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TECHNICAL SPECIFICATION

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Contents

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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.

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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

External monitoring systems are used by Mobile Network Operators (MNOs) to track network activity for analysis and troubleshooting purposes, and subsequently to perform diagnosis and fault analysis of their system. Such monitoring has been usually performed by tapping the connections between the network functions in order to extract the signalling messages for further analysis.

Due to the encryption of the signalling traffic exchanged between network functions in 5G Core, the monitoring of the network activity as performed in legacy systems is not possible. In order to monitor the signalling messages of the 5G core, each core NFs needs to provide copies of signalling messages, that it sends or receives, to the monitoring system.

The present document covers the stage 1, stage 2 and stage 3 aspects for the Signalling Traffic Monitoring.

1 Scope

The present document specifies the definitions of signalling traffic monitoring management. This monitoring is performed at network signalling level on 5GC control plane. When the monitoring is enabled, the 5GC network function collects the required decrypted signalling message and forwards it to the configured collection entity.

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 28.532: "Generic management services".

[3] 3GPP TS 28.533: "Management and orchestration; Architecture framework".

[4] 3GPP TS 33.501: " Security architecture and procedures for 5G System ".

[5] 3GPP TS 28.622: "Generic Network Resource Model (NRM); Integration Reference Point (IRP); Information Service (IS)".

[6] void.

[7] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[8] IETF RFC8086: GRE-in-UDP Encapsulation.

[9] IETF draft-ietf-opsawg-pcapng-034: PCAP Next Generation (pcapng) Capture File Format.

[10] 3GPP TS 32.160: "Management and orchestration; Management Service Template".

[11] 3GPP TS 28.623: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Solution Set (SS) definitions".

[12] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[13] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane Nodes; Stage 3".

[14] 3GPP TS 28.541: “Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3”

[15] 3GPP TS 23.273: “5G System (5GS) Location Services (LCS); Stage 2”

[16] 3GPP TS 23.502: "Procedures for the 5G System (5GS); Stage 2"

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in 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 TR 21.905 [1].

STM Data Consumer: A consumer that receives the signalling traffic message copies which are streamed by the STM Data Producer.

STM Data Producer: A producer that has the responsibility to send the signalling traffic message copies to the STM Data Consumer.

NOTE: The STM Data Producer may be part of or outside of a 5GC NF implementation, which is out of scope of the present document.

STM Management Consumer: A consumer that can provision STM control NRM fragments on STM Management Producers.

NOTE: It is either located at the operator's OAM system or at the external monitoring system.

STM Management Producer: A producer that supports the STM control NRM fragment.

NOTE: The STM Management Producer may be part of or outside of a 5GC NF implementation, which is out of scope of the present document.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 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 TR 21.905 [1].

STM Signalling Traffic Monitoring

4 Signalling traffic monitoring management capabilities (stage 1)

The 3GPP management system shall have the capabilities as listed in the following table.

Table 4-1: Signalling Trace Monitoring Management Requirements

Requirement label	Description	Related use case(s)
REQ-SM-FUN-1	The 3GPP system shall have the capability to send copies of the 5G Core control plane signalling messages, of selected interface(s) of selected NF(s), to an external entity that collects these signalling messages.	Signalling Traffic Monitoring Streaming
REQ-SM-FUN-2	Authorised consumers shall have the capability to control (to configure, to enable, and to disable) sending copies of the 5G Core control plane signalling messages to the external collecting entity.	Signalling Monitoring Activation Signalling Monitoring Termination

Requirement label	Description	Related use case(s)
REQ-SM-FUN-3	The 3GPP system shall have the capability to send the copies of the 5G Core control plane signalling messages in a reliable or unreliable transport manner.	Signalling Traffic Monitoring Streaming
REQ-SM-FUN-4	Authorised consumers shall have the capability to indicate the network interface type, and optionally the network interface instance and service operations within the specified network interface type, of which the signalling messages are to be monitored.	Signalling Traffic Monitoring Activation

5 Signalling traffic monitoring management operations (stage 2)

5.1 Overview

The STM Management Producer is configured by an authorized STM Management Consumer via a secured link. The network signalling messages at 5GC control plane are the target to be collected. Any relevant signalling traffic messages are forwarded by the STM Data Producer to the STM Data Consumer using a secured tunnel.

