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Contents

Foreword

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

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

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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.

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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)".

[11]　　　3GPP TS 28.554: "Management and orchestration; 5G end to end Key Performance Indicators (KPI)".

[12]　　　3GPP TS 28.552: " Management and orchestration; 5G performance measurements".

[13]　　　3GPP TS 29.510: " 5G System; Network Function Repository Services".

[14]　　　3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception "

[15]　　　3GPP TS 23.003: "Numbering, Addressing and Identification".

[16]　　　Management and Orchestration APIs Stage3 repository, "https://forge.3gpp.org/rep/sa5/MnS/-/tree/Tag_Rel18_SA104/".

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.
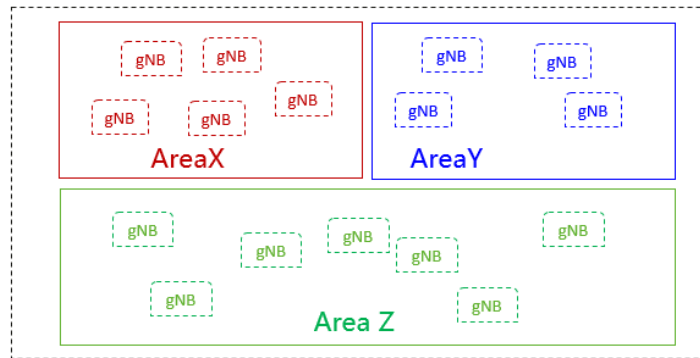
Figure 4.1.1-1

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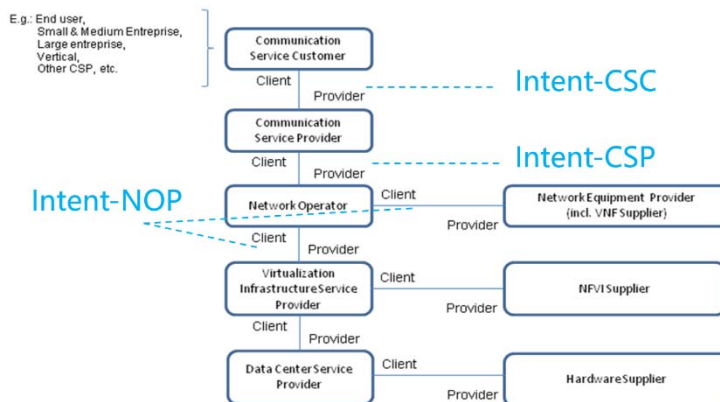
Figure 4.1.2-1: High-level model of different kind of intents expressed by different roles

- **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 which actions are needed for intent fulfilment.

- The producer executes the required actions 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's or service's state to satisfy the new or updated intent. The fulfilment of some intents may end at the intent deployment, in these cases, the intent's goal only describes the availability or presence of a network or service. In other cases, the intent's goal describes additionally 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.
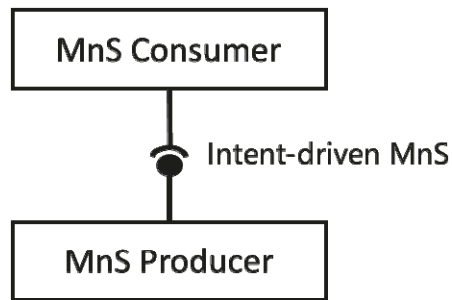
Figure 4.2.2-1: Intent-driven MnS

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 into solutions of various complexity, ranging from a simple approach used 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 illustrates a possible way to satisfy intent-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 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 requirements, then takes some internal actions to fulfil the intent-NOP.
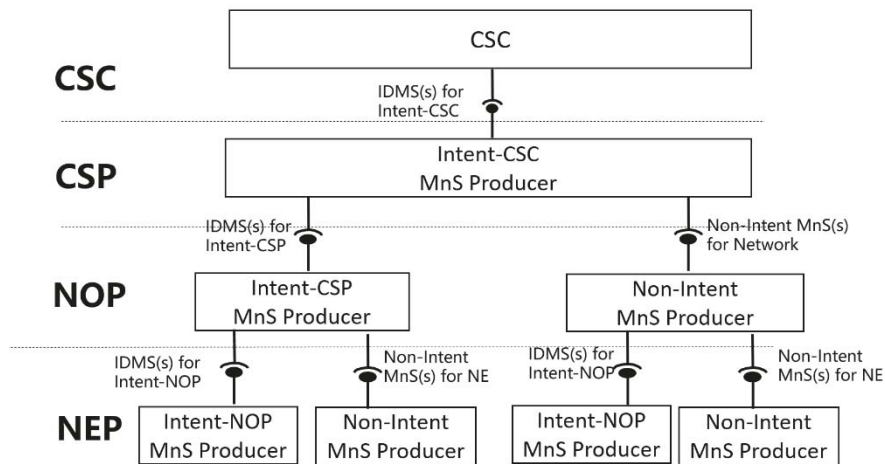
Figure 4.2.3-1: Potential way to satisfy intent-CSC

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.
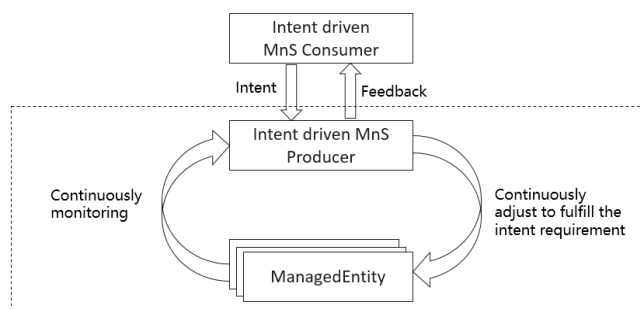
Figure 4.3-1: Intent driven closed-loop

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.
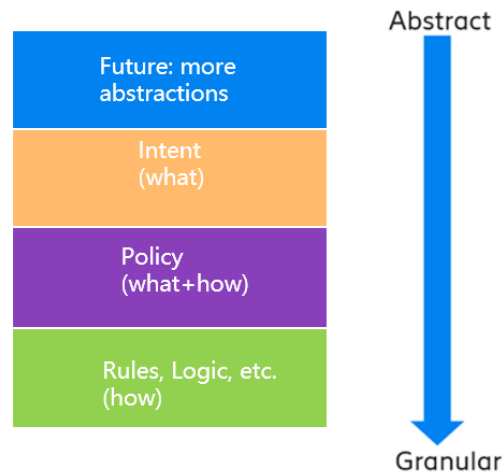

Figure 4.4-1: Relation between rule, policy and intent

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 $\{O_1, O_2, \dots O_N\}$ 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 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 Objects and Targets for different Intent expectations

Example of Intent Expectations	ExpectationObject	Example of Expectation Targets		
		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.

Multiple contexts may be stated on an intent, on an intentExpecation, on an expectationObject or on an expectationtarget. However, the MnS consumer expressing multiple overlapping contexts may not have interest in simultaneously applying all the overlapping contexts but only in applying any one or more of the contexts. For example, the consumer may have requirements for any one of multiple physical locations at any given time. In such cases, the MnS consumer requires means to express the context to be selected among any one of these. Otherwise, the producer will either deliver for all contexts. Alternatively, the MnS consumer would only be able to express one context at time and wait e.g., for a feasibility check to fail to then resend the intent with revised context.

4.5.5 General Requirements

REQ-Intent_GEN-1 The intent driven MnS shall include a capability enabling MnS consumer to express intent containing one or more intent expectations, each expectation is a list of desired outcomes on objects of the same type with optional contexts for the desired outcomes, expectations or the intent.

REQ-Intent_ GEN-2 The intent driven MnS shall include a capability enabling MnS consumer to state the selection mechanism (including "ALL_OF", "ONE_OF", "ANY_OF") to be applied to the stated list of contexts.

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-IDMS_RadioNetworkIntent-CON-1 The intent driven MnS producer for radio network shall have capability enabling MnS consumer to express intent containing an expectation for delivering a radio network for the specified area.

REQ-IDMS_RadioNetworkIntent-CON-2 The intent driven MnS producer for radio network shall have capability enabling MnS consumer to obtain intent report information (including fulfilment information) for 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-IDMS_RadioServiceIntent -CON-1 The intent driven MnS producer for radio service shall have capability enabling MnS consumer to express intent containing an expectation for delivering a radio service for the specified area.

REQ-IDMS_RadioServiceIntent-CON-2 The intent driven MnS producer for radio service shall have capability enabling MnS consumer to obtain intent report information (including fulfilment information) for the intent containing an expectation for a service.

5.1.3 Intent containing an expectation for delivering a service at the edge.

5.1.3.1 Introduction

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

MnS producer notifies MnS consumer about the fulfilment information of the intent containing an expectation for delivering a service at the edge.

5.1.3.2 Requirements

REQ-IDMS_EdgeServiceIntent-CON-1 The intent driven MnS producer for edge service shall have capability enabling authorized MnS consumer to express intent containing an expectation for delivering a service at the edge of the network.

REQ-IDMS_EdgeServiceIntent-CON-2 The intent driven MnS producer for edge service shall have capability enabling authorized MnS consumer to obtain intent report information (including fulfilment information) for intent containing an expectation for delivering a service at the edge of the network.

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, MnS producer 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-IDMS_RadioNetworkIntent-CON-3 The intent driven MnS producer for radio network shall have capability enabling MnS consumer to express intent containing an expectation on coverage performance to be assured for the specified area.

REQ-IDMS_RadioNetworkIntent-CON-4 The intent driven MnS producer for radio network shall have capability enabling MnS consumer to obtain intent report information (including fulfilment information) for 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), frequency information (e.g. nRFrequencyBand), radio network performance targets, optional performance scope (e.g. specific service type, specific UE groups).

The radio network performance targets include the targets in the following target categories based on what radio network performance MnS consumer expects to be assured.

-    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%), target average UL/DL PRB load (e.g. <85%).

Based on the intent containing expectation on radio network performance for the specified area 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 the cause, evaluates, decides and adjusts the radio feature configuration parameters for impacted RAN NEs/Cells to address the radio network performance issues in the specified areas. The artificial intelligence or machine learning technologies may be used to select the optimal radio feature configuration parameters 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 are satisfied.

MnS producer may notify MnS consumer about the intent fulfilment information and achieved value for radio network targets, including the radio network 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-IDMS_RadioNetworkIntent-CON-5 The intent driven MnS producer 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.

REQ-IDMS_RadioNetworkIntent-CON-6 The intent driven MnS producer for radio network shall have capability enabling MnS consumer to obtain intent report information (including fulfilment information) for the intent containing an expectation on RAN UE throughput performance to be assured.

REQ-IDMS_RadioNetworkIntent-CON-7: The intent driven MnS producer 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-IDMS_RadioNetworkIntent -CON-8: The intent driven MnS producer 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.

MnS producer notifies MnS consumer about the fulfilment information of the intent containing an expectation for end-to-end network optimization.

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-IDMS_E2ENetworkIntent-CON-1 The intent driven MnS producer for end-to-end network shall have capability enabling MnS consumer to express intent containing an expectation with targets on the end-to-end network including the RAN and Core.

REQ-IDMS_E2ENetworkIntent-CON-2 The intent driven MnS producer 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-IDMS_E2ENetworkIntent-CON-3 The intent driven MnS producer for end-to-end network shall have capability enabling MnS consumer to obtain intent report information (including fulfilment information) for the intent containing an expectation with targets for 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-IDMS_ RadioNetworkIntent-CON-9: The intent driven MnS producer for radio network shall have capabilites enabling MnS consumer to express intent containing an expectation for RAN energy saving for the specified area.

REQ-IDMS_RadioNetworkIntent-CON -10: The intent driven MnS producer 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 expresses intent containing an expectation related to 5GC network to the intent driven MnS producer. In this scenario, MnS consumer expresses its intent expectation which may

include area information (e.g. geographic area, data center), type of the network (e.g. NPN), included 5GC NF list (e.g. NF type, range of NF instance ID), PLMN information, supported APN information, transport related parameters (e.g. list of end point addresses information), and target network capacity information (e.g. number of PDU session, number of registered subscribers, UL/DL throughput).

Based on the received intent containing an expectation for 5GC network, the intent driven MnS producer decides whether to deploy a new 5GC network in the specified area or to re-use and modify an existing 5GC network. If a new 5GC network is to be deployed, the intent driven MnS producer translates the intent 5GC network expectations into appropriate 5GC network provisioning actions, this may include generation of network configuration parameters (including 5GC network/NFs configuration parameters and transport network configuration parameters) and triggering NS/VNF creation procedure by interworking with ETSI NFV MANO. If an existing 5GC network is to be re-used, the intent driven MnS producer identifies the potential 5GC network performance 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 driven MnS consumer and the intent driven MnS producer may be needed based on the intent management capabilities (e.g. intent feasibility check) provided by intent driven MnS producer.

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

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

5.1.8.2 Requirements

REQ-IDMS_5GCIntent-CON-1 The intent driven MnS producer for 5GC network shall have capability enabling MnS consumer to express intent containing an expectation for delivering a 5GC network for the specified area.

REQ-IDMS_5GCIntent -CON-2 The intent driven MnS producer for 5GC network shall have capability enabling MnS consumer to obtain intent report information (i.e. fulfilment information, achieved value for corresponding targets, conflict information and fulfilment feasibility check information) of the intent containing an expectation for delivering a 5GC network.

REQ-IDMS_5GCIntent -CON-3 The intent driven MnS producer for 5GC network shall have capability enabling MnS consumer to express intent containing an expectation on 5GC network performance to be assured.

REQ-IDMS_5GCIntent-CON-4 The intent driven MnS producer for 5GC network shall have capability enabling MnS consumer to obtain intent report information (i.e. fulfillment information, achieved value for corresponding targets, conflict information and fulfillment feasibility check information) of the intent containing an expectation on 5GC network performance to be assured.

5.2 Generic requirements for intent driven MnS

REQ-IDMS_IntentLCM-CON-1 The intent driven MnS producer shall have capability enabling MnS consumer to request to create a new intent instance.

REQ-IDMS_IntentLCM -CON-2 The intent driven MnS producer shall have capability enabling MnS consumer to request to remove an intent instance.

REQ-IDMS_IntentLCM-CON-3 The intent driven MnS producer shall have capability to report intent fulfilment information to MnS consumer.

REQ-IDMS_IntentLCM-CON-4 The intent driven MnS producer shall have capability enabling MnS consumer to request to modify an existing intent instance.

REQ-IDMS_IntentLCM-CON-5 The intent driven MnS producer shall have capability enabling MnS consumer to query intent instance information.

REQ-IDMS_IntentLCM-CON-6 The intent driven MnS producer shall have a capability enabling an MnS consumer to requestto activate a suspended intent instance.

REQ-IDMS_IntentLCM-CON-7 The intent driven MnS producer shall have a capability enabling an MnS consumer to request to deactivate an intent instance for a suspension.

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 expectation objects and expectation targets 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.

In case the MnS producer updates the intent handling capabilities for one or more intent handling functions, the MnS producer may inform these updates to the MnS consumer.

5.3.1.2 Requirements

REQ-IDMS_IHCO-CON-1 The intent driven MnS producer shall have capabilities enabling an MnS consumer to obtain intent handling capabilities of each intent handling function.

5.3.2 Intent report

5.3.2.1 Introduction

The intent fulfilment information is defined as one type of intent report information in which the intentFulfilmentInfo, expectationFulfilmentInfo and targetFulfilmentInfo are included for the MnS consumer to monitor the intent fulfilment information. The intent fulfilment information also can contain the current 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). Besides, intent conflict information and intent fulfilment feasibility check information sent by MnS producer to MnS consumer is another type of intent report information. So, following are the three 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 intent with conflict. The information includes conflict type (i.e., intent conflict, expectation conflict and target conflict) and possible solutions (e.g. intent deletion, intent modification).

- 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 receiving 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).

MnS consumers may subscribe to get notifications of changes in the intent report.

An intent under fulfilment may go through multiple states, i.e., the life cycle includes multiple alternative transitions. The transitions are triggered either by actions of the MnS consumer or observations at the MnS producer or its intent handling function. Generally, intents received at the MnS producer will have one of the states represented in Figure 5.3.2.1-1.
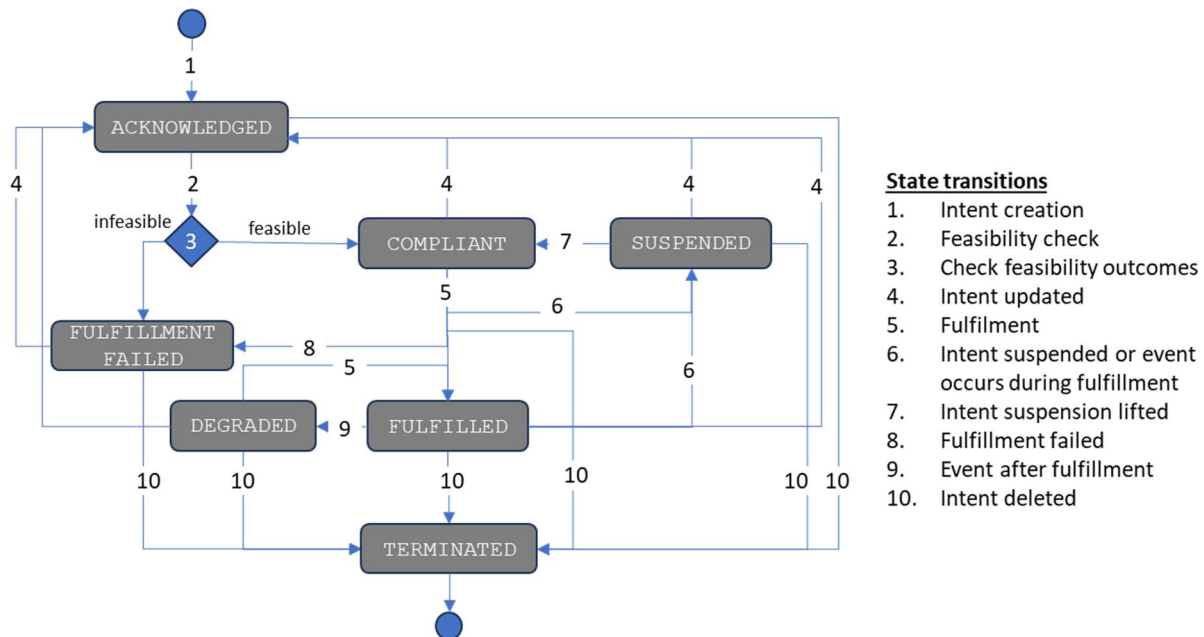
Figure 5.3.2.1-1: State transitions and reporting events for Intents delivered for fulfilment.

Intent reports should be delivered for each of these different states and related state transitions, specifically for:

1. `ACKNOWLEDGED`: When an intent instance is created, its default state is "`ACKNOWLEDGED`". An intent report should be delivered to indicate that the intent instance has been created. The transitions from "`ACKNOWLEDGED`" state can only be to "`COMPLIANT`", "`FULFILLMENT_FAILED`" or "`TERMINATED` " states as described hereafter.

