->

An attribute which is used when FulfilmentInfo is implemented for IntentFulfilmentInfo

type: string

readOnly: true

ExpectationVerb:

type: string

enum:

- DELIVER

- ENSURE

#-------Definition of the generic dataType --------------#

#-------Definition of the generic IntentContext dataType --------------#

IntentContext:

description: >-

This data type is the "IntentContext" data type without specialisations

type: object

properties:

contextAttribute:

type: string

contextCondition:

$ref: "#/components/schemas/Condition"

contextValueRange:

type: array

items:

type: number

#-------Definition of the generic IntentContext dataType --------------#

#-------Definition of the generic ExpectationTarget dataType----------#

ExpectationTarget:

description: >-

This data type is the "ExpectationTarget" data type without specialisations

type: object

properties:

targetName:

type: string

targetCondition:

$ref: "#/components/schemas/Condition"

targetValueRange:

type: number

targetContexts:

type: array

items:

$ref: "#/components/schemas/TargetContext"

TargetContext:

description: >-

This data type is the "TargetContext" data type without specialisations

type: object

properties:

contextAttribute:

type: string

contextCondition:

$ref: "#/components/schemas/Condition"

contextValueRange:

type: number

#-------Definition of the generic ExpectationTarget dataType----------#

#-------Definition of the generic ObjectContext dataType----------------#

ObjectContext:

description: >-

This data type is the "ObjectContext" data type without specialisations

type: object

properties:

contextAttribute:

type: string

contextCondition:

$ref: "#/components/schemas/Condition"

contextValueRange:

type: array

items:

type: number

#-------Definition of the generic ObjectContext dataType----------------#

#-------Definition of the generic ExpectionContext dataType----------------#

ExpectationContext:

description: >-

This data type is the "ExpectationContext" data type without specialisations

type: object

properties:

contextAttribute:

type: string

contextCondition:

$ref: "#/components/schemas/Condition"

contextValueRange:

type: array

items:

type: number

#-------Definition of the concrete ExpectionContext dataType----------------#

#------Definition of JSON arrays for name-contained IOCs ---------------#

SubNetwork-Multiple:

type: array

items:

$ref: '#/components/schemas/SubNetwork-Single'

Intent-Multiple:

type: array

items:

$ref: '#/components/schemas/Intent-Single'

#------Definition of JSON arrays for name-contained IOCs ---------------#

#----- Definitions in TS 28.312 for TS 28.532 --------------------------#

resources-intentNrm:

oneOf:

- $ref: '#/components/schemas/SubNetwork-Single'

- $ref: '#/components/schemas/Intent-Single'

#----- Definitions in TS 28.312 for TS 28.532 --------------------------#

### 7.2.3 OpenAPI document "TS28312\_IntentExpectations.yaml"

openapi: 3.0.1

info:

title: Scenario specific Intent Expectations

version: 18.0.0

description: >-

OAS 3.0.1 definition of scenario specific Intent Expectations

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externalDocs:

description: 3GPP TS 28.312; Intent driven management services for mobile networks

url: http://www.3gpp.org/ftp/Specs/archive/28\_series/28.312/

paths: {}

components:

schemas:

#-------Definition of the Scenario specific IntentExpectation dataType ----------#

RadioNetworkExpectation:

description: >-

This data type is the "IntentExpectation" data type with specialisations to represent MnS consumer's expectations for radio network delivering and performance assurance

type: object

properties:

expectationId:

type: string

expectationVerb:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/ExpectationVerb"

expectationObjects:

type: array

items:

$ref: "#/components/schemas/RadioNetworkExpectationObject"

expectationTargets:

type: array

items:

type: object

oneOf:

- $ref: "#/components/schemas/WeakRSRPRatioTarget"

- $ref: "#/components/schemas/LowSINRRatioTarget"

- $ref: "#/components/schemas/AveULRANUEThptTarget"

- $ref: "#/components/schemas/AveDLRANUEThptTarget"

- $ref: "#/components/schemas/LowULRANUEThptRatioTarget"

- $ref: "#/components/schemas/LowDLRANUEThptRatioTarget"

expectationContexts:

type: array

items:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/ExpectationContext"

expectationfulfilmentInfo:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/FulfilmentInfo"

required:

- expectationId

ServiceSupportExpectation:

description: >-

This data type is the "IntentExpectation" data type with specialisations to represent MnS consumer's expectations for service deployment

type: object

properties:

expectationId:

type: string

expectationVerb:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/ExpectationVerb"

expectationObjects:

type: array

items:

$ref: "#/components/schemas/ServiceSupportExpectationObject"

expectationTargets:

type: array

items:

type: object

oneOf:

- $ref: "#/components/schemas/DLThptPerUETarget"

- $ref: "#/components/schemas/ULThptPerUETarget"

- $ref: "#/components/schemas/DLLatencyTarget"

- $ref: "#/components/schemas/ULLatencyTarget"

- $ref: "#/components/schemas/MaxNumberofUEsTarget"

- $ref: "#/components/schemas/ActivityFactorTarget"

- $ref: "#/components/schemas/UESpeedTarget"

- $ref: "TS28312\_IntentNrm.yaml#/components/schemas/ExpectationTarget"

expectationContexts:

type: array

items:

type: object

oneOf:

- $ref: "#/components/schemas/ServiceStartTimeContext"

- $ref: "#/components/schemas/ServiceEndTimeContext"

