ETSI TS 128 550 V15.4.0 (2020-03)

5G;
Management and orchestration;
Performance assurance
(3GPP TS 28.550 version 15.4.0 Release 15)

Reference
RTS/TSGS-0528550vF40

Keywords
5G

ETSI

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Contents

Foreword

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

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1 Scope

The present document specifies the stage 1, 2 and 3 of performance assurance related management services for 5G networks including network slicing.

The present document does not specify the performance measurements.

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 28.552: "Management and orchestration; 5G performance measurements".

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

[4] ITU-T Recommendation X.721 (1992): "Information technology - Open Systems Interconnection - Structure of management information: Definition of management information".

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

[6] ISO 8601:2000(E) Data elements and interchange formats – Information interchange – Representation of dates and times".

[7] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[8] Void

[9] Void

[10] Void

[11] Void

[12] Void

[13] 3GPP TS 28.628: "Telecommunication management; Self-Organizing Networks (SON) Policy Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[14] 3GPP TS 32.158: "Management and orchestration; Design rules for Representational State Transfer (REST) Solution Sets (SS)".

[15] ITU-T Recommendation X.680 (08/2015) "Information Technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation" (Same as the ISO/IEC International Standard 8824-1).

[16] ITU-T Recommendation X.681 (08/2015) "Information Technology - Abstract Syntax Notation One (ASN.1): Information object specification" (Same as the ISO/IEC International Standard 8824-2).

[17] ITU-T Recommendation X.691 (08/2015) "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)" (Same as the ISO/IEC International Standard 8825-2).

[18] IETF RFC 6455: "The WebSocket Protocol".

[19] IETF RFC 793: "TRANSMISSION CONTROL PROTOCOL".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions 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].

3.2 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 overview

4.1 Overview

The 5G networks and network slicing are designed to support eMBB, URLLC and mIoT services. Some services have ultra-low latency, high data capacity, and strict reliability requirements, as any faults or performance issues in the networks can cause service failure which may result in property damage and body injury. Therefore, it is necessary to collect real-time performance data that can be used by analytic applications (e.g., network optimization, SON, etc.) to detect the potential issues in advance, and take appropriate actions to prevent or mitigate the issues. Also, the performance data shall be able to be consumed by multiple analytic applications with specific purposes.

4.2 Management data analytics

The raw performance data of NFs of the mobile network can be analysed, together with other management data (e.g., alarm information, configuration data),and formed into one or more management analytical data for NFs, sub-networks, NSSIs or NSIs. The management analytical data can be used to diagnose ongoing issues impacting the performance of the mobile network and predict any potential issues (e.g., potential failure and/or performance degradation). For example, the analysis of NSI/NSSI resource usage can form a management analytical data indicating whether a certain resource is deteriorating. The analysis and correlation of the overall performance data of mobile network may indicate overload situation and potential failure(s).

SON Capacity and Coverage Optimization (CCO) is one typical case that may consume the management analytical data. CCO provides optimal coverage and capacity for the E-UTRAN, see clause 4.5 of TS 28.628 [13], which may also be applicable for 5G radio networks. The management analytical data related to coverage and capacity help the SON CCO to realise the situation of coverage and capacity or interference, and to trigger corresponding optimization if needed.

NOTE: Details of the management analytical data including e.g. format, categorisation and method/algorithm of calculations are to be defined.

4.3 PM services

The PM for 5G networks and network slicing is comprised of the management services listed in the table 4.3-1 below:

Table 4.3-1: PM services for 5G networks and network slicing

Management service	Description
Measurement job control service for NF	The management service for creating, terminating and querying the measurement job(s) for the NF(s).
Performance data file reporting service for NF	The management service for reporting the NF performance data file.
Performance data streaming service for NF	The management service for reporting the NF performance data steam.
Measurement job control service for NSSI	The management service for creating, terminating and querying the measurement job(s) for the NSSI(s).
Performance data file reporting service for NSSI	The management service for reporting the NSSI performance data file.
Performance data streaming service for NSSI	The management service for reporting the NSSI performance data stream.
Measurement job control service for NSI	The management service for creating, terminating and querying the measurement job(s) for the NSI(s).
Performance data file reporting service for NSI	The management service for reporting the NSI performance data file.
Performance data streaming service for NSI	The management service for reporting the NSI performance data stream.
Measurement job control service for network/sub-network	The management service for creating, terminating and querying the measurement job(s) for the network(s)/subnetwork(s). The measurement job for the network(s)/subnetwork(s) is to collect the network/subnetwork performance data that are not specific to network slicing.
Performance data file reporting service for network/sub-network	The management service for reporting the file of the network/subnetwork performance data that is not specific to network slicing.
Performance data streaming service for network/sub-network	The management service for reporting the stream of the network/subnetwork performance data that is not specific to network slicing.

5 Specification level requirements

5.1 Use cases

5.1.0 Introduction

The steps of the use cases are logical illustration on how the management service request can be fulfilled. Depending on the deployment scenario, other steps can be used to fulfil the management service request.

5.1.1 NF PM services

5.1.1.1 NF measurement job control service

5.1.1.1.1 Creation of measurement job for NF(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to create a measurement job for collecting the performance data of NF(s).	
Actors and Roles	An authorized consumer of NF measurement job control service.	
Telecom resources	NF(s); Producer of the NF measurement job control service.	
Assumptions	N/A	
Pre-conditions	- The NF(s) have been deployed. - The NF measurement job control service producer is in operation.	
Begins when	The authorized consumer needs to create measurement job for collecting the performance data of NF(s).	
Step 1 (M)	The authorized consumer requests the NF measurement job control service producer to create measurement job to collect the performance data of NF(s). The request needs to indicate that the performance data needs to be reported by performance data file or by performance data streaming.	
Step 2 (M)	The NF measurement job control service producer requests the NF(s) to collect the performance data, per the received measurement job creation request.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The measurement job for NF(s) has been created, and the NF measurement job control service producer generates the performance data for the NF measurement job.	
Traceability	**REQ-MJCS_NF-FUN-1, REQ-MJCS_NF-FUN-2, REQ-MJCS_NF-FUN-3, REQ-MJCS_NF-FUN-4 and REQ-MJCS_NF-FUN-7**	

5.1.1.1.2 Termination of measurement job for NF(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to request the NF measurement job control service producer to terminate a NF measurement job.	
Actors and Roles	An authorized consumer of NF measurement job control service.	
Telecom resources	NF(s) NF measurement job control service producer.	
Assumptions	N/A	
Pre-conditions	The NF measurement job has been created.	
Begins when	The authorized consumer does not need the NF measurement job that is collecting the performance data of NF(s).	
Step 1 (M)	The authorized consumer requests the NF measurement job control service producer to terminate a measurement job that is collecting the performance data of NF(s).	
Step 2 (M)	The NF measurement job control service producer terminates the measurement job and may request the NF(s) to stop collecting the measurements requested by the measurement job.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The NF measurement job is terminated, or still retained but not does not serve the subject consumer anymore.	
Traceability	**REQ-MJCS_NF-FUN-5**	

5.1.1.1.3 Query of measurement jobs for NF(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to query the ongoing NF measurement jobs (i.e. the NF measurement jobs that have been created by the subject consumer and not terminated).	
Actors and Roles	An authorized consumer of NF measurement job control service.	
Telecom resources	NF(s) NF measurement job control service producer.	
Assumptions	N/A	
Pre-conditions	The NF measurement job control service producer is in operation.	
Begins when	The authorized consumer needs to query the ongoing NF measurement jobs.	
Step 1 (M)	The authorized consumer queries the information about the ongoing NF measurement jobs from the NF measurement job control service producer.	
Step 2 (M)	The NF measurement job control service producer provides the information about the ongoing NF measurement jobs to the consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The information about the ongoing NF measurements jobs are available to the consumer.	
Traceability	**REQ-MJCS_NF-FUN-6**	

5.1.1.2 NF performance data file reporting service

5.1.1.2.1 3GPP NF performance data file reporting

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to get the performance data file of 3GPP NF(s).	
Actors and Roles	An authorized consumer of NF performance data file reporting service.	
Telecom resources	Producer of the NF performance data file reporting service.	
Assumptions	N/A	
Pre-conditions	- The 3GPP NF has been deployed. - The NF performance data file reporting service producer is in operation. - The NF performance data file reporting service consumer has subscribed the notification about NF performance data file ready.	
Begins when	The performance data file of 3GPP NF is ready at the NF performance data file reporting service producer.	
Step 1 (M)	The NF performance data file reporting service producer sends the notification about performance data file ready to the authorized consumer.	
Step 2 (M)	The authorized consumer fetches the performance data file from the NF performance data file reporting service producer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The performance data file of 3GPP NF have been reported.	
Traceability	**REQ-PDFR_NF-FUN-1, REQ-PDFR_NF-FUN-2**	

5.1.1.3 NF performance data streaming service

5.1.1.3.1 3GPP NF performance data streaming

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to receive the performance data stream of 3GPP NF(s).	
Actors and Roles	An authorized consumer of NF performance data streaming service.	
Telecom resources	Producer of the NF performance data streaming service.	
Assumptions	N/A	
Pre-conditions	- The 3GPP NF has been deployed. - The NF performance data streaming service producer is in operation. - The NF performance data streaming service consumer has subscribed for receiving the performance data stream from the NF performance data streaming service producer.	
Begins when	The performance data of 3GPP NF is ready at the NF performance data streaming service producer.	
Step 1 (M)	The NF performance data streaming service producer sends the NF performance data stream to the consumer.	
Ends when	The NF performance data streaming service consumer receives the performance data stream.	
Exceptions	One of the steps identified above fails.	
Post-conditions		
Traceability	**REQ-PDS_NF-FUN-1**	

5.1.2 NSSI PM services

5.1.2.1 NSSI measurement job control service

5.1.2.1.1 Creation of measurement job for NSSI(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to create a measurement job for collecting the performance data of NSSI(s).	
Actors and Roles	An authorized consumer of NSSI measurement job control service.	
Telecom resources	NSSI(s); NSSI measurement job control service producer; NF measurement job control service producer; NF performance data file reporting service producer and/or NF performance data streaming service producer; NSSI performance data file reporting service producer and/or NSSI performance data streaming service producer.	
Assumptions	N/A	
Pre-conditions	- The NSSI(s) have been deployed. - The NSSI measurement job control service producer is in operation.	
Begins when	The authorized consumer needs to create measurement job for collecting the performance data of NSSI(s).	
Step 1 (M)	The authorized consumer requests the NSSI measurement job control service producer to create a NSSI measurement job to collect the performance data of NSSI(s). The request needs to indicate that the performance data needs to be reported by performance data file or by performance data streaming.	
Step 2 (M)	The NSSI measurement job control service producer decomposes the performance data type(s) of NSSI into performance data type(s) of the constituent NSSI(s) and/or NF(s).The NSSI measurement job control service producer checks whether the decomposed performance data types of the constituent NSSI(s) and NF(s) can be collected by the existing measurement job(s) for NSSI(s) and/or NF(s). If new measurement job(s) for the constituent NSSI(s) and/or NF(s) are required, the NSSI measurement job control service producer consumes the NSSI measurement job control service and/or the NF measurement job control service to create the new measurement job(s) for the constituent NSSI(s) and/or NF(s) respectively (according to the use case "Creation of measurement job for NF" as described in clause 5.1.1.1.1).	Creation of measurement job for NF
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The measurement job for NSSI has been created, and the NSSI measurement job control service producer consumes the NSSI performance data file reporting service and/or NSSI performance data streaming service to get the performance data of the constituent NSSI(s), and/or consumes the NF performance data file reporting service and/or NF performance data streaming service to get the performance data of the constituent NF(s), and generates the performance data for the NSSI measurement job.	NSSI performance data file reporting; NSSI performance data streaming; NF performance data file reporting; NF performance data streaming
Traceability	**REQ-MJCS_NSSI-FUN-1, REQ-MJCS_NSSI-FUN-2, REQ-MJCS_NSSI-FUN-3, REQ-MJCS_NSSI-FUN-4 and REQ-MJCS_NSSI-FUN-7**	

5.1.2.1.2 Termination of measurement job for NSSI(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to request the NSSI measurement job control service producer to terminate a NSSI measurement job.	
Actors and Roles	An authorized consumer of NSSI measurement job control service.	
Telecom resources	NSSI(s) NSSI measurement job control service producer. NF measurement job control service producer	
Assumptions	N/A	
Pre-conditions	The NSSI measurement job has been created.	
Begins when	The authorized consumer does not need the NSSI measurement job.	
Step 1 (M)	The authorized consumer requests the NSSI measurement job control service producer to terminate a measurement job that is collecting the performance data of NSSI(s).	
Step 2 (M)	The NSSI measurement job control service producer terminates the NSSI measurement job, and may - request the corresponding NSSI measurement job control service producer(s) to terminate the supporting measurement job(s) of the constituent NSSI(s), and/or - consume the NF measurement job control service to request termination of the supporting measurement job(s) of the constituent NF(s) (according to the use case "Termination of measurement job for NF(s)" as described in clause 5.1.1.1.2).	Termination of measurement job for NF(s)
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The NSSI measurement job is terminated.	
Traceability	**REQ-MJCS_NSSI-FUN-5**	