2. `COMPLIANT`: When the feasibility check for the intent is successful and the intent is accepted as being compliant, the intent state is changed to "`COMPLIANT`". An intent report should be delivered to indicate the results of the feasibility check. In the case of an intent delivered for fulfillment, a corresponding intent report should be delivered to indicate the status change. The payload for the intent feasibility report (outcome of the feasibility check) may be one of the following:

   1. an indication for feasible or infeasible;

   2. a detailed report indicating which intent expectations or ExpectationTargets are infeasible and the corresponding reasons;

   The transitions from "`COMPLIANT`" state are either to "`ACKNOWLEDGED`" state when the intent attributes are modified by the MnS consumer, or to "`SUSPENDED`", " `FULFILLED` " or "`FULFILLMENT_FAILED`" states as described hereafter.

3. `SUSPENDED`: If the MnS consumer decides to suspend the intent, the intent state changes to "`SUSPENDED`". Alternatively, an event may occur while the MnS producer attempts to fulfil the intent, in which case the MnS producer may suspend the intent pending further actions. Such events at the MnS producer may among others include conflicts from another intent and resource constraints. An intent report should be delivered to indicate that the intent has been suspended. The intent report may include a reason for the suspension when the intent was suspended by the MnS producer.

The transitions from "SUSPENDED" state are either to "ACKNOWLEDGED" state when the intent attributes are modified by the MnS consumer, or to "COMPLIANT" state if the suspension is lifted by the entity (MnS consumer or MnS producer) that suspended the intent. Otherwise, the state is "TERMINATED" if the intent is deleted.

4. FULFILLED: If the MnS producer considers that the intent, expectation or target has been fulfilled as stated by the MnS consumer, the state changes to "FULFILLED". An intent report should be delivered to indicate that the intent has been fulfilled.

   The transitions from "FULFILLED" state are either to "ACKNOWLEDGED" state when the intent attributes are modified by the MnS consumer or to "DEGRADED" as described for the "DEGRADED" state below.

5. DEGRADED: If an intent that was previously fulfilled but after a period of observation it is found not be meeting the initially stated requirements, the state changes to "DEGRADED". An intent report should be delivered to indicate that the intent has degraded.

   The transitions from "DEGRADED" state are either to "ACKNOWLEDGED" state when the intent attributes are modified by the MnS consumer, or to "FULFILLED" state if the MnS producer once again fulfills the intent.

6. FULFILLMENT_FAILED: If the MnS producer determines that they cannot do anything to fulfil the intent, the state changes to "FULFILLMENT_FAILED". An intent report should be delivered to indicate that the fulfillment of the intent has ceased. The intent is not deleted unless the MnS consumer explicitly requests for it to be deleted.

   The only transition from "FULFILLMENT_FAILED" state is to "ACKNOWLEDGED" state when the intent attributes are modified by the MnS consumer.

7. TERMINATED: If the MnS consumer requests to delete the intent, the state changes to "TERMINATED". An intent report should be delivered to indicate that the intent has been terminated.

   There is no possible transition from TERMINATED state.

8. The intent may be modified when in any of the states "ACKNOWLEDGED", "COMPLIANT ", "SUSPENDED " "FULFILLED ", "DEGRADED" or "FULFILLMENT_FAILED". An intent report should be delivered to indicate that the intent has been modified.

9. The intent may be deleted when in any of the states "ACKNOWLEDGED", "COMPLIANT ", "SUSPENDED " "FULFILLED ", "DEGRADED" or "FULFILLMENT_FAILED". An intent report should be delivered to indicate that the intent has been deleted.

5.3.2.2   Requirements

REQ-IDMS_IntentReport-CON-1: The intent driven MnS producer shall have the capability to enable the MnS consumer to request intent report information.

REQ-IDMS_IntentReport-CON-2: The intent driven MnS producer 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-IDMS_IntentReport-CON-3: The intent driven MnS producer shall have the capability to enable the MnS consumer to obtain intent report information with intent conflict information.

REQ-IDMS_IntentReport-CON-4: The intent driven MnS producer shall have the capability to enable the MnS consumer to obtain intent report information with intent fulfilment feasibility check information.

REQ-IDMS_IntentReport-CON-5: The intent driven MnS producer shall have capability enabling MnS consumer to specify the content of the intent report.

REQ-IDMS_IntentReport-CON-6: The intent driven MnS producer shall have capability enabling MnS consumer to configure the frequency of the intent reporting.

REQ-IDMS_IntentReport-CON-7: The intent driven MnS producer shall have the capability enabling MnS consumer to receive reports, with different content and intervals according to its specified requirements.

REQ-IDMS_IntentReport-CON-8 The intent driven MnS producer shall have capability enabling the MnS consumer to receive an intent report when any of the following happens:

- the intent state has been changed to either "ACKNOWLEDGED" (intent has been created or modified), "COMPLIANT ", "SUSPENDED " "FULFILLED ", "DEGRADED" or "TERMINATED" (intent has been deleted).

REQ-IDMS_IntentReport-CON-9 The intent driven MnS producer shall have capability enabling MnS consumer to receive an intent report indicating the reasons associated with any of the following events: "SUSPENDED", "DEGRADED" or "TERMINATED".

REQ-IDMS_IntentReport-CON-10 The intent driven MnS producer shall have capability enabling MnS consumer to receive an intent report on the outcomes of a feasibility check, the report indicating either of 1) an indication for feasible or infeasible; 2) a detailed report indicating which intent expectations or ExpectationTargets are infeasible and corresponding reasons.

5.3.3 Intent fulfilment feasibility check

5.3.3.1 Introduction

This capability can be used to assist MnS consumer to generate the suitable intent information for intent driven MnS producer. When intent driven MnS producer receives the intent instance creation or modification request from MnS consumer, the intent driven 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), and notify MnS consumer the result of feasibility check. If the result of intent fulfillment feasibility check is feasible, the MnS producer performs the service or network management tasks to satisfy the intent instance. In case the result of intent fulfillment feasibility check is infeasible, MnS producer notifies the MnS consumer the reason of infeasibility and corresponding recommendations, then the MnS consumer decides how to handle the issue that intent is infeasible, e.g. update the intent, suspend the intent, delete the intent, etc.

5.3.3.2 Requirements

REQ-IDMS_IntentFeasibilityCheck-CON-1: The intent-driven MnS producer should have capability to report the authorized MnS consumer the output of automatic feasibility check when receive the intent creation and modification request.

REQ-IDMS_IntentFeasibilityCheck-CON-2: 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-IDMS_IntentFeasibilityCheck-CON-3: 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 infeasible.

5.3.4 Intent-related conflicts

5.3.4.1 Introduction

An intent may contain multiple intent expectations, and each intent expectation may contain multiple expectation targets. The MnS producer (or its intent handling functions) may realize that conflict between different intents or conflict between different intent expectations within an intent or conflict between different targets within an intent expectation. The intent may have conflict with other intent if any of its targets conflict with another target in another intent. The conflicts should be detected and resolved.

5.3.4.2 Detecting Intent-related conflicts

Given two expectation targets, e.g., target_1=: throughput > V1 and target_2=: interference < V2, the MnS producer will see that the targets are conflicting if one target gets degraded while attempting to achieve the other, i.e., actions taken by the two targets have mutually exclusive effects. There is intent conflict if any of its targets conflict with another target in another intents, expectation conflict if any of its targets conflict with another target in the same intent but different intent expectations, otherwise it is a target conflict if any of its targets conflict with another target in the same intent expectation. Accordingly, there are three intent related conflict scenarios:

- Target conflict, which represents the conflict between two or more expectation targets within the same intent expectation.

- Expectation conflict, which represents the conflict between two or more intent expectations within the same intent.

- Intent conflict, which represents the conflict between two or more different intents.

When such conflicts are detected, the MnS producer needs to notify the MnS consumer about the conflict, indicating the intent, intent expectations or expectation targets which give rise to the conflict. The MnS producer may also notify the MnS consumer about additional information related to the conflict (e.g., the likely impact on other expectation targets).

5.3.4.3 Resolving Intent-related conflicts

To resolve the conflict, the MnS producer may derive required solutions, such as suspension of the whole intent that contains conflicts or has conflicts with another intent. Alternatively, the MnS producer may recommend a new intent in place of the conflict intent (e.g., adding recommended expectations or targets, or termination of part of the intent). Also, the MnS producer may suggest alternative intent fulfilment e.g., by updating the execution time of the intent.

The decisions taken by the MnS producer may also be guided by the MnS consumer through explicit conflict handling guidelines. The MnS consumer may provide intent expectations and expectation targets as an ordered list for which the first intent expectations or expectation targets are the most important and should thus be prioritized in case of conflicts. Alternatively, the MnS consumer may assign explicit priorities for such intents or intent expectations or expectation targets so that the MnS producer uses the priorities to choose the intents or intent expectations or expectation targets to be discarded in favour of others. The priority mechanism not only applies to targets, but also to the expected managed entities (listed or scoped by the object context). The MnS consumer may also send the reduced scope of the expected managed entities in intent creation or modification request Then, when the intent cannot be fulfilled in the expected managed entities, actions would be taken by the MnS producer to only ensure the fulfilment of targets on the part of the expected managed entities until the intent conflict is solved.

5.3.4.4 Requirements

REQ-IDMS_IntentConflict-CON-1: The intent driven MnS producer should have the capability to inform an authorized MnS consumer about any detected intent-related conflicts, including intent conflict, expectation conflict and target conflict.

REQ-IDMS_IntentConflict-CON-2: The intent driven MnS producer should have the capability to inform an authorized MnS consumer about the decision taken by the MnS producer to resolve or handle a detected intent-related conflict.

REQ-IDMS_IntentConflict-CON-3: The intent driven MnS producer should have the capability to inform an authorized MnS consumer about the MnS producer's recommended actions that may be taken by the MnS consumer towards resolving a detected intent-related conflict, including recommendations on how to revise the intent expectations or expectation targets and to delete one of the conflicting intents.

REQ-IDMS_IntentConflict-CON-4: The intent driven MnS producer should have the capability enabling an authorized MnS consumer to provide intents with priorities to be applied when handling conflicts among intents, expectations, or targets.

6 Stage 2 definition for Intent Driven Management

6.1 Management operation for intent driven management (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 driven management, including intent lifecycle management, intent report management and intent handling capability obtaining. The Intent, IntentReport and IntentHandlingFunction can be treated as Managed Object instances.

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
Activate an intent	modifyMOIAttributes operation
Deactivate an intent	modifyMOIAttributes operation

Following is the IS to support intent report management:

Table 6.1-2: IS to support intent report management

intent lifecycle management	IS operation
Query an intent report	getMOIAttributes operation
Subscribe an intent report	createMOI operation
Notify an intent report	notifyMOIAttributeValueChanges notification
Unsubscribe an intent report	deleteMOI operation
Query an intent report subscription	getMOIAttributes operation

Following is the IS to support intent handling capability obtaining:

Table 6.1-3: IS to support intent handling capability obtaining

intent lifecycle management	IS operation
Query intent handling capability	getMOIAttributes operation

6.2 Information model definition for Intent (MnS component typeB)

6.2.1 Generic Information model definition

6.2.1.0 Imported information entities and local labels

3GPP TS 28.622 [6], `DataType, DateTime`	`DateTime`
3GPP TS 28.622 [6], `DataType, GeoArea`	`GeoArea`
3GPP TS 28.658 [10], `DataType, PLMNId`	`PLMNId`
3GPP TS 28.622 [6], `DataType, TimeWindow`	`TimeWindow`
3GPP TS 28.622 [6], `DataType, GeoCoordinate`	`GeoCoordinate`

6.2.1.1 Class diagram

6.2.1.1.1 Relationship
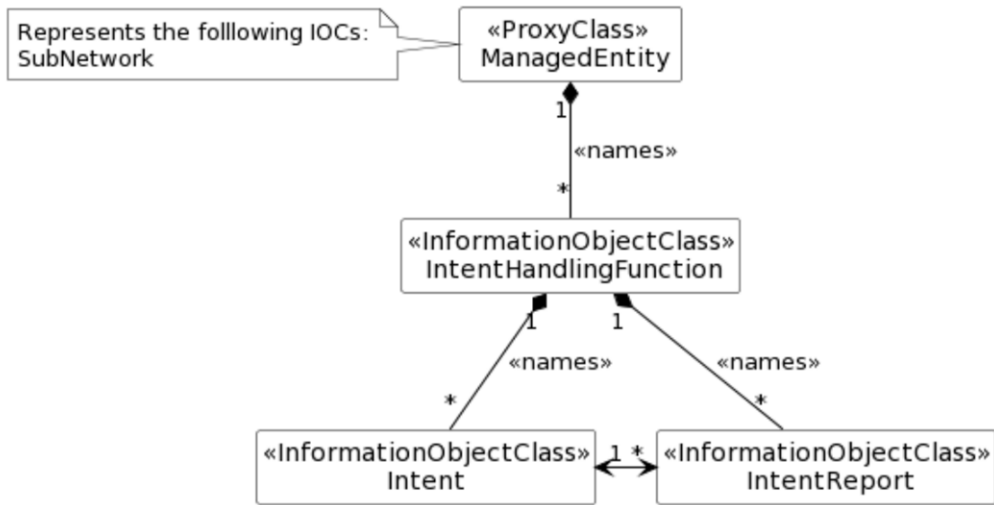
NOTE: Void

Figure 6.2.1.1.1-1: Relationship UML diagram for intent driven management
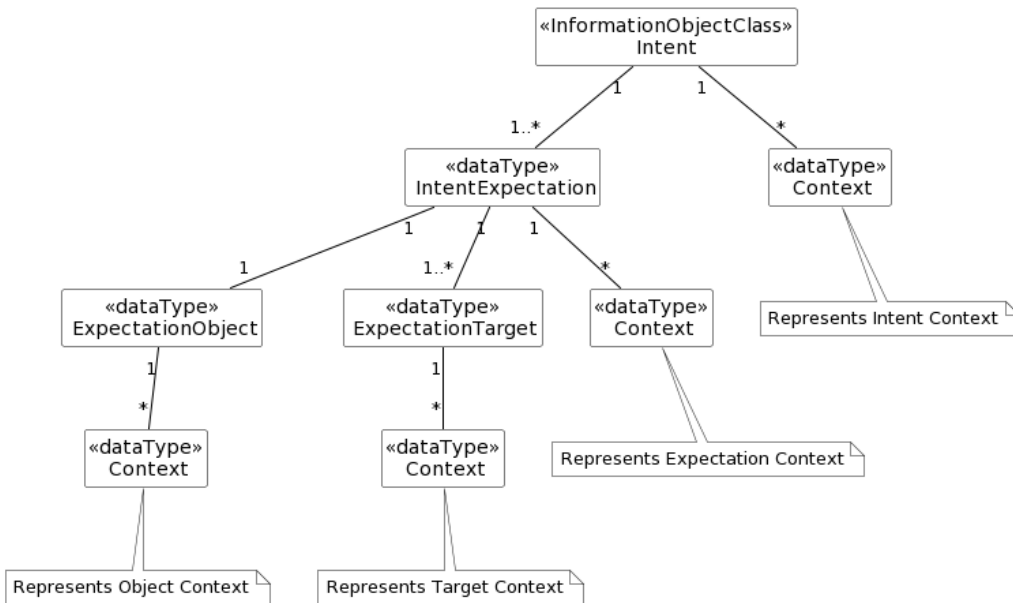
Figure 6.2.1.1.1-2: Relationship UML diagram for intent
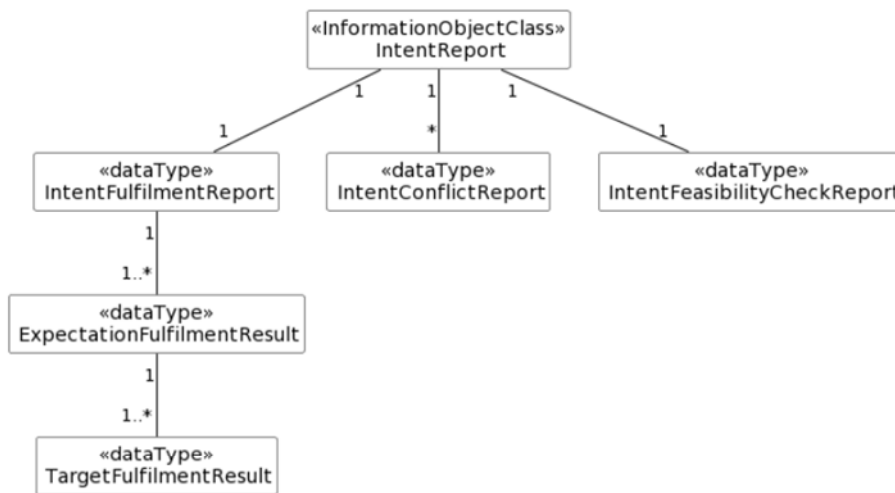
Figure 6.2.1.1.1-3: Relationship UML diagram for intent report

6.2.1.1.2 Inheritance
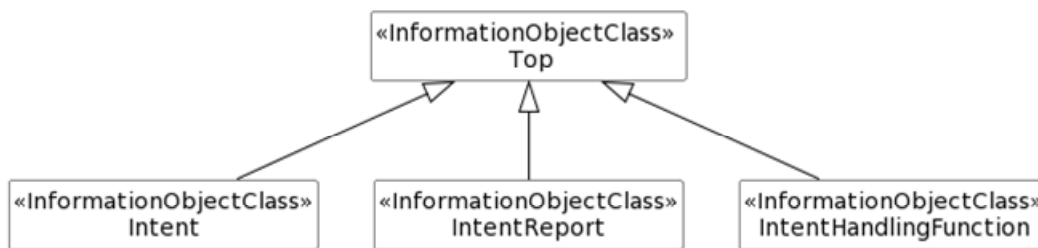
Figure 6.2.1.1.2-1: Inheritance UML diagram for intent driven management

6.2.1.2 Class definition

6.2.1.2.1 Intent <<InformationObjectClass>>

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 also contains intentAdminState to support intent suspension mechanism. In case MnS consumer wants to suspend an intent, MnS consumer can request MnS producer to configure attribute intentAdminState with the value "DEACTIVATED". A suspended intent means this intent is not considered for fulfillment. In case MnS consumer wants to resume an intent on the MnS producer side when the intent is suspended, MnS consumer can request MnS producer to configure attribute `intentAdminState` with the value "`ACTIVATED`".

The attribute "observationPeriod" indicates the time period for which the fulfilment process is observed and at the end of which the fulfilmentInfo for corresponding ExpectationTargets, IntentExpectations and Intent is updated. The observation period can be set by the MnS consumer or by the MnS producer if the MnS consumer does not provide a value.

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.

The Intent IOC includes `contextSelectivity` respectively used to define how to select among the stated `intentContexts`

6.2.1.2.1.2   Attributes

The `Intent` IOC includes attributes inherited from `Top` 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
contextSelectivity	O	T	T	F	F
intentContexts	O	T	T	F	F
observationPeriod	O	T	T	F	F
intentPriority	O	T	T	F	T
intentAdminState	CM	T	T	F	F
intentPreemptionCapabil ity	CM	T	T	F	F
Attribute related roles					
intentReportReference	M	T	F	F	F

6.2.1.2.1.3   Attribute constraints

Name	Definition
intentAdminState Support Qualifier	Condition: MnS consumer-suspension mechanism is supported.
intentPreemptionC apability Support Qualifier	Condition: The preemption mechanism is supported.