- $ref: "#/components/schemas/UEMobilityLevelContext"

- $ref: "#/components/schemas/ResourceSharingLevelContext"

- $ref: "TS28312\_IntentNrm.yaml#/components/schemas/ExpectationContext"

expectationfulfilmentInfo:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/FulfilmentInfo"

required:

- expectationId

#-------Definition of the IntentExpectation dataType ----------#

#-------Definition of the scenario specific ExpectationObject dataType ----------#

RadioNetworkExpectationObject:

description: >-

This data type is the "ExpectationObject" data type with specialisations for RadioNetworkExpectation

type: object

properties:

objectType:

type: string

enum:

- RAN\_SubNetwork #value for Radio Network Expectation--#

objectInstance:

$ref: "TS28623\_ComDefs.yaml#/components/schemas/Dn"

objectContexts:

type: array

items:

type: object

oneOf:

- $ref: "#/components/schemas/CoverageAreaPolygonContext"

- $ref: "#/components/schemas/CoverageTACContext"

- $ref: "#/components/schemas/PLMNContext"

- $ref: "#/components/schemas/NRFqBandContext"

- $ref: "#/components/schemas/RATContext"

- $ref: "#/components/schemas/ObjectContext"

ServiceSupportExpectationObject:

description: >-

This data type is the "ExpectationObject" data type with specialisations for ServiceSupportExpectation

type: object

properties:

objectType:

type: string

enum:

- Service\_Support #value for Service Support Expectation--#

objectInstance:

$ref: "TS28623\_ComDefs.yaml#/components/schemas/Dn"

objectContexts:

type: array

items:

type: object

oneOf:

- $ref: "#/components/schemas/EdgeIdenfiticationIdContext"

- $ref: "#/components/schemas/EdgeIdenfiticationLocContext"

- $ref: "#/components/schemas/CoverageAreaTAContext"

- $ref: "#/components/schemas/ObjectContext"

#-------Definition of the ExpectationObject dataType ----------#

#-------Definition of the Scenario specific ExpectationTarget dataType----------#

WeakRSRPRatioTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for WeakRSRPRatioTarget

type: object

properties:

targetName:

type: string

enum:

- WeakRSRPRatio

targetCondition:

type: string

enum:

- IS\_LESS\_THAN

targetValueRange:

type: integer

minimum: 0

maximum: 100

targetContexts:

$ref: "#/components/schemas/WeakRSRPContext"

targetFulfilmentInfo:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/FulfilmentInfo"

WeakRSRPContext:

description: >-

This data type is the "TargetContext" data type with specialisations for WeakRSRPContext

type: object

properties:

contextAttribute:

type: string

enum:

- WeakRSRPThreshold

contextCondition:

type: string

enum:

- IS\_LESS\_THAN

contextValueRange:

type: number

LowSINRRatioTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for LowSINRatioTarget

type: object

properties:

targetName:

type: string

enum:

- LowSINRRatio

targetCondition:

type: string

enum:

- IS\_LESS\_THAN

targetValueRange:

type: integer

minimum: 0

maximum: 100

targetContexts:

$ref: "#/components/schemas/LowSINRContext"

targetFulfilmentInfo:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/FulfilmentInfo"

LowSINRContext:

description: >-

This data type is the "TargetContext" data type with specialisations for LowSINRContext

type: object

properties:

contextAttribute:

type: string

enum:

- LowSINRThreshold

contextCondition:

type: string

enum:

- IS\_LESS\_THAN

contextValueRange:

type: integer

AveULRANUEThptTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for AveULRANUEThptTarget

type: object

properties:

targetName:

type: string

enum:

- AveULRANUEThpt

targetCondition:

type: string

enum:

- IS\_GREATER\_THAN

targetValueRange:

type: integer

targetFulfilmentInfo:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/FulfilmentInfo"

AveDLRANUEThptTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for AveDLRANUEThptTarget

type: object

properties:

targetName:

type: string

enum:

- AveDLRANUEThpt

targetCondition:

type: string

enum:

- IS\_GREATER\_THAN

targetValueRange:

type: integer

targetFulfilmentInfo:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/FulfilmentInfo"

LowULRANUEThptRatioTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for LowULRANUEThptRatioTarget

type: object

properties:

targetName:

type: string

enum:

- LowULRANUEThptRatio

targetCondition:

type: string

enum:

- IS\_LESS\_THAN

targetValueRange:

type: integer

minimum: 0

maximum: 100

targetContexts:

$ref: "#/components/schemas/LowULRANUEThptContext"

targetFulfilmentInfo:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/FulfilmentInfo"

LowULRANUEThptContext:

description: >-

This data type is the "TargetContext" data type with specialisations for LowULRANUEThptContext

type: object

properties:

contextAttribute:

type: string

enum:

- LowULRANUEThptThreshold

contextCondition:

type: string

enum:

- Is\_less\_than

contextValueRange:

type: number

LowDLRANUEThptRatioTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for LowDLRANUEThptRatioTarget

type: object

properties:

targetName:

type: string

enum:

- LowDLRANUEThptRatio

targetCondition:

type: string

enum:

- IS\_LESS\_THAN

targetValueRange:

type: integer

minimum: 0

maximum: 100

targetContexts:

$ref: "#/components/schemas/LowDLRANUEThptContext"

targetFulfilmentInfo:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/FulfilmentInfo"