5.1.2.1.3 Query of measurement jobs for NSSI(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to query the ongoing NSSI measurement jobs (i.e. the NSSI measurement jobs that have been created by the subject consumer and not terminated).	
Actors and Roles	An authorized consumer of NSSI measurement job control service.	
Telecom resources	NSSI measurement job control service producer.	
Assumptions	N/A	
Pre-conditions	The NSSI measurement job control service producer is in operation.	
Begins when	The authorized consumer needs to query the ongoing NSSI measurement jobs.	
Step 1 (M)	The authorized consumer queries the information about the ongoing NSSI measurement jobs from the NSSI measurement job control service producer.	
Step 2 (M)	The NSSI measurement job control service producer provides the information about the ongoing NSSI measurement jobs to the consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The information about the ongoing NSSI measurements jobs are available to the consumer.	
Traceability	**REQ-MJCS_NSSI-FUN-6**	

5.1.2.2 NSSI performance data file reporting service

5.1.2.2.1 NSSI performance data file reporting

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to get the performance data file of 3GPP NSSI(s).	
Actors and Roles	An authorized consumer of NSSI performance data file reporting service.	
Telecom resources	Producer of the NSSI performance data file reporting service.	
Assumptions	N/A	
Pre-conditions	- The 3GPP NSSI has been deployed. - The NSSI performance data file reporting service producer is in operation. - The NSSI performance data file reporting service consumer has subscribed the notification about performance data file ready.	
Begins when	The performance data file of 3GPP NSSI(s) is ready at the NSSI performance data file reporting service producer.	
Step 1 (M)	The NSSI performance data file reporting service producer sends the notification about performance data file ready to the authorized consumer.	
Step 2 (M)	The authorized consumer fetches the performance data file from the NSSI performance data file reporting service producer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The performance data file of 3GPP NSSI have been reported.	
Traceability	**REQ-PDFR_NSSI-FUN-1, REQ-PDFR_NSSI-FUN-2**	

5.1.2.3 NSSI performance data streaming service

5.1.2.3.1 NSSI performance data streaming

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to receive the performance data stream of NSSI(s).	
Actors and Roles	An authorized consumer of NSSI performance data streaming service.	
Telecom resources	Producer of the NSSI performance data streaming service.	
Assumptions	N/A	
Pre-conditions	- The 3GPP NSSI has been deployed. - The NSSI performance data streaming service producer is in operation. - The NSSI performance data streaming service consumer has subscribed for receiving the performance data stream from the NSSI performance data streaming service producer.	
Begins when	The performance data of 3GPP NSSI is ready at the NSSI performance data streaming service producer.	
Step 1 (M)	The NSSI performance data streaming service producer sends the NSSI performance data stream to the consumer.	
Ends when	The NSSI performance data streaming service consumer receives the performance data stream.	
Exceptions	One of the steps identified above fails.	
Post-conditions		
Traceability	**REQ-PDS_NSSI-FUN-1**	

5.1.3 NSI PM services

5.1.3.1 NSI measurement job control service

5.1.3.1.1 Creation of measurement job for NSI(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to create a measurement job for collecting the performance data of NSI(s).	
Actors and Roles	An authorized consumer of NSI measurement job control service.	
Telecom resources	NSI(s); NSI measurement job control service producer; The set of NSSI measurement job control service producer, NSSI performance data file reporting service producer and/or NSSI performance data streaming service producer; and/or The set of NF measurement job control service producer, NF performance data file reporting service producer and/or NF performance data streaming service producer.	
Assumptions	N/A	
Pre-conditions	- The NSI(s) have been deployed. - The NSI measurement job control service producer is in operation.	
Begins when	The authorized consumer needs to create measurement job for collecting the performance data of NSI(s).	
Step 1 (M)	The authorized consumer requests the NSI measurement job control service producer to create a NSI measurement job to collect the performance data of NSI(s). The request needs to indicate that the performance data needs to be reported by performance data file or by performance data streaming.	
Step 2 (M)	The NSI measurement job control service producer decomposes the performance data type of NSI(s) into performance data type(s) of the constituent NSSI(s) and/or of constituent NF(s). - The NSI measurement job control service producer checks whether the decomposed performance data of the constituent NSSI(s) can be collected by the existing measurement job(s) for NSSI(s). If new measurement job(s) for the constituent NSSI(s) are required, the NSI measurement job control service producer consumes the NSSI measurement job control service to create the new measurement job(s) for the constituent NSSI(s) (according to the use case "Creation of measurement job for NSSI(s)" as described in clause 5.1.2.1.1); or - The NSI measurement job control service producer checks whether the decomposed performance data of the constituent NF(s) can be collected by the existing measurement job(s) for NF(s). If new measurement job(s) for the constituent NF(s) are required, NSI measurement job control service producer requests the NF PM measurement job control service producer to create the new measurement job(s) for the constituent NF(s) (according to the use case "Creation of measurement job for NF" as described in clause 5.1.1.1.1).	Creation of measurement job for NSSI; and/or Creation of measurement job for NF
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The measurement job for NSI has been created, and the NSI measurement job control service producer consumes the NSSI performance data file reporting service, NSSI performance data streaming service, the NF performance data file reporting service and/or NF performance data streaming service to get the performance data of the constituent NSSI(s) and/or NF(s), and generates the performance data for the NSI measurement job.	NSSI performance data file reporting; NSSI performance data streaming NF performance data file reporting; and/or NF performance data streaming
Traceability	**REQ-MJCS_NSI-FUN-1, REQ-MJCS_NSI-FUN-2, REQ-MJCS_NSI-FUN-3, REQ-MJCS_NSI-FUN-4 and REQ-MJCS_NSI-FUN-7.**	

5.1.3.1.2 Termination of measurement job for NSI(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to request the NSI measurement job control service producer to terminate a NSI measurement job.	
Actors and Roles	An authorized consumer of NSI measurement job control service.	
Telecom resources	NSI(s); NSI measurement job control service producer; NSSI measurement job control service producer; NF measurement job control service producer.	
Assumptions	N/A	
Pre-conditions	The NSI measurement job has been created.	
Begins when	The authorized consumer does not need the NSI measurement job.	
Step 1 (M)	The authorized consumer requests the NSI measurement job control service producer to terminate a NSI measurement job that is collecting the performance data of NSI(s).	
Step 2 (M)	The NSI measurement job control service producer terminates the NSI measurement job, and may - consume the NSSI measurement job control service to request termination of the supporting measurement job(s) of the constituent NSSI(s) if any (according to the use case "Termination of measurement job for NSSI(s)" as described in clause 5.1.2.1.2), and - consume the NF measurement job control service to request termination of the supporting measurement job(s) of the constituent NF(s) if any (according to the use case "Termination of measurement job for NF(s)" as described in clause 5.1.1.1.2).	Termination of measurement job for NSSI(s); Termination of measurement job for NF(s)
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The NSI measurement job is terminated, or still retained to serve other consumers according to step 2.	
Traceability	**REQ-MJCS_NSI-FUN-5**	

5.1.3.1.3 Query of measurement jobs for NSI(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to query the ongoing NSI measurement jobs (i.e. the NSI measurement jobs that have been created by the subject consumer and not terminated).	
Actors and Roles	An authorized consumer of NSI measurement job control service.	
Telecom resources	NSI(s) NSI measurement job control service producer.	
Assumptions	N/A	
Pre-conditions	The NSI measurement job control service producer is in operation.	
Begins when	The authorized consumer needs to query the ongoing NSI measurement jobs.	
Step 1 (M)	The authorized consumer queries the information about the ongoing NSI measurement jobs from the NSI measurement job control service producer.	
Step 2 (M)	The NSI measurement job control service producer provides the information about the ongoing NSI measurement jobs to the consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The information about the ongoing NSI measurements jobs are available to the consumer.	
Traceability	**REQ-MJCS_NSI-FUN-6**	

5.1.3.2 NSI performance data file reporting service

5.1.3.2.1 NSI performance data file reporting

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to get the performance data file of 3GPP NSI(s).	
Actors and Roles	An authorized consumer of NSI performance data file reporting service.	
Telecom resources	Producer of the NSI performance data file reporting service.	
Assumptions	N/A	
Pre-conditions	- The 3GPP NSI has been deployed. - The NSI performance data file reporting service producer is in operation. - The NSI performance data file reporting service consumer has subscribed the notification about performance data file ready.	
Begins when	The performance data file of 3GPP NSI(s) is ready at the NSI performance data file reporting service producer.	
Step 1 (M)	The NSI performance data file reporting service producer sends the notification about performance data file ready to the authorized consumer.	
Step 2 (M)	The authorized consumer fetches the performance data file from the NSI performance data file reporting service producer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The performance data file of 3GPP NSSI have been reported.	
Traceability	**REQ-PDFR_NSI-FUN-1, REQ-PDFR_NSI-FUN-2**	

5.1.3.3 NSI performance data streaming service

5.1.3.3.1 NSI performance data streaming

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to receive the performance data stream of NSI(s).	
Actors and Roles	An authorized consumer of NSI performance data streaming service.	
Telecom resources	Producer of the NSI performance data streaming service.	
Assumptions	N/A	
Pre-conditions	- The 3GPP NSI has been deployed. - The NSI performance data streaming service producer is in operation. - The NSI performance data streaming service consumer has subscribed for receiving the performance data stream from the NSI performance data streaming service producer.	
Begins when	The performance data of 3GPP NSI is ready at the NSI performance data streaming service producer.	
Step 1 (M)	The NSI performance data streaming service producer sends the NSI performance data stream to the consumer.	
Ends when	The NSI performance data streaming service consumer receives the performance data stream.	
Exceptions	One of the steps identified above fails.	
Post-conditions		
Traceability	**REQ-PDS_NSI-FUN-1**	

5.1.4 Network/Sub-network PM services

5.1.4.1 Network/Sub-network measurement job control service

5.1.4.1.1 Creation of measurement job for network(s)/sub-network(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to create a measurement job for collecting the network/sub-network performance data that are not specific to network slicing.	
Actors and Roles	An authorized consumer of network measurement job control service.	
Telecom resources	Network(s)/sub-network(s); Network measurement job control service producer; NF measurement job control service producer; NF performance data file reporting service producer and/or NF performance data streaming service producer.	
Assumptions	N/A	
Pre-conditions	- The network(s)/sub-network(s) have been deployed; - The network measurement job control service producer is in operation.	
Begins when	The authorized consumer needs to create a network measurement job for collecting the network performance data that are not specific to network slicing.	
Step 1 (M)	The authorized consumer requests the network measurement job control service producer to create measurement job to collect the network performance data that are not specific to network slicing. The request needs to indicate that the performance data needs to be reported by performance data file or by performance data streaming.	
Step 2 (M)	The network measurement job control service producer decomposes the performance data type of network/sub-network into performance data type(s) of the constituent 3GPP NF(s). The network measurement job control service producer whether the decomposed performance data type(s) of the constituent NF(s) can be collected by the existing measurement job(s) for NF(s). If new measurement job(s) for the constituent NF(s) are required, the network measurement job control service producer requests the NF measurement job control service producer to create the new measurement job(s) for the constituent NF(s) (according to the use case "Creation of measurement job for NF" as described in clause 5.1.1.1.1).	Creation of measurement job for NF
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The measurement job for network(s)/sub-network(s) has been created, and the network measurement job control service producer consumes the NF performance data file reporting service and/or NF performance data streaming service to get the performance data of the constituent NF(s), and generates the performance data for the network measurement job.	NF performance data file reporting; NF performance data streaming
Traceability	**REQ-MJCS_NW-FUN-1, REQ-MJCS_NW-FUN-2, REQ-MJCS_NW-FUN-3, REQ-MJCS_NW-FUN-4 and REQ-MJCS_NW-FUN-7**	

5.1.4.1.2 Termination of measurement job for network(s)/sub-network(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to request the network measurement job control service producer to terminate a network measurement job.	
Actors and Roles	An authorized consumer of network measurement job control service.	
Telecom resources	NSSI(s); Network measurement job control service producer; NF measurement job control service producer.	
Assumptions	N/A	
Pre-conditions	The network measurement job has been created.	
Begins when	The authorized consumer does not need the network measurement job.	
Step 1 (M)	The authorized consumer requests the network measurement job control service producer to terminate a network measurement job that is collecting the performance data of network(s)/sub-network(s).	
Step 2 (M)	The network measurement job control service producer terminates the network measurement job, and may consume the NF measurement job control service to request termination of the supporting measurement job(s) of the constituent NF(s) (according to the use case "Termination of measurement job for NF(s)" as described in clause 5.1.1.1.2).	Termination of measurement job for NF(s)
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The network measurement job is terminated, or still retained to serve other consumers according to step 2.	
Traceability	**REQ-MJCS_NW-FUN-5**	