6.2.1.2.1.4   Notifications

The common notifications defined in clause 6.2.1.5 are valid for this IOC. In addition, the following set of notifications is also valid.

Name	S	Notes
notifyMOIChanges	M	--

6.2.1.2.2   IntentReport <<InformationObjectClass>>

6.2.1.2.2.1   Definition

This IOC represents intent report information from MnS producer to MnS consumer. The IntentReport instance is created by MnS producer automatically when creating an Intent instance. When the MnS producer delete an intent instance based on a request from MnS consumer, the corresponding intent report instance is also deleted by MnS producer automatically. MnS consumers cannot request MnS producer to create or delete IntentReport instance.

The `IntentReport` IOC includes

- `intentFulfilmentReport`, which represents the properties of fulfillment information for expectation target, intent expectation, and the whole intent. The fulfilmentReport will be observed from the start of each observation period (specified in Intent IOC), then at the end of each observation period, the corresponding values will be derived and configured.

- `intentConflictReport`, which represents detected conflict information, including conflict type (i.e., intent conflict, expectation conflict and target conflict) and possible solution recommendations to address the conflicts.

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

Each instance of IntentReport IOC can contain one or any combination of `intentFulfilmentReport`, `intentConflictReport` and `intentFeasibilityCheckReport`.

Different MnS consumers can use the "getMOIAttributeValue" operation to query different attributes of the IntentReport <<IOC>> to obtain corresponding intent report information (including `intentFulfilmentReport`, `intentConflictReport` and `intentFeasibilityCheckReport`).

Different MnS consumers can subscribe attribute value change notifications for IntentReport <<IOC>> to obtain the notification for different intent report information.

6.2.1.2.2.2   Attributes

The IntentReport <<IOC>> includes attributes inherited from `Top` IOC (defined in TS 28.622 [6]) and the following attributes

Table 6.2.1.2.2.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
`intentFulfilmentReport`	CM	T	F	F	T
`intentConflictReports`	CM	T	F	F	T
`intentFeasibilityCheckReport`	CM	T	F	F	T
`lastUpdatedTime`	M	T	F	F	T
Attribute related to roles					
`intentReference`	M	T	F	F	F

6.2.1.2.2.3   Attribute constraints

Table 6.2.1.2.2.3-1

Name	Definition
`intentFulfilmentReport` Support Qualifier	Condition: intent fulfilment information is supported by IntentReport
`intentConflictReports` Support Qualifier	Condition: intent conflict information is supported by IntentReport
`intentFeasibilityCheckReport` Support Qualifier	Condition: intent feasibility check information is supported by IntentReport

6.2.1.2.2.4   Notifications

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

6.2.1.2.3   IntentHandlingFunction <<InformationObjectClass>>

6.2.1.2.3.1   Definition

This IOC represents the intent handling capabilities can be supported by a specific intent handling function of MnS producer. `IntentHandlingFunction` instances are created by the MnS producer or are pre-installed, and also are modified, deleted by the MnS producer if needed. MnS consumers cannot request to create, modify or delete `IntentHandlingFunction` instances.

An MnS consumer can query the `IntentHandlingFunction` IOC to obtain the intent handling capability information for a specific intent handling function of MnS producer. Based on the obtained intent handling capability information and management requirements, MnS consumer generates the corresponding intent information and sends it to MnS producer. The intent information includes the expectation object and expectation targets supported by the obtained intent handing capabilities.

The MnS consumer also can use the DN of IntentHandlingFunction instance to query all Intent instances handlei by a specific intent handling function.

6.2.1.2.3.2 Attributes

The IntentHandlingFunction <<IOC>> includes attributes inherited from `Top` IOC (defined in TS 28.622 [6]) and the following attributes

Table 6.2.1.2.3.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
intentHandlingCapability List	M	T	F	F	T

6.2.1.2.3.3 Attribute constraints

None.

6.2.1.2.3.4 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.

The `IntentExpectation` <<dataType>> includes `contextSelectivity` used to define how to select among the stated `expectationContexts`.

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
contextSelectivity	O	T	T	F	F
expectationContexts	O	T	T	F	F
NOTE: The scenariospecific IntentExpectations in clause 6.2.2 are defined utilizing the constructs of this generic IntentExpectation <<dataType>>.					

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 target of the IntentExpectation that are required to be achieved.

The ExpectationTarget <<dataType>> includes a contextSelectivity used to define how to select among the stated targetContexts.

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
contextSelectivity	O	T	T	F	F
targetContexts	O	T	T	F	F

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 expectation targets or to the expectation 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:

- NOT_FULFILLED: This is the default status for any aspect of the intent and the fulfilmentStatus remains as "NOT_FULFILLED" until 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 degree of fulfilment of an intent with the NOT_FULFILLED 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 state and is the initial notFulfilledState right after the intent has been received and its instance has been created.

- 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 or MnS consumer decides to suspend 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 `"TERMINATED"`.

- 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 `notFulfilledState` with value "DEGRADED", "TERMINATED", "SUSPENDED" and "FULFILMENTFAILED"), 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 `FulfilmentInfo` 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.

6.2.1.3.6 IntentFulfilmentReport <<dataType>>

6.2.1.3.6.1 Definition

This <<dataType>> includes the `intentFulfilmentInfo` and `expectationFulfilmentResults`. The `intentFulfilmentInfo` describes status of fulfilment of an intent and the related reasons for the infeasible status.

6.2.1.3.6.2 Attributes

The `IntentFulfilmentReport` includes the following attributes.

Table 6.2.1.3.6.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
intentFulfilmentInfo	M	T	F	F	T
expectationFulfilmentResults	O	T	F	F	T

6.2.1.3.6.3 Attribute constraints

None.

6.2.1.3.7 ExpectationFulfilmentResult <<dataType>>

6.2.1.3.7.1 Definition

`ExpectationFulfilmentResult` <<dataType>> includes the `expectationFulfilmentInfo` and `targetFulfilmentResults` for each IntentExpectation. The `expectationFulfilmentInfo` describes status of fulfilment of an intentExpectation and the related reasons for the infeasible status.

6.2.1.3.7.2 Attributes

The `ExpectationFulfilmentResult` includes the following attributes.

Table 6.2.1.3.7.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
expectationId	M	T	F	T	T
expectationFulfilmentInfo	M	T	F	F	T
targetFulfilmentResults	O	T	F	F	T

6.2.1.3.7.3 Attribute constraints

None.

6.2.1.3.8 TargetFulfilmentResult<<dataType>>

6.2.1.3.8.1 Definition

`TargetFulfilmentResult` <<dataType>> includes `targetFulfilmentInfo` and `targetAchievedValue` for each ExpectationTarget. The `targetFulfilmentInfo` describes status of fulfilment of an expectationTarget and the related reasons for the infeasible status. The `targetAchievedValue` describes current performance value for the ExpectationTarget.

6.2.1.3.8.2 Attributes

The `TargetFulfilmentResult` includes the following attributes.

Table 6.2.1.3.8.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
targetName	M	T	F	F	T
targetFulfilmentInfo	M	T	F	F	T
targetAchievedValue	O	T	F	F	T

6.2.1.3.8.3 Attribute constraints

None.

6.2.1.3.9 IntentConflictReport << dataType >>

6.2.1.3.9.1 Definition

`IntentConflictReport` <<dataType>> represents the conflict information for the detected conflict.

When a conflict is detected, the MnS producer will configure the value of attributes of IntentConflictReport and notify the MnS consumer about the conflict, indicating the intent, intent expectation or expectation target which give rise to the conflict. The value of recommendedSolutions may be configured by MnS producer and notified to MnS consumer.

6.2.1.3.9.2 Attributes

The `IntentConflictReport` includes the following attributes.

Table 6.2.1.3.9.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
conflictId	M	T	F	T	T
conflictType	M	T	F	F	T
conflictingIntent	CM	T	F	F	T
conflictingExpectation	CM	T	F	F	T
conflictingTarget	CM	T	F	F	T
recommendedSolutions	O	T	F	F	T

6.2.1.3.9.3 Attribute constraints

Name	Definition
conflictingIntent Support Qualifier	Condition: This will be present if the value of conflictType is INTENT_CONFLICT
conflictingExpectation Support Qualifier	Condition: This will be present if the value of conflictType is EXPECTATION_CONFLICT
conflictingTarget Support Qualifier	Condition: This will be present if the value of conflictType is TARGET_CONFLICT

6.2.1.3.10 IntentFeasibilityCheckReport <<dataType>>

6.2.1.3.10.1 Definition

The `IntentFeasibilityCheckReport` <<dataType>> represents the intent feasibility check information. Intent feasibility check information is provided after MnS producer automatically performs feasibility check when the MnS producer received the intent creation or modification request from the MnS consumer. In case the feasibility check result is 'INFEASIBLE' the MnS producer will notify the MnS consumer about the infeasible reasons.

6.2.1.3.10.2 Attributes

The `FeasibilityCheckReport` includes the following attributes.

Table 6.2.1.3.10.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
feasibilityCheckResult	M	T	F	F	T
infeasibilityReasons	CM	T	F	F	T

6.2.1.3.10.3   Attribute constraints

Table 6.2.1.3.10.3-1

Name	Definition
infeasibilityReason Support Qualifier	Condition: when feasibilityCheckResult is INFEASIBLE

6.2.1.3.11   IntentHandlingCapability <<dataType>>

6.2.1.3.11.1   Definition

The IntentHandlingCapability <<dataType>> represents expectation object information and expectation target information which can be supported by a specific intent handling function of MnS producer.

The IntentHandlingCapability <<dataType>> includes a supportedExpectationObjectType and corresponding supportedExpectationTargetNames.

6.2.1.3.11.2   Attributes

The IntentHandlingCapability includes the following attributes.

Table 6.2.1.3.11.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
intentHandlingCapabilityId	M	T	F	F	T
supportedExpectationObjectType	M	T	F	F	T
supportedExpectationTargetNames	M	T	F	F	T

6.2.1.3.11.3   Attribute constraints

None.

6.2.1.3.12   ValueRangeType<<choice>>

6.2.1.3.12.1   Definition

This <<choice>> defines the data type for value of the "targetValueRange" and "contextValueRange".

6.2.1.3.12.2   Attributes

Table 6.2.1.3.12.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
`CHOICE_1.1 real`	CM	T	T	F	F
`CHOICE_2.1 enum`	CM	T	T	F	F
`CHOICE_3.1 string`	CM	T	T	F	F
`CHOICE_4.1 boolean`	CM	T	T	F	F
`CHOICE_5.1 integer`	CM	T	T	F	F
`CHOICE_6.1 timeWindow`	CM	T	T	F	F
`CHOICE_7.1 dateTime`	CM	T	T	F	F
`CHOICE_8.1 geoArea`	CM	T	T	F	F
`CHOICE_9.1 pLMNId`	CM	T	T	F	F
`CHOICE_10.1 geoCoordinate`	CM	T	T	F	F
`CHOICE_11.1 uEGroup`	CM	T	T	F	F
`CHOICE_12.1 frequency`	CM	T	T	F	F

6.2.1.3.12.3   Attribute constrains

Table 6.2.1.3.12.3-1

Name	Definition
`CHOICE_1.1 real` CM Support Qualifier	Condition: This attribute shall be supported, when the type is Real.
`CHOICE_2.1 enum` CM Support Qualifier	Condition: This attribute shall be supported, when the type is Enum.
`CHOICE_3.1 string` CM Support Qualifier	Condition: This attribute shall be supported, when the type is String.
`CHOICE_4.1 boolean` CM Support Qualifier	Condition: This attribute shall be supported, when the type is Boolean.
`CHOICE_5.1 integer` CM Support Qualifier	Condition: This attribute shall be supported, when the type is Integer.
`CHOICE_6.1 timeWindow` CM Support Qualifier	Condition: This attribute shall be supported, when the type is TimeWindow.
`CHOICE_7.1 dateTime` CM Support Qualifier	Condition: This attribute shall be supported, when the type is DateTime.
`CHOICE_8.1 geoArea` CM Support Qualifier	Condition: This attribute shall be supported, when the type is GeoArea.
`CHOICE_9.1 pLMNId` CM Support Qualifier	Condition: This attribute shall be supported, when the type is PLMNId.
`CHOICE_10.1 geoCoordinate` CM Support Qualifier	Condition: This attribute shall be supported, when the type is `GeoCoordinate`.
`CHOICE_11.1 uEGroup` CM Support Qualifier	Condition: This attribute shall be supported, when the type is `UEGroup`.
`CHOICE_12.1 frequency` CM Support Qualifier	Condition: This attribute shall be supported, when the type is `frequency`.

6.2.1.3.13   Frequency<<dataType>>

6.2.1.3.13.1   Definition

It describes the RF reference frequency (i.e. Absolute Radio Frequency Channel Number) and/or the frequency operating band used for a given direction (UL or DL) in FDD or for both UL and DL directions in TDD.

6.2.1.3.13.2   Attributes

Table 6.2.1.3.13.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
arfcn	CM	T	T	F	F
freqband	CM	T	T	F	F

6.2.1.3.13.3   Attribute constrains

Table 6.2.1.3.13.3-1

Name	Definition
arfcn CM Support Qualifier	Condition: This attribute shall be supported, when the frequency information represent RF reference frequency.
freqband CM Support Qualifier	Condition: This attribute shall be supported, when the frequency information represent frequency operating band.

6.2.1.3.14   UEGroup <<dataType>>

6.2.1.3.14.1   Definition

This <<dataType>> describes the UE Group, which is represented by specific 5QI, specific S-NSSAI, or a specific combination of S-NSSAI and 5QI

6.2.1.3.14.2   Attributes

Table 6.2.1.3.14.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
fiveQI	CM	T	T	F	F
sNSSAI	CM	T	T	F	F

6.2.1.3.14.3   Attribute constrains

Table 6.2.1.3.14.3-1

Name	Definition
fiveQI CM Support Qualifier	Condition: This attribute shall be supported, when UE group is represented by 5QI.
sNSSAI CM Support Qualifier	Condition: This attribute shall be supported, when UE group is represented by S-NSSAI.

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

Attribute Name	Documentation and Allowed Values	Properties
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). The intentExpectations are arranged in an ordered list such that the most important intentExpectations are on the top of the list. allowedValues: Not Applicable	type: IntentExpectation multiplicity: 1..* isOrdered: True 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 fulfilment result for intent, intentExpectation or expectationTarget, 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: "NOT_FULFILLED" isNullable: False
notFulfilledState	It describes the current state 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: "ACKNOWLEDGED" isNullable: False
notFulfilledReasons	It describes the reasons/observations related to the specific 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 unique identifier of the intentExpectation within the intent. allowedValues: Not Applicable	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A

Attribute Name	Documentation and Allowed Values	Properties
		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 target performance value. allowedValues: DELIVER, ENSURE Vendor extensions are allowed	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 is required to be applied to. It can be class name of the managed object. allowedValues: see scenario specific IntentExpectation	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
expectationTargets	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. The `expectionTargets` are arranged in an ordered list such that the most important `expectionTargets` are on the top of the list.	type: ExpectationTarget multiplicity: 1..* isOrdered: True 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

Attribute Name	Documentation and Allowed Values	Properties
targetName	It describes the name 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: None 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 value 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 values 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: ValueRangeType multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None 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: None 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 value 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 values 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: ValueRangeType multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None isNullable: True
intentPriority	It expresses the priority of the stated intent within an MnS consumer.	type: integer multiplicity: 1

Attribute Name	Documentation and Allowed Values	Properties
	AllowedValue: values in the range [1-100] where 1 indicates the highest priority and 100 indicates the lowest priority. NOTE: The handing of the priorities across MnS consumers is left to implementation	isOrdered: False isUnique: True defaultValue: 1 isNullable: False
geoArea	It describes a geographical area defined in 3GPP TS 28.622[6]. AllowedValue: As defined by the data type	type: GeoArea multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
pLMNId	It describes the information of a PLMN identification defined in 3GPP 28.658[10] AllowedValue: As defined by the data type	type: PLMNId multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
dateTime	It describes the information of a date time defined in 3GPP TS 28.622[6]. AllowedValue: As defined by the data type	type: DateTime multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
timeWindow	It describes the information of a time window (including startTime, endTime) defined in 3GPP TS 28.622[6]. AllowedValue: As defined by the data type	type: TimeWindow multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
geoCoordinate	It describes the information of a geoCoordinate defined in 3GPP TS 28.622[6]. AllowedValue: As defined by the data type	type: GeoCoordinate multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
frequency	It desribes the RF reference frequency (i.e. Absolute Radio Frequency Channel Number) and/or the frequency operating band used for a given direction (UL or DL) in FDD or for both UL and DL directions in TDD. AllowedValue: As defined by the data type	type: Frequency multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
arfcn	It desribes the RF reference frequency (i.e. Absolute Radio Frequency Channel Number). Allowed Value: For NR, see TS 38.104 [8] clause 5.4.2.1. For EUTRAN, see TS 36.104 [14] clause 5.7.3.	type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
freqband	It desribes the the frequency operating band. Allowed Value: For NR, see TS 38.104 [8] clause 5.4.2.3. For EUTRAN, see TS 36.104 [14] clause 5.7.3.	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
uEGroup	It describes the information of a UE Group (represented by specific 5QI, specific S-NSSAI, or a specific combination of S-NSSAI and 5QI).	type: UEGroup multiplicity: 1 isOrdered: N/A