LowDLRANUEThptContext:

description: >-

This data type is the "TargetContext" data type with specialisations for LowDLRANUEThptContext

type: object

properties:

contextAttribute:

type: string

enum:

- LowDLRANUEThptThreshold

contextCondition:

type: string

enum:

- IS\_LESS\_THAN

contextValueRange:

type: number

DLThptPerUETarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for DLThptPerUETarget

type: object

properties:

targetName:

type: string

enum:

- DlThptPerUE

targetCondition:

type: string

enum:

- IS\_GREATER\_THAN

targetValueRange:

$ref: "TS28541\_SliceNrm.yaml#/components/schemas/XLThpt"

ULThptPerUETarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for ULThptPerUETarget

type: object

properties:

targetName:

type: string

enum:

- UlThptPerUE

targetCondition:

type: string

enum:

- IS\_GREATER\_THAN

targetValueRange:

$ref: "TS28541\_SliceNrm.yaml#/components/schemas/XLThpt"

DLLatencyTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for DLLatencyTarget

type: object

properties:

targetName:

type: string

enum:

- DlLatency

targetCondition:

type: string

enum:

- IS\_LESS\_THAN

targetValueRange:

type: integer

ULLatencyTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for ULLatencyTarget

type: object

properties:

targetName:

type: string

enum:

- UlLatency

targetCondition:

type: string

enum:

- IS\_LESS\_THAN

targetValueRange:

type: integer

MaxNumberofUEsTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for MaxNumberofUEsTarget

type: object

properties:

targetName:

type: string

enum:

- maxNumberofUEs

targetCondition:

type: string

enum:

- IS\_LESS\_THAN

targetValueRange:

type: integer

ActivityFactorTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for ActivityFactorTarget

type: object

properties:

targetName:

type: string

enum:

- activityFactor

targetCondition:

type: string

enum:

- IS\_EQUAL\_TO

targetValueRange:

type: integer

UESpeedTarget:

description: >-

This data type is the "ExpectationTarget" data type with specialisations for UESpeedTarget

type: object

properties:

targetName:

type: string

enum:

- uESpeed

targetCondition:

type: string

enum:

- IS\_LESS\_THAN

targetValueRange:

type: integer

#-------Definition of the concrete ExpectationTarget dataType----------#

#-------Definition of the concrete ObjectTarget dataType----------------#

ObjectContext:

description: >-

This data type is the "ObjectContext" data type without specialisations

type: object

properties:

contextAttribute:

type: string

contextCondition:

$ref: "TS28312\_IntentNrm.yaml#/components/schemas/Condition"

contextValueRange:

type: array

items:

type: number

CoverageAreaPolygonContext:

description: >-

This data type is the "ObjectContext" data type with specialisations for CoverageAreaPolygonContext

type: object

properties:

contextAttribute:

type: string

enum:

- CoverageAreaPolygon

contextCondition:

type: string

enum:

- IS\_ALL\_OF

contextValueRange:

type: array

items:

$ref: "#/components/schemas/CoverageArea"

CoverageArea:

type: string

CoverageTACContext:

description: >-

This data type is the "ObjectContext" data type with specialisations for CoverageTACContext

type: object

properties:

contextAttribute:

type: string

enum:

- CoverageAreaTac

contextCondition:

type: string

enum:

- IS\_ALL\_OF

contextValueRange:

type: array

items:

$ref: "TS28541\_NrNrm.yaml#/components/schemas/NrTac"

PLMNContext:

description: >-

This data type is the "ObjectContext" data type with specialisations for PLMNContext

type: object

properties:

contextAttribute:

type: string

enum:

- PLMN

contextCondition:

type: string

enum:

- IS\_ALL\_OF

contextValueRange:

type: array

items:

$ref: "TS28623\_ComDefs.yaml#/components/schemas/PlmnId"

NRFqBandContext:

description: >-

This data type is the "ObjectContext" data type with specialisations for NRFqBandContext

type: object

properties:

contextAttribute:

type: string

enum:

- NRFqBand

contextCondition:

type: string

enum:

- IS\_ALL\_OF

contextValueRange:

type: array

items:

type: string

RATContext:

description: >-

This data type is the "ObjectContext" data type with specialisations for RATContext

type: object

properties:

contextAttribute:

type: string

enum:

- RAT

contextCondition:

type: string

enum:

- IS\_ALL\_OF

contextValueRange:

type: array

items:

type: string

enum:

- UTRAN

- EUTRAN

- NR

EdgeIdenfiticationIdContext:

description: >-

This data type is the "ObjectContext" data type with specialisations for EdgeIdenfiticationIdContext

type: object

properties:

contextAttribute:

type: string

enum:

- edgeIdentificationId

contextCondition:

type: string

enum:

- IS\_EQUAL\_TO

contextValueRange:

type: array

items:

type: string

EdgeIdenfiticationLocContext:

description: >-

This data type is the "ObjectContext" data type with specialisations for EdgeIdenfiticationLocContext

type: object

properties:

contextAttribute:

type: string

enum:

- edgeIdentificationTarget

contextCondition:

type: string

enum:

- IS\_EQUAL\_TO

contextValueRange:

type: array

items:

type: string

CoverageAreaTAContext:

description: >-

This data type is the "ObjectContext" data type with specialisations for CoverageAreaTAContext

type: object

properties:

contextAttribute:

type: string

enum:

- coverageAreaTA

contextCondition:

type: string

enum:

- IS\_ALL\_OF

contextValueRange:

type: array

items:

$ref: "#/components/schemas/CoverageAreaTAList"

CoverageAreaTAList:

type: integer

#-------Definition of the scenario specific ObjectTarget dataType----------------#

#-------Definition of the concrete ExpectionContext dataType----------------#

ServiceStartTimeContext:

description: >-

This data type is the "ExpectationContext" data type with specialisations for ServiceStartTimeContext

type: object

properties:

contextAttribute:

type: string

enum:

- ServiceStartTime

contextCondition:

type: string

enum:

- IS\_EQUAL\_TO

contextValueRange:

type: string

ServiceEndTimeContext:

description: >-

This data type is the "ExpectationContext" data type with specialisations for ServiceEndTimeContext

type: object

properties:

contextAttribute:

type: string

enum:

- ServiceEndTime

contextCondition:

type: string

enum:

- IS\_EQUAL\_TO

contextValueRange:

type: string

UEMobilityLevelContext:

description: >-

This data type is the "ExpectationContext" data type with specialisations for UEMobilityLevelContext

type: object

properties:

contextAttribute:

type: string

enum:

- UEMobilityLevel

contextCondition:

type: string

enum:

- IS\_WITHIN\_RANGE

contextValueRange:

type: array

items:

$ref: "TS28541\_SliceNrm.yaml#/components/schemas/MobilityLevel"

ResourceSharingLevelContext:

description: >-

This data type is the "ExpectationContext" data type with specialisations for ResourceSharingLevelContext

type: object

properties:

contextAttribute:

type: string

enum:

- ResourceSharingLevel

contextCondition:

type: string

enum:

- IS\_WITHIN\_RANGE

contextValueRange:

type: array

items:

$ref: "TS28541\_SliceNrm.yaml#/components/schemas/SharingLevel"

#-------Definition of the concrete ExpectionContext dataType----------------#

# 8 Guidelines for using scenario specific intent expectation for intent driven use cases

This clause describes guidelines for using scenario specific intent expectation defined in clause 6.2.2 to satisfy the intent driven use cases defined in clause 5.1. Following table provide the information which ObjectContexts and ExpectationTargets defined in clause 6.2.2 are used for corresponding use case.

Table 8-1

|  |  |  |  |
| --- | --- | --- | --- |
| Use case | Scenario specific IntentExpectation | ExpectationObject.  ObjectContext | ExpectationTarget |
| Intent containing an expectation for delivering radio network (clause 5.1.1) | Radio Network Expectation | -coverageAreaPolygonContext  - coverageTACContext  - pLMNContext  - nRFqBandContext  - rATContext | -weakRSRPRatioTarget  - lowSINRRatioTarget  - aveULRANUEThptTarget  - aveDLRANUEthptTarget |
| Intent containing an expectation for delivering a service (clause 5.1.3) | Service Support Expectation | - edgeIdenfiticationIdContext  - edgeIdenfiticationLocContext  - coverageAreaTAContext | - dlThptPerUETarget  - UlThptPerUETarget  - dLLatencyTarget  - uLLatencyTarget  - maxNumberofUEsTarget  - activityFactorTarget  - uESpeedTarget |
| Intent containing an expectation on coverage performance to be assured (clause 5.1.4) | Radio Network Expectation | -coverageAreaPolygonContext  - nRFqBandContext  - rATContext | -weakRSRPRatioTarget  -lowSINRRatioTarget |
| Intent containing an expectation on RAN UE throughput performance to be assured (clause 5.1.5) | Radio Network Expectation | -coverageAreaPolygonContext  - nRFqBandContext  - rATContext | -aveULRANUEThptTarget  -aveDLRANUEthptTarget  -lowULRANUEThptRatioTarget  -lowDLRANUEThptRatioTarget |

Annex A (informative):  
PlantUML source code

# A.1 Procedures for intent management

## A.1.1 Create an intent

@startuml

title "[Create an intent]"

actor "MnS Consumer" as MnS\_Consumer

participant "MnS Producer" as MnS\_Producer

Collections "ManagedEntity" as ManagedEntity

MnS\_Consumer -> MnS\_Producer: 1. Request to create an intent instance (list of attributes of intent IOC)

MnS\_Producer -> MnS\_Producer: 2. Create and configure intent MOI

MnS\_Producer -> MnS\_Consumer: 3. Response for create an intent instance

MnS\_Producer -> MnS\_Producer: 4. Perform the feasibility check of the intent instance

alt feasibility check result is "Feasible"

Ref over MnS\_Producer, ManagedEntity: 5a. Perform service or network management tasks

loop

Ref over MnS\_Producer, ManagedEntity: 6. Evaluate intent fulfilment

opt

Ref over MnS\_Producer, ManagedEntity: 7. Adjust to fulfil the intent requirement

end

end

MnS\_Producer -> MnS\_Consumer:8. Notify of intent fulfillment Information\n (DN of intent MOI, FulfilmentInfo)

else feasibility check result is "inFeasible"

MnS\_Producer -> MnS\_Consumer: 5b. Notify of intent infeasibile information

end

hide footbox

@enduml

## A.1.2 Modify an intent

@startuml

title "[Create an intent]"

actor "MnS Consumer" as MnS\_Consumer

participant "MnS Producer" as MnS\_Producer

Collections "ManagedEntity" as ManagedEntity

MnS\_Consumer -> MnS\_Producer: 1. Request to create an intent instance (list of attributes of intent IOC)