5.1.4.1.3 Query of measurement jobs for network(s)

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to query the ongoing network measurement jobs (i.e. the network measurement jobs that have been created by the subject consumer and not terminated).	
Actors and Roles	An authorized consumer of network measurement job control service.	
Telecom resources	Network(s)/sub-network(s) Network measurement job control service producer.	
Assumptions	N/A	
Pre-conditions	The network measurement job control service producer is in operation.	
Begins when	The authorized consumer needs to query the ongoing network measurement jobs.	
Step 1 (M)	The authorized consumer queries the information about the ongoing network measurement jobs from the network measurement job control service producer.	
Step 2 (M)	The network measurement job control service producer provides the information about the ongoing network measurement jobs to the consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The information about the ongoing network measurements jobs are available to the consumer.	
Traceability	**REQ-MJCS_NW-FUN-6**	

5.1.4.2 Network/Sub-network performance data file reporting service

5.1.4.2.1 Network/Sub-network performance data file reporting

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to get the network/sub-network performance data that are not specific to network slicing.	
Actors and Roles	An authorized consumer of network/sub-network performance data file reporting service.	
Telecom resources	Network/sub-network performance data file reporting service producer.	
Assumptions	N/A	
Pre-conditions	- The network/sub-network has been deployed. - The network/sub-network performance data file reporting service producer is in operation. - The network/sub-network performance data file reporting service consumer has subscribed the notification about performance data file ready.	
Begins when	The performance data file of network/sub-network is ready at the network/sub-network performance data file reporting service producer.	
Step 1 (M)	The network/sub-network performance data file reporting service producer sends the notification about performance data file ready to the authorized consumer.	
Step 2 (M)	The authorized consumer fetches the network /sub-network performance data file from the network/sub-network performance data file reporting service producer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The network/sub-network performance data file have been reported.	
Traceability	**REQ-PDFR_NW-FUN-1, REQ-PDFR_NW-FUN-2**	

5.1.4.3 Network/Sub-network performance data streaming service

5.1.4.3.1 Network/Sub-network performance data streaming

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to receive the stream of the network/sub-network performance data that are not specific to network slicing.	
Actors and Roles	An authorized consumer of network/sub-network performance data streaming service.	
Telecom resources	Network/Sub-network performance data streaming service producer.	
Assumptions	N/A	
Pre-conditions	- The network/sub-network has been deployed. - The network/sub-network performance data streaming service producer is in operation. - The network/sub-network performance data streaming service consumer has subscribed for receiving the performance data stream from the network/sub-network performance data streaming service producer.	
Begins when	The performance data of network is ready at the network/sub-network performance data streaming service producer.	
Step 1 (M)	The network/sub-network performance data streaming service producer sends the network/sub-network performance data stream to the consumer.	
Ends when	The Network/sub-network performance data streaming service consumer receives the network performance data stream.	
Exceptions	One of the steps identified above fails.	
Post-conditions		
Traceability	**REQ-PDS_NW-FUN-1**	

5.1.5 Management data analytics

5.1.5.1 Management data analytics for NSIs/NSSIs

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to collect management analytical data for NSIs/NSSIs.	
Actors and Roles	An authorized consumer of management data analytics service.	
Telecom resources	NSI(s), NSSI(s), NF(s); Producer of management data analytics service; Producer of measurement job control service for NSI(s); Producer of measurement job control service for NSSI(s); Producer of measurement job control service for NF(s); Producer of performance data file reporting service for NSI(s); Producer of performance data file reporting service for NSSI(s); Producer of performance data file reporting service for NF(s);	
Assumptions	N/A	
Pre-conditions	- The NSI(s) have been deployed. - The management data analytics service producer is in operation.	
Begins when	The authorized consumer subscribes to the management analytical data for NSI(s)/NSSI(s).	
Step 1 (M)	The management data analytics service producer determines what performance measurements of NSI(s), NSSI(s) and NF(s) are needed to generate the subject management analytical data.	
Step 2 (M)	The management data analytics service producer checks whether the required NSI performance measurements can be collected by the existing measurement job(s) for NSI(s), NSSI(s) and NF(s). - If new measurement job(s) for the NSI(s) are required, the management data analytics service producer consumes the NSI measurement job control service to create the new measurement job(s) for the NSI(s) (according to the use case "Creation of measurement job for NSI(s)" as described in clause 5.1.3.1.1); - If new measurement job(s) for the NSSI(s) are required, the management data analytics service producer consumes the NSSI measurement job control service to create the new measurement job(s) for the NSSI(s) (according to the use case "Creation of measurement job for NSSI(s)" as described in clause 5.1.2.1.1); - If new measurement job(s) for the NF(s) are required, the management data analytics service producer consumes the NF measurement job control service to create the new measurement job(s) for the NF(s) (according to the use case "Creation of measurement job for NF(s)" as described in clause 5.1.1.1.1).	Creation of measurement job for NSI(s); Creation of measurement job for NSSI(s); Creation of measurement job for NF(s)
Ends when	The consumer unsubscribes to the management analytical data for NSI(s)/NSSI(s).	
Exceptions	One of the steps identified above fails.	
Post-conditions	The management data analytics service producer consumes the performance data reporting related services to get the required performance measurements for NSI(s), NSSI(s) and NF(s), generate the management analytical data based on the collected performance measurements, and makes the management analytical data available to the management service responsible for reporting the data.	
Traceability	**REQ-MDAS-FUN-1**	

5.1.5.2 Management data analytics for network

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To enable the authorized consumer to collect management analytical data for the network.	
Actors and Roles	An authorized consumer of network management data analytics service.	
Telecom resources	3GPP network(s); Producer of network management data analytics service; Producer of measurement job control service for NF(s); Producer of performance data file reporting service for NF(s);	
Assumptions	N/A	
Pre-conditions	- The 3GPP network(s) have been deployed. - The network management data analytics service producer is in operation.	
Begins when	The authorized consumer subscribes to the service of management analytical data for network(s).	
Step 1 (M)	The network management data analytics service producer determines what performance measurements of NF(s) are needed to generate the subject network management analytical data.	
Step 2 (M)	The management data analytics service producer checks whether the required network performance measurements can be collected by the existing measurement job(s) for NF(s. - If new measurement job(s) for the constituent NF(s) are required, the management data analytics service producer consumes the NF measurement job control service to create the new measurement job(s) for the NF(s) (according to the use case "Creation of measurement job for NF(s)" as described in clause 5.1.1.1.1).	Creation of measurement job for NF(s)
Step 3 (M)	The management data analytics service producer consumes the performance data reporting related services to get the required performance measurements for NF(s) and generates the management analytical KPI(s) based on the collected performance measurements.	
Ends when	The consumer unsubscribes to the management analytical data for network(s).	
Exceptions	One of the steps identified above fails.	
Post-conditions	The management analytical data is available to the management service responsible for reporting the data to the consumer.	
Traceability	**REQ-MDAS-FUN-2**	

5.2 Requirements

5.2.1 Requirements for NF measurement job control service

REQ-MJCS_NF-FUN-1 The management service producer responsible for NF measurement job control shall have the capability allowing its authorized consumer to request creation of a measurement job to collect the performance data of NF(s).

REQ-MJCS_NF-FUN-2 The management service producer responsible for NF measurement job control shall have the capability allowing its authorized consumer to indicate the reporting method (i.e. by performance data file or by performance data streaming) for the performance data when requesting to create a measurement job for NF(s).

REQ-MJCS_NF-FUN-3 The management service producer responsible for NF measurement job control shall have the capability to fulfill the consumer's request to create a measurement job for NF(s).

REQ-MJCS_NF-FUN-4 The management service producer responsible for NF measurement job control shall have the capability to generate the performance data of NF(s) according to the measurement job.

REQ-MJCS_NF-FUN-5 The management service producer responsible for NF measurement job control shall have the capability to fulfill the request from its authorized consumer to terminate a NF measurement job.

REQ-MJCS_NF-FUN-6 The management service producer responsible for NF measurement job control shall have the capability allowing its authorized consumer to query the information about the ongoing NF measurement jobs.

REQ-MJCS_NF-FUN-7 The management service producer responsible for NF measurement job control may reject a NF measurement job creation request.

5.2.2 Requirements for NF performance data file reporting service

REQ-PDFR_NF-FUN-1 The management service producer responsible for NF performance data file reporting shall have the capability to send the notification about NF performance data file ready to its authorized consumer.

REQ-PDFR_NF-FUN-2 The management service producer responsible for NF performance data file reporting shall have the capability to allow its authorized consumer to fetch the performance data file of NF(s).

5.2.3 Requirements for NF performance data streaming service

REQ-PDS_NF-FUN-1 The management service producer responsible for NF performance data streaming shall have the capability to send the NF performance data stream to its authorized consumer.

5.2.4 Requirements for NSSI measurement job control service

REQ-MJCS_NSSI-FUN-1 The management service producer responsible for NSSI measurement job control shall have the capability allowing its authorized consumer to request creation of a measurement job to collect the performance data of NSSI(s).

REQ-MJCS_NSSI-FUN-2 The management service producer responsible for NSSI measurement job control shall have the capability allowing its authorized consumer to indicate the reporting method (i.e. by performance data file or by performance data streaming) for the performance data when requesting to create a measurement job for NSSI(s).

REQ-MJCS_NSSI-FUN-3 The management service producer responsible for NSSI measurement job control shall have the capability to generate the performance data of NSSI(s).

REQ-MJCS_NSSI-FUN-4 The management service producer responsible for NSSI measurement job control shall have the capability to fulfill the consumer's request to create a measurement job for NSSI(s).

REQ-MJCS_NSSI-FUN-5 The management service producer responsible for NSSI measurement job control shall have the capability to fulfill the request from its authorized consumer to terminate a NSSI measurement job.

REQ-MJCS_NSSI-FUN-6 The management service producer responsible for NSSI measurement job control shall have the capability to fulfil the request from its authorized consumer to query the information about the ongoing NSSI measurement jobs.

REQ-MJCS_NSSI-FUN-7 The management service producer responsible for NSSI measurement job control may reject a NSSI measurement job creation request.

5.2.5 Requirements for NSSI performance data file reporting service

REQ-PDFR_NSSI-FUN-1 The management service producer responsible for NSSI performance data file reporting shall have the capability to send the notification about NSSI performance data file ready to its authorized consumer.

REQ-PDFR_NSSI-FUN-2 The management service producer responsible for NSSI performance data file reporting shall have the capability to allow its authorized consumer to fetch the performance data file of NSSI(s).

5.2.6 Requirements for NSSI performance data streaming service

REQ-PDS_NSSI-FUN-1 The management service producer responsible for NSSI performance data streaming shall have the capability to send the NSSI performance data stream to its authorized consumer.

5.2.7 Requirements for NSI measurement job control service

REQ-MJCS_NSI-FUN-1 The management service producer responsible for NSI measurement job control shall have the capability allowing its authorized consumer to request creation of a measurement job to collect the performance data of NSI(s).

REQ-MJCS_NSI-FUN-2 The management service producer responsible for NSI measurement job control shall have the capability allowing its authorized consumer to indicate the reporting method (i.e. by performance data file or by performance data streaming) for the performance data when requesting to create a measurement job for NSI(s).

REQ-MJCS_NSI-FUN-3 The management service producer responsible for NSI measurement job control shall have the capability to generate the performance data of NSI(s).

REQ-MJCS_NSI-FUN-4 The management service producer responsible for NSI measurement job control shall have the capability to fulfill the consumer's request to create a measurement job for NSI(s).

REQ-MJCS_NSI-FUN-5 The management service producer responsible for management service producer responsible for NSI measurement job control shall have the capability to fulfill the request from its authorized consumer to terminate a NSI measurement job.

REQ-MJCS_NSI-FUN-6 The management service producer responsible for NSI measurement job control shall have the capability to fulfill the request from its authorized consumer to query the information about the ongoing NSI measurement jobs.

REQ-MJCS_NSI-FUN-7 The management service producer responsible for NSI measurement job control may reject a NSI measurement job creation request.

5.2.8 Requirements for NSI performance data file reporting service

REQ-PDFR_NSI-FUN-1 The management service producer responsible for NSI performance data file reporting shall have the capability to send the notification about NSI performance data file ready to its authorized consumer.

REQ-PDFR_NSI-FUN-2 The management service producer responsible for NSI performance data file reporting shall have the capability to allow its authorized consumer to fetch the performance data file of NSI(s).

5.2.9 Requirements for NSI performance data streaming service

REQ-PDS_NSI-FUN-1 The management service producer responsible for NSI performance data streaming shall have the capability to send the NSI performance data stream to its authorized consumer.

5.2.10 Requirements for network/sub-network measurement job control service

REQ-MJCS_NW-FUN-1 The management service producer responsible for network/sub-network measurement job control shall have the capability allowing its authorized consumer to request creation of a measurement job to collect the network/sub-network performance data that are not specific to network slicing.