Attribute Name	Documentation and Allowed Values	Properties
	AllowedValue: As defined by the data type	isUnique: N/A defaultValue: None isNullable: True
`fiveQI`	It describes the information of a 5QI defined in 3GPP TS 28.541[5]. AllowedValue: 0 - 255	type: integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
`sNSSAI`	It describes the information of a S-NSSAI defined in 3GPP TS 28.541[5]. AllowedValue: As defined by the data type	type: S-NSSAI multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
`intentAdminState`	It describes the intent administrative state, which enables the MnS consumer to suspend an intent or cancel the suspension for a suspended intent. A suspended intent means this intent is not considered for fulfilment allowedValues: "ACTIVATED", "DEACTIVATED"	type: Enum multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: "ACTIVATED" isNullable: False
`intentReference`	It indicates the associated intent instance allowedValues: Not Applicable	type: DN multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
`intentReportReference`	It indicates the associated intent report instance(s) allowedValues: Not Applicable	type: DN multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: False
`observationPeriod`	It represents the observation period of the fulfilmentInfo for corresponding ExpectationTargets, IntentExpectations and Intent. At the end of the observation period, the corresponding fulfilment info is updated in the intent report. The observation period can be assigned by MnS consumer through requesting the MnS producer to set attribute `"observationPeriod"`. MnS producer also can assign the observation period if MnS consumer didn't assign it. The observation time is expressed in `seconds`. allowedValues: Not Applicable	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
`intentFulfilmentReport`	It describes the fulfillment information which is reported for the associated intent instance. allowedValues: Not Applicable	type: IntentFulfilmentReport multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
intentConflictReports	It describes the conflict information which is reported for associated intent instance if needed. allowedValues: Not Applicable	type: IntentConflictReport multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: False
conflictId	It is used to identify the detected conflict within an IntentReport instance. allowedValues: Not Applicable	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
conflictType	It describes the type of intent conflict. allowedValues: INTENT_CONFLICT, EXPECTATION_CONFLICT, TARGET_CONFLICT	type: Enum multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
conflictingIntent	It describes the DN of the conflicting intent allowedValues: Not Applicable	type: DN multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
conflictingExpectation	It describes the expectationId of the conflicting IntentExpectation within an Intent. allowedValues: Not Applicable	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
conflictingTarget	It describes the targetName of the conflicting ExpectationTarget within an IntentExpectation. allowedValues: Not Applicable	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
recommendedSolutions	It describes the action recommended by the MnS producer to be undertaken by the MnS consumer to resolve intent conflict. The recommended solution applies only for the specific intent whose intent report contains this attribute. allowedValues: "MODIFY", "DELETE"	type: ENUM multiplicity: 1 isOrdered: False isUnique: True defaultValue: None isNullable: False
expectationFulfilmentResults	It includes the expectationFulfilmentInfo and targetFulfilmentResults for each IntentExpectation. The expectationFulfilmentInfo describes status of fulfilment of an intentExpectation and the related reasons for infeasible status. allowedValues: Not Applicable	type: ExpectationFulfilmentResult multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
`targetFulfilmentResults`	It includes targetFulfilmentInfo and targetAchievedValue for each ExpectationTarget. The targetFulfilmentInfo describes status of fulfilment of an expectationTarget and the related reasons for infeasible status. The targetAchieveValue describes current performance value for the ExpectationTarget. allowedValues: Not Applicable	type: TargetFulfilmentResult multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: False
`targetAchievedValue`	It describes the value that has been achieved for the expectation target at the time at which the report is generated. allowedValues: Not Applicable	type: Number multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
`intentFeasibilityCheckReport`	It describes the intent feasibility check information which is reported if needed. allowedValues: Not Applicable	type: IntentFeasibilityCheckReport multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
`feasibilityCheckResult`	It describes the result of intent fulfilment feasibility check allowedValues: FEASIBLE, INFEASIBLE	type: Enum multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
`infeasibilityReasons`	It describes the reason (e.g. invalid intent expression, the intent conflict) of the result of intent fulfilment feasibility check is INFEASIBLE Editor's Note: the ENUM value for infeasibilityReason is FFS.	type: ENUM multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None isNullable: False
`intentHandlingCapabilityList`	It describes the list of expectation object information and expectation target information which can be supported by intent handling function. allowedValues: Not Applicable	type: IntentHandlingCapability multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None isNullable: False
`intentHandlingCapabilityId`	A unique identifier of property of intent handling capability should be supported by the intent handling function of MnS producer. allowedValues: Not Applicable	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
`supportedExpectationObjectType`	It describes the expectation object type which can be supported by a specific intent handling function of MnS producer. allowedValues: objectType defined in clause 6.2.1.3.2.	type: Enum multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
supportedExpectationTargetNames	It describes the supported expectation targets for the supported expectation object type. allowedValues: targetName defined in clause 6.2.1.3.3	type: String multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None isNullable: False
lastUpdatedTime	It describes the time for the latest update of the IntentReport Instance.	type: DateTime multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
ContextSelectivity	It expresses the may in which all or a subset of the expectationTargets may be applied. AllowedValue: "ALL_OF", "ONE_OF", "ANY_OF"	type: Enum multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: "ALL_OF" isNullable: False
intentPreemptionCapability	It describes the pre-emption capability. The attribute is used by MnS producer to decide the target of intent deletion or intent modification AllowedValue: TRUE, FALSE	type: Enum multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: "FALSE" isNullable: False
NOTE: For "IS_ALL_OF", the value shall be a 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. The usage of following contexts for corresponding use cases see Table 8.1 Guidelines for using scenario specific intent expectation for intent driven use cases.

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
dlFrequencyContext	O	T	T	F	F
ulFrequencyContext	O	T	T	F	F
rATContext	O	T	T	F	F
uEGroupContext	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 the same with properties of ExpectationTargets defined in clause 6.2.1.3. The usage of following targets for corresponding use cases see Table 8.1 Guidelines for using scenario specific intent expectation for intent driven use cases.

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
highUlPrbLoadRatioTarget	O	T	T	F	F
highDlPrbLoadRatioTarget	O	T	T	F	F
aveUlPrbLoadTarget	O	T	T	F	F
aveDlPrbLoadTarget	O	T	T	F	F
rANEnergyConsumptionTarget	O	T	T	F	F
rANEnergyEfficiencyTarget	O	T	T	F	F

6.2.2.1.1.4   ExpectationContexts

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

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
targetAssuranceTimeContext	O	T	F	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 the same as the 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
edgeIdentificationIdContext	CM	T	T	F	F
edgeIdentificationLocContext	CM	T	T	F	F
coverageAreaTAContext	CM	T	T	F	F

NOTE: Following are the qualifier description for attribute "edgeIdentificationIdContext" and " edgeIdentificationLocContext":

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

- In case of the Service deployment is needed at a particular location, the attribute "edgeIdentificationLocContext" 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 the same as 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 the same as 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

6.2.2.1.3 End-to-end Network Resource Optimization Expectation

6.2.2.1.3.1 Definition

End-to-end Network Resource Optimization Expectation is an IntentExpectation which can be used to represent MnS consumer's expectations for the resource optimization of network resources across multiple network domains, i.e., MnS consumer expresses its intent containing an intent expectation with targets on the whole network comprising RAN and Core Network.

The End-to-end Network Resource Optimization Expectation is defined utilizing the constructs of the generic IntentExpectation <<dataType>> with set of allowed values and concrete dataTypes specified. It enables optimization among desired targets for end-to-end network optimization based on a list of expectation targets that are provided in an ordered list where those at the top of the list are the most important.

Following are the specific allowed values when implemented the IntentExpectation for End-to-end Network Resource Optimization Expectation.

Table 6.2.2.1.3.1-1

Attribute	Allowed Values
objectType (CM)	Subnetwork
objectInstance (CM)	DN of the Subnetwork

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

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

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

6.2.2.1.3.2 ObjectContexts

Based on the common structure of ObjectContext, the concrete ObjectContexts for end-to-end Network Resource Optimization Expectation is the combination of ObjectContext defined for the RAN in clause 6.2.2.1.1.2 and for the 5GC in clause 6.2.2.1.4.2.

6.2.2.1.3.3 ExpectationTargets

Following provides the concrete ExpectationTargets for end-to-end Network Resource Optimization Expectation based on the common structure of ExpectationTarget. The attribute properties defined for these ExpectationTargets should be the same with the properties defined for ExpectationTargets in clause 6.2.1.3.

Editor's Note: Which KPIs defined in TS 28.554 can be used is FFS.

6.2.2.1.4 5GC Network Expectation

6.2.2.1.4.1 Definition

5GC Network Expectation is an IntentExpectation which can be used to represent MnS consumer's expectations for 5GC network (5GC SubNetwork) delivering

The 5GC 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 5GC Network Expectation.

Table 6.2.2.1.4.1-1

Attribute Name	Allowed Values
objectType (CM)	5GC SubNetwork
objectInstance (CM)	DN of the 5GC SubNetwork

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

- In case of the intent expectation is not for a specific 5GC SubNetwork instance or/and MnS consumer have no knowledge of the DN of this 5GC SubNetwork instance, the attribute "objectType" needs to be specified.

- In case of the intent expectation is for a specific 5GC SubNetwork instance and MnS consumer have the knowledge of the DN of this 5GC SubNetwork instance, the attribute "objectInstance" needs to specified.

6.2.2.1.4.2 ObjectContexts

Following provides the concrete ObjectContexts for 5GC 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 6.2.2.1.4.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
nfTypeContext	O	T	T	F	F
nfInstanceLocationContext	O	T	T	F	F
pLMNContext	O	T	T	F	F
taiContext	O	T	T	F	F
servingScopeContext	O	T	T	F	F
dnnContext	O	T	T	F	F

6.2.2.1.4.3 ExpectationTargets

Following provides the concrete ExpectationTargets for 5GC Network Expectation based on the common structure of ExpectationTarget. The properties of the attributes in the following table should be the same with properties of ExpectationTargets defined in clause 6.2.1.3.

Table 6.2.2.1.4.3-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
maxNumberofPDUsessionsTarget	O	T	T	F	F
maxNumberofRegisteredsubscribersTarget	O	T	T	F	F
incomingDataTarget	O	T	T	F	F
outgoingDataTarget	O	T	T	F	F

6.2.2.1.4.4 ExpectationContexts

Following provides the concrete ExpectationContexts for 5GC network Expectation based on the common structure of ExpectationContext. The attribute properties defined in the table below should be the same as the properties defined for ExpectationContexts in clause 6.2.1.3.

Table 6.2.2.1.4.4-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
startTimeContext	O	T	T	F	F
resourceSharingLevelContext	O	T	T	F	F

6.2.2.1.5 Radio Service Expectation

6.2.2.1.5.1 Definition

Radio Service Expectation is an IntentExpectation which can be used to represent MnS consumer's expectations for radio service (radio network as a service) delivering and assurance in the specified area.

The Radio Servive 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 Service Expectation.

Table 6.2.2.1.5.1-1

Attribute Name	Allowed Values
objectType	RadioService

Editor's Note: the allowed values for objectType needs further discussion (e.g., whether ObjectType value needs to refer to an IOC defined in an NRM fragment, the relation with RANSliceSubnet).

6.2.2.1.5.2 ObjectContexts

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

Table 6.2.2.1.5.2-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
coverageAreaPolygonContext	M	T	T	F	F
serviceTypeContext	M	T	T	F	F

6.2.2.1.5.3 ExpectationTargets

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

Table 6.2.2.1.5.3-1

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
dLLatencyTarget	O	T	T	F	F
uLLatencyTarget	O	T	T	F	F
dLThptPerUETarget	O	T	T	F	F
uLThptPerUETarget	O	T	T	F	F

NOTE: At least one of above targets needs to be supported.

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 GeoArea defined in 3GPP TS 28. 622 [6]	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 TAC defined in 3GPP TS 28. 622 [6]	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
dlFrequencyContext	It describes the downlink frequency information (RF reference frequencies and/or the frequency operating band) supported by the RAN SubNetwork that the intent expectation is applied. dLFrequencyContext is a Context including attributes: contextAtrribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: "dLFrequency" - contextCondition: "IS_ALL_OF" - contextValueRange: a list of Frequency defined in clause 6.2.1.3.13	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
ulFrequencyContext	It describes the uplink frequency information (RF reference frequencies and/ or the frequency operating band) supported by the RAN SubNetwork that the intent expectation is applied. uLFrequencyContext is a Context including attributes: contextAtrribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: uLFrequency"	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True

Attribute Name	Documentation and Allowed Values	Properties
	- contextCondition: "IS_ALL_OF" - contextValueRange: a list of Frequency defined in clause 6.2.1.3.13	
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
uEGroupContext	It describes the UE Groups (represented by specific 5QI, specific S-NSSAI, or specific combination of S-NSSAI and 5QI) that the intent expectation is applied. UEGroupContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: "UEGroup" - contextCondition: "IS_ALL_OF" - contextValueRange: a list of UEGroup <<dataType>>	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
targetAssuranceTimeContext	It describes the timeWindows (including startTime, endTime) when the targets in the Intent Expectation need to be assured. - contextAttribute: "targetAssuranceTime" - contextCondition: "IS_EQUAL_TO" - contextValueRange: a list of TimeWindow(s) defined in TS 28.622 [6].	type: Context multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: True
weakRSRPRatioTarget	It describes the downlink weak coverage ratio target for the RAN SubNetwork that the intent expectation is applied. The numerator is the number of the cells with downlink weak RSRP, and the denominator is the total number of cells of the RAN Subnetwork in the specified area. 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 cells (see RSRP measurements in TS 28.552 [6]) 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. The numerator is the number of the cells with low SINR, and the denominator is the total number of cells of the RAN Subnetwork in the specified area. LowSINRRatioTarget is an ExpectationTarget including attributes: targetName, targetCondition, targetValueRange and targetContxt. Following are the allowed values:	type:ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True

Attribute Name	Documentation and Allowed Values	Properties
	- targetName: "lowSINRRatio" - targetCondition: "IS_LESS_THAN" - targetValueRange: integer with allowed value [0,100] - targetContext: LowSINRContext	
`lowSINRRatioTarget.l owSINRContext`	It describes the threshold for low SINR of the cells (see SINR measurements in TS 28.552 [6]) of the 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 (see UL RAN UE throughput for a sub-network in TS 28.554[11]) 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 (see DL RAN UE throughput for a sub-network in TS 28.554[11]) 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
`lowULRANUEThptRatioT arget`	It describes the low UL RAN UE throughput ratio target for the RAN SubNetwork that the intent expectation is applied. The numerator is the number of the cells with low UL RAN UE throughput, and the denominator is the total number of cells of the RAN Subnetwork in the specified area. 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
`lowULRANUEThptRatioT arget.lowULRANUEThpt Context`	It describes the threshold for the low UL RAN UE throughput cells (see average UL RAN UE throughput in gNB and distribution of UL UE throughput in gNB in TS 28.552[6]) 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
`lowDLRANUEThptRatioT arget`	It describes the low DL RAN UE throughput ratio target for the RAN SubNetwork that the intent expectation is applied. The numerator is the	type: ExpectationTarget

Attribute Name	Documentation and Allowed Values	Properties
	number of the cells with low DL RAN UE throughput, and the denominator is the total number of cells of the RAN Subnetwork in the specified area. 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	multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
lowDLRANUEThptRatioT arget.lowDLRANUEThpt Context	It describes the threshold for the low DL RAN UE throughput cells (see average DL RAN UE throughput in gNB and distribution of DL UE throughput in gNB in TS 28.552[6]) 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
nfTypeContext	It identifies the types of NF supported by the 5GC SubNetwork that the intent expectation is applied. nfTypeContext is a Context including attributes: contextAtrribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: " nfType " - contextCondition:" IS_ALL_OF " - contextValueRange: a list of ENUM with allowed value: Enumeration NFType in 3GPP TS 29.510[13]	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
nfInstanceLocationCo ntext	It describes the location of NF instance supported by the 5GC SubNetwork that the intent expectation is applied. nfInstancelocationContext is a Context including attributes: contextAtrribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: " nfInstanceLocation " - contextCondition:" IS_ALL_OF " - contextValueRange: a list of string. See Locality in TS 29.510 [13]	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
taiContext	It describes the tracking area Identifiers supported by the 5GC SubNetwork that the intent expectation is applied. taiContext is a Context including attributes: contextAtrribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: "tai" - contextCondition:" IS_ALL_OF " - contextValueRange: a list of tai defined in TS 28.622 [6]	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
maxNumberofPDUsessio nsTarget	It describes the maximum number of PDU sessions for 5GC SubNetwork supporting that the intent expectation is applied. For details, see maxNumberofPDUsessions in clause 5.3.1.2 in TS 28.552 [12] maxNumberofPDUsessionsTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: "maxNumberofPDUsessions" - targetCondition: " IS_LESS_THAN"	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True

Attribute Name	Documentation and Allowed Values	Properties
	- targetValueRange: integer - targetContext: 5GSessionContext.	
maxNumberofPDUsessionsTarget.5GSessionContext	It describes the maximum supported 5G PDU session of the 5GC SubNetwork related to the intent expectation. 5GSessionContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: "5GSession" - contextCondition: "IS_ LESS_THAN" - contextValueRange: integer	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
maxNumberofRegisteredsubscribersTarget	It describes the maximum number of Registered subscribers for 5GC SubNetwork supporting that the intent expectation is applied. For details, see maxNumberofRegisteredsubscribers in clause 5.6.2 in TS 28.552 [12] maxNumberofRegisteredsubscribersTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: "maxNumberofRegisteredsubscribers" - targetCondition: " IS_LESS_THAN" - targetValueRange: Integer	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
highUlPrbLoadRatioTarget	It describes the high UL PRB load ratio target (as percentage) for the RAN SubNetwork that the intent expectation is applied. The numerator is the number of the cells with high UL PRB load, and the denominator is the total number of cells of the RAN Subnetwork in the specified area. HighUlPrbLoadRatioTarget is an ExpectationTarget including attributes: targetName, targetCondition,targetValueRange and targetContext. Following are the allowed values: - targetName: "highUlPrbLoadRatio" - targetCondition: "IS_LESS_THAN " - targetValueRange: integer with allowed value [0,100] % - targetContext: HighUlPrbLoadContext	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
highUlPrbLoadRatioTarget.HighUlPrbLoadContext	It describes the threshold for high uplink PRB load (i.e. UL Total PRB Usage in TS 28.552 [12] to represent the percentage of UL PRBs used) of the cells of the RAN SubNetwork in the specified area that the intent expectation is applied. HighUlPrbLoadContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: "HighUlPrbLoad" - contextCondition: "IS_GREATER_THAN" - contextValueRange: integer with allowed value [0,100] %	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
highDlPrbLoadRatioTarget	It describes the high DL PRB load ratio target (as percentage) for the RAN SubNetwork that the intent expectation is applied. The numerator is the number of the cells with high DL PRB load, and the denominator is the total number of cells of the RAN Subnetwork in the specified area. HighDlPrbLoadRatioTarget is an ExpectationTarget including attributes: targetName, targetCondition, targetValueRange and targetContext. Following are the allowed values: - targetName: "highDlPrbLoadRatio" - targetCondition: "IS_LESS_THAN " - targetValueRange: integer with allowed value [0,100] % - targetContext: HighDlPrbLoadContext	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True

Attribute Name	Documentation and Allowed Values	Properties
highDlPrbLoadRatioTarget.HighDlPrbLoadContext	It describes the threshold for high downlink PRB load (i.e. DL Total PRB Usage in TS 28.552 [12] to represent the percentage of DL PRBs used) of the cells of the RAN SubNetwork in the specified area that the intent expectation is applied. HighDlPrbLoadContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: "HighDlPrbLoad" - contextCondition: "IS_GREATER_THAN" - contextValueRange: integer with allowed value [0,100] %	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
aveUlPrbLoadTarget	It describes the average uplink PRB load target (i.e. UL Total PRB Usage in TS 28.552 [12] to represent the percentage of UL PRBs used) of the cells of the RAN SubNetwork that the intent expectation is applied. AveULPrbLoadTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: "aveULPrbLoad" - targetCondition: "IS_LESS_THAN" - targetValueRange: integer with allowed value [0,100] %	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
aveDlPrbLoadTarget	It describes the average downlink PRB load (i.e. DL Total PRB Usage in TS 28.552 [12] to represent the percentage of DL PRBs used) target for RAN SubNetwork that the intent expectation is applied. AveDLPrbLoadTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: "aveDLPrbLoad" - targetCondition: "IS_LESS_THAN" - targetValueRange: integer with allowed value [0,100] %	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
rANEnergyConsumptionTarget	It describes the RAN energy consumption target for RAN SubNetwork that the intent expectation is applied. The definition for RAN energy consumption see EC$_{NG-RAN}$ in clause 6.7.3.4.1 in TS 28.554 [11]. RANEnergyConsumptionTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: "rANEnergyConsumption" - targetCondition: "IS_LESS_THAN" - targetValueRange: Integer	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
rANEnergyEfficiencyTarget	It describes the RAN energy efficiency target for RAN SubNetwork that the intent expectation is applied. The unit of this target is bit/J. The definition for RAN energy efficiency target for RAN SubNetwork see EE$_{MN,DV}$ in clause 6.7.1.1 in TS 28.554 [11] RANEnergyEfficiencyTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: " rANEnergyEfficiency " - targetCondition: " IS_GREATER_THAN" - targetValueRange: Integer	type: ExpectationTarget 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: DateTime	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True