MnS\_Producer -> MnS\_Producer: 2. Create and configure intent MOI

MnS\_Producer -> MnS\_Consumer: 3. Response for create an intent instance

MnS\_Producer -> MnS\_Producer: 4. Perform the feasibility check of the intent instance

alt feasibility check result is "Feasible"

Ref over MnS\_Producer, ManagedEntity: 5a. Perform service or network management tasks

loop

Ref over MnS\_Producer, ManagedEntity: 6. Evaluate intent fulfilment

opt

Ref over MnS\_Producer, ManagedEntity: 7. Adjust to fulfil the intent requirement

end

end

MnS\_Producer -> MnS\_Consumer:8. Notify of intent fulfillment Information\n (DN of intent MOI, FulfilmentInfo)

else feasibility check result is "inFeasible"

MnS\_Producer -> MnS\_Consumer: 5b. Notify of intent infeasibile information for \n the created intent instance

end

## A.1.3 Delete an intent

@startuml

title "[Delete an intent]"

actor "MnS Consumer" as MnS\_Consumer

participant "MnS Producer" as MnS\_Producer

MnS\_Consumer -> MnS\_Producer: 1.Requst to delete an intent instance\n('objectInstance' of intent MOI)

MnS\_Producer -> MnS\_Producer: 2.Delete the intent MOI

MnS\_Producer -> MnS\_Consumer: 3.Response for delete an intent instance\n ('objectInstance' of intent MOI)

hide footbox

@enduml

## A.1.4 Query an intent

@startuml

title "[Query an intent]"

actor "MnS Consumer" as MnS\_Consumer

participant "MnS Producer" as MnS\_Producer

MnS\_Consumer -> MnS\_Producer: 1.Request to query an intent instance(objectInstance,AttributeList of Intent IOC )

MnS\_Producer -> MnS\_Producer: 2.Query the intent MOI

MnS\_Producer -> MnS\_Consumer: 3.Response for query an intent instance \n (objectClass,objectInstance,status,list of [Attribute,value] of Intent IOC )

hide footbox

@enduml

# A.2 Information model definition for intent

## A.2.1 Relationship UML diagram for intent (figure 6.2.1.1.2-1)

@startuml

hide circle

hide methods

hide members

skinparam class {

AttributeIconSize 0

BackgroundColor white

BorderColor black

ArrowColor black

}

skinparam Shadowing false

skinparam Monochrome true

skinparam ClassBackgroundColor White

skinparam NoteBackgroundColor White

class "<<proxyClass>> \n ManagedEntity " as ManagedEntity{}

class "<<InformationObjectClass>>\n Intent " as Intent {}

class "<<dataType>>\n IntentExpectation" as IntentExpectation{}

class "<<dataType>>\n IntentContext" as IntentContext{}

class "<<dataType>>\n ExpectationObject" as ExpectationObject{}

class "<<dataType>>\n ObjectContext" as ObjectContext{}

class "<<dataType>>\n ExpectationTarget" as ExpectationTarget{}

class "<<dataType>>\n TargetContext" as TargetContext{}

class "<<dataType>>\n ExpectationContext" as ExpectationContext{}

ManagedEntity "1" \*-- "\*" Intent

Intent "1" -- "1..\*" IntentExpectation

Intent "1" -- "\*" IntentContext

IntentExpectation "1" -- "1..\*" ExpectationTarget

IntentExpectation "1" -- "1" ExpectationObject

IntentExpectation "1" -- "\*" ExpectationContext

ExpectationObject "1" -- "\*" ObjectContext

ExpectationTarget "1" -- "\*" TargetContext

note left of ManagedEntity

Represents the folllowing IOCs:

Subnetwork

end note

@enduml

Annex B (informative):  
Intent Life Cycle Management

# B.1 Intent Life Cycle Management

As the MnS producer's (i.e. 3gpp system) capabilities (e.g. number and/or availability of the system resources) can change even after the Intent is accepted by the MnS producer, the Intent content (i.e. a list of Intent Expectations) might not be best aligned with the MnS producer' capabilities**.** For example, the resources in MnS producer are overbooked, and the intent content is failing to meet expectations of the MnS consumer or the resources of the MnS producer become underbooked which makes such a solution very expensive and therefore useless. Hence the creation/adjustment of an Intent content (i.e. a list of Intent Expectations) and keeping it aligned with the MnS producer's capabilities, can be automated.

This means that the life cycle of the Intent can begin before Intent content is retrieved by the MnS producer, e.g. the Intent content is being defined in a MnS consumer based on requirements towards a MnS producer (e.g. to deliver a service with certain characteristics), then be optimized based on the MnS producer's capabilities (e.g. availability of MnS Producer resources in certain area, time, etc.), then be refinedif the initially captured requirement needs further detalization, etc.

The intent lifecycle consists of the following phases.