NOTE: The STM Data Producer, and the STM Data Consumer are left for implementation. They are the endpoints of the interfaces used for streaming of the signalling message copies.

The STM Management Producer may be configured by an authorized STM Management Consumer located in OAM system. And the STM configuration may be enabled/disabled by an authorized STM Management Consumer located in OAM system or located in external monitoring system. When STM Management Consumers are located in different systems, the different STM Management Consumers have different authorization, resulting in a different visibility of the same STM Management Producer. Where the STM Management Consumer is located is out of scope of the present document. Examples of signalling traffic monitoring deployment scenarios are shown in figure 5.1-1 and figure 5.1-2. It is up to implementation, whether the STM Data Producer is located inside the 5G NF as showed in the figure 5.1-1 or outside the 5GC NF as shown in figure 5.1-2.

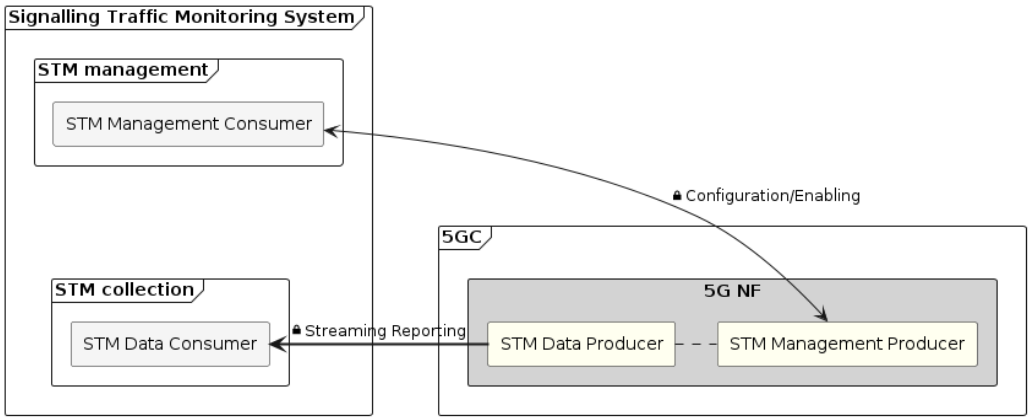

Figure 5.1-1: Signalling traffic monitoring deployment scenario - 1

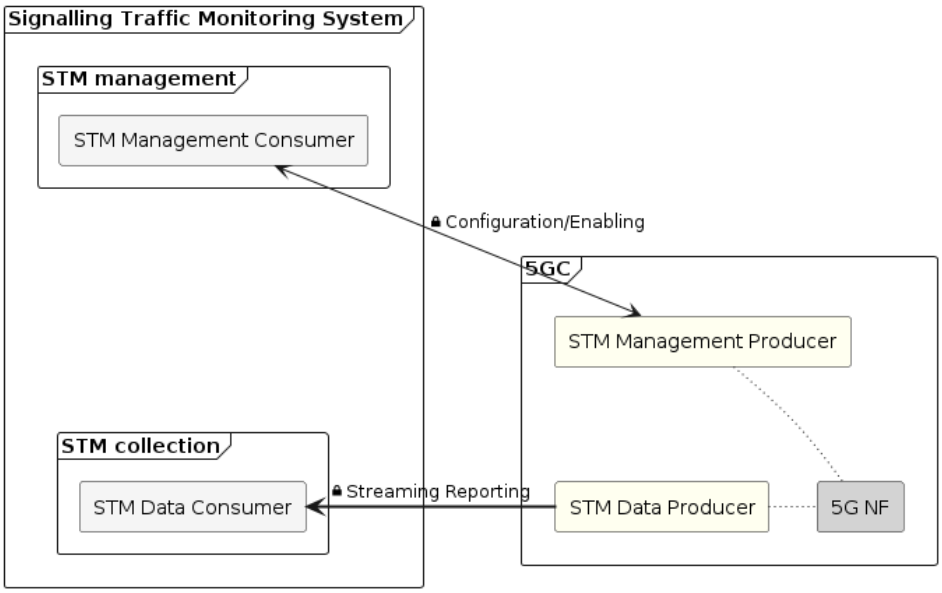

Figure 5.1-2: Signalling traffic monitoring deployment scenario - 2

5.2 STM Provisioning

This clause provides the stage 2 definitions of STM provisioning operations, including creation and deletion, as well as enablement and disablement, for managing STM reporting control objects. According to clause 4.2.2 of 3GPP TS 28.533 [3], these operations are the MnS component type A. The operations specified in this clause in combination with a NRM (MnS component type B) constitute a MnS, as defined in clause 4.3 of 3GPP TS 28.533 [3] providing generic provisioning services for supported NRM (MnS component type B) of all MnS.