Attribute Name	Documentation and Allowed Values	Properties
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: DateTime	type:Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
edgeIdentificationIdContext	This identifies the edge network where the service needs to be deployed. For details see EDNidentifier defined in TS 28.538 [9]. 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: String	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
edgeIdentificationLocContext	This identifies the location where the service needs 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: GeoCoordinate dfined in TS 28.622 [6].	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 TAC defined in 3GPP TS 28.622 [6]	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
EdgeServiceSupport Expectation. dlThptPerUETarget	It describes the DL throughput target by the per UE for the edge service Supporting that the intent expectation is applied. For details see dlThptPerUE defined in clause 6.3.1 of TS 28.541 [5]. DLThptperUETarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange: - targetName: "DLThptperUE" - targetCondition: "IS_GREATER_THAN" - targetValueRange: Integer.	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
EdgeServiceSupport Expectation. ulThptPerUETarget	It describes the UL throughput target by the per UE for the edge service Supporting that the intent expectation is applied. For details see ulThptPerUE defined in clause 6.3.1 of TS 28.541 [5]. ULThptperUETarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. - targetName: "ulThptperUE" - targetCondition: "IS_GREATER_THAN" - targetValueRange: Integer.	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
EdgeServiceSupport Expectation. dLLatencyTarget	It describes the DL latency target for the edge service Supporting that the intent expectation is applied. DLLatencyTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. For details see attribute dlLatency defined in clause 6.3.1 of TS 28.541 [5]. - targetName: "dLLatency" - targetCondition: "IS_LESS_THAN" - targetValueRange: Integer.	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True

Attribute Name	Documentation and Allowed Values	Properties
EdgeServiceSupport Expectation.`uLLatencyTarget`	It describes the UL latency target for the edge service Supporting that the intent expectation is applied. For details see attribute ulLatency defined in clause 6.3.1 of TS 28.541 [5]. uLLatencyTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. - targetName: "uLLatency" - targetCondition: "IS_LESS_THAN" - targetValueRange: Integer.	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
EdgeServiceSupport Expectation.`maxNumberofUEsTarget`	It describes the the number of UEs for edge service supporting that the intent expectation is applied. For details see attribute maxNumberofUE defined in clause 6.3.1 of of TS 28.541 [5]. maxNumberofUEsContext is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: "maxNumberofUEs" - targetCondition: " IS_LESS_THAN" - targetValueRange: Integer.	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
EdgeServiceSupport Expectation.`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. For details see activityFactor in clause 6.3.1 in TS 28.541 [5.] activityFactorTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: " activityFactor " - targetCondition: " IS_EQUAL_TO" - targetValueRange: Integer	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
EdgeServiceSupport Expectation.`uESpeedTarget`	It describes the speed (in km/hour) supported for edge service supporting that the intent expectation is applied. For details see uESpeed in clause 6.3.1 in TS 28.541[5]. uESpeedTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: "uESpeed" - targetCondition: " IS_LESS_THAN" - targetValueRange: Integer	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
EdgeServiceSupport Expectation.`uEMobilityLevelContext`	It describes the mobility level of UE for edge service supporting that the intent expectation is applied. For details see uEMobilityLevel in clause 6.3.1 in TS 28.541 [5.] uEMobilityLevelContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: " uEMobilityLevel " - contextCondition: "IS_EQUAL_TO" - contextValueRange: ENUM.	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
EdgeServiceSupport Expectation.`resourceSharingLevelContext`	It describes the resource sharing level for which the intent expectation is applied. For details see resourceSharinglevel in clause 6.3.1 in TS 28.541 [5]. resourceSharingLevelContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: "resourceSharingLevel" - contextCondition: "IS_EQUAL_TO" - contextValueRange: ENUM	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True

Attribute Name	Documentation and Allowed Values	Properties
`RadioServiceExpectation.coverageAreaPolygonContext`	It describes the coverage areas for the Radio Service 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
`RadioServiceExpectation.serviceTypeContext`	It describes the service type for the Radio Service that the intent expectation is applied. For details see sST in clause 6.4.1 in TS 28.541 [5]. ServiceTypeContext is a Context including attributes: contextAttribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: "serviceType" - contextCondition: "IS_EQUAL_TO" - contextValueRange: string	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
`RadioServiceExpectation.dlThptPerUETarget`	It describes the DL throughput target per UE for the Radio Service that the intent expectation is applied. For details see dlThptPerUE defined in clause 6.3.1 of TS 28.541 [5]. DLThptperUETarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange: - targetName: "DLThptperUE" - targetCondition: "IS_GREATER_THAN" - targetValueRange: Integer.	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
`RadioServiceExpectation.ulThptPerUETarget`	It describes the UL throughput target per UE for the Radio Service that the intent expectation is applied. For details see ulThptPerUE defined in clause 6.3.1 of TS 28.541 [5]. ULThptperUETarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. - targetName: "ulThptperUE" - targetCondition: "IS_GREATER_THAN" - targetValueRange: Integer.	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
`RadioServiceExpectation.dLLatencyTarget`	It describes the DL latency target for the Radio Service that the intent expectation is applied. DLLatencyTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. For details see attribute dlLatency defined in clause 6.3.1 of TS 28.541 [5]. - targetName: "dLLatency" - targetCondition: "IS_LESS_THAN" - targetValueRange: Integer.	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
`RadioService.ExpectationuLLatencyTarget`	It describes the UL latency target for the Radio Service that the intent expectation is applied. For details see attribute ulLatency defined in clause 6.3.1 of TS 28.541 [5]. uLLatencyTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. - targetName: "uLLatency" - targetCondition: "IS_LESS_THAN" - targetValueRange: Integer.	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
`servingScopeContext`	It describes the served area(s) of the 5GC NF instance supported by the 5GC SubNetwork that the intent expectation is applied. For detail, see servingScope in TS 29.510[13]. servingScopeContext is a Context including attributes: contextAtrribute, contextCondition and contextValueRange.	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None

Attribute Name	Documentation and Allowed Values	Properties
	Following are the allowed values: - contextAttribute: " servingScope " - contextCondition:" IS_ALL_OF " - contextValueRange: a list of string.	isNullable: True
dnnContext	It describes the DNN of the 5GC NF instance supported by the 5GC SubNetwork that the intent expectation is applied. dnnContext is a Context including attributes: contextAtrribute, contextCondition and contextValueRange. Following are the allowed values: - contextAttribute: " dnn " - contextCondition:" IS_ALL_OF " - contextValueRange: a list of string as specified in 3GPP TS 23.003 [15]	type: Context multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
incomingDataTarget	It describes the maximum incoming data packets for 5GC SubNetwork related to the intent expectation. For details, see N6 incoming link usage measurement in clause 5.4.2.1 in TS 28.552 [12] incomingDataTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: "incomingData" - targetCondition: " IS_LESS_THAN" - targetValueRange: integer	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
outgoingDataTarget	It describes the maximum outgoing data packets for 5GC SubNetwork related to the intent expectation. For details, see N6 outgoing link usage measurement in clause 5.4.2.2 in TS 28.552 [12] outgoingDataTarget is an ExpectationTarget including attributes: targetName, targetCondition and targetValueRange. Following are the allowed values: - targetName: "outgoingData" - targetCondition: " IS_LESS_THAN" - targetValueRange: integer	type: ExpectationTarget multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: True
startTimeContext	This describes the start time at which the expected result of the expectation shall be available. Following are the allowed values: - contextAttribute: "startTime" - contextCondition: "IS_EQUAL_TO" - contextValueRange: DateTime	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.
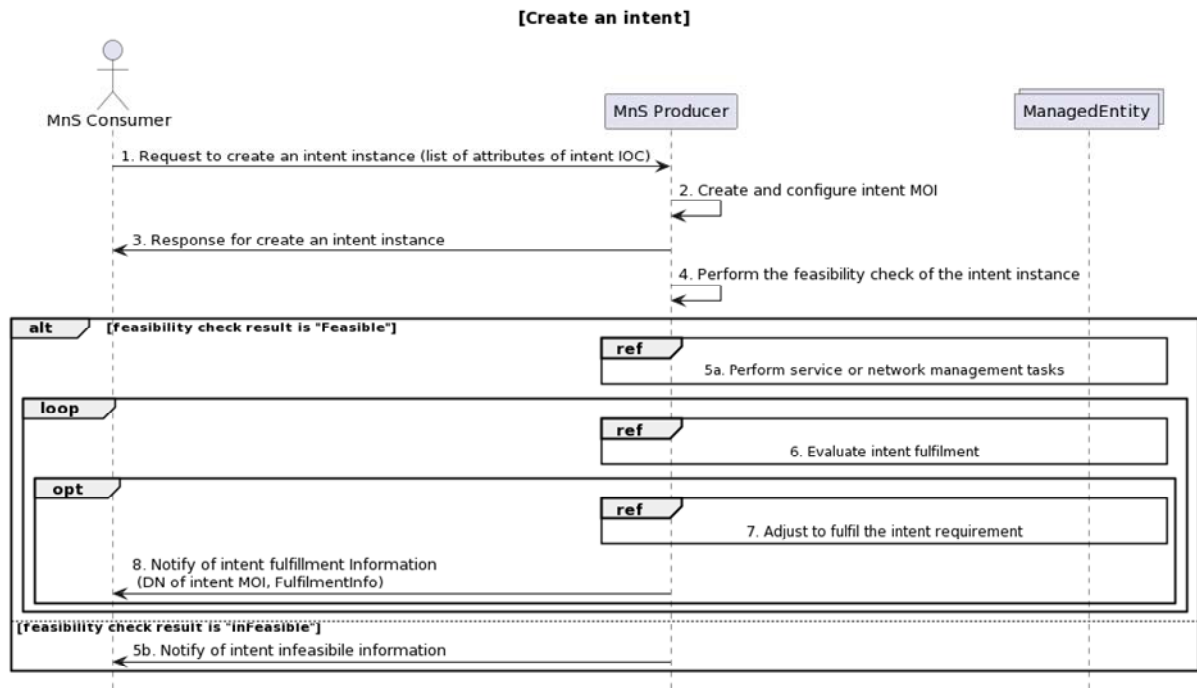
[Create an intent]

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 sees 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', steps 5a-step8 are continuously 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 report instance and corresponding intent report information that contains one or any

combination of `intentFulfilmentReport`, `intentConflictReport` and `intentFeasibilityCheckReport` which are required by the MnS Consumer.

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

5b. MnS Producer notifies MnS consumer about `intentFeasibilityCheckReport` with infeasible information 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.
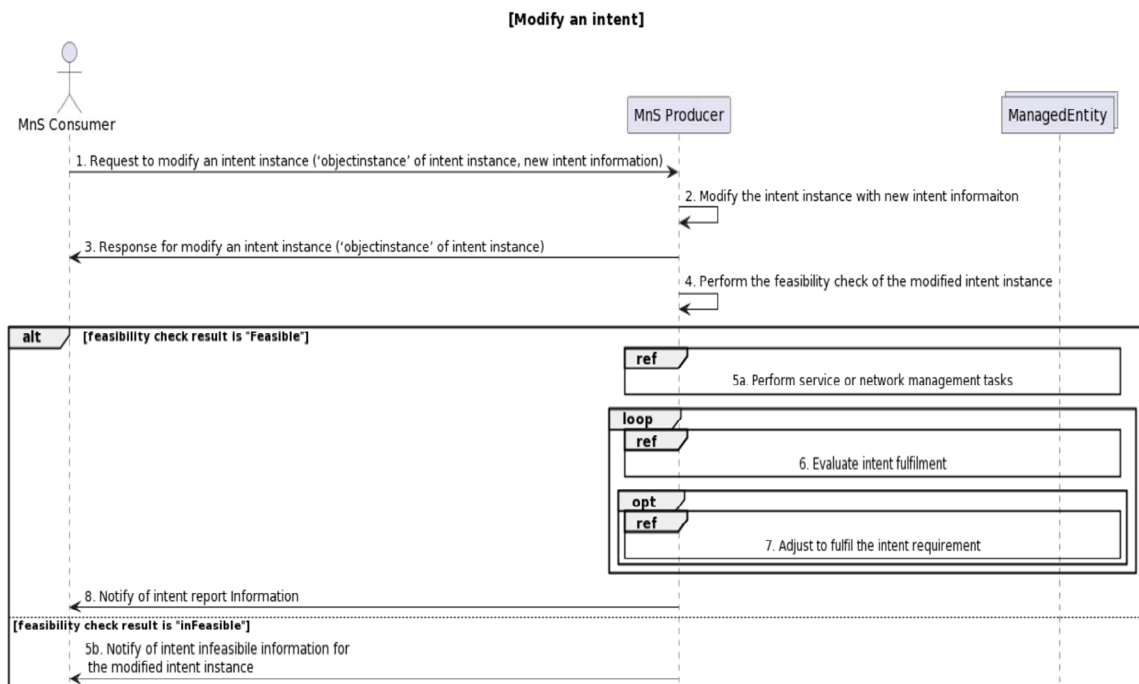
Figure 6.3.3-1: Procedure for modify an intent

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 intent report instance and corresponding intents report information that contains one or any combination of `intentFulfilmentReport`, `intentConflictReport` and `intentFeasibilityCheckReport`.

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

5b.   MnS Producer notifies MnS consumer about `intentFeasibilityCheckReport` with 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.
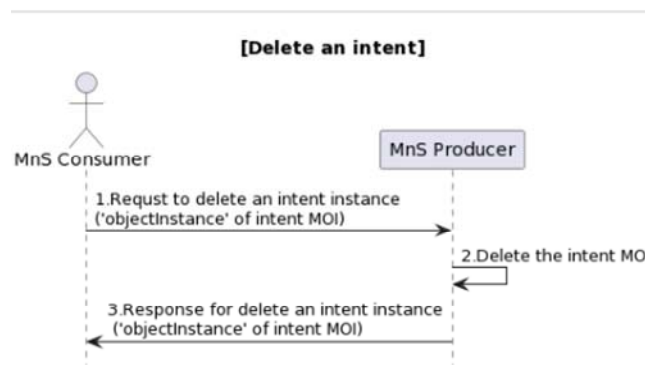
Figure 6.3.4-1: Procedure for delete an intent

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.
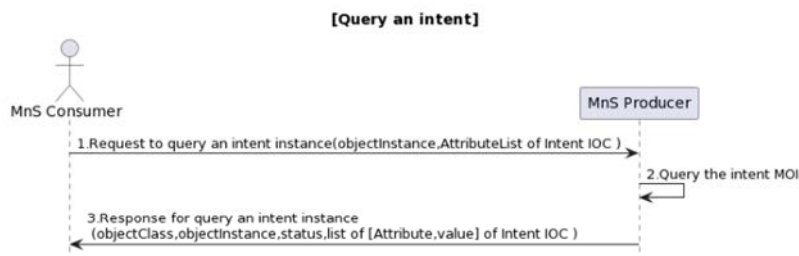
Figure 6.3.5-1: Procedure for query an intent

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.

6.3.6   Intent conflict resolution

6.3.6.0   Procedure

[Intent conflict resolution]

Intent MnS Consumer

Intent MnS Producer

1. Subscribe for notifyMOIChanges

2. Detect conflict

3. Configure IntentReport MOI

4. Notification notifyMOIChanges

alt   [Consumer decides to delete the intent]

5. deleteMOI

[Consumer decides to modify the intent]

6. modifyMOIAttributes
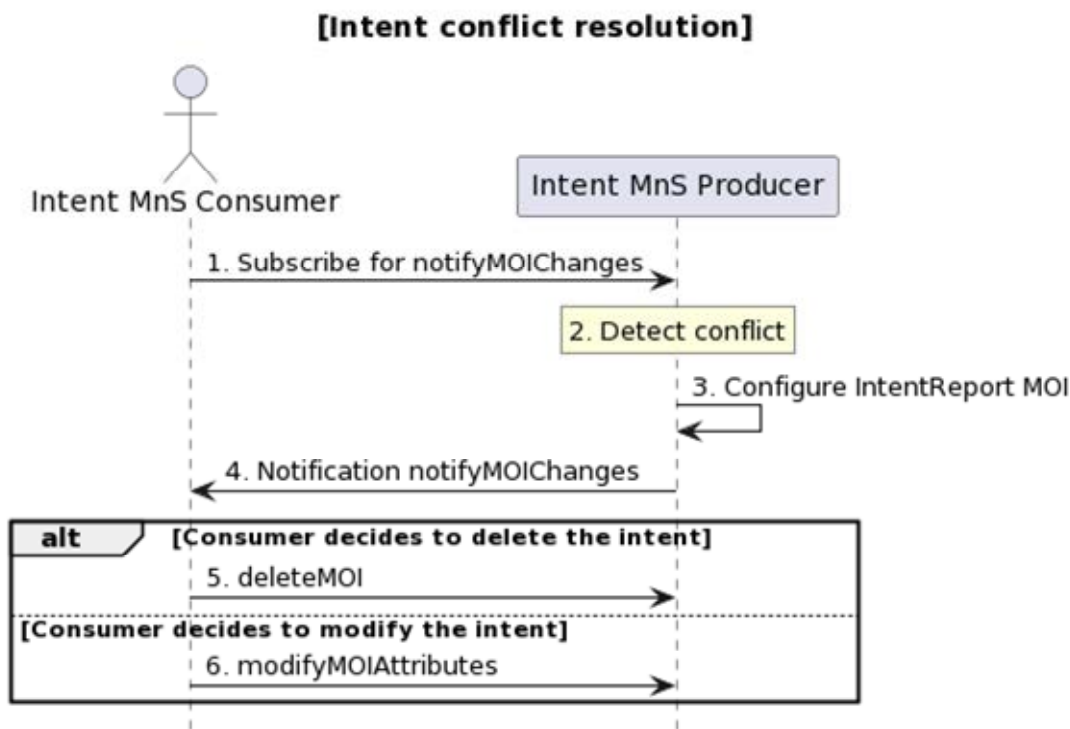
Figure 6.3.6-1: Procedure for Intent Conflict Resolution

1) MnS Consumer subscribes to receive notifyMOIChanges related to IntentReport MOI using NtfSubscriptionControl as defined in clause 4.3.22 of TS 28.622 [6].