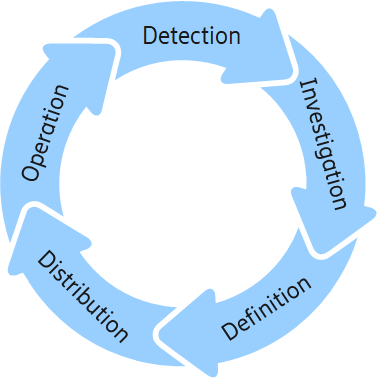


Figure B.1-1: Intent Lifecycle Phases

**Detection:**

In the detection phase, the MnS Consumer as the system generating the intent content (a list of expectations), identifies if there is a need to define new or change/remove existing intent expectations to set requirements, goals, and constraints. The MnS Consumer has its own terminal expectations to fulfill. It would break its terminal expectations down into a suitable set of detailed instrumental expectations. Typically, these instrumental expectations need to be fulfilled by other management functions and domains and therefore they need to be not only defined but distributed to suitable MnS producer. In the detection phase, the MnS consumer can react to changes in its own terminal expectations or to changes in the fulfillment in its instrumental expectations. In this respect the MnS consumer deriving the expectations will need to collect information about the expectation' fulfillment. Intent reports coming from MnS producer, as a system to receive intent expectations are one source for this information. Through intent reports the MnS Consumer is able to react on intent handling outcomes in the MnS producer. In any case it is task of the MnS consumer to assure the fulfillment of its terminal expectations and the first step is to detect if any changes are needed in its instrumental expectations.

**Investigation:**

In the investigation phase, the MnS Consumer finds out what intent content (a list of expectations) are feasible. This has two aspects: first, it needs to find right MnS producer that have the right domain responsibilities and support the intent expectations the MnS consumer wants to define. MnS producer capability management and detection would be used for this process.

The other aspect of investigation would be finding out if the wanted intent expectations are realistic. This means, if the MnS producer would be able to successfully reach the wanted expectations. This depends on the current resource situation and capabilities of the system and can vary over time. Typically, the feasibility of intent expectations is done through a guided negotiation process between the MnS Producer and MnS Consumer. The MnS Consumer can explore what the handling result of wanted intent expectations would be, what would be the best result the MnS producer can achieve, or what would be the most challenging requirements, the aspiring MnS producer can offer to fulfill.

**Definition:**

At the end of the investigation phase the MnS consumer knows what is possible and what the MnS producer to be involved. By combining this information with the needs that were identified in detection, the MnS Consumer can now decide and plan all needed intent expectations. In the definition phase the MnS consumer formulates the intent expectations it needs to use.

**Distribution:**

In the distribution phase the MnS Consumer contacts a MnS producer in order to create a new intent object or modify or change an existing one to include the intent expectations derived in the Definition phase. This way the MnS consumer acts on the plan it has made in definition phase. In this phase a MnS producer starts handling the intent expectations by receiving them and included in the intent object. The MnS producer decides if it can accept the intent expectations. If not, it would send a report with the rejection reason back to the MnS consumer. While this finishes the lifecycle of this particular intent, the MnS consumer can start over with detection to create a new plan. If the MnS producer accepts the intent, it starts operating based on it.

**Operation:**

Each intent expectations yet another set of requirements, goals and constraints to be considered for decisions and actions by the MnS producers. The MnS producers operate their domains of responsibility according to the given intent expectations. They also report back to the MnS consumer about status and success while continuously reacting to intent fulfillment threats. Intent reports would be evaluated by the MnS consumer as part of its detection process, which leads to the next iteration of the intent life cycle.

Annex C(informative):  
Mapping the 3GPP and the TM Forum intentExpectation Models

The TM forum defines the structure of an intent as a list of expectations with each expectation containing the requirements goals and constraints to be achieved. The expectation is defined to contain 3 attributes - the icm:target, icm:propertyParams and the icm:deliveryParams.

Table C.1 illustrates the mapping between 3GPP Intent Expectation and TM Forum ICM IntentExpectation.

Table C.1. Mapping between 3GPP Intent Expectation and TM Forum ICM IntentExpectation

|  |  |
| --- | --- |
| 3GPP Intent Expectation | TM Forum Intent Expectation (IG1253A v1.1.0 [7]) |
| Attribute | Attribute |
| expectationObject.ObjectInstance | icm:target |
| expectationTargets | icm:propertyParams |
| expectationContexts |
| expectationObject.objectType | icm:deliveryParams |
| expectationObject.ObjectContexts |

Annex D(informative):  
YAML document examples for scenario specific intent instance

# D.1 YAML document example for Intent containing an expectation for delivering radio network

Intent:

userLabel: 'Radio\_Network\_Deliver'

IntentExpectation:

- expectationId: '1'

expectationVerb: 'Deliver'

expectationObjects:

- objectType: 'RAN\_SubNetwork'

- objectContexts:

- contextAttribute: 'CoverageAreaPolygon'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- 'Downtown'

- contextAttribute: 'PLMN'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- '46000'

- contextAttribute: 'CoverageAreaTAC'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- '4457507'

- contextAttribute: 'NRFqBand'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- '384000'

- '385000'

- contextAttribute: 'RAT'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- 'NR'

expectationTargets:

- targetName: 'WeakRSRPRatio'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '10'

targetContexts:

- contextAttribute: 'WeakRSRPThreshold'

contextCondition: 'IS\_LESS\_THAN'

contextValueRange: '-130.00'

- targetName: 'LowSINRRatio'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '5'

targetContexts:

- contextAttribute: 'LowSINRThreshold'

contextCondition: 'IS\_LESS\_THAN'

contextValueRange: '-20'

- targetName: 'AveULRANUEThpt'

targetCondition: 'IS\_GREATER\_THAN'

targetValueRange: '100'

- targetName: 'AveDLRANUEThpt'

targetCondition: 'IS\_GREATER\_THAN'

targetValueRange: '300'