REQ-MJCS_NW-FUN-2 The management service producer responsible for network/sub-network measurement job control shall have the capability allowing its authorized consumer to indicate the reporting method (i.e. by performance data file or by performance data streaming) for the performance data that are not specific to network slicing when requesting to create a measurement job for network(s)/sub-network(s).

REQ-MJCS_NW-FUN-3 The management service producer responsible for network/sub-network measurement job control shall have the capability to generate the network/sub-network performance data that are not specific to network slicing.

REQ-MJCS_NW-FUN-4 The management service producer responsible for network/sub-network measurement job control shall have the capability to fulfill the consumer's request to create a measurement job for network(s)/sub-network(s).

REQ-MJCS_NW-FUN-5 The management service producer responsible for network/sub-network measurement job control shall have the capability to fulfill the request from its authorized consumer to terminate a network/sub-network measurement job.

REQ-MJCS_NW-FUN-6 The management service producer responsible for network/sub-network measurement job control shall have the capability to fulfill the request from its authorized consumer to query the information about the ongoing network measurement jobs.

REQ-MJCS_NW-FUN-7 The management service producer responsible for network/sub-network measurement job control may reject a network/sub-network measurement job creation request.

5.2.11 Requirements for network/sub-network performance data file reporting service

REQ-PDFR_NW-FUN-1 The management service producer responsible for network/sub-network performance data file reporting shall have the capability to send the notification about network/sub-network performance data file ready to its authorized consumer.

REQ-PDFR_NW-FUN-2 The management service producer responsible for network/sub-network performance data file reporting shall have the capability to allow its authorized consumer to fetch the performance data file of network(s)/sub-network(s).

5.2.12 Requirements for network/sub-network performance data streaming service

REQ-PDS_NW-FUN-1 The management service producer responsible for network/sub-network performance data streaming shall have the capability to send the network/sub-network performance data stream to its authorized consumer.

5.2.13 Management data analytics service

REQ-MDAS-FUN-1 The management data analytics service producer shall have the capability allowing its authorized consumer to request collection of management analytical data for NSIs/NSSIs.

REQ-MDAS-FUN-2 The management data analytics service producer shall have the capability allowing its authorized consumer to request collection of management analytical data for network(s).

6. Performance assurance specific operations and notifications

6.1 Measurement job control related operations

6.1.1 Operation createMeasurementJob (M)

6.1.1.1 Definition

This operation supports the authorized consumer to request the measurement job control related service producer to create a measurement job.

One measurement job can collect the value of one or multiple measurement types. The measurement types are the performance measurements and assurance data defined in TS 28.552 [2].

When a measurement type is collected by one measurement job for a given instance (e.g., an NF instance), another measurement job creation request which wants to collect the same measurement type for the same instance with different granularity period may be rejected. This behaviour shall be consistent for a given implementation by a specific management service producer.

There are two different methods for the performance data to be reported:

- Performance data file method: In this method the performance data is accumulated for certain time before it is reported; the data will be delivered as a file.

- Performance data streaming method: In this method, the performance data streaming producer, when the performance data are ready, sends the performance data to the consumer (i.e., stream target). The volume of the performance data reported by streaming is expected to be small, and the Granularity period of the performance data stream needs to be configurable and is expected to be short.

6.1.1.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
iOCName	M	The IOC name defined of the NRMs (e.g., as defined in TS 28.541 [3]), or the class name defined locally in the performance measurements specifications (e.g., TS 28.552 [2]).	It specifies one object class name. The consumer requests to collect one or more measurement type(s) of the instances of this class.
iOCInstanceList	M	List of DN	It specifies the list of DNs of object instances whose measurements of the corresponding type(s) are to be collected. An empty list means that for all instances (including the object instances existing at the time of measurement job creation, and the instances added later) known by the management service producer the measurements will be collected.
measurementCategoryList	M	List of measurement type names (see TS 28.552 [2]).	It specifies the measurement type(s) to be measured. The elements of the measurementCategoryList shall be one of the following forms: - The form "family.measurementName.subcounter" can be used in order to retrieve a specified subcounter of a measurement type. - The form "family.measurementName" can be used in order to retrieve a specific measurement type. In case the measurement type includes subcounters, all subcounters will be retrieved. - The form "family" can be used in order to retrieve all measurement types in this family.
reportingMethod	M	The reporting method of the collected performance data.	It specifies the method for the collected performance data to be reported. One of the following methods can be selected: - by performance data file - by performance data streaming (optional).
granularityPeriod	M	The period between generation of two successive measurements.	The management service producer will produce the value of the measurements at the end of each granularityPeriod. If the reportingMethod is performance data file reporting: - The value of granularityPeriod can be 5 minutes, 15 minutes, 30 minutes, 1 hour, 12 hours or 24 hours or other values (see Note 1 below). If the reportingMethod is performance data streaming: - The value of granularityPeriod is an integer value in seconds (see Note 1 below).
reportingPeriod	M	The period between two successive performance data reporting.	Applicable when the reportingMethod is performance data file reporting. The performance data report(s) are produced when the reporting period arrives. The reportingPeriod shall be one or multiple of granularityPeriod. The measurement value of each granularityPeriod will be made available to the performance data reporting related service producer, who will prepare the performance data file(s) for each reportingPeriod. If the consumer has subscribed to the notifyFileReady and notifyFilePreparationError notifications from the performance data reporting related service producer, the consumer will receive the notifications about the result of the performance data file preparation from that producer with the interval as defined by reportPeriod;

Parameter Name	Qualifier	Information type	Comment
startTime	O	It specifies the begin time from which the measurement job will be active.	All values that indicate valid timestamp. Default value is "start now". If startTime is in the past, the current time will be used and the job will start immediately. When a measurement job becomes active, it does not mean that the measurement job immediately starts generation of the measurements of the given type(s). The consumer can set the detailed time frame (e.g. dailySchedule or weeklySchedule) by schedule parameter for a measurement job to generate the measurements. If there is no time frame scheduled, the measurement job immediately starts generation of the measurements when it becomes active.
stopTime	O	It specifies the end time after which the measurement job will be stopped.	The value indicates valid timestamp and shall be later than startTime and current time. This attribute may carry the value "indefinitely". Default value is to run indefinitely.
schedule	O	It specifies the detailed time frames (within the startTime and stopTime) during which the measurement job is active and monitors the measurement type(s).	Its value is only one of the following, dailyScheduling or weeklyScheduling. The legal values for them refer to ITU-T Recommendation X.721 [4]. The legal values for them are as follows. dailyScheduling: {{ intervalStart {hour 0, minute 0}, intervalEnd {hour 23, minute 59}}} weeklyScheduling: {{ daysOfWeek '1111111'B, intervalsOfDay dailyScheduling}} Default value is "daily".
streamTarget	M	It specifies the target of performance data streams carrying the performance data stream unit(s).	Applicable when the reportingMethod is performance data streaming.
priority	O	It specifies the priority of measurement job	Its value should be one of the following: Low, Medium, High Default value is “Medium”
reliability	O	It specifies the reliability of measurement job	Its value is vendor specific. See NOTE 2.

NOTE 1: The granularityPeriod defines the measurement data production rate. The supported rates are dependent on the capacity of the producer involved (e.g. the processing power of the producer, number of measurements being measured by the producer at the time, the complexity of the measurement type involved etc) and therefore, it cannot be standardized for all producers involved. The supported rates can only reflect the negotiated agreement between producer and the consumer involved.

NOTE 2: meaning of “reliability” is not defined in the present document.

6.1.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
jobId	M	It identifies the measurement job instance (and distinguishes it from all other ongoing and stopped measurement job instances that have been created for the subject consumer).	Unique identifier of the measurement job from all the ongoing and stopped Measurement jobs that have been created for the subject consumer.
unsupportedList	M	List of < iOC instance, measurement type name, reason >	To create a measurement job, best-effort is required. The parameter of 'unsupportedList' has to be returned if status = PartialSuccess. The reason can be any of: - Measurement type name is unknown. - Measurement type name is invalid. - Measurement type name is not supported in the specific implementation. - Measurement type name is already monitored for the IOC instance with a different granularityPeriod. - The related IOC instance is unknown (e.g. it does not exist at the time of this operation invocation). - Insufficient capacity to monitor the related IOC instance(s).
status	M	ENUM (Success, Failure, PartialSuccess)	An operation may fail because of a specified or unspecified reason.

6.1.1.4 Exceptions

Exception Name	Definition
invalidStartTime	**Condition:** startTime is invalid. **Returned Information:** Name of the exception; status is set to 'Failure'.
invalidStopTime	**Condition:** stopTime is invalid. **Returned Information:** Name of the exception; status is set to 'Failure'.
invalidSchedule	**Condition:** schedule is invalid. **Returned Information:** Name of the exception; status is set to 'Failure'.
invalidReportingMethod	**Condition:** reportingMethod is invalid. **Returned Information:** Name of the exception; status is set to 'Failure'.
invalidGranularityPeriod	**Condition:** granularityPeriod is invalid. **Returned Information:** Name of the exception; status is set to 'Failure'.
invalidReportingPeriod	**Condition:** reportingPeriod is invalid. **Returned Information:** Name of the exception; status is set to 'Failure'.
highWorkLoad	**Condition:** no sufficient capacity **Returned Information:** Name of the exception and the detailed reason which is one of: CpuBusy; DiskShortage, LowMemory, maxJobReached, otherReason; status is set to 'Failure'.
noValidMeasurementType	**Condition:** all measurement type names are invalid (i.e. none of the measurement type names are valid). **Returned information:** output parameter status is set to 'Failure'.
invalidPriority	**Condition:** priority is invalid. **Returned Information:** Name of the exception; status is set to ‘Failure'.
invalidReliability	**Condition:** reliability is invalid. **Returned Information:** Name of the exception; status is set to ‘Failure'.

6.1.2 Operation stopMeasurementJob (M)

6.1.2.1 Definition

This operation supports the authorized consumer to request the measurement job control related service producer to terminate a measurement job.

Whether the measurement job is removed from the management service producer is vendor specific and out of scope of the present document.

The measurement job shall be stopped at the end of the `granularityPeriod`.

After the job has been stopped, the performance data reporting related notification (i.e. `notifyFileReady` or `notifyFilePreparationError`) and the performance data stream unit(s) for the last `granularityPeriod` shall be emitted, by the performance data reporting related service producer immediately.

6.1.2.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
`jobId`	M	See subclause 6.1.1.3	It specifies the measurement job to be stopped.

6.1.2.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
`Status`	M	ENUM (Success, Failure)	An operation may fail because of a specified or unspecified reason.

6.1.2.4 Exceptions

Exception Name	Definition
`unknownJob`	**Condition:** the `jobId` does not exist. **Returned information:** output parameter status is set to 'Failure'.
`jobCannotBeStopped`	**Condition:** the measurement job cannot be stopped. **Returned information:** output parameter status is set to 'Failure'.

6.1.3 Operation listMeasurementJobs (M)

6.1.3.1 Definition

This operation supports the authorized consumer to request the measurement job control related service producer to list the information of all or a set of specified ongoing measurement jobs.

6.1.3.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
`jobIdList`	M	List of `jobId` of the measurement jobs	This parameter specifies the criteria to list the measurement jobs. If the parameter specifies the list of `jobId` to be retrieved, then the corresponding information of measurement jobs will be returned. If the parameter contains no information, all the measurement jobs are retrieved.

6.1.3.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
jobInfoList	M	List of <attributes (refer to input and output parameter of operation createMeasurementJob in clause 6.1.1.2 and clause 6.1.1.3) of measurement job: - jobId - iOCName - iOCInstanceList - measurementCategoryList - granularityPeriod - reportingMethod - reportingPeriod - startTime - stopTime - streamTarget - schedule - priority - reliability>	Returned information of corresponding Measurement Jobs matching the input criteria. If no match, then the length of the jobInfolist will be 0 (with status == Success). If the measurement job is created using non-empty iOCInstanceList in createMeasurementJob, then iOCInstanceList here shall contain the DNs of the supported IOC instances. If the measurement job is created using empty iOCInstanceList, then iOCInstanceList here shall be empty as well.
status	M	ENUM (Success, Failure)	An operation may fail because of a specified or unspecified reason.

6.1.3.4 Exceptions

Exception Name	Definition
invalidJobIdList	**Condition:** jobIdList specified in the input parameter is valid. **Returned information:** output parameter status is set to 'Failure'.

6.2 Performance data streaming related operations

6.2.1 Operation establishStreamingConnection (M)

6.2.1.1 Definition

This operation supports the performance data streaming service producer to establish streaming connection with the consumer (i.e., stream target), as illustrated in the Annex D.

One connection supports one or more streams, and the information about the supported streams are sent from the producer to the consumer during the connection establishment.

If the streaming connection is successfully established, the producer sends the Performance Data Stream Units (see annex C) to the consumer on this connection according to the information of the supported streams when the performance data is ready for each granularity period.