2) MnS Producer detects the intent-related conflict(s).

3) MnS Producer configures IntentReport MOI with attributes describing the intent conflict.

4) MnS Producer notifies the modification of IntentReport MOI using notifyMOIChanges as defined in TS 28.532 [3]. The notification contains the IntentReport MOI attributes which may include information to assist MnS Consumer to resolve the conflict.

5) MnS Consumer may send a deleteMOI request to delete the intent identified by the MnS Producer in the report.

6) MnS Consumer may send a modifyMOIAttributes request to modify the Intent, Expectation and/or Target based on the information provided in the report.

6.3.6.1   Resolution of an intent conflict based on pre-emption

In the procedure for intent conflict resolution, it is necessary to recommend which intent instance is the target of intent deletion or intent modification. Typically, MnS producer chooses the intent instance based on intent priority level. Intent instance that has lower intent priority will be recommended as the target of intent deletion or intent modification. However, if two conflicting intents have the same priority, it is impossible for MnS producer to choose the intent instance that is target of intent deletion or intent modification. In this case, the intent instance that is target of intent deletion or intent modification is identified using pre-emption. Based on pre-emption, the choise is made using the

attributes of " `intentPreemptionCapability`". The " `intentPreemptionCapability`" specifies whether pre-emption shall be applied. The role of MnS Consumer and MnS Producer is as follows: MnS Consumer can set intent pre-emption capability as "TRUE" for prioritized intent during pre-emption. MnS Producer decides the target of intent deletion or intent modification during pre-emption. Here, there are existing intent and new intent. When MnS Producer creates new intent, there is a conflict between the existing intent and new intent with same priority. If `intentPreemptionCapability` ="TRUE" for existing intent, target of intent deletion or intent modification is new intent. If `intentPreemptionCapability` ="FALSE" for existing intent and `intentPreemptionCapability` ="TRUE" for new intent, target of intent deletion or intent modification will be existing intent. If both existing intent and new intent have the same value for `intentPreemptionCapability`, new intent will be target of intent deletion or intent modification.

6.3.7 Intent Report Management

6.3.7.1 Overview of Intent Report Management

Figure 6.3.7.1-1 illustrates the procedure for intent report management.
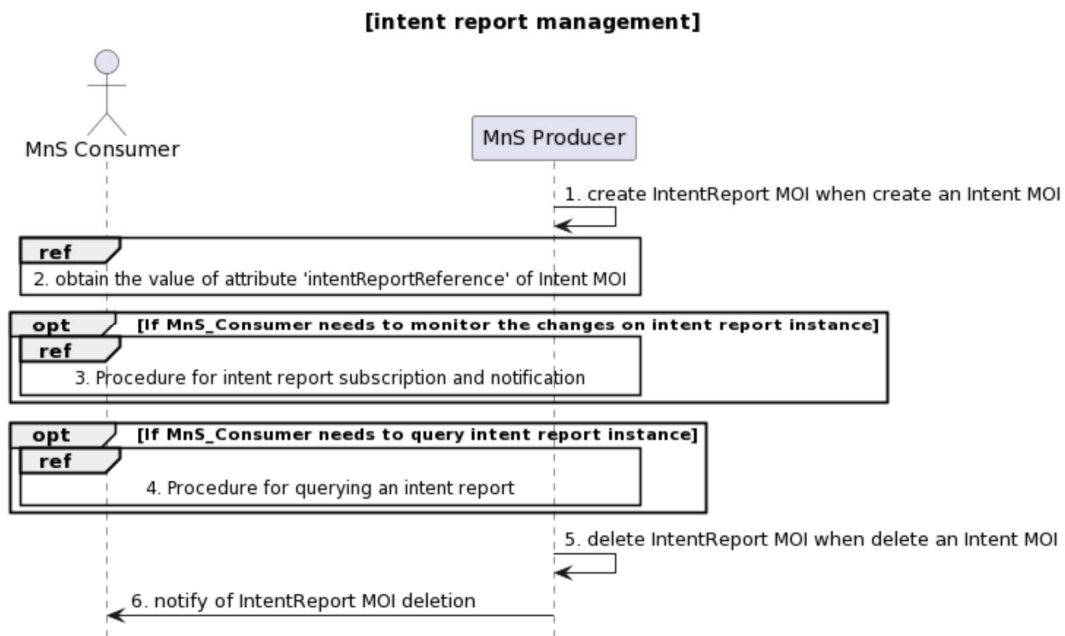
Figure 6.3.7.1-1: intent report management

1. MnS Producer creates the IntentReport MOI (i.e. instance of IntentReport IOC) when creating an Intent MOI. MnS producer also configures 'intentReportReference' of the Intent MOI. The detailed intent MOI creation see step 1 and step 2 in procedure to create an intent in clause 6.3.2.

2. MnS Consumer obtains the value of attribute 'intentReportReference' of Intent MOI. The value of attribute 'intentReportReference' of Intent MOI represents the DN of the created IntentReport MOI.

3. If MnS Consumer needs to monitor the changes on intent report instance, MnS consumer triggers the procedure for intent report subscription and notification as defined in clause E.1.2.

4. If MnS Consumer needs to query intent report instance , MnS consumer triggers the procedure for querying intent report instance as defined in clause E.1.1. This step can happen anytime until the IntentReport MOI is deleted.

5. MnS Producer deletes the IntentReportMOI when deleting an Intent MOI. The detailed intent MOI deletion see procedure for deleting an intent in clause 6.3.4.

6. MnS producer sends a NotifyMOIDeletion notification notifies the MnS consumer about deletion of IntentReport MOI.

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, IntentReport and IntentHandlingFunction.

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}
Activate an intent	modifyMOIAttributes operation	PUT PATCH	{MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{intent}={id}
Deactivate an intent	modifyMOIAttributes operation	PUT PATCH	{MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{intent}={id}

Following is the SS to support intent report management based on Table 12.1.1.1.1-1 and Table 12.1.1.2.1-1 in TS 28.532 [3].

Table 7.1-2: SS to support intent report management

intent report management	IS operation	HTTP Method	Resource URI
Query an intent report	getMOIAttributes operation	GET	{MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{intentReport}={id}
Subscribe an intent report	createMOI operation	PUT	{MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{NtfSubscriptionControl }={id}
Notify an intent report	notifyMOIAttributeValueChanges notification	POST	{notificationTarget}
Unsubscribe an intent report	deleteMOI operation	DELETE	{MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{NtfSubscriptionControl }={id}
Query an intent report subscription	getMOIAttributes operation	GET	{MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{NtfSubscriptionControl }={id}

NOTE: The NtfSubscriptionControl is defined in TS 28.622 [6].

Following is the SS to support intent handling capability obtaining based on Table 12.1.1.1.1-1 in TS 28.532 [3].

Table 7.1-2: SS to support intent handling capability obtaining

intent report management	IS operation	HTTP Method	Resource URI
Query intent handling capability	getMOIAttributes operation	GET	{MnSRoot}/ProvMnS/{MnSVersion}/{URI-LDN-first-part}/{intentHandlingFunction}={id}

7.2 OpenAPI specification

7.2.1 OpenAPI document for provisioning MnS

The OpenAPI/YAML definitions for provisioning MnS are specified in 3GPP Forge [16].

Directory: OpenAPI

File: TS28532_ProvMnS.yaml

7.2.2 OpenAPI document for intent NRM

The OpenAPI/YAML definitions for intent NRM are specified in 3GPP Forge [16].

Directory: OpenAPI

File: TS28312_IntentNrm.yaml

7.2.3 OpenAPI document for scenario specific IntentExpectation

The OpenAPI/YAML definitions for scenario specific IntentExpectation are specified in 3GPP Forge [16].

Directory: OpenAPI

File: TS28312_IntentExpectations.yaml

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 provides the information on which ObjectContexts and ExpectationTargets defined in clause 6.2.2 are used for the corresponding use case.

Table 8-1: Guidelines for using scenario specific intent expectation for intent driven use cases

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 - dlFrequencyContext - ulFrequencyContext - rATContext	-weakRSRPRatioTarget - lowSINRRatioTarget - aveULRANUEThptTarget - aveDLRANUEthptTarget
Intent containing an expectation for delivering a service at the edge (clause 5.1.3)	Edge Service Support Expectation	- edgeIdentificationIdContext - edgeIdentificationLocContext - 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 - dlFrequencyContext - ulFrequencyContext - rATContext	-weakRSRPRatioTarget -lowSINRRatioTarget
Intent containing an expectation on RAN UE throughput performance to be assured (clause 5.1.5)	Radio Network Expectation	- coverageAreaPolygonContext - dlFrequencyContext - ulFrequencyContext - rATContext - uEGroupContext	- aveULRANUEThptTarget - aveDLRANUEthptTarget - lowULRANUEThptRatioTarget - lowDLRANUEThptRatioTarget
Intent containing an expectation for delivering 5GC network (clause 5.1.8)	5GC Network Expection	- nfTypeContext - nfInstanceLocationContext - pLMNContext- taiContext - servingScopeContext - dnnContext	- maxNumberofPDUsessionsTarget - maxNumberofRegisteredsubscribersTarget - incomingDataTarget - outgogingDataTarget
Intent containing an expectation on RAN capacity performance to be assured (clause 5.1.5)	Radio Network Expectation	- coverageAreaPolygonContext - dlFrequencyContext - ulFrequencyContext - rATContext	- highUlPrbLoadRatioTarget - highDlPrbLoadRatioTarget - aveUlPrbLoadTarget - aveDlPrbLoadTarget
Intent containing an expectation on RAN energy saving (clause 5.1.7)	Radio Network Expectation	- coverageAreaPolygonContext - pLMNContext - dlFrequencyContext - ulFrequencyContext - rATContext	- rANEnergyConsumptionTarget -rANEnergyEfficiencyTarget - aveULRANUEThptTarget - aveDLRANUEThptTarget
Intent containing an expectation for delivering radio service (clause 5.1.2)	Radio Service Expectation	- coverageAreaPolygonContext - serviceType	- dLLatencyTarget - uLLatencyTarget - dLThptPerUETarget - uLThptPerUETarget

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
  MnS_Producer -> MnS_Consumer:8. Notify of intent fulfillment Information\n (DN of intent MOI,
FulfilmentInfo)
     end
  end


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 "[Modify 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 modify an intent instance ('objectinstance' of intent
instance,new intent information)
MnS_Producer -> MnS_Producer: 2. Modify the intent instance with new intent information
MnS_Producer -> MnS_Consumer: 3. Response for modify an intent instance ('objectinstance' of intent
instance)
MnS_Producer -> MnS_Producer: 4. Perform the feasibility check of the modified 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 report Information

else feasibility check result is "inFeasible"
  MnS_Producer -> MnS_Consumer: 5b. Notify of intent infeasibile information for \n the modified
intent instance
end
hide footbox
@enduml
```

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.1.5   Intent Report Management

A.1.5.1   Intent report management

```
@startuml
title [intent report management]
actor "MnS Consumer" as MnS_Consumer
participant "MnS Producer" as MnS_Producer
MnS_Producer -> MnS_Producer: 1. create IntentReport MOI when create an Intent MOI
Ref over MnS_Consumer, MnS_Producer: 2. obtain the value of attribute 'intentReportReference' of
Intent MOI

Opt If MnS_Consumer needs to monitor the changes on intent report instance
Ref over MnS_Consumer, MnS_Producer: 3. Procedure for intent report subscription and notification
End

Opt If MnS_Consumer needs to query intent report instance
Ref over MnS_Consumer, MnS_Producer: 4. Procedure for querying an intent report
End

MnS_Producer -> MnS_Producer: 5. delete IntentReport MOI when delete an Intent MOI
MnS_Producer -> MnS_Consumer: 6. notify of IntentReport MOI deletion

hide footbox
@enduml
```

A.1.5.2   Query an intent report

```
@startuml
title [Query an intent report]
actor "MnS Consumer" as MnS_Consumer
participant "MnS Producer" as MnS_Producer
MnS_Consumer -> MnS_Producer: 1. Request to query an intent report
instance(objectInstance,AttributeList of IntentReport IOC )
MnS_Producer -> MnS_Producer: 2. Read the intent report MOI
MnS_Producer -> MnS_Consumer: 3. Response for querying an intent report instance \n
(objectClass,objectInstance,status,list of [Attribute,value] of IntentReport IOC )
hide footbox
@enduml
```

A.1.5.3 Intent report subscription and notification

```
@startuml
title [Intent report subscription and notification]
actor "MnS Consumer" as MnS_Consumer
participant "MnS Producer" as MnS_Producer
MnS_Consumer -> MnS_Producer: 1. Requst to create NtfSubscriptionControl instance for an intent
report instance\n(including objectInstance and list of NtfSubscriptionControl IOC)
MnS_Producer -> MnS_Producer: 2. Create a NtfSubscriptionControl MOI for the intent report instance
\n and configure the created NtfSubscriptionControl MOI
MnS_Producer -> MnS_Consumer: 3. Reponse for creating NtfSubscriptionControl instance for an intent
report instance

loop until the NtfSubscriptionControl MOI is deleted

MnS_Producer -> MnS_Producer: 4. Configure the value of the atttributes for IntentReport MOI
MnS_Producer -> MnS_Consumer: 5. Notify intent report information \n (objectinstance,
attributeListValueChanges of IntentReport MOI)

end

hide footbox
@enduml
```

A.1.6 Intent Handling Capability Obtaining

A.1.6.1 Query intent handling capability suported by an intentHandlingFunction

```
@startuml
title [Query intent handling capability supported by an intentHandlingFunction]
actor "MnS Consumer" as MnS_Consumer
participant "MnS Producer" as MnS_Producer
MnS_Consumer -> MnS_Producer: 1. Request to query intent handling capabilities supported by an
IntentHandlingFunction \n (objectInstance of IntentHandlingFunction MOI,AttributeList of
IntentHandlingFunction MOI)
MnS_Producer -> MnS_Producer: 2. Read the value of the attribute \n "intentHandlingCapabilityList"
of intentHandlingFunction MOI
MnS_Producer -> MnS_Consumer: 3. Response for querying intent handling capabilities supported by an
IntentHandlingFunction\n objectInstance,list of [Attribute,value] of IntentHandlingFunction MOI )
hide footbox
@enduml
```

A.1.7 Intent conflict resolution

```
@startuml
title "[Intent conflict resolution]"
actor "Intent MnS Consumer" as Consumer
participant "Intent MnS Producer" as Producer
Consumer -> Producer: 1. Subscribe for notifyMOIChanges
rnote over Producer
 2. Detect conflict
endrnote
Producer -> Producer: 3. Configure IntentReport MOI
Producer -> Consumer: 4. Notification notifyMOIChanges
alt Consumer decides to delete the intent
   Consumer -> Producer: 5. deleteMOI
else Consumer decides to modify the intent
   Consumer -> Producer: 6. modifyMOIAttributes
end alt
hide footbox
@enduml
```

A.2 Information model definition for intent

A.2.1 Relationship UML diagram for intent (figure 6.2.1.1.1-1)

```
@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 IntentHandlingFunction" as IntentHandlingFunction{}
class "<<InformationObjectClass>>\n Intent " as Intent {}
class "<<InformationObjectClass>>\n IntentReport" as IntentReport{}

ManagedEntity "1" *-- "*" IntentHandlingFunction : <<names>>
IntentHandlingFunction "1" *-- "*" Intent : <<names>>
IntentHandlingFunction "1" *-- "1..*" IntentReport : <<names>>
IntentReport "*" <-left-> "1" Intent

note left of ManagedEntity
Represents the folllowing IOCs:
SubNetwork
end note

@enduml
```

A.2.2 Relationship UML diagram for intent (figure 6.2.1.1.1-2)

```
@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 "<<InformationObjectClass>>\n Intent " as Intent{}
class "<<dataType>>\n IntentExpectation" as IntentExpectation{}
class "<<dataType>>\n Context" as IntentContext{}
class "<<dataType>>\n ExpectationObject" as ExpectationObject{}
class "<<dataType>>\n Context" as ObjectContext{}
class "<<dataType>>\n ExpectationTarget" as ExpectationTarget{}
class "<<dataType>>\n Context" as TargetContext{}
class "<<dataType>>\n Context" as ExpectationContext{}

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 bottom of IntentContext
Represents Intent Context
end note

note bottom of ExpectationContext
Represents Expectation Context
end note
```

```
note bottom of ObjectContext
Represents Object Context
end note

note bottom of TargetContext
Represents Target Context
end note


@enduml
```

A.2.3   Relationship UML diagram for intentReport IOC (figure 6.2.1.1.1-3)

```
@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 "<<InformationObjectClass>>\n IntentReport" as IntentReport{}
class "<<dataType>>\n IntentFulfilmentReport" as IntentFulfilmentReport{}
class "<<dataType>>\n IntentConflictReport" as IntentConflictReport{}
class "<<dataType>>\n IntentFeasibilityCheckReport" as IntentFeasibilityCheckReport{}
class "<<dataType>>\n ExpectationFulfilmentResult" as ExpectationFulfilmentResult{}
class "<<dataType>>\n TargetFulfilmentResult" as TargetFulfilmentResult{}


IntentReport "1" -- "1" IntentFulfilmentReport
IntentReport "1" -- "*" IntentConflictReport
IntentReport "1" -- "1" IntentFeasibilityCheckReport
IntentFulfilmentReport "1" -- "1..*" ExpectationFulfilmentResult
ExpectationFulfilmentResult "1" -- "1..*" TargetFulfilmentResult

@enduml
```

A.2.4   Relationship UML diagram for Inheritance UML diagram for intent driven management (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 "<<InformationObjectClass>> \n  Top " as TOP{}
class "<<InformationObjectClass>>\n Intent " as Intent{}
class "<<InformationObjectClass>>\n IntentReport " as IntentReport{}
class "<<InformationObjectClass>>\n IntentHandlingFunction " as IntentHandlingFunction{}
TOP  <|--  Intent
```

```
TOP  <|--  IntentReport
TOP  <|--  IntentHandlingFunction
@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 refined if the initially captured requirement needs further detalization, etc.

The intent lifecycle consists of the following phases.
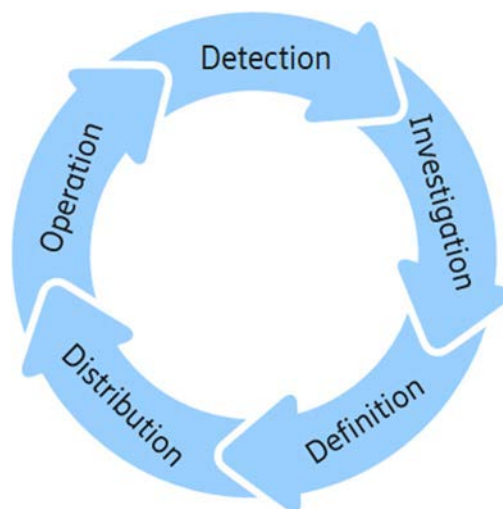
Figure B.1-1: Intent Lifecycle Phases

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.0 Introduce

This clause provides the YAML document examples for scenario specific intent instance according to the OpenAPI specification defined in clause 7.2. Following examples do not include the complete attributes defined in the OpenAPI specification.

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