# D.2 YAML document example for Intent containing an expectation for delivering a service

Intent:

userLabel: 'Service Deliver'

IntentExpectation:

- expectationId: '1'

expectationVerb: 'Deliver'

expectationObjects:

- objectType: 'ServiceSupport'

objectContexts:

- contextAttribute: 'EdgeIdentificationId'

contextCondition: 'IS\_EQUAL\_TO'

contextValueRange:

- '46000'

- contextAttribute: 'EdgeIdentificationLoc'

contextCondition: 'IS\_EQUAL\_TO'

contextValueRange:

- '0'

- contextAttribute: 'CoverageAreaTA'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- '7'

expectationTargets:

- targetName: 'DlThptPerUE'

targetCondition: 'IS\_GREATER\_THAN'

targetValueRange: '30'

- targetName: 'UlThptPerUE'

targetCondition: 'IS\_GREATER\_THAN'

targetValueRange: '10'

- targetName: 'DlLatency'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '25'

- targetName: 'ULLatency'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '15'

- targetName: 'MaxNumberofUEs'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '40'

- targetName: 'ActivityFactor'

targetCondition: 'IS\_EQUAL\_TO'

targetValueRange: '20'

- targetName: 'UESpeed'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '120'

expectationContexts:

- contextAttribute: 'ServiceStartTime'

contextCondition: 'IS\_EQUAL\_TO'

contextValueRange: '2023-05-06 14:11:30'

- contextAttribute: 'ServiceEndTime'

contextCondition: 'IS\_EQUAL\_TO'

contextValueRange: '2023-05-07 14:11:30'

- contextAttribute: 'UEMobilityLevel'

contextCondition: 'IS\_WITHIN\_RANGE'

contextValueRange:

- 'NOMADIC'

- contextAttribute: 'ResourceSharingLevel'

contextCondition: 'IS\_WITHIN\_RANGE'

contextValueRange:

- 'SHARED'

# D.3 YAML document example for Intent containing an expectation on coverage performance to be assured

Intent:

userLabel: 'Radio\_Network\_Coverage\_Performance\_Assurance'

IntentExpectation:

- expectationId: '1'

expectationVerb: 'Aussure'

expectationObjects:

- objectInstance: 'SubNetwork\_1'

- objectContexts:

- contextAttribute: 'CoverageAreaPolygon'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- 'Downtown'

- contextAttribute: 'NRFqBand'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- '384000'

- contextAttribute: 'RAT'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- 'NR'

expectationTargets:

- targetName: 'WeakRSRPRatio'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '10'

targetContexts:

- contextAttribute: 'WeakRSRPThreshold'

contextCondition: 'IS\_LESS\_THAN'

contextValueRange: '-130.00'

- targetName: 'LowSINRRatio'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '5'

targetContexts:

- contextAttribute: 'LowSINRThreshold'

contextCondition: 'IS\_LESS\_THAN'

contextValueRange: '-20'

# D.4 YAML document example for Intent containing an expectation on RAN UE throughput performance to be assured

Intent:

userLabel: 'Radio\_Network\_RANUEThpt\_Performance\_Assurance'

IntentExpectation:

- expectationId: '1'

expectationVerb: 'Aussure'

expectationObjects:

- objectInstance: 'SubNetwork\_1'

- objectContexts:

- contextAttribute: 'CoverageAreaPolygon'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- 'Downtown'

- contextAttribute: 'NRFqBand'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- '384000'

- contextAttribute: 'RAT'

contextCondition: 'IS\_ALL\_OF'

contextValueRange:

- 'NR'

expectationTargets:

- targetName: 'lowULRANUEThptRatio'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '10'

targetContexts:

- contextAttribute: 'LowULRANUEThpt'

contextCondition: 'IS\_LESS\_THAN'

contextValueRange: '50'

- targetName: 'lowDLRANUEThptRatio'

targetCondition: 'IS\_LESS\_THAN'

targetValueRange: '5'

targetContexts:

- contextAttribute: 'LowDLRANUEThpt'

contextCondition: 'IS\_LESS\_THAN'

contextValueRange: '200'

- targetName: 'AveULRANUEThpt'

targetCondition: 'IS\_GREATER\_THAN'

targetValueRange: '100'

- targetName: 'AveDLRANUEThpt'

targetCondition: 'IS\_GREATER\_THAN'

targetValueRange: '300'