6.2.1.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
`producerReference`	M	The reference of the producer who requests to establish the streaming connection.	The format of the reference may have dependency on the solution set.
`streamInfoList`	M	List of < streamId, measObjDn, measTypes, >	It contains the information on the performance data streams: - streamId: unique identifier of the stream between the performance data streaming producer and the stream target; - measObjDn: the DN of the measured object instance; - measTypes: a list of measurement type whose measurement result values are to be reported by the Performance Data Stream Units via this stream. The measurement result values shall be reported following the sequence of the measurement types as presented in the `'measTypes'` parameter.

6.2.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
connectionId	M	The identifier of the established streaming connection.	It identifies the streaming connection. The format may have dependency on the solution set.
status	M	ENUM (Success, Failure)	An operation may fail because of a specified or unspecified reason.

6.2.1.4 Exceptions

Exception Name	Definition
unexpectedStreams	**Condition:** Some information in streamInfoList are unexpected by the consumer. **Returned Information:** Name of the exception; status is set to 'Failure'.

6.2.2 Operation terminateStreamingConnection (M)

6.2.2.1 Definition

This operation supports the performance data streaming service producer to terminate the streaming connection with the consumer (i.e., stream target).

If the streaming connection is successfully terminated, the producer shall stop sending the Performance Data Stream Units (see annex C) to the consumer on this connection.

6.2.2.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
connectionId	M	See clause 6.2.1.3	It specifies the streaming connection to be terminated.

6.2.2.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
Status	M	ENUM (Success, Failure)	An operation may fail because of a specified or unspecified reason.

6.2.2.4 Exceptions

Exception Name	Definition
unknownConnection	**Condition:** the connectionId is invalid. **Returned Information:** Name of the exception; status is set to 'Failure'.

6.2.3 Operation reportStreamData (M)

6.2.3.1 Definition

This operation is used by the performance data streaming service producer to send the Performance Data Stream Unit (see annex C) to the consumer on the connection established between the producer and consumer.

6.2.3.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
streamId	M	The identifier of the stream.	The streamId of the performance data stream.
granularityPeriodEndTime	M	It specifies the time stamp of the end of the granularity period, for which the measResults are reported.	Time stamp referring to the end of the granularity period.
measResults	M	The actual measurement results.	This parameter contains the sequence of result values for the observed measurement types. The "measResults" sequence shall have the same number of elements, which follow the same order as the measurement types presented in "measTypes" for the subject stream in the input parameter streamInfoList of the establishStreamingConnection operation (see clause 6.2.1.2).

6.2.3.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
status	M	ENUM (Success, Failure)	An operation may fail because of a specified or unspecified reason.

6.2.3.4 Exceptions

Exception Name	Definition

6.2.4 Operation getStreamInfo (M)

6.2.4.1 Definition

This operation supports the performance data streaming service producer (or another authorized entity) to get the information for one or more streams from the streaming consumer (i.e, stream target).

6.2.4.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
`streamIdList`	M	List of streamId	It provides the list of the streamId for which the stream information to be returned. The empty list indicates the stream information for all streams are to be returned.

6.2.4.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
`listOfStreamInfoOut`	M	List of < streamId, measObjDn, measTypes, >	It provides the list of the stream information successfully returned. The stream information contains the following information: - streamId: unique identifier of the stream to add; - measObjDn: the DN of the measured object instance; - measTypes: a list of measurement type.
`status`	M	ENUM (Success, Failure, PartialSuccess)	An operation may fail or partially fail because of a specified or unspecified reason.

6.2.4.4 Exceptions

Exception Name	Definition
`UnknownstreamIds`	**Condition:** One or more of streamId in the `streamIdList` are unknown. **Returned Information:** Name of the exception; status is set to 'Failure' or 'PartialSuccess'.

6.2.5 Operation addStreamInfo (M)

6.2.5.1 Definition

This operation supports the performance data streaming service producer to add the information for one or more new streams to the consumer (i.e., stream target).

6.2.5.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
listOfStreamInfoToAdd	M	List of < streamId, measObjDn, measTypes, >	It provides the list of the stream information to be added. The stream information contains the following information: - streamId: unique identifier of the stream to add; - measObjDn: the DN of the measured object instance; - measTypes: a list of measurement type whose measurement result values are to be reported by the Performance Data Stream Units via this stream. The measurement result values shall be reported following the sequence of the measurement types as presented in the 'measTypes' parameter.

6.2.5.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
listOfStreamInfoAdded	M	List of < streamId, measObjDn, measTypes, >	It provides the list of the stream information successfully added. The stream information contains the following information: - streamId: unique identifier of the stream to add; - measObjDn: the DN of the measured object instance; - measTypes: a list of measurement type whose measurement result values are to be reported by the Performance Data Stream Units via this stream. The measurement result values shall be reported following the sequence of the measurement types as presented in the 'measTypes' parameter.
status	M	ENUM (Success, Failure, PartialSuccess)	An operation may fail or partially fail because of a specified or unspecified reason.

6.2.5.4 Exceptions

Exception Name	Definition
streamIdsAleadyExist	**Condition:** One or more of streamId in the listOfStreamInfoToAdd already exist in the streamInfoList. **Returned Information:** Name of the exception; status is set to 'Failure' or 'PartialSuccess'.

6.2.6 Operation updateStreamInfo (M)

6.2.6.1 Definition

This operation supports the performance data streaming service producer to update the information for one or more streams to the consumer (i.e., stream target).

6.2.6.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
streamIdList	M	List of streamId	It provides the list of the streamId for which the stream information is to update.
listOfStreamInfoToUpdate	M	List of < measObjDn, measTypes, >	The list of stream information to be updated. It shall have the same number of entries as streamIdList parameter in this operation. The measObjDn: the updated DN of the measured object instance. Empty value means no update on this parameter. The measTypes: the updated list of measurement type whose measurement result values are to be reported by the Performance Data Stream Units via this stream. The measurement result values shall be reported following the sequence of the measurement types as presented in the 'measTypes' parameter. Empty value means no update on this parameter. At least one of the measObjDn and measTypes shall be non-empty.

6.2.6.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
listOfStreamInfoUpdated	M	List of < streamId, measObjDn, measTypes, >	It provides the list of the stream information successfully updated. The stream information contains the following information: - streamId: unique identifier of the stream to update; - measObjDn: the DN of the measured object instance; - measTypes: a list of measurement type.
status	M	ENUM (Success, Failure, PartialSuccess)	An operation may fail or partially fail because of a specified or unspecified reason.

6.2.6.4 Exceptions

Exception Name	Definition
unknownStreamIds	**Condition:** One or more streamId are unknown by the consumer. **Returned Information:** Name of the exception; status is set to 'Failure' or "PartialSuccess".

6.2.7 Operation deleteStreamInfo (M)

6.2.7.1 Definition

This operation supports the performance data streaming service producer to delete the information for one or more streams from the consumer (i.e., stream target).

6.2.7.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
streamIdList	M	List of streamId	It provides the list of the streamId for which the stream information is to delete.

6.2.7.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
status	M	ENUM (Success, Failure)	An operation may fail because of a specified or unspecified reason.

6.2.7.4 Exceptions

Exception Name	Definition
unknownStreamId	**Condition:** The streamId is unknown by the consumer. **Returned Information:** Name of the exception; status is set to 'Failure'.

7. Performance assurance services components

7.1 Measurement job control services

The components of measurement job control services for NFs, NSSIs, NSIs and networks/sub-networks are listed in table 7.1-1.

Table 7.1-1: Components of measurement job control services

Management service	Management service component type A	Management service component type B	Management service component type C
Measurement job control services for NFs	createMeasurementJob stopMeasurementJob listMeasurementJobs	IOCs for 5G NFs, as defined in TS 28.541 [3]	Performance measurements and assurance data for 5G NFs, as defined in draft TS 28.552 [2].
Measurement job control services for NSSIs	createMeasurementJob stopMeasurementJob listMeasurementJobs	IOC(s) for NSSI, as defined in TS 28.541 [3].	Performance measurements and assurance data for NSSI, as defined in draft TS 28.552 [2].
Measurement job control services for NSIs	createMeasurementJob stopMeasurementJob listMeasurementJobs	IOC(s) for NSI, as defined in TS 28.541 [3]	Performance measurements and assurance data for NSI, as defined in draft TS 28.552 [2].
Measurement job control services for sub-networks	createMeasurementJob stopMeasurementJob listMeasurementJobs	IOC(s) for sub-network, as defined in TS 28.541 [3]	Performance measurements and assurance data for sub-network, as defined in draft TS 28.552 [2].

7.2 Performance data file reporting services

The components of performance data file reporting services for NFs, NSSIs, NSIs and networks/sub-networks are listed in table 7.2-1.

Table 7.2-1: Components of performance data file reporting services

Management service	Management service component type A	Management service component type B	Management service component type C
Performance data file reporting services for NFs	notifyFileReady (see TS 28.532 [7]	IOCs for 5G NFs, as defined in TS 28.541 [3]	Performance measurements for 5G NFs, as defined in draft TS 28.552 [2].
	notifyFilePreparationError (see TS 28.532 [7]		
	listAvailableFiles (see TS 28.532 [7]		
	subscribe (see TS 28.532 [7])		
	unsubscribe (see TS 28.532 [7])		
Performance data file reporting services for NSSIs	notifyFileReady (see TS 28.532 [7]	IOC(s) for NSSI, as defined in TS 28.541 [3].	Performance measurements for NSSI, as defined in draft TS 28.552 [2].
	notifyFilePreparationError (see TS 28.532 [7]		
	listAvailableFiles (see TS 28.532 [7]		
	subscribe (see TS 28.532 [7])		
	unsubscribe (see TS 28.532 [7])		
Performance data file reporting services for NSIs	notifyFileReady (see TS 28.532 [7]	IOC(s) for NSI, as defined in TS 28.541 [3].	Performance measurements for NSI, as defined in draft TS 28.552 [2].
	notifyFilePreparationError (see TS 28.532 [7]		
	listAvailableFiles (see TS 28.532 [7]		
	subscribe (see TS 28.532 [7])		
	unsubscribe (see TS 28.532 [7])		
Performance data file reporting services for sub-networks	notifyFileReady (see TS 28.532 [7]	IOC(s) for sub-network, as defined in TS 28.622 [5].	Performance measurements for sub-network, as defined in draft TS 28.552 [2].
	notifyFilePreparationError (see TS 28.532 [7]		
	listAvailableFiles (see TS 28.532 [7]		
	subscribe (see TS 28.532 [7])		
	unsubscribe (see TS 28.532 [7])		

7.3 Performance data streaming services

The components of performance data streaming services for NFs, NSSIs, NSIs and networks/sub-networks are listed in table 7.3-1.

Table 7.3-1: Components of performance data streaming services

Management service	Management service component type A	Management service component type B	Management service component type C
Performance data streaming service for NFs	establishStreamingConnection; terminateStreamingConnection; reportStreamData; getStreamInfo; addStreamInfo; updateStreamInfo; deleteStreamInfo.createMeasurementJob; stopMeasurementJob; listMeasurementJobs	IOCs for 5G NFs, as defined in TS 28.541 [3]	Performance measurements for 5G NFs, as defined in TS 28.552 [2].
Performance data streaming service for NSSIs	establishStreamingConnection; terminateStreamingConnection; reportStreamData; getStreamInfo; addStreamInfo; updateStreamInfo; deleteStreamInfo.createMeasurementJob; stopMeasurementJob; listMeasurementJobs	IOC(s) for NSSI, as defined in TS 28.541 [3].	Performance measurements for NSSI, as defined in TS 28.552 [2].
Performance data streaming service for NSIs	establishStreamingConnection; terminateStreamingConnection; reportStreamData; getStreamInfo; addStreamInfo; updateStreamInfo; deleteStreamInfo.createMeasurementJob; stopMeasurementJob; listMeasurementJobs	IOC(s) for NSI, as defined in TS 28.541 [3].	Performance measurements for NSI, as defined in TS 28.552 [2].
Performance data streaming service for sub-networks	establishStreamingConnection; terminateStreamingConnection; reportStreamData; getStreamInfo; addStreamInfo; updateStreamInfo; deleteStreamInfo.createMeasurementJob; stopMeasurementJob; listMeasurementJobs	IOC(s) for sub-network, as defined in TS 28.541 [3].	Performance measurements for sub-network, as defined in TS 28.552 [2].

7.4 Void

8 RESTful HTTP-based solution set of performance measurement job control service specific operations and notifications

8.1 Mapping of operations

8.1.1 Introduction

The IS operations are mapped to SS equivalents according to table 8.1.1-1.

Table 8.1.1-1: Mapping of IS operations to SS equivalents

IS operation	HTTP Method	Resource URI	Qualifier
createMeasurementJob	POST	/measJobs	M
listMeasurementJobs	GET	/measJobs	M
		/measJobs/{jobId}	M
stopMeasurementJob	DELETE	/measJobs/{jobId}	M

8.1.2 Operation "createMeasurementJob"

The IS operation parameters are mapped to SS equivalents according to table 8.1.2-1 and table 8.1.2-2.