The creation operation is invoked by STM Management Consumers to request a STM Management Producer to create, one or more STM control objects using createMOI or changeMOIs operations as specified in 3GPP TS 28.532 [2]. Once the STM control object is created, it may be enabled or disabled by the STM Management Consumer.

NOTE: The STM control objects can be also preconfigured, as per MNO decision.

If the STM control object is enabled by the STM Management Consumer, the STM Data Producer shall start reporting the signalling messages according to the STM control object definition. The enablement operation may be invoked by the STM Management Consumer using changeMOI containing only the enablement attribute.

If the STM control object is disabled by the STM Management Consumer, the reporting of the signalling messages shall be stopped. The disablement operation may be invoked by the STM Management Consumer using changeMOI containing only the disablement attribute, without STM control object deletion.

If the STM Management Consumer is located in the external monitoring system, it may be only allowed to perform enabling and disabling operation on the STM control object.

The deletion operation is invoked by STM Management Consumers to request a STM Management Producer to remove one or more STM control objects using deleteMOI or changeMOIs operations as specified in 3GPP TS 28.532 [2]. Upon successful removal of the STM control objects, the STM Data Producer shall stop reporting any signalling traffic.

The STM provision operations shall be secured according to 3GPP TS 33.501 [4].

5.3 STM Streaming

STM reporting consists of STM signalling message copies that shall be output to streams. The STM Data Consumer URI is provided by a STM Management Consumer to indicate where the STM report shall be streamed to.

In case of a failure to report the requested signalling protocol messages, a STM administrative message may be sent to the STM Data Consumer.

The STM streaming service shall be secured according to 3GPP TS 33.501 [4].

6 Signalling traffic monitoring management Information Model (stage 2)

6.1 Imported and associated information entities

6.1.1 Imported information entities and local labels

Label reference	Local label
3GPP TS 28.622 [5], IOC, `SubNetwork`	`SubNetwork`
3GPP TS 28.622 [5], IOC, `ManagedElement`	`ManagedElement`
3GPP TS 28.622 [5], IOC, `ManagedFunction`	`ManagedFunction`
3GPP TS 28.622 [5], dataType, `OperationalState`	`OperationalState`
3GPP TS 28.622 [5], dataType, `BasicAdministrativeState`	`BasicAdministrativeState`

6.1.2 Class diagram

6.1.2.1 Relationships

This clause provides the overview of the relationships of relevant classes in UML. Subsequent clauses provide more detailed specification of various aspects of these classes. The following figure shows the containment/naming hierarchy and the associations of the classes defined in the present document.

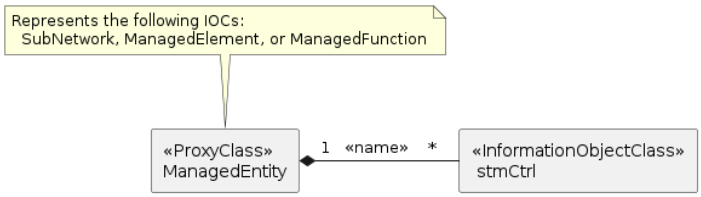

Figure 6.1.2.1-1: STM control NRM fragment

6.1.2.2 Inheritance

This clause depicts the inheritance relationships.

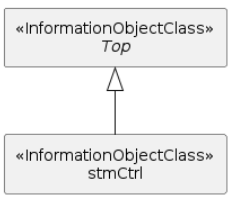

Figure 6.1.2.2-1: STM control NRM inheritance relationships

6.2 Class definitions

6.2.1 StmCtrl <<IOC>>

6.2.1.1 Definition

This IOC represents STM jobs. It can be name-contained by SubNetwork, ManagedElement, or ManagedFunction.

reportingNFList specifies the network function whose signalling traffic is to be monitored. If this parameter is not present or it is empty, then all Network Functions within the SubNetwork or ManagedElement shall be monitored. This parameter shall be omitted if the STM control object is specified under a ManagedFunction.

networkInterfaceList specifies the target network interfaces to be monitored. If this parameter is not present or it is empty, then all applicable interfaces from the target NF shall be monitored.

stmTargetUri is the URI of the STM consumer that shall receive the monitored signalling message copies.

administrativeState is used by the STM consumer to lock or unlock the StmCtrl instance in order to stop or start the signalling traffic monitoring.

operationalState is used by STM consumer to report its working state.