```
Intent:
  id: 'Intent_1'
  userLabel: 'Radio_Network_Deliver'
  intentExpectation:
    - expectationId: '1'
      expectationVerb: 'Deliver'
      expectationObjects:
        - objectType: 'RAN_SubNetwork'
          objectContexts:
            - contextAttribute: 'CoverageAreaPolygon'
              contextCondition: 'IS_ALL_OF'
              contextValueRange:
                - convexGeoPolygon:
                  - latitude: '31.2696'
                    longitude: '121.6322'
                  - latitude: '31.2668'
                    longitude: '121.6323'
                  - latitude: '31.2669'
                    longitude: '121.6412'
                  - latitude: '31.2696'
                    longitude: '121.6410'
            - contextAttribute: 'PLMN'
              contextCondition: 'IS_ALL_OF'
              contextValueRange:
                - '46000'
            - contextAttribute: 'CoverageAreaTA'
              contextCondition: 'IS_ALL_OF'
              contextValueRange:
                - '4457507'
            - contextAttribute: 'DlFrequency'
              contextCondition: 'IS_ALL_OF'
              contextValueRange:
                - arfcn: '384000'
                - freqband: 'n39'
            - contextAttribute: 'UlFrequency'
              contextCondition: 'IS_ALL_OF'
              contextValueRange:
                - arfcn: '380000'
                - freqband: 'n2'
            - 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'
  intentPriority: '1'
  observationPeriod: '60'
  intentReportReferece: 'IntentReport_1'
```

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

```
Intent:
  id: 'Intent_2'
  userLabel: 'Edge_Service_Deliver'
  intentExpectation:
    - expectationId: '1'
      expectationVerb: 'Deliver'
      expectationObjects:
        - objectType:  'Edge_Service_Support'
          objectContexts:
            - contextAttribute: 'EdgeIdentificationId'
              contextCondition: 'IS_EQUAL_TO'
              contextValueRange:
                - '46000'
            - contextAttribute: 'EdgeIdentificationLoc'
              contextCondition: 'IS_EQUAL_TO'
              contextValueRange:
                - latitude: '31.2696'
                  longitude: '121.6322'
            - 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_EQUAL_TO'
          contextValueRange:
            - 'NOMADIC'
```

```
        - contextAttribute: 'ResourceSharingLevel'
          contextCondition: 'IS_EQUAL_TO'
          contextValueRange:
            - 'SHARED'
  intentPriority: '2'
  observationPeriod: '60'
  intentReportReferece: 'IntentReport_2'
```

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

```
Intent:
  id: 'Intent_3'
  userLabel: 'Radio_Network_Coverage_Performance_Assurance'

intentExpectation:
    - expectationId: '1'
      expectationVerb: 'Ensure'
      expectationObjects:
        - objectInstance: 'SubNetwork_1'
        - objectContexts:
            - contextAttribute: 'CoverageAreaPolygon'
              contextCondition: 'IS_ALL_OF'
              contextValueRange:
                - convexGeoPolygon:
                  - latitude: '31.2696'
                    longitude: '121.6322'
                  - latitude: '31.2668'
                    longitude: '121.6323'
                  - latitude: '31.2669'
                    longitude: '121.6412'
                  - latitude: '31.2696'
                    longitude: '121.6410'
            - contextAttribute: 'DlFrequency'
              contextCondition: 'IS_ALL_OF'
              contextValueRange:
                - arfcn: '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'
  intentPriority: '4'
  observationPeriod: '60'
  intentReportInference: 'IntentReport_3'
```

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

```
Intent:
  Id: 'Intent_4'
```

```
    userLabel: 'Radio_Network_RANUEThpt_Performance_Assurance'
    intentExpectation:
      - expectationId: '1'
        expectationVerb: 'Ensure'
        expectationObjects:
          - objectInstance: 'SubNetwork_1'
          - objectContexts:
                contextAttribute: 'CoverageAreaPolygon'
                contextCondition: 'IS_ALL_OF'
                contextValueRange:
                  - convexGeoPolygon:
                    - latitude: '31.2696'
                      longitude: '121.6322'
                    - latitude: '31.2668'
                      longitude: '121.6323'
                    - latitude: '31.2669'
                      longitude: '121.6412'
                    - latitude: '31.2696'
                      longitude: '121.6410'
              - contextAttribute: 'DlFrequency'
                contextCondition: 'IS_ALL_OF'
                contextValueRange:
                  - arfcn: '384000'
              - contextAttribute: 'RAT'
                contextCondition: 'IS_ALL_OF'
                contextValueRange:
                   - 'NR'
              - contextAttribute: 'UEGroup'
                contextCondition: 'IS_ALL_OF'
                contextValueRange:
                  - sNSSAI: '1'
                  - fiveQIValue: '5'
                  - sNSSAI: '2'
                    fiveQIValue: '6'
        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'
    intentPriority: '5'
    observationPeriod: '60'
    intentReportRefernece: 'IntentReport_4'
```

D.5 YAML document example for Intent containing an expectation on RAN energy saving

```
Intent:
  Id: 'Intent_5'
  userLabel: 'RAN_Energy_Saving'
  intentExpectation:
    - expectationId: '1'
      expectationVerb: 'Ensure'
      expectationObjects:
        - objectInstance: 'SubNetwork_1'
          objectContexts:
            - contextAttribute: 'CoverageAreaPolygon'
              contextCondition: 'IS_ALL_OF'
```

```
                        contextValueRange:
                          - convexGeoPolygon:
                            - latitude: '31.2696'
                              longitude: '121.6322'
                            - latitude: '31.2668'
                              longitude: '121.6323'
                            - latitude: '31.2669'
                              longitude: '121.6412'
                            - latitude: '31.2696'
                              longitude: '121.6410'
                      - contextAttribute: 'PLMN'
                        contextCondition: 'IS_ALL_OF'
                        contextValueRange:
                          - '46000'
                      - contextAttribute: 'DlFrequency'
                        contextCondition: 'IS_ALL_OF'
                        contextValueRange:
                          - arfcn: '384000'
                      - contextAttribute: 'RAT'
                        contextCondition: 'IS_ALL_OF'
                        contextValueRange:
                          - 'NR'
                      - contextAttribute: 'TargetAssuranceTime'
                        contextCondition: 'IS_EQUAL_TO'
                        contextValueRange:
                          - startTime: '2023-10-27-22-00-00'
                          - endTime: '2023-10-28-06-00-00'
              expectationTargets:
                - targetName: 'RANEnergyConsumption'
                  targetCondition: 'IS_LESS_THAN'
                  targetValueRange: '1000'
                - targetName: 'RANEnergyEfficiency'
                  targetCondition: 'IS_GREATER_THAN'
                  targetValueRange: '400000'
                - targetName: 'AveULRANUEThpt'
                  targetCondition: 'IS_GREATER_THAN'
                  targetValueRange: '100'
                - targetName: 'AveDLRANUEThpt'
                  targetCondition: 'IS_GREATER_THAN'
                  targetValueRange: '300'
    intentPriority: '6'
    observationPeriod: '60'
    intentReportReference: 'IntentReport_5'
```

D.6 YAML document example for Intent containing an expectation on radio network capacity performance to be assured

```
Intent:
  id: 'Intent_6'
  userLabel: 'Radio_Network_Capacity_Performance_Assurance'
  intentExpectation:
    - expectationId: '1'
      expectationVerb: 'Ensure'
      expectationObjects:
        - objectInstance: 'SubNetwork_1'
          objectContexts:
            - contextAttribute: 'CoverageAreaPolygon'
              contextCondition: 'IS_ALL_OF'
              contextValueRange:
                - convexGeoPolygon:
                  - latitude: '31.2696'
                    longitude: '121.6322'
                  - latitude: '31.2668'
                    longitude: '121.6323'
                  - latitude: '31.2669'
                    longitude: '121.6412'
                  - latitude: '31.2696'
                    longitude: '121.6410'
            - contextAttribute: 'DlFrequency'
              contextCondition: 'IS_ALL_OF'
```

```
                         contextValueRange:
                            - arfcn: '384000'
                            - freqband: 'n39'
                      - contextAttribute: 'RAT'
                         contextCondition: 'IS_ALL_OF'
                         contextValueRange:
                            - 'NR'
            expectationTargets:
               - targetName: 'highUlPrbLoadRatio'
                  targetCondition: 'IS_LESS_THAN'
                  targetValueRange: '20'
                  targetContexts:
                     - contextAttribute: 'HighUlPrbLoad'
                        contextCondition: 'IS_Greater_THAN'
                        contextValueRange: '85'
               - targetName: 'highDlPrbLoadRatio'
                  targetCondition: 'IS_LESS_THAN'
                  targetValueRange: '10'
                  targetContexts:
                     - contextAttribute: 'HighUlPrbLoad'
                        contextCondition: 'IS_Greater_THAN'
                        contextValueRange: '85'
               - targetName: 'AveUlPrbLoad'
                  targetCondition: 'IS_LESS_THAN'
                  targetValueRange: '85'
               - targetName: 'AveDlPrbLoad'
                  targetCondition: 'IS_LESS_THAN'
                  targetValueRange: '90'
   intentPriority: '7'
   observationPeriod: '60'
   intentReportReference: 'IntentReport_6'
```

D.7 YAML document example for Intent containing an expectation for delivering 5GC network

```
Intent:
 Id: 'Intent_7'
 userLabel: '5GC_Network_Deliver'
 intentExpectation:
   - expectationId: '1'
     expectationVerb: 'Deliver'
     expectationObjects:
        - objectType: '5GC_SubNetwork'
           objectContexts:
              - contextAttribute: 'NfType'
                 contextCondition: 'IS_ALL_OF'
                 contextValueRange:
                    - 'UPF'
              - contextAttribute: 'NfInstanceLocation'
                 contextCondition: 'IS_ALL_OF'
                 contextValueRange:
                    - 'Beijing, China'
              - contextAttribute: 'PLMN'
                 contextCondition: 'IS_ALL_OF'
                 contextValueRange:
                    - '46000'
              - contextAttribute: 'Tai'
                 contextCondition: 'IS_ALL_OF'
                 contextValueRange:
                    - '460000x65'
     expectationTargets:
        - targetName: 'MaxNumberofPDUsessions'
           targetCondition: 'IS_LESS_THAN'
           targetValueRange: '250000'
        - targetName: 'maxNumberofRegisteredsubscribers'
           targetCondition: 'IS_LESS_THAN'
           targetValueRange: '2500'
   intentPriority: '3'
   observationPeriod: '60'
   intentReportReference: 'IntentReport_7'
```

D.8 YAML document example for Intent report instance

```
IntentReport:
  id: 'RAN_Energy_Saving_Report'
  intentFulfilmentReport:
    intentFulfilmentInfo:
      fulfilmentStatus: 'NOTFULFILLED'
      notFulfilledState: 'SUSPENDED'
      notFulfilledReasons:
        - 'Target_conflict_detected'
    expectationFulfilmentResults:
      - expectationId: '1'
        expectationFulfilmentInfo:
          fulfilmentStatus: 'NOTFULFILLED'
        targetFulfilmentResults:
          - targetName: 'RANEnergyConsumption'
            targetFulfilmentInfo:
              fulfilmentStatus: 'FULFILLED'
            targetAchievedValue: '900'
          - targetName: 'RANEnergyEfficiencyTarget'
            targetFulfilmentInfo:
              fulfilmentStatus: 'FULFILLED'
            targetAchievedValue: '410000'
          - targetName: 'AveULRANUEThpt'
            targetFulfilmentInfo:
              fulfilmentStatus: 'FULFILLED'
            targetAchievedValue: '100'
          - targetName: 'AveDLRANUEThpt'
            targetFulfilmentInfo:
              fulfilmentStatus: 'NOTFULFILLED'
            targetAchievedValue: '200'
  intentConflictReports:
    - conflictType: 'TARGET_CONFLICT'
      conflictingTarget: 'RANEnergyConsumption'
      recommendedSolutions: 'MODIFY'
    - conflictType: 'TARGET_CONFLICT'
      conflictingTarget: 'AveDLRANUEThpt'
      recommendedSolutions: 'MODIFY'
  intentFeasibilityCheckReport:
    feasibilityCheckResult: 'FEASIBLE'
  lastUpdatedTime: '2023-09-15-14-37-50'
  intentReference: 'RAN_Energy_Saving'
```

D.9 YAML document example for Intent containing an expectation for delivering radio service

```
Intent:
  Id: 'intent_8'
  userLabel: 'Radio_Service_Deliver'
  IntentExpectation:
    - expectationId: '1'
      expectationVerb: 'Deliver'
      expectationObjects:
        - objectType: 'Radio_Service'
        - objectContexts:
            - contextAttribute: 'CoverageAreaPolygon'
              contextCondition: 'IS_ALL_OF'
              contextValueRange:
                - convexGeoPolygon:
                    - latitude: '31.2696'
                      longitude: '121.6322'
                    - latitude: '31.2668'
                      longitude: '121.6323'
                    - latitude: '31.2669'
                      longitude: '121.6412'
                    - latitude: '31.2696'
                      longitude: '121.6410'
            - contextAttribute: 'ServiceType'
              contextCondition: 'IS_EQUAL_TO'
              contextValueRange:
```