Table 8.1.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
iOCName	request body	iOCName	string	M
iOCInstanceList	request body	iOCInstanceList	array(uri-Type)	M
measurementCategoryList	request body	measurementCategoryList	array(string)	M
reportingMethod	request body	reportingMethod	reportingMethodType	M
granularityPeriod	request body	granularityPeriod	Integer	M
reportingPeriod	request body	reportingPeriod	Integer	M
startTime	request body	startTime	dateTime-Type	O
stopTime	request body	stopTime	dateTime-Type	O
schedule	request body	schedule	ScheduleType	O
streamTarget	request body	streamTarget	string	M
priority	request body	priority	PriorityType	O
reliability	request body	reliability	string	O

Table 8.1.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
jobId	Location header	href	uri-Type	M
unsupportedList	response body	unsupportedList	array(unsupportedMeas-Type)	M
status	response status codes response body	n/a error	n/a error-ResponseType	M

8.1.3 Operation "listMeasurementJobs"

The IS operation parameters are mapped to SS equivalents according to table 8.1.3-1 and table 8.1.3-2.

Table 8.1.3-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
jobIdList	Path Query	MeasJobs/{jobId} jobIdList	jobId: string array(string)	O

Table 8.1.3-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
jobInfoList	response body	data	measJobsRetrieval-ResponseType	O
status	response status codes response body	n/a error	n/a error-ResponseType	M

8.1.4 Operation "stopMeasurementJob"

The IS operation parameters are mapped to SS equivalents according to table 8.1.4-1 and table 8.1.4-2.

Table 8.1.4-1: Mapping of IS operation input parameters to SS equivalents (HTTP DELETE)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
jobId	path	/MeasJobs/{jobId}	jobId:string	M

Table 8.1.4-2: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
status	response status codes response body	n/a error	n/a error-ResponseType	M

8.2 Resources

8.2.0 Resource structure

Figure 8.2.0-1 shows the resource structure of the performance measurement job control service.

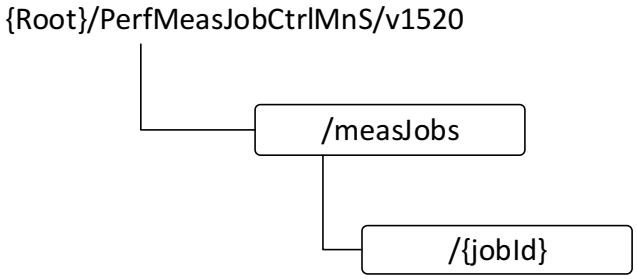

Figure 8.2.0-1: Resource URI structure of the performance measurement job control service

Table 8.2.0-1 provides an overview of the resources and applicable HTTP methods.

Table 8.2.0-1: Resources and methods overview

Resource name	Resource URI	HTTP method	Description
measJobs	/measJobs	GET	Retrieve all or a list of measurement jobs
		POST	Create a measurement job
measJob	/measJobs /{jobId}	GET	Retrieve a measurement job
		DELETE	Stop a measurement job

8.2.1 Resource definitions

8.2.1.1 Void

8.2.1.2 Resource "/measJobs"

8.2.1.2.1 Description

This resource represents a collection of measurement jobs.

8.2.1.2.2 URI

Resource URI = {DN_prefix_authority_part}/{DN_prefix_remainder}/PerfMeasJobCtrlMnS/v1520/measJobs

The resource URI variables a defined in the following table.

Table 8.2.1.2.2-1: URI variables

Name	Definition
DN_prefix_authority_part	See subclause 4.4 of TS 32.158 [14]
DN_prefix_remainder	See subclause 4.4 of TS 32.158 [14]

8.2.1.2.3 HTTP methods

8.2.1.2.3.1 HTTP POST

This method shall support the URI query parameters specified in the following table.

Table 8.2.1.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	Description	SQ

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 8.2.1.2.3.1-2: Data structures supported by the POST request body on this resource

Data type	Description	SQ
measJobCreation-RequestType	The resource representation of the measurement job to be created	M

Table 8.2.1.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	Response codes	Description	SQ
measJobCreation-ResponseType	201 Created	In case of success the representation of the created measurement job is returned.	M
	202 Partially created	In case of partial success the representation of the created measurement job with unsupported list is returned.	
error-Type	4xx/5xx	Returned in case of an error	M

8.2.1.2.3.2 HTTP GET

This method shall support the URI query parameters specified in the following table.

Table 8.2.1.2.3.2-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	SQ
jobIdList	Array (string)	This parameter extends the set of targeted resources beyond the base resource identified with the path component of the URI. No scoping mechanism is specified in the present release.	O

This method shall support the request data structures, the response data structures and response codes specified in the following tables.

Table 8.2.1.2.3.2-2: Data structures supported by the GET request body on this resource

Data type	Description	SQ

Table 8.2.1.2.3.2-3: Data structures supported by the GET response body on this resource

Data type	Response codes	Description	SQ
measJobsRetrieval-ResponseType	200 OK	The resource representations of the measurement job list retrieved.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

8.2.1.3 Resource "/measJobs/{jobId}"

8.2.1.3.1 Description

This resource represents a measurement job.

8.2.1.3.2 URI

Resource URI = {DN_prefix_authority_part}/{DN_prefix_remainder}/PerfMeasJobCtrlMnS/v1620/measJobs/{jobId}

The resource URI variables a defined in the following table.

Table 8.2.1.3.2-1: URI variables

Name	Definition
DN_prefix_authority_part	See subclause 4.4 of TS 32.158 [14]
DN_prefix_remainder	See subclause 4.4 of TS 32.158 [14]
jobId	The id of the measurement job

8.2.1.3.3 HTTP methods

8.2.1.3.3.1 HTTP GET

This method shall support the URI query parameters specified in the following table.

Table 8.2.1.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	SQ

This method shall support the request data structures, the response data structures and response codes specified in the following tables.

Table 8.2.1.3.3.1-2: Data structures supported by the GET request body on this resource

Data type	Description	SQ
n/a	n/a	n/a

Table 8.2.1.3.3.1-3: Data structures supported by the GET response body on this resource

Data type	Response codes	Description	SQ
measJobsRetrieval-ResponseType	200 OK	The resource representations of the measurement job retrieved.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

8.2.1.3.3.2 HTTP DELETE

This method shall support the URI query parameters specified in the following table.

Table 8.2.1.3.3.2-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	Description	SQ

This method shall support the request data structures, the response data structures and response codes specified in the following tables.

Table 8.2.1.3.3.2-2: Data structures supported by the DELETE request body on this resource

Data type	Description	SQ
n/a	n/a	n/a

Table 8.2.1.3.3.2-3: Data structures supported by the DELETE response body on this resource

Data type	Response codes	Description	SQ
n/a	204 No Content	In case of success no message body is returned	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

8.3 Data type definitions

8.3.1 General

Table 8.3.1-1: Data types defined in this specification

Data type	Reference	Description
General types		
dataTime-Type	8.3.8.2	Data type of date and time.
uri-Type	8.3.8.2	The data type of a URI
Types used in paths		
Types used in query parts		
Types used in request bodies		
measJobCreation-RequestType	8.3.6.1	Used in the request body of HTTP POST describing the measurement job to be created
Types used in response bodies		
measJobCreation-ResponseType	8.3.6.2	Used in the response body of HTTP POST describing the measurement job created
measJobsRetrieval-ResponseType	8.3.6.3	Used in the response body of HTTP GET describing the measurement job(s) retrieved
error-ResponseType	8.3.6.4	Used in the response body describing the error.
Types used for resources		
measJobInfo-ResourceType	8.3.6.5	Used for representation of the measurement job information.
Types referenced by the definitions above		
reportingMethod-Type	8.3.8.3	This defines the data type for reporting method.
schedule-Type	8.3.7.1	This defines the data type for schedule.
priority-Type	8.3.8.4	This defines the data type for priority of the measurement job.
unsupportedMeas-Type	8.3.7.5	This defines the data type for the unsupported measurement types for an IOC instance.

Table 8.3.1-2: Data types imported

Data type	Reference	Description

8.3.2 Void

8.3.3 Void

8.3.4 Structured general data types

None.

8.3.5 Structured path data types

None.

8.3.6 Query, message body and resource data types

8.3.6.1 Type measJobCreation-RequestType

Table 8.3.6.1-1: Definition of type measJobCreation-RequestType

Attribute name	Data type	Description	SQ
iOCName	string	The IOC name of the IOC instances for which the measurement job is to be created.	M
iOCInstanceList	array(uri-Type)	The URI(s) of the IOC instances for which the measurement job is to be created.	M
measurementCategoryList	array(string)	The list of measurement type(s) to be measured.	M
reportingMethod	reportingMethod-Type	The reporting method of the measurements to be collected, i.e., by performance data file or by performance data streaming.	M
granularityPeriod	Integer	The granularity period of the measurement job.	M
reportingPeriod	Integer	The reporting period of the measurement job.	M
startTime	dateTime-Type	The begin time from which the measurement job will be active.	O
stopTime	dateTime-Type	The end time after which the measurement job will be stopped.	O
schedule	schedule-Type	The detailed time frames (within the startTime and stopTime) during which the measurement job is active and monitors the measurement type(s).	O
streamTarget	string	The target of performance data streams carrying the performance data stream unit(s).	M
priority	priority-Type	The priority of the measurement job.	O
reliability	string	The reliability of the measurement job.	O

8.3.6.2 Type measJobCreation-ResponseType

Table 8.3.6.2-1: Definition of type measJobCreation-ResponseType

Attribute name	Data type	Description	SQ
unsupportedList	array(unsupportedMeas-Type)	The list of unsupported IOC instances, unsupported measurement types and reason.	M

8.3.6.3 Type measJobsRetrieval-ResponseType

Table 8.3.6.3-1: Definition of type measJobsRetrieval-ResponseType

Attribute name	Data type	Description	SQ
jobInfoList	array(measJobInfo-ResourceType)	The list of measurement job information.	M

8.3.6.4 Type error-ResponseType

Table 8.3.6.4-1: Definition of type error-ResponseType

Attribute name	Data type	Description	SQ
error	object	Key indicating the response body containing an error	M
> errorInfo	string	Attribute allowing to convey error information in string format	M

8.3.6.5 Type measJobInfo-ResourceType

Table 8.3.6.3-1: Definition of type measJobsRetrieval-ResponseType

Attribute name	Data type	Description	SQ
href	uri-Type	The URI of the measurement job.	M
iOCName	string	The IOC name of the IOC instances for which the measurement job created.	M
iOCInstanceList	array(uri-Type)	The URI(s) of the IOC instances for which the measurement job is created.	M
measurementCategoryList	array(string)	The list of measurement type(s) measured.	M
reportingMethod	reportingMethod-Type	The reporting method of the measurements, i.e., by performance data file or by performance data streaming.	M
granularityPeriod	Integer	The granularity period of the measurement job.	M
reportingPeriod	Integer	The reporting period of the measurement job.	M
startTime	dateTime-Type	The begin time from which the measurement job is active.	O
stopTime	dateTime-Type	The end time after which the measurement job will be stopped.	O
schedule	schedule-Type	The detailed time frames (within the startTime and stopTime) during which the measurement job is active and monitors the measurement type(s).	O
streamTarget	string	The target of performance data streams carrying the performance data stream unit(s).	M
priority	priority-Type	The priority of the measurement job.	O
reliability	string	The reliability of the measurement job.	O

8.3.7 Referenced structured data types

8.3.7.1 Type schedule-Type

Table 8.3.7.1-1: Definition of schedule-Type

Attribute name	Data type	Description	SQ
scheduleOption	scheduleOption-Type	It indicates the schedule is daily or weekly	M
dailySchedule	array(timeInterval-Type)	It defines the daily schedule.	M
weeklySchedule	array(scheduleOfDay-Type)	It defines the weekly schedule.	M

8.3.7.2 Type timeInterval-Type

Table 8.3.7.2-1: Definition of timeInterval-Type

Attribute name	Data type	Description	SQ
intervalStart	string	It defines the start time of the schedule, by a string in Time format.	M
intervalEnd	string	It defines the end time of the schedule, by a string in Time format.s	M

8.3.7.3 Type scheduleOfDay-Type

Table 8.3.7.3-1: Definition of scheduleOfDay-Type

Attribute name	Data type	Description	SQ
dayOfWeek	dayOfWeek-Type	It defines the day of a week.	M
intervalsOfDay	array(timeInterval-Type)	It defines the schedule of the day.	M

8.3.7.4 Void

8.3.7.5 Type unsupportedMeas-Type

Table 8.3.7.5-1: Definition of unsupportedMeas-Type

Attribute name	Data type	Description	SQ
iOCInstance	uri-Type	The URI of the IOC instance.	M
measurementTypeName	string	It defines the measurement type name that the IOC Instance as indicated above does not support	M
reason	string	It specifies the reason that measurement type name is not supported by the IOC instance	M

8.3.8 Simple data types and enumerations

8.3.8.1 General

This subclause defines simple data types and enumerations that are used by the data structures defined in the previous subclauses.