Annex E (informative):  
Change history

| **Change history** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2022-06 | SA#96 | SP-220491 |  |  |  | Presented for approval | 2.0.0 |
| 2022-06 | SA#96 |  |  |  |  | Upgrade to change control version | 17.0.0 |
| 2022-06 | SA#96 |  |  |  |  | Editorial fixes according to EditHelp | 17.0.1 |
| 2022-09 | SA#97e | SP-220852 | 0001 | - | F | Add missing guidelines for using scenario specific intent expectation for intent driven use cases | 17.1.0 |
| 2022-09 | SA#97e | SP-220852 | 0002 | - | F | Correct the misalignment information in Annex C | 17.1.0 |
| 2022-09 | SA#97e | SP-220852 | 0003 | - | F | Update intentNRM yaml file to distinguish the generic intent expectation part and scenario specific intent part | 17.1.0 |
| 2022-09 | SA#97e | SP-220852 | 0004 | - | F | Correct procedures for intent management | 17.1.0 |
| 2022-09 | SA#97e |  |  |  |  | Alignment with content in FORGE | 17.1.1 |
| 2022-12 | SA#98e | SP-221175 | 0005 | 2 | F | Correction to Context and Expectation Object definitions | 17.2.0 |
| 2022-12 | SA#98e | SP-221175 | 0006 | 2 | F | Correction to Stage 3 and Stage 2 definitions for Intent Driven Management | 17.2.0 |
| 2022-12 | SA#98e | SP-221175 | 0007 | 2 | F | Addition of notification clauses, correction of mis-numbered clauses and addition of common notifications | 17.2.0 |
| 2022-12 | SA#98e | SP-221175 | 0008 | - | F | Add clarification for ambiguous relation description between classic MnS and intent MnS | 17.2.0 |
| 2022-12 | SA#98e | SP-221175 | 0009 | - | F | Update Enum value to use upper case characters to align with TS 32.156 (Stage2 and Stage3) | 17.2.0 |
| 2022-12 | SA#98e | SP-221175 | 0010 | - | F | Correct the procedure for create an intent and modify an intent | 17.2.0 |
| 2022-12 | SA#98e | SP-221175 | 0011 | - | F | Add missing generic requirements for intent driven MnS | 17.2.0 |
| 2022-12 | SA#98e | SP-221175 | 0012 | 1 | F | Correct intent class diagram | 17.2.0 |
| 2022-12 | SA#98e | SP-221175 | 0013 | - | F | Correct notFulfilledReasons attribute | 17.2.0 |
| 2023-03 | SA#99 | SP-230195 | 0015 | 1 | F | Update procedures for delete an intent and query an intent | 17.3.0 |
| 2023-03 | SA#99 | SP-230195 | 0016 | 1 | F | Udpate Annex C Mapping the 3GPP and the TM Forum intentExpectation Models | 17.3.0 |
| 2023-03 | SA#99 | SP-230195 | 0017 | 1 | F | Update clause 4.2.2 Intent driven MnS | 17.3.0 |
| 2023-03 | SA#99 | SP-230196 | 0018 | 1 | F | Update stage 3 PlmnId reference | 17.3.0 |
| 2023-03 | SA#99 | SP-230195 | 0019 | 1 | F | Add clarification on clause 4.5 General concept of Intent Content | 17.3.0 |
| 2023-03 | SA#99 | SP-230195 | 0020 | - | F | Update clause 6.2.2.1.2.4 ExpectationContexts | 17.3.0 |
| 2023-03 | SA#99 | SP-230195 | 0021 | - | F | Correct the value of the defaultValue in Table 6.2.2.2-1 | 17.3.0 |
| 2023-03 | SA#99 | SP-230195 | 0022 | 1 | F | Correct Context date type definition | 17.3.0 |
| 2023-03 | SA#99 | SP-230195 | 0023 | - | F | Change targetAttribute to targetName | 17.3.0 |
| 2023-03 | SA#99 | SP-230195 | 0024 | - | F | Update the figure 6.2.1.1.1-1:Relationship UML diagram for intent | 17.3.0 |
| 2023-03 | SA#99 | SP-230196 | 0026 | 3 | F | Correction to Context and Expectation object definitions Title | 17.3.0 |
| 2023-03 | SA#99 |  |  |  |  | Correction of an implementation error | 17.3.1 |
| 2023-06 | SA#100 | SP-230670 | 0044 | 1 | F | Correct the supported qualifier for ExpectationObject and allowed value for contextCondition | 17.4.0 |
| 2023-06 | SA#100 | SP-230670 | 0045 | - | F | Update IntentNRM YAML file to align with stage2 | 17.4.0 |
| 2023-06 | SA#100 | SP-230670 | 0046 | 1 | F | Separate YAML file for generic Information model definition and scenario specific IntentExpectation definition | 17.4.0 |
| 2023-06 | SA#100 | SP-230670 | 0047 | 1 | F | Correct the errors in Table 6.2.2.2-1 | 17.4.0 |
| 2023-06 | SA#100 | SP-230670 | 0058 | 1 | F | Clarify the definition of intent expectation fulfilment | 17.4.0 |
| 2023-06 | SA#100 | SP-230670 | 0066 | 1 | F | Fixing documentation and allowed value bug in contextValueRange attribute | 17.4.0 |
| 2023-06 | SA#100 | SP-230654 | 0031 | 1 | B | Use case and Requirements on expectation for network optimization | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0034 | 1 | B | Clarify how generic provisioning MnS can be used for intent lifecycle management | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0035 | - | B | Add missing yaml document examples for scenario specific intent instance | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0036 | - | B | Add use case and requirements for intent driven approach for RAN energy saving | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0037 | 1 | B | Add use case and requirements for intent driven approach for radio network capacity optimization | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0038 | 2 | B | Add general concept and requirements for intent handling capability obtaining | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0039 | 1 | B | Add general concept and requirements for intent report | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0043 | 1 | B | Add new capabilities for intent driven management for Intent fulfilment feasibility checks | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0052 | 1 | B | Remove concept of intent validation | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0055 | 2 | B | Add the use cases for Intent containing an expectation for delivering 5GC subnetwork | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0059 | - | C | Clarify service support intent expectation | 18.0.0 |
| 2023-06 | SA#100 | SP-230654 | 0067 | 2 | B | Add description on monitoring the intent fulfilment information | 18.0.0 |