```
                      - 'eMBB'
        expectationTargets:
          - targetName: 'ULLatency'
            targetCondition: 'IS_LESS_THAN'
            targetValueRange: '15'
          - targetName: 'DLLatency'
            targetCondition: 'IS_LESS_THAN'
            targetValueRange: '20'
          - targetName: 'ULThptPerUE'
            targetCondition: 'IS_GREATER_THAN'
            targetValueRange: '100'
          - targetName: 'DLThptPerUE'
            targetCondition: 'IS_GREATER_THAN'
            targetValueRange: '300'
intentPriority: '8'
observationPeriod: '60'
intentReportReference: 'IntentReport_8'
```

Annex E (informative): Intent management procedures

E.1 Basic intent report management

E.1.1 Query an intent report

Figure E.1.1-1 illustrates the procedure for querying an intent report.
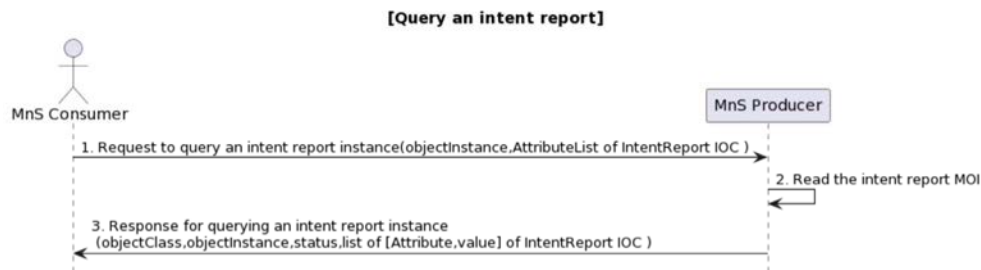
Figure E.1.1-1: Procedure for querying an intent report

1. The MnS Consumer sends a request to query an intent report instance (see getMOIAttributes operation defined in TS 28.532[3]) to the MnS Producer with 'objectInstance' of the existing IntentReport MOI and a list of attribute names of IntentReport IOC. The 'objectInstance' of the existing IntentReport MOI is obtained from attribute 'intentReportRef' of corresponding Intent MOI.

   - If the MnS Consumer wants to obtain the Intent Fulfilment information, the attribute name 'intentFulfilmentReport' needs to be specified.

   - If the MnS Consumer wants to obtain Intent conflict information, the attribute name 'intentConflictReports' needs to be specified.

   - If the MnS Consumer wants to obtain Intent fulfilment feasibility check information, the attribute name ' intentFeasibilityCheckReport' needs to be specified.

2. Based on the request, the MnS Producer reads the values of required attributes in IntentReport MOI.

3. The MnS Producer sends a response (see getMOIAttributes operation defined in TS 28.532[3]) to the MnS Consumer with 'objectInstance' of IntentReport MOI and other values of attributes in IntentReport MOI (defined in clause 6.2.1.2.2) based on a specified list of attribute names of IntentReport IOC, including at least one of the attributes 'intentFulfilmentReport', 'intentConflictReports', and 'intentFeasibilityCheckReport'.

E.1.2 Intent report subscription and notification

Figure E.1.2-1 illustrates the procedure for intent report subscription and notification.
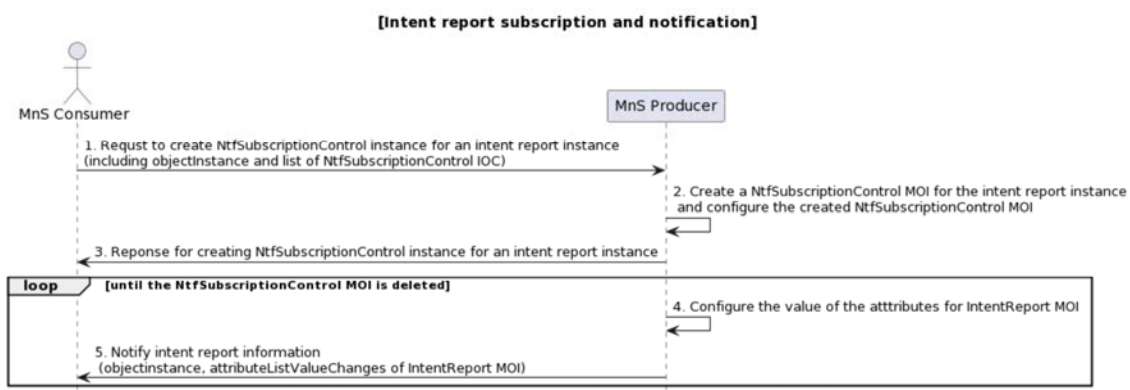
Figure E.1.2-1: Procedure for intent report subscription and notification

1. The MnS Consumer sends a request to create a NtfSubscriptionControl instance (see createMOI operation defined in TS 28.532 [3]) to the MnS Producer with intent report subscription information (see attributes of NtfSubscriptionControl IOC in TS 28.622 [6]) to establish a subscription for the attribute value change notification for IntentReport MOI. The "objectInstance" of IntentReport MOI is specified in the attribute "scope" of NtfSubscriptionControl IOC.

   - If the MnS Consumer wants to subscribe the Intent Fulfilment information, the attribute name 'intentFulfilmentReport' needs to be specified in the attribute 'notificationFilter' of NtfSubscriptionControl IOC.

   - If the MnS Consumer wants to obtain Intent conflict information, the attribute name 'intentConflictReports' needs to be specified

   - If the MnS Consumer wants to obtain Intent fulfilment feasibility check information, the attribute name 'intentFeasibilityCheckReport' needs to be specified.

2. Based on the request, the MnS Producer creates and configures NtfSubscriptionControl MOI to establish a subscription for the attribute value change notification for IntentReport MOI.

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

The following steps are executed until NtfSubscriptionControl MOI is deleted.

4. The MnS Producer configures the value of attributes for IntentReport MOI at the end of each observation period.

5. The MnS Producer sends a notification (see notifyMOIAttributeValueChanges notification defined in TS 28.532[3]) to the subscribed MnS Cosumer about intent report information, including at least one of the attributes 'intentFulfilmentReport', 'intentConflictReports', and 'intentFeasibilityCheckReport'.

E.2 Intent Handling Capability obtaining

E.2.1 Query intent handling capability provided by an intentHandlingFunction

Figure 6.3.7.1-1 illustrates the procedure for querying intent handling capability provided by an intentHandlingFunction.
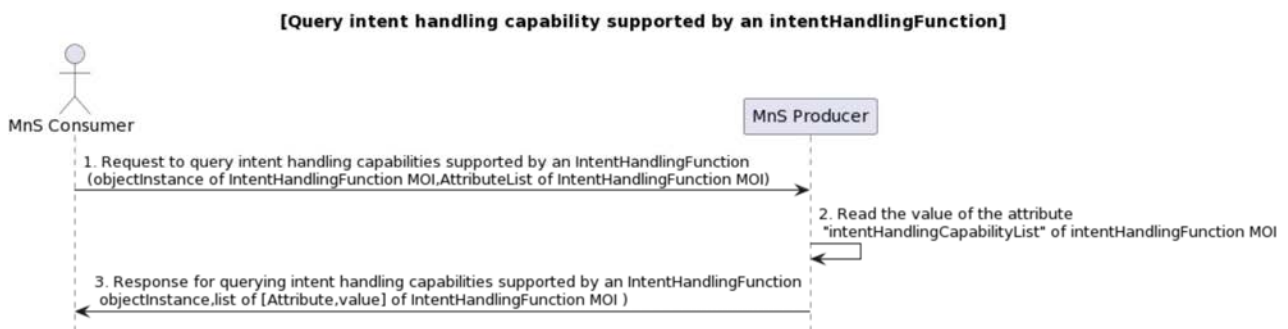
Figure E.2.1-1: Procedure for querying intent handling capabilities supported by an intentHandlingFunction

1. MnS Consumer sends a request to query intent handling capabilities supported by an intentHandlingFunction (see getMOIAttributes operation defined in TS 28.532[3]) to MnS Producer with 'objectInstance' of the existing IntentHandlingFunction MOI and a list of attribute names of IntentHandlingFunction (including attribute 'intentHandlingCapabilityList', see clause 6.2.1.2.3).

2. Based on the request, the MnS Producer reads the values of required attribute 'intentHandlingCapabilityList' in IntentHandlingFunction MOI.

3. MnS Producer sends a response (see getMOIAttributes operation defined in TS 28.532[3]) to the MnS Consumer with 'objectInstance' of IntentHandlingFunction MOI and the value of attribute 'intentHandlingCapabilityList' (defined in clause 6.2.1.2.3).

Annex F (informative):
Potential deployment scenarios for intent interface

F.1 Description

Clause 4.1.2 describes different kinds of intents which can be applicable for different kinds of standardized reference interfaces based on roles related to 5G networks and network slicing management, see Figure 4.1.2-1.

The present clause provides potential deployment scenarios for intent interface for the management of 3GPP network and services.

F.2 Potential deployment scenario#1

In this deployment scenario, 3GPP intent driven MnS (including Management operation for Intent defined in clause 6.1 and generic Information model definition in clause 6.2.1) can be applicable for following kinds of standardized reference interfaces for the management of 3GPP network and services:

- Management interactions for Intent-NOP between NOP and NEP;

- Management interactions for Intent-CSP between CSP and NOP;

- Management interactions for Intent-CSC between CSC and CSP.

The scenario specific IntentExpectation definition can be different for above kinds of standardized reference interfaces. For example, the RadioNetworkExpectation can be used for Management interactions for Intent-NOP between NOP and NEP, while the EdgeServiceSupportExpectation can be based for Management interactions for Intent-CSP between CSP and NOP.
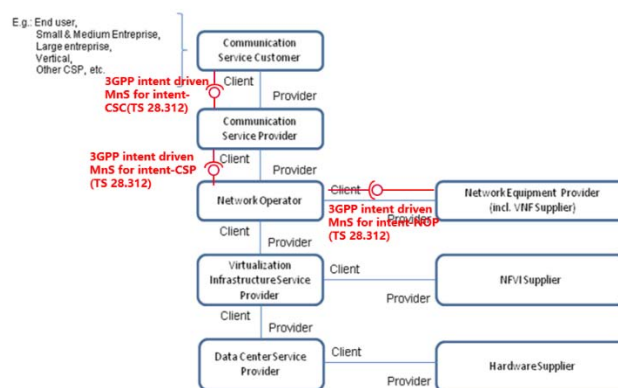
Figure F.2-1: Potential intent interface deployment scenario#1

F.3 Potential deployment scenario#2

In this deployment scenario, 3GPP intent driven MnS can be applicable for following kinds of standardized reference interfaces for the management of 3GPP network and services:

- Management interactions for Intent-NOP between NOP and NEP;

- Management interactions for Intent-CSP between CSP and NOP.

The TM Forum intent management API [7] can be applicable for following kinds of standardized reference interfaces for the management of 3GPP network and services:

- Management interactions for Intent-CSC between CSC and CSP.
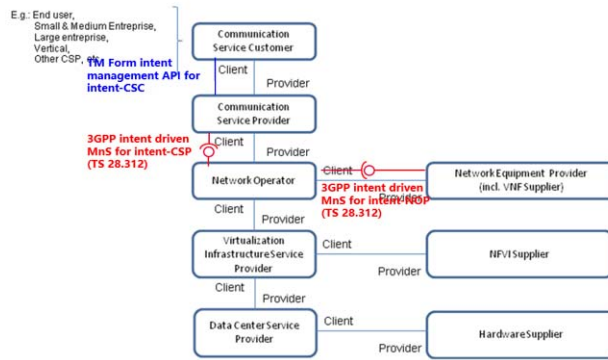
Figure F.3-1: Potential intent interface deployment scenario#2

In this intent interface deployment scenario, following contents can be used as guidelines for transformation functionality between the TM Forum intent management API for intent-CSC and the 3GPP intent driven MnS for intent-CSP.

-    Mapping the 3GPP and the TM Forum intentExpectation Models described in Annex C.

Annex G (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

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
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
2023-09	SA#101	SP-230962	0069	1	A	Correct use case for delivering a service at the edge	18.1.0
2023-09	SA#101	SP-230962	0070	1	A	Add missing stage 3	18.1.0
2023-09	SA#101	SP-230963	0072	1	B	Add solution for intent driven approach for RAN energy saving	18.1.0
2023-09	SA#101	SP-230963	0073	1	B	Add solution for intent driven approach for intent report and intent handling capability obtaining	18.1.0
2023-09	SA#101	SP-230963	0074	-	B	Add solution for intent driven approach for radio network capacity optimization	18.1.0
2023-09	SA#101	SP-230963	0075	1	B	Add requirements and solution for intent activate and intent deactivate	18.1.0
2023-09	SA#101	SP-230963	0076	1	B	Update the RadioNetworkExpectation to support targeted scope	18.1.0
2023-09	SA#101	SP-230963	0077	-	F	Extend the allowed value for contextValueRange and targetValueRange	18.1.0
2023-09	SA#101	SP-230963	0078	-	F	Correct the description in clause 5.3.2 Intent report	18.1.0
2023-09	SA#101	SP-230963	0080	1	B	Enhance clause 6.3 Procedures for intent management	18.1.0
2023-09	SA#101	SP-230963	0083	1	B	Resolve intent conflict	18.1.0
2023-09	SA#101	SP-230963	0085	1	B	Requirements on Intent conflicts	18.1.0
2023-09	SA#101	SP-230963	0086	1	B	Support for intent priorities	18.1.0
2023-09	SA#101	SP-230963	0087	1	B	Solution for End-to-end Network Resource Expectation	18.1.0
2023-09	SA#101	SP-230962	0093	1	A	Correct issues for generic intent information model	18.1.0
2023-09	SA#101	SP-230962	0095	2	A	Correct issues for Service Support Expectation	18.1.0
2023-09	SA#101	SP-230962	0097	-	A	Update stage3 to align with stage2	18.1.0
2023-09	SA#101	SP-230962	0099	1	A	Clarification on intent translate	18.1.0
2023-09	SA#101	SP-230963	0100	1	F	5GC use case updates	18.1.0
2023-09	SA#101	SP-230963	0101	1	B	Adding new requirement for feasibility check	18.1.0
2023-09	SA#101	SP-230963	0102	1	B	Add the solution for 5GC Network Expectation	18.1.0
2023-09	SA#101	SP-230963	0111	-	F	Correct the use of ExpectationObjects	18.1.0
2023-09	SA#101	SP-230963	0112	1	B	Intent Conflict Resolution Procedure	18.1.0
2023-09	SA#101	SP-230962	0114	-	A	Editorial corrections in 3GPP TS 28.312 stage 3 OpenAPI section	18.1.0
2023-09	SA#101					Placing new clause 5.4.3 in its correct place	18.1.1
2023-12	SA#102	SP-231475	0117	2	F	Rel-18 CR TS 28.312 Update the stage3 for intent report to align with the stage2 definition	18.2.0
2023-12	SA#102	SP-231475	0120	-	F	Rel-18 CR TS 28.312 Correct issues for Relationship UML diagram for intent	18.2.0
2023-12	SA#102	SP-231475	0121	-	F	Rel-18 CR TS 28.312 Correct issues for the use of context in the OpenAPI document.	18.2.0
2023-12	SA#102	SP-231474	0123	1	A	Rel-18 CR TS28.312 Correct issues for area related attributes definition in stage2 and stage3	18.2.0
2023-12	SA#102	SP-231475	0126	-	B	Rel-18 CR TS 28.312 Update 6.1 and 7.1 to support intent report and intent handling capability obtaining	18.2.0
2023-12	SA#102	SP-231475	0127	1	B	Add YAML document examples for intent report instance	18.2.0
2023-12	SA#102	SP-231475	0128	1	B	Rel-18 CR TS 28.312 Add procedure for intent report and intent handling capability obtaining	18.2.0
2023-12	SA#102	SP-231475	0129	1	F	Rel-18 CR TS 28.312 Correct issues for IntentReport model(6.4.4.3)	18.2.0
2023-12	SA#102	SP-231475	0130	-	B	Rel-18 CR TS28.312 Enhance the RadioNetworkExpectation	18.2.0
2023-12	SA#102	SP-231475	0131	1	B	Rel-18 CR TS 28.312 Add Intent interface deployment scenarios in Annex	18.2.0
2023-12	SA#102	SP-231475	0132	1	B	Add RadioServiceExpectation	18.2.0
2023-12	SA#102	SP-231475	0133	-	F	Rel-18 CR TS 28.312 Rapporteur clean up	18.2.0
2023-12	SA#102	SP-231474	0135	-	A	Clarification on intent management procedure	18.2.0
2023-12	SA#102	SP-231475	0136	-	B	Adding 5GC expectation in Intent IOC stage 3	18.2.0
2023-12	SA#102	SP-231474	0139	2	A	Rel-18 CR TS 28.312 Update the definition of expectationId in Table 6.2.1.4-1	18.2.0
2023-12	SA#102	SP-231475	0140	1	B	Rel-18 CR TS 28.312 Selection among Expectation, targets and contexts	18.2.0
2023-12	SA#102	SP-231475	0141	1	B	Rel18 CR 28312 Requirements on intent Reporting	18.2.0
2023-12	SA#102	SP-231475	0142	3	F	Rel-18 CR 28.312 Intent Conflict Resolution Procedure	18.2.0
2023-12	SA#102	SP-231475	0143	1	F	Rel-18 CR TS 28.312 Correct issues for the reference to maxNumberofPDUsessions	18.2.0
2023-12	SA#102	SP-231475	0150	1	B	Rel-18 CR TS 28.312 add intent conflict resolution based on intent preemption	18.2.0
2023-12	SA#102	SP-231475	0152	1	C	Add one case and requirement for supporting change of intent handling function	18.2.0
2023-12	SA#102	SP-231475	0153	2	F	Clarify MnS consumer how handling infeasible results of intent fulfilment feasibility check	18.2.0
2023-12	SA#102	SP-231475	0154	1	F	Enhance the description of intent report	18.2.0
2023-12	SA#102	SP-231475	0155	1	B	Add description and potential requirement for intent report	18.2.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2023-12	SA#102	SP-231476	0156	-	F	Correct issues for Class definition including Intent and IntentReport	18.2.0
2023-12	SA#102	SP-231476	0158	1	F	Rel-18 CR TS 28.312 Correct issues of attibutes in IntentFulfillmentReport.	18.2.0
2023-12	SA#102	SP-231476	0159	1	F	Rel-18 CR TS 28.312 Enhancement for Intent handling capability obtaining	18.2.0
2023-12	SA#102	SP-231476	0161	-	F	Rel-18 CR TS 28.312 Correct use case for Intent containing an expectation for 5GC network	18.2.0
2023-12	SA#102	SP-231474	0166	1	A	Correct the description for Context <<dataType>>	18.2.0
2023-12	SA#102	SP-231476	0171	1	F	Rel-18 CR TS 28.312 Update RadioNetworkExpectation definition	18.2.0
2023-12	SA#102	SP-231476	0172		F	Rel-18 CR TS 28.312 Update Annex D YAML document example to align with the latest intentNRM and intentExpectationNRM YAML definition	18.2.0
2023-12	SA#102	SP-231476	0173	1	F	Rel-18 CR TS 28.312 Update ValueRangeType to support scenario specific intent expectation	18.2.0
2023-12	SA#102	SP-231476	0174	1	F	Rel-18 CR TS 28.312 Correct the stage2 and stage3 definition for intentPriority	18.2.0
2023-12	SA#102	SP-231476	0175	1	F	Rel-18 CR TS28.312 Update the stage3 to aign with the latest stage2	18.2.0
2023-12	SA#102	SP-231476	0176	1	B	Rel-18 CR TS 28.312 add recommendedSolutions value in IntentReport	18.2.0
2023-12	SA#102	SP-231476	0177	1	B	Rel-18 CR TS 28.312 add attributes of intent preemption	18.2.0
2023-12	SA#102	SP-231476	0179	1	F	Rel-18 CR 28.312 Missing attribute definitions	18.2.0
2023-12	SA#102	SP-231476	0182	1	C	Rel18_CR_28312 Clarify observation period and fulfilment deadline	18.2.0
2023-12	SA#102	SP-231476	0183	-	F	Rel-18 CR 28.312 Errors in attribute definitions	18.2.0
2023-12	SA#102	SP-231476	0184		B	Update 5GC expectation	18.2.0
2023-12	SA#102	SP-231476	0185	1	F	Rel-18 CR TS 28.312 Update the description of requirements for obtaining intent report information in use cases	18.2.0
2023-12	SA#102	SP-231476	0186	-	F	Rel-18 CR TS 28.312 Update the description about intent handling function	18.2.0
2023-12	SA#102	SP-231474	0188	-	A	Rel-18 CR TS28.312 Clarify the description of object instance	18.2.0
2023-12	SA#102	SP-231476	0190	1	F	Rel-18 CR TS 28.312 5.3.4.3 Adjust the content in clause 5.3.4.3 Resolving Intent-related conflicts	18.2.0
2023-12	SA#102	SP-231476	0191	1	F	Correct issues for End-to-end Network Resource Expectation	18.2.0
2023-12	SA#102	SP-231474	0193	1	A	Clarify verbs in attribute definitions	18.2.0
2023-12	SA#102	SP-231474	0195	1	A	Correct intent driven MnS description in clause 4.2.2	18.2.0
2023-12	SA#102	SP-231476	0196	-	F	Correct Yaml documents in Annex D	18.2.0
2023-12	SA#102	SP-231476	0198	1	F	Rel-18 CR TS 28.312 Revisions to ValueRange	18.2.0
2023-12	SA#102	SP-231476	0199	1	B	Rel-18 CR TS 28.312 Update 6.1 and 7.1 to support the operations of unsubscribing intent reporting and querying intent reporting subscriptions	18.2.0
2023-12	SA#102	SP-231474	0201	1	A	Rel-18 CR 28.312 Correct create an intent procedure	18.2.0
2023-12	SA#102					Adding code files to Zip file	18.2.1
2024-03	SA#103	SP-240186	0202	-	F	TS28.312 Rel18 correction to Schema definition Issues for SubNetwork of OpenAPI SS	18.3.0
2024-03	SA#103	SP-240170	0205	1	F	Rel-18 CR TS 28.554 Correction of Intent Conflict Resolution	18.3.0
2024-03	SA#103	SP-240170	0206	1	F	Rel-18 CR TS 28.312 Rapporteur clean up	18.3.0
2024-03	SA#103	SP-240170	0207	1	F	Rel-18 CR TS 28.312 Update the YAML document examples to align with yaml definition	18.3.0
2024-03	SA#103	SP-240170	0208	1	F	Rel-18 CR TS 28.312 Address CR implementation issue for CR0171 and CR0173	18.3.0
2024-03	SA#103	SP-240170	0210	1	F	Rel-18 CR TS 28.312 clarification about notFulfilledState condition	18.3.0
2024-03	SA#103	SP-240170	0211	1	F	Rel-18 CR TS 28.312 Update the description of clause 5.3.2 intent report	18.3.0
2024-03	SA#103	SP-240170	0212	-	F	Rel-18 CR TS 28.312 Remove optional predicted value in intent report	18.3.0
2024-03	SA#103	SP-240170	0213	1	F	Rel-18 CR TS 28.312 normative yaml code in 3gpp forge	18.3.0
2024-06	SA#104	SP-240846	0214	-	F	Rel-18 CR 28312 Fix incorrect attribute values and improve wording	18.4.0
2024-06	SA#104	SP-240846	0218	-	F	Rel-18 CR TS 28.312 Correct the misalignment issues for requirements	18.4.0
2024-06	SA#104	SP-240846	0219	-	F	Rel-18 CR TS 28.312 Rapporteur clean up	18.4.0
2024-06	SA#104	SP-240846	0220	1	F	Rel-18 CR TS 28.312 Update the stage3 to align with stage2	18.4.0
2024-06	SA#104	SP-240846	0221	1	F	Rel-18 CR TS 28.312 correction of attribute definition	18.4.0
2024-06	SA#104	SP-240846	0224	1	F	Rel-18 CR TS 28.312 Correction of Expectation Targets	18.4.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2024-06	SA#104	SP-240846	0226	-	F	Rel-18 CR TS 28.312 Correct incorrect description for clause 5.1.5	18.4.0
2024-06	SA#104	SP-240846	0227	-	F	Rel-18 CR TS 28.312 Correction of attribute definition and incorrect description	18.4.0
2024-06	SA#104	SP-240846	0228	-	F	Rel-18 CR TS 28.312 Update the Annex D to align with stage2	18.4.0
2024-06	SA#104	SP-240803	0230	-	A	Rel-18 CR TS 28.312 correct the definition for FulfilmentInfo dataType	18.4.0

History

Document history		
V18.3.0	May 2024	Publication
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