8.3.8.2 Simple data types

Table 8.3.8.2-1: Simple data types

Type name	Type definition	Description
dataTime-Type	string	The data type for date and time in “date-time” format.
uri-Type	string	The type of a URI

8.3.8.3 Enumeration reportingMethod-Type

Table 8.3.8.3-1: Enumeration reportingMethod-Type

Enumeration value	Description
file	It indicates that the performance data are to be reported by performance data file.
streaming	It indicates that the performance data are to be reported by performance data streaming.

8.3.8.4 Enumeration priority-Type

Table 8.3.8.4-1: Enumeration priority-Type

Enumeration value	Description
Low	It indicates that the priority of the measurement job is low
medium	It indicates that the priority of the measurement job is medium
high	It indicates that the priority of the measurement job is high

8.3.8.5 Enumeration scheduleOption-Type

Table 8.3.8.5-1: Enumeration scheduleOption-Type

Enumeration value	Description
daily	It indicates the schedule of the measurement job is daily.
weekly	It indicates the schedule of the measurement job is weekly.

8.3.8.6 Enumeration dayOfWeek-Type

Table 8.3.8.6-1: Enumeration dayOfWeek-Type

Enumeration value	Description
Monday	It indicates Monday of a week.
Tuesday	It indicates Tuesday of a week.
Wednesday	It indicates Wednesday of a week.
Thursday	It indicates Thursday of a week.
Friday	It indicates Friday of a week.
Saturday	It indicates Saturday of a week.
Sunday	It indicates Sunday of a week.

9 RESTful HTTP-based solution set of performance data streaming operations with WebSocket-based extensions

9.1 Introduction

This clause specifies the stage 3 solution set of the performance data streaming related operations (as defined in clause 6.2) based on RESTful HTTP and WebSocket protocol (see IETF RFC 6455 [18]).

9.2 Mapping of operations

9.2.1 Introduction

The IS operations are mapped to SS equivalents according to table 9.2.1-1.

Table 9.2.1-1: Mapping of IS operations to SS equivalents

IS operation	Method/frame	Qualifier
`establishStreamingConnection`	HTTP POST (see NOTE)	M
	HTTP GET (Upgrade, see NOTE)	M
`terminateStreamingConnection`	`WebSocket` Close frame sent (frame with opcode of 0x8), and `WebSocket` Close frame received (frame with opcode of 0x8 for successful case)	M
`reportStreamData`	`WebSocket` Data frame sent (frame with opcode of 0x2)	M
`addStreamInfo`	HTTP GET	M
`updateStreamInfo`	HTTP PATCH	M
`deleteStreamInfo`	HTTP DELETE	M
Note: the `establishStreamingConnection` is mapped to a HTTP POST operation followed by a HTTP GET operation. The HTTP POST operation is to send the information in StreamInfoList parameter to the consumer, and the HTTP GET (Upgrade) operation is to establish the WebSocket connection.		

9.2.2 Operation "establishStreamingConnection"

The IS operation parameters are mapped to SS equivalents according to table x.2.2-1 and table x.2.2-4.

Table 9.2.2-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
streamInfoList	request body	streamInfoList	array(streamInfoList - Type)	M

Table 9.2.2-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
status	response status codes response body	n/a error	n/a error-ResponseType	M

Table 9.2.2-3: Mapping of IS operation input parameters to SS equivalents (HTTP GET (Upgrade))

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
producerReference	Headers	Origin	String	n/a
--	HTTP-Version (Request-Line)	--	String (see Note 1)	M
--	Upgrade Header	--	Constant string: websocket	M
--	Connection Header	--	Constant string: Upgrade	M
--	Sec-WebSocket-Key Header	--	String (see Note 2)	M
--	Sec-WebSocket-Version Header	--	String (see Note 3)	M
--	See Note 4.			

NOTE 1: The HTTP version shall be not earlier than HTTP/1.1.
NOTE 2: The valid value needs to be assigned according to WebSocket protocol (see IETF RFC 6455 [18]).
NOTE 3: The valid value needs to be assigned according to WebSocket protocol (see IETF RFC 6455 [18]).
NOTE 4: Other SS parameters (not listed in this table) independent from the Stage 2 may be used, according to the WebSocket protocol (see IETF RFC 6455 [18]).

Table 9.2.2-4: Mapping of IS operation output parameters to SS equivalents (HTTP GET (Upgrade))

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
connectionId	n/a	--	n/a	n/a
status	HTTP-Version (Response-Line)	--	String (see Note 1)	M
	Status-Code	--	String	
	response body	error	error-ResponseType	
--	Upgrade Header		Constant string: websocket	M
--	Connection Header	--	Constant string: Upgrade	M
	Sec-WebSocket-Accept Header	--	String (see Note 2)	M
--	See Note 3.			

NOTE 1: The HTTP version shall be not earlier than HTTP/1.1.
NOTE 2: The valid value needs to be assigned according to WebSocket protocol (see IETF RFC 6455 [18]).
NOTE 3: Other SS parameters (not listed in this table) independent from the Stage 2 may be used, according to the WebSocket protocol (see IETF RFC 6455 [18]).

The message flow for establishing a streaming connection is as follows:

1. The performance data streaming service producer sends a HTTP POST request to the consumer.

   The URI identifies the "…/streamInfoList" collection resource.

   The request message body shall carry the information about the streams, by parameter “StreamInfoList”.

2. The consumer sends a HTTP POST response to the producer.

   On success "201 Posted" shall be returned.

   On failure, an appropriate error code shall be returned. The response message body may carry an error object.

3. If step 2 is successful, the performance data streaming service producer sends a HTTP GET (upgrade) request to the consumer to establish the WebSocket connection.

   The URI identifies the "…/streamingConnection" resource with the /secure/flag;

   The HTTP-version in the Request-line indicates the HTTP version which is no earlier than HTTP/1.1;

   The Upgrade header is with value “websocket”;

   The Connection header is with value “Upgrade”;

   The Sec-WebSocket-Key header is with a valid value according to IETF RFC 6455 [18].

   The Sec-WebSocket-Version header is with a valid according to IETF RFC 6455 [18].

4. The consumer sends a HTTP GET (Upgrade) response to the producer.

   On success, "101 Switching Protocols" shall be returned;

   On failure, an appropriate error code shall be returned. The response message body may carry an error object.

   The HTTP-version in the Response-line indicates the HTTP version which is no earlier than HTTP/1.1;

   The Upgrade header is with value “websocket”;

   The Connection header is with value “Upgrade”;

   The Sec-WebSocket-Accept header is with a valid value according to IETF RFC 6455 [18].

9.2.3 Operation "terminateStreamingConnection"

The IS operation parameters are mapped to SS equivalents according to table x.2.3-1 and table x.2.3-2.

Table 9.2.3-1: Mapping of IS operation input parameters to SS equivalents (WebSocket Close frame sent)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
connectionId	n/a	--	n/a	n/a
--	Opcode (see clause 5 of IETF RFC 6455 [18])	--	Constant value: 0x8	M

Table 9.2.3-2: Mapping of IS operation output parameters to SS equivalents (WebSocket Close frame received)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
Status	Opcode	--	For a successful operation, the Opcode is 0x8, and for an unsuccessful operation, the Opcode has a value other than 0x8 (see clause 5 of IETF RFC 6455 [18]).	M

9.2.4 Operation "reportStreamData"

The IS operation parameters are mapped to SS equivalents according to table 9.2.4-1 and table 9.2.4-2.

Table 9.2.4-1: Mapping of IS operation input parameters to SS equivalents (WebSocket Data frame sent with Opcode of 0x1)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
streamId	Payload data	streamId	See Annex X for the ASN.1 definition of Performance Data Stream Units.	M
granularityPeriodEndTime	Payload data	granularityPeriodEndTime	See Annex X for the ASN.1 definition of Performance Data Stream Units.	M
measResults	Payload data	measResults	See clause Annex X for the ASN.1 of Performance Data Stream Units.	M

Table 9.2.4-2: Mapping of IS operation output parameters to SS equivalents

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
Status	n/a	-- See Note 1.	n/a	n/a
NOTE 1: The delivery of WebSocket Data frame is taken care of by the underlying TCP (see IETF RFC 793 [19]) which provides reliable data transmission and ensures the data delivery. There is no mechanism at WebSocket protocol level to report the delivery status for WebSocket Data frame.				

9.2.5 Operation "getStreamInfo"

The IS operation parameters are mapped to SS equivalents according to table 9.2.5-1 and table 9.2.5-2.

Table 9.2.5-1: Mapping of IS operation input parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
streamIdList	Path query	/streamInfoList/{streamId} streamIdList	streamId: integer array(integer)	M

Table 9.2.5-2: Mapping of IS operation output parameters to SS equivalents (HTTP GET)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
listOfStreamInfoOut	response body	streamInfoOut, listOfStreamInfoOut	streamInfoRetrieval-ResponseType, listOfStreamInfoRetrieval-ResponseType,	M
status	response status codes response body	n/a error	n/a error-ResponseType	M

9.2.6 Operation "addStreamInfo"

The IS operation parameters are mapped to SS equivalents according to table 9.2.6-1 and table 9.2.6-2.

Table 9.2.6-1: Mapping of IS operation input parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
ListOfStreamInfoToAdd	request body	streamInfoList	streamInfoListPost-RequestType	M

Table 9.2.6-2: Mapping of IS operation output parameters to SS equivalents (HTTP POST)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
listOfStreamInfoAdded	response body	ListOfStreamInfoPosted	streamInfoListPost-ResponseType	
status	response status codes response body	n/a error	n/a error-ResponseType	M

9.2.7 Operation "updateStreamInfo"

The IS operation parameters are mapped to SS equivalents according to table 9.2.7-1 and table 9.2.7-2.

Table 9.2.7-1: Mapping of IS operation input parameters to SS equivalents (HTTP PATCH)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
streamIdList	path, query	/streamInfoList/{streamId} streamIdList	streamId: integer array(integer)	M
listOfStreamInfoToUpdate	request body	streamInfoToUpdate, listOfStreamInfoToUpdate	streamInfoToUpdate-RequestType, listOfStreamInfoToUpdate-RequestType,	M

Table 9.2.7-2: Mapping of IS operation output parameters to SS equivalents (HTTP PATCH)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
`listOfStreamInfoUpdated`	response body	streamInfoUpdated listOfStreamInfoUpdated	streamInfoUpdate-ResponseType, listOfStreamInfoUpdate-ResponseType,	M
`status`	response status codes response body	n/a error	n/a error-ResponseType	M

9.2.8 Operation "`deleteStreamInfo`"

The IS operation parameters are mapped to SS equivalents according to table 9.2.8-1 and table 9.2.8-2.

Table 9.2.8-1: Mapping of IS operation input parameters to SS equivalents (HTTP DELETE)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
`streamId`	path	/streamInfoList/{streamId}	streamId: integer	M

Table 9.2.8-2: Mapping of IS operation output parameters to SS equivalents (HTTP DELETE)

IS operation parameter name	SS parameter location	SS parameter name	SS parameter type	Qualifier
`status`	response status codes response body	n/a error	n/a error-ResponseType	M

9.3 Resources

9.3.1 Resource structure

Figure 9.3.1-1 shows the resource structure of the Performance Data Streaming Service.

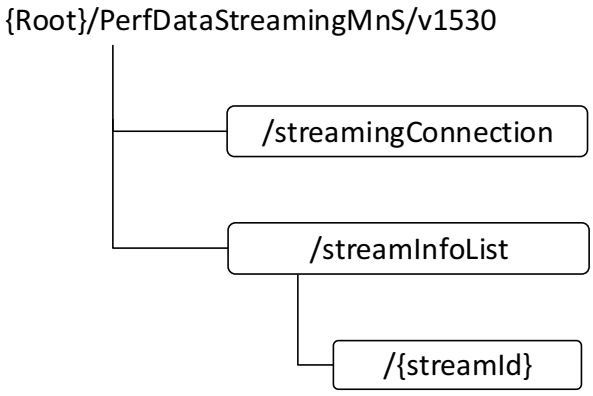

Figure 9.3.1-1: Resource URI structure of the Performance Data Streaming Service

Table 9.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 9.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method	Description
streamInfoList	/streamInfoList	POST	Send the information about the streams to the consumer.
streamInfo	/streamInfoList/{streamId}	PATCH	Update the stream information
		DELETE	Delete the stream information
streamingConnection	/streamingConnection	GET (Upgrade)	Establish the WebSocket connection.

9.3.2 Resource definitions

9.3.2.1 Resource "/streamInfoList"

9.3.2.1.1 Description

This resource represents a set of information about the streams.

9.3.2.1.2 URI

Resource URI = http://{streamTarget}/PerfDataStreamingMnS/v1530/streamInfoList

The resource URI variables a defined in the following table.