6.2.1.2 Attributes

The StmCtrl IOC includes attributes inherited from Top IOC (defined in 3GPP TS 28.622 [5] subclause 4.3.29) and the following attributes:

Attribute name	S	isReadable	isWritable	isInvariant	isNotifyable
reportingNFList	M	T	T	F	T
targetInterfaceInfoList	M	T	T	F	T
stmTargetUri	M	T	T	T	T
administrativeState	M	T	T	F	T
operationalState	M	T	F	F	T

6.2.1.3 Attribute constraints

None.

6.2.1.4 Notifications

The common notifications defined in 3GPP TS 28.622 [5] subclause 4.5 are valid for this IOC, without exceptions or additions.

6.2.2 NetworkInterface <<dataType>>

6.2.2.1 Definition

This defines the network interface for which signalling traffic messages are to be copied and sent to the external entity.

The attribute networkInterfaceType specifies the network interface type to be monitored. The optional attribute networkInterfaceInstanceList specifies the network interface instances to be monitored. It is a list of applicable network interface instances of the network interface type specified by networkInterfaceType. The optional attribute serviceOperationList specifies the service operations to be monitored. It is a list of applicable service operations exchanged over the network interface instances specified by networkInterfaceInstanceList, or, if networkInterfaceInstanceList is not present, it is list of applicable service operations exchanged over the network interface type specified by networkInterfaceType.

6.2.2.2 Attributes

The `NetworkInterface` data type contains the following attributes:

Attribute name	S	isReadable	isWritable	isInvariant	isNotifyable
`networkInterfaceType`	M	T	T	F	T
`networkInterfaceInstanceList`	O	T	T	F	T
`serviceOperationList`	O	T	T	F	T

6.2.2.3 Attribute constraints

None.

6.2.2.4 Notifications

The common notifications defined in 3GPP TS 28.622 [5] subclause 4.5 are valid for this IOC, without exceptions or additions.

6.3 Attribute definitions

6.3.1 Attribute properties

The following table defines the properties of attributes specified in the present document.

Attribute Name	Documentation and Allowed Values	Properties
reportingNFList	List of Network Function Distinguished Name. allowedValues: N/A	Type: DN multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: False
targetInterfaceInfoList	List of network interfaces to be monitored.	Type: NetworkInterface multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: False
networkInterfaceType	The network interface type to be monitored. The applicable network interface type names are specified based on subclause 4.2.3 of 3GPP TS 23.501 [7] and clause 4.2.1 of 3GPP TS 23.273 [15]. The value "ALL" is specified for the case if all the applicable interface type of the network function shall be monitored. allowedValues: ALL, N2, N4, N5, N7, N8, N10, N11, N12, N13, N14, N15, N16, N17, N18, N20, N21, N22, N23, N26, N28, N29, N30, N33, N34, N35, N36, N37, N40, N41, N42, N51, N52, N58, N59, N60, N61, N62, N63, N80, N81, N82, N83, N84, N85, N86, N87, N88, N89, N96, NL1, NL2, NL5, NL6, NL8, NL9.	Type: ENUM multiplicity: 1 isOrdered: N/A isUnique: False defaultValue: ALL isNullable: False
networkInterfaceInstanceList	The list of applicable network interface instances, for which the monitoring is to be performed, of the network interface type specified by networkInterfaceType. allowedValues: DN of MOIs of the following endpoints IOCs as specified in subclause 5.2.1 of 3GPP TS 28.541 [14]: EP_N2, EP_N4, EP_N5, EP_N7, EP_N8, EP_N10, EP_N11, EP_N12, EP_N13, EP_N14, EP_N15, EP_N16, EP_N17, EP_N18, EP_N20, EP_N21, EP_N22, EP_N23, EP_N26, EP_N28, EP_N29, EP_N30, EP_N33, EP_N34, EP_N35, EP_N36, EP_N37, EP_N40, EP_N41, EP_N42, EP_N51, EP_N52, EP_N58, EP_N59, EP_N60, EP_N61, EP_N62, EP_N63, EP_N80, EP_N81, EP_N82, EP_N83, EP_N84, EP_N85, EP_N86, EP_N87, EP_N88, EP_N89, EP_N96, EP_NL1, EP_NL2, EP_NL5, EP_NL6, EP_NL8, EP_NL9.	Type: DN multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: False
serviceOperationList	The list of applicable service operations, exchanged over the network interface instances specified by networkInterfaceInstanceList, that needs to be monitored Or, If networkInterfaceInstanceList is not present, the list of applicable service operations exchanged over the network interface type specified by networkInterfaceType, that needs to be monitored allowedValues: refer to subclause 5.2 of 3GPP TS 23.502 [16].	Type: String multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: False
stmTargetUri	It specifies the Uniform Resource Identifier (URI) of the streaming target where the signalling traffic shall be sent. The detailed URI structure is defined in clause 4.4 of 3GPP TS 32.158 [6].	type: Uri multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
administrativeState	Administrative state of a managed object instance. The administrative state describes the permission to use or prohibition against using the object instance. The administrative state is set by the STM consumer.	type: BasicAdministrativeState multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: LOCKED isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
operationalState	Operational state of manged object instance. The operational state describes if an object instance is operable ("ENABLED") or inoperable ("DISABLED"). This state is set by the object instance or the STM producer and is hence READ-ONLY.	type: OperationalState multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: DISABLED isNullable: False

6.4 Common notifications

This clause presents a list of notifications, defined in 3GPP TS 28.533 [3], that a STM consumer can receive.

Name	S	Notes
notifyMOICreation	O	
notifyMOIDeletion	O	
notifyMOIAttributeValueChanges	O	
notifyMOIChanges	O	

7 Management services for Signalling traffic monitoring management (stage 3)

7.1 Reporting format

7.1.1 Protocol

The STM report shall be sent as payload on either UDP or TCP transport protocols based on operator's policy.

7.1.2 Format of the STM reports

7.1.2.0 General

The STM report may be formatted based on operator policy by UDP – GRE – PCAPNG encapsulation or by a generic Type – Length – Value encoding.

7.1.2.1 UDP-GRE-PCAPNG Encapsulation

Encoding of STM Payloads shall be performed using GRE in UDP Encapsulation as specified in IETF RFC 8086 [8]. The packet is encapsulated as IP header, UDP header, GRE header, and STM Payload.

The encapsulated STM Payload is shown in figure 7.1.2-1.

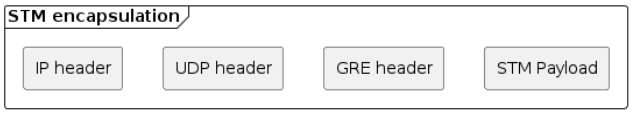

Figure 7.1.2.1-1: STM encapsulation

The STM payload contains the PCAPNG header and payload (IETF draft-ietf-opsawg-pcapng-04 [9]). The PCAPNG payload contains the collected signalling messages. The STM payload has following attributes, as specified in the table 7.1.2.1-1.

Table 7.1.2.1-1: STM Payload

STM Payload attribute name	Description
PCAPNG Header (M)	The received HTTP header of the collected signalling message, over the service-based interfaces, as defined in subclause 5.2 of 3GPP TS 29.500 [12]. See Note 1. or The received PFCP message header of the collected signalling message, over the N4 reference point, as defined in subclause 5.2.2.3 of 3GPP TS 29.244 [13]. See Note 2.
PCAPNG Payload (M)	The collected signalling messages. The collected signalling message is sent before security encapsulation, or received after security decapsulation.
Note 1: the PCAPNG header shall include the received 3gpp-sbi-nf-peer-info. Note 2: the the PCAPNG header shall include the PFCP Entity which is the endpoint in a CP (or UP) function supporting PFCP, that is identified by the IP address.	

7.1.2.2 Generic Type – Length- Value encoding

Depending on operator policy the STM payload shall be transferred over UDP or TCP.

The STM payload is formatted as generic Type - Length - Value (TLV) encoding.

Each message starts with four bytes protocol ID, followed by two bytes to indicate the number of bytes of the whole message (including protocol ID and length). The rest of the message consists of a non-empty list of data chunks.

Each data chunk is composed by a chunk type, the total lengths of the chunk, and the payload of the chunk.

Each chunk type reflects an information element that is used by the various signalling protocols on the different protocol layers.

NOTE: In this release of the specification there is no defined format for Type-Length-Value encoding and it is considered informative.

7.2 YANG Definitions

The present clause contains the YANG definitions for the STM NRM.

The Information Service (IS) of the STM NRM is defined in subclause 6.

Mapping rules to produce the YANG definition based on the IS are defined in 3GPP TS 32.160 [10].

YANG definitions are specified in 3GPP Forge, refer to clause 4.4 of TS 28.623 [11] for the Forge location.

Directory: yang-models

Files: _3gpp-stm-nrm-stmfunction.yang

Annex A (informative): Use Cases

A.1 Signalling Monitoring Activation

External monitoring systems are often used by Mobile Network Operators (MNOs) to track network activity for analysis and troubleshooting purposes, and subsequently to perform diagnosis and analysis of their system. Such monitoring system(s) are fully under the control of the MNOs, and the monitoring is performed at signalling level.

The goal of this use case is to enable the authorized consumer (signalling monitor consumer) to activate the streaming of packets from a specific NF or entity acting on behalf of the NF (signalling monitor producer) for a list of network interface type and applicable interface instances and service operations. In this activation it will be requested the desired reliability for the streaming of the signalling traffic, along with the targeted interface(s).

A.2 Signalling Monitoring Termination

Once the signalling traffic monitoring is not needed anymore it needs to be possible to stop the streaming of signalling traffic. The goal of this use case is to enable the authorized consumer (signalling monitoring consumer) to request a specified NF to terminate the streaming of signalling traffic.

A.3 Signalling Traffic Monitoring Streaming

For the signalling traffic to be sent to a signalling monitor consumer it needs to be streamed by the signalling monitor producer. The signalling traffic streams will be transported in a reliable or unreliable way depending on the request at the time of activation.

Annex B (informative): Plant UML source code

B.1 STM architecture

The following PlantUML source code is used to describe STM architecture. As depicted by Figure 5.1-1:

```
@startuml
frame "Signalling Traffic Monitoring System" as STMsystem {
  frame  "STM management" as Zone2 {
    rectangle "STM Management Consumer" as STMConsumer1 #whitesmoke
  }
  frame "STM collection" as Zone3 {
    rectangle "STM Data Consumer" as STMConsumerURI #whitesmoke
  }
}
frame "5GC" as Zone1 {
  rectangle "5G NF" as NF1 #lightgrey {
    rectangle "STM Management Producer" as STMProducer2 #ivory
    rectangle "STM Data Producer" as STMProducer1 #ivory
  }
}
STMConsumer1 <-> STMProducer2  : <&lock-locked>Configuration/Enabling
STMConsumer1 -[hidden]- STMConsumerURI
STMProducer1 => STMConsumerURI: <&lock-locked>Streaming Reporting
STMProducer1 . STMProducer2
@enduml
```

B.2 STM architecture

The following PlantUML source code is used to describe STM architecture. As depicted by Figure 5.1-2:

```
@startuml
frame "Signalling Traffic Monitoring System" as STMsystem {
  frame  "STM management" as Zone2 {
    rectangle "STM Management Consumer" as STMConsumer1 #whitesmoke
  }
  frame "STM collection" as Zone3 {
    rectangle "STM Data Consumer" as STMConsumerURI #whitesmoke
  }
}
frame "5GC" as Zone1 {
  together {
    rectangle "5G NF" as NF2 #lightgrey
    rectangle "STM Data Producer" as STMProducer2 #ivory
    rectangle "STM Management Producer" as STMProducer1 #ivory
  }
}
STMConsumer1 -[hidden]-- STMConsumerURI
STMProducer2 ~ NF2
STMProducer1 ~ NF2
STMProducer1 -[hidden]- STMProducer2
STMConsumer1 <--> STMProducer1 : <&lock-locked>Configuration/Enabling
STMProducer2 ==> STMConsumerURI : <&lock-locked>Streaming Reporting
@enduml
```

B.3 STM control NRM fragment

The following PlantUML source code is used to describe STM control NRM fragment. As depicted by Figure 6.1.2.1-1:

```
@startuml
rectangle "<<InformationObjectClass>>\n stmCtrl" as stmCtrl
rectangle "<<ProxyClass>>\nManagedEntity" as ManagedElement
stmCtrl -left-* ManagedElement : 1   <<name>>    *

note top of ManagedElement
  Represents the following IOCs:
    SubNetwork, ManagedElement, or ManagedFunction
```

```
end note
@enduml
```

B.4 STM control NRM inheritance relationships

The following PlantUML source code is used to describe STM control NRM inheritance relationships. As depicted by Figure 6.1.2.2-1:

```
@startuml
skinparam defaultTextAlignment center
rectangle "<<InformationObjectClass>>\n//Top//" as top
rectangle "<<InformationObjectClass>>\nstmCtrl" as stm
top <|-- stm
@enduml
```

B.5 STM encapsulation

The following PlantUML source code is used to describe STM encapsulation. As depicted by Figure 7.1.2-1:

```
@startuml
frame "STM encapsulation" {
rectangle "GRE header" as GRE
rectangle "STM Payload" as Payload
rectangle "UDP header" as UDP
rectangle "IP header" as IP

IP-[hidden]>UDP
UDP-[hidden]>GRE
GRE-[hidden]>Payload
}
@enduml
```

Annex C (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2024-10	SA5#157	S5-245983	-	-	-	Initial skeleton (v0.0.0)	0.0.0
2024-10	SA5#157	S5-245986				pCR of draft TS28.abc Stage 1 skeleton	0.1.0
2024-10	SA5#157	S5-245987				pCR of draft TS28.abc Stage 2 skeleton	0.1.0
2024-10	SA5#157	S5-245988				pCR of draft TS28.abc Stage 3 skeleton	0.1.0
2024-10	SA5#157	S5-245984				pCR of draft TS28.abc Introduction	0.1.0
2024-10	SA5#157	S5-245985				pCR of draft TS28.abc Scope	0.1.0
2024-10	SA5#157	S5-245989				pCR of draft TS28.abc Stage 1 requirements	0.1.0
2024-11	SA5#158	S5-247351				Rel-19 pCR TS 28.abc Add introduction	0.2.0
2024-11	SA5#158	S5-247072				Signalling traffic monitoring Abbreviations of the drafted TS28.abc	0.2.0
2024-11	SA5#158	S5-247074				Signalling traffic monitoring management operations of the drafted TS28.abc	0.2.0
2024-11	SA5#158	S5-247075				Signalling traffic monitoring management NRM of the drafted TS28.abc	0.2.0
2024-11	SA5#158	S5-247359				Signalling traffic monitoring Report Format of the drafted TS28.abc	0.2.0
2024-11	SA5#158	S5-247073				Rel-19 pCR TS 28.abc Clarify requirements for controlling the monitoring of signalling	0.2.0
2024-11	SA5#158	S5-247077				Signalling traffic monitoring management NRM stage 3 of the drafted TS28.abc	0.2.0
2024-11	SA5#158	Forge				Originally based on MR https://forge.3gpp.org/rep/sa5/MnS/-/merge_requests/1524	
2024-12						editHelp's cleanup	0.2.1
2024-12	SA#106	SP-241610				Presented at SA#105 for Information and Approval	1.0.0
2024-12	SA#106	SP-241951				TS number added	2.0.0
2024-12	SA#106					Upgrade to change control version	19.0.0
2025-01	SA#106					Adding the YANG file as an attachment	19.0.1
2025-03	SA#107	SP-250180	0001	1	F	Rel-19 CR 28560-j00 Corrections according to Edit Helpdesk	19.1.0
2025-06	SA#108	SP-250559	0003	1	F	Rel-19 CR TS 28.560 Corrections on PCAPNG header	19.2.0
2025-06	SA#108	SP-250539	0005	1	D	Removal of already addressed Editor's Note	19.2.0
2025-06	SA#108	SP-250539	0007	1	C	Removal of Editor's Note on encoding	19.2.0
2025-06	SA#108	SP-250539	0008	1	F	Correction of the description of the attribute stmTargetUri	19.2.0
2025-06	SA#108	SP-250539	0009	2	C	Rel-19 CR TS 28.560 Corrections on STM NRM	19.2.0
2025-06	SA#108	SP-250539	0010		C	Rel-19 CR 28.560 Rename YANG module for stmfunction	19.2.0
2025-09	SA#109	SP-251116	0011	1	F	Rel-19 CR TS 28.560 Small Corrections on STM	19.3.0

History

Document history		
V19.3.0	November 2025	Publication