Table 9.3.2.1.2-1: URI variables

Name	Definition
streamTarget	The "streamTarget" part corresponds to the streamTarget parameter provided in the createMeasurementJob operation (see clause 6.1.1.2) or the `streamTarget` attribute of the MOI of `MeasurementControl`or `MeasurementReader`, see 3GPP TS 28.622 [5]).

9.3.2.1.3 HTTP methods

9.3.2.1.3.1 HTTP POST

This method shall support the URI query parameters specified in the following table.

Table 9.3.2.1.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	Description	SQ

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 9.3.2.1.3.1-2: Data structures supported by the POST request body on this resource

Data type	Description	SQ
streamInfoListPost-RequestType	The resource representation of the set of information about streams to be posted.	M

Table 9.3.2.1.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	Response codes	Description	SQ
streamInfoListPost-ResponseType	201 Posted	In case of success the representation of the posted streamInfoList is returned.	M
	202 Partially posted	In case of partial success the representation of the posted streamInfoList is returned.	
error-ResponseType	4xx/5xx	Returned in case of an error	M

9.3.2.1.3.2 HTTP GET

This method shall support the URI query parameters specified in the following table.

Table 9.3.2.1.3.2-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	SQ
streamIdList	array(integer)	The list of streamId for which the stream information are to be returned.	

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 9.3.2.1.3.2-2: Data structures supported by the GET request body on this resource

Data type	Description	SQ
n/a	n/a	n/a

Table 9.3.2.1.3.2-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	SQ
listOfStreamInfoRetrieval-ResponseType	200 OK	In case of success the representation of the retrieved streamInfoList is returned.	M
	202 Partially retrieved	In case of partial success the representation of the retrieved streamInfoList is returned.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

9.3.2.1.3.3 HTTP PATCH

This method shall support the URI query parameters specified in the following table.

Table 9.3.2.1.3.3-1: URI query parameters supported by the PATCH method on this resource

Name	Data type	Description	SQ
streamIdList	array(integer)	The list of streamId for which the stream information are to be updated.	

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 9.3.2.1.3.3-2: Data structures supported by the PATCH request body on this resource

Data type	Description	SQ
listOfStreamInfoToUpdate-RequestType	The information of the streams identified by the streamIdList parameter in the “query” field to be updated.	M

Table 9.3.2.1.3.3-3: Data structures supported by the PATCH Response Body on this resource

Data type	Response codes	Description	SQ
listOfStreamInfoUpdate-ResponseType	200 OK	In case of success the representation of the updated streamInfoList is returned.	M
	200 Partially updated	In case of partial success the representation of the updated streamInfoList is returned.	
error-ResponseType	4xx/5xx	Returned in case of an error	M

9.3.2.1a Resource "/streamInfoList/{streamId}"

9.3.2.1a.1 Description

This resource represents the information for a stream.

9.3.2.1a.2 URI

Resource URI = http://{streamTarget}/PerfDataStreamingMnS/v1530/streamInfoList/{streamId}

The resource URI variables a defined in the following table.

Table 9.3.2.1a.2-1: URI variables

Name	Definition
streamTarget	See table 9.3.2.1.2-1.

9.3.2.1a.3 HTTP methods

9.3.2.1a.3.1 HTTP GET

This method shall support the URI query parameters specified in the following table.

Table 9.3.2.1a.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	Description	SQ

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 9.3.2.1a.3.1-2: Data structures supported by the GET request body on this resource

Data type	Description	SQ
n/a	n/a	n/a

Table 9.3.2.1a.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	Response codes	Description	SQ
streamInfoRetrieval-ResponseType	200 OK	In case of success the representation of the retrieved stream information is returned.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

9.3.2.1a.3.2 HTTP PATCH

This method shall support the URI query parameters specified in the following table.

Table 9.3.2.1a.3.2-1: URI query parameters supported by the PATCH method on this resource

Name	Data type	Description	SQ

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 9.3.2.1a.3.2-2: Data structures supported by the PATCH request body on this resource

Data type	Description	SQ
streamInfoToUpdate-RequestType	Represention of the stream information to be updated.	M

Table 9.3.2.1a.3.2-3: Data structures supported by the PATCH Response Body on this resource

Data type	Response codes	Description	SQ
streamInfoUpdate-ResponseType	200 OK	In case of success the representation of the updated stream information is returned.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

9.3.2.1a.3.3 HTTP DELETE

This method shall support the URI query parameters specified in the following table.

Table 9.3.2.1a.3.3-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	Description	SQ

This method shall support the request data structures, the response data structures and response codes specified in the following table.

Table 9.3.2.1a.3.3-2: Data structures supported by the DELETE request body on this resource

Data type	Description	SQ
n/a	n/a	n/a

Table 9.3.2.1a.3.3-3: Data structures supported by the DELETE Response Body on this resource

Data type	Response codes	Description	SQ
n/a	204 No Content	In case of success no message body is returned	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

9.3.2.2 Resource "/streamingConnection"

9.3.2.2.1 Description

This resource represents a streamingConnection (to be) upgraded to WebSocket protocol.

9.3.2.2.2 URI

Resource URI = wss://{streamTarget}/PerfDataStreamingMnS/v1530/streamingConnection

The resource URI variables a defined in the following table.

Table 9.3.2.2.2-1: URI variables

Name	Definition
streamTarget	The "streamTarget" part corresponds to the streamTarget parameter provided in the createMeasurementJob operation (see clause 6.1.1.2) or the `streamTarget` attribute of the MOI of `MeasurementControl`or `MeasurementReader`, see 3GPP TS 28.622 [5]).

9.3.2.2.3 HTTP methods

9.3.2.2.3.1 HTTP GET

This method shall support the URI query parameters specified in the following table.

Table 9.3.2.2.3.1-1: Header parameters supported by the GET request on this resource

Name	Data type	Description	SQ
Upgrade	Upgrade-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to WebSocket protocol	
Connection	Connection-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to another protocol	
Sec-WebSocket-Key	Sec-WebSocket-Key-HeaderType	The Sec-WebSocket-Key needed for establishing the WebSocket connection.	
Sec-WebSocket-Version	Sec-WebSocket-Version-HeaderType	The Sec-WebSocket-Version needed for establishing the WebSocket connection.	

This method shall support the URI query parameters specified in the following table.

Table 9.3.2.2.3.1-2: URI query parameters supported by the GET method on this resource

Name	Data type	Description	SQ

This method shall support the request data structures, the response data structures and response codes specified in the following tables.

Table 9.3.2.2.3.1-3: Data structures supported by the GET request body on this resource

Data type	Description	SQ
n/a	n/a	n/a

Table 9.3.2.2.3.1-4: Header parameters supported by the GET response on this resource

Name	Data type	Description	SQ
Upgrade	Upgrade-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to WebSocket protocol	
Connection	Connection-HeaderType	To indicate the HTTP GET operation is to upgrade the connection to another protocol	
Sec-WebSocket-Accept	Sec-WebSocket-Accept-HeaderType	The Sec-WebSocket-Accept responded when establishing the WebSocket connection.	

Table 9.3.2.2.3.1-5: Data structures supported by the GET response body on this resource

Data type	Response codes	Description	SQ
n/a	101 Switching Protocols	The status code indicating the connection has been successfully upgraded to WebSocket.	M
error-ResponseType	4xx/5xx	Returned in case of an error	M

9.4 Data type definitions

9.4.1 General

Table 9.4.1-1: Data types defined in this specification

Data type	Reference	Description
General types		
uri-Type	x.4.6.2	The data type of a URI
Types used in paths		
Types used in headers		
Upgrade-HeaderType	x.4.6.2	Used in the headers of HTTP GET request to upgrade the connection to WebSocket.
Connection-HeaderType	x.4.6.2	Used in the headers of HTTP GET request to upgrade the connection to WebSocket.
Sec-WebSocket-Key-HeaderType	x.4.6.2	Used in the headers of HTTP GET request to upgrade the connection to WebSocket.
Sec-WebSocket-Version-HeaderType	x.4.6.2	Used in the headers of HTTP GET request to upgrade the connection to WebSocket.
Sec-WebSocket-Accept	x.4.6.2	Used in the headers of HTTP GET response for upgrading the connection to WebSocket.
Types used in query parts		
Types used in request bodies		
streamInfoListPost-RequestType	x.4.4.1	Used in the request body of HTTP POST to post the set of information about the streams.
streamInfoToUpdate-RequestType	9.4.4.x	Used in the request body of HTTP PATCH to update the information for one or more streams.
Types used in response bodies		
error-ResponseType	x.4.4.2	Used in the response body describing the error.
streamInfoListPost-ResponseType	9.4.4.p	Used in the response body of HTTP POST to return the set of stream information posted.
streamInfoRetrieval-ResponseType	9.4.4.u	Used in the response body of HTTP GET to return the information about one stream.
streamInfoListRetrieval-ResponseType	9.4.4.w	Used in the response body of HTTP GET to return the set of information about the streams.
streamInfoUpdate-ResponseType	9.4.4.y	Used in the response body of HTTP PATCH to return the updated information about one stream.
streamInfoListUpdate-ResponseType	9.4.4.z	Used in the response body of HTTP PATCH to return the set of updated information about the streams.
Types used for resources		
Types referenced by the definitions above		
streamInfoIn-Type	9.4.5.1	
streamInfoOut-Type	9.4.5.x	

Table 9.4.1-2: Data types imported

Data type	Reference	Description

9.4.2 Structured general data types

None.

9.4.3 Structured path data types

None.

9.4.4 Query, message body and resource data types

9.4.4.1 Type streamInfoListPost-RequestType

Table 9.4.4.1-1: Definition of type streamInfoListPost-RequestType

Attribute name	Data type	Description	SQ
streamInfoList	Array (streamInfoIn-Type)	The list of information about the streams.	M

9.4.4.2 Type error-ResponseType

Table 9.4.4.2-1: Definition of type error-ResponseType

Attribute name	Data type	Description	SQ
error	object	Key indicating the response body containing an error	M
> errorInfo	string	Attribute allowing to convey error information in string format	M

9.4.4.3 Type streamInfoToUpdate-RequestType

Table 9.4.4.3-1: Definition of type streamInfoToUpdate-RequestType

Attribute name	Data type	Description	SQ
iOCInstance	uri-Type	The updated URI of the measured object instance	M
measTypes	array(string)	The updated list of measurement type.	M

9.4.4.4 Type streamInfoListPost-ResponseType

Table 9.4.4.p-1: Definition of type streamInfoListPost-ResponseType

Attribute name	Data type	Description	SQ
ListOfStreamInfoPosted	array(streamInfoOut-Type)	The set of stream information posted	M

9.4.4.5 Type streamInfoRetrieval-ResponseType

Table 9.4.4.u-1: Definition of type streamInfoRetrieval-ResponseType

Attribute name	Data type	Description	SQ
streamInfoOut	streamInfoOut-Type	The returned stream information	M

9.4.4.6 Type streamInfoListRetrieval-ResponseType

Table 9.4.4.w-1: Definition of type streamInfoRetrieval-ResponseType

Attribute name	Data type	Description	SQ
listOfStreamInfoOut	array(streamInfoOut-Type)	The returned information for the list of streams	M

9.4.4.7 Type streamInfoUpdate-ResponseType

Table 9.4.4.u-1: Definition of type streamInfoUpdate-ResponseType

Attribute name	Data type	Description	SQ
streamInfoUpdated	streamInfoOut-Type	The updated stream information	M

9.4.4.8 Type streamInfoListUpdate-ResponseType

Table 9.4.4.8-1: Definition of type streamInfoUpdate-ResponseType

Attribute name	Data type	Description	SQ
listOfStreamUpdated	array(streamInfoOut-Type)	The updated information for the list of streams	M

9.4.5 Referenced structured data types

9.4.5.1 Type streamInfoIn-Type

Table 9.4.5.1-1: Definition of streamInfoIn-Type

Attribute name	Data type	Description	SQ
streamId	integer	The id of the stream	M
iOCInstance	uri-Type	The URI of the IOC instance whose measurement types as indicated as below are (to be) reported vis this stream.	M
measTypes	array(string)	It specifies the measurement type names whose measurement result values are (to be) reported by the Performance Data Stream Units via this stream	M

9.4.5.2 Type streamInfoOut-Type

Table 9.4.5.2-1: Definition of streamInfoOut-Type

Attribute name	Data type	Description	SQ
streamId	uri-Type	The id of the stream	M
iOCInstance	uri-Type	The URI of the IOC instance whose measurement types as indicated as below are (to be) reported vis this stream.	M
measTypes	array(string)	It specifies the measurement type names whose measurement result values are (to be) reported by the Performance Data Stream Units via this stream	M

9.4.6 Simple data types and enumerations

9.4.6.1 General

This subclause defines simple data types and enumerations that are used by the data structures defined in the previous subclauses.

9.4.6.2 Simple data types

Table 9.4.6.2-1: Simple data types

Type name	Type definition	Description
Upgrade-HeaderType	Constant string “websocket”	The data type of upgrade header of HTTP GET operation (request and response) for establishing the WebSocket connection.
Connection-HeaderType	Constant string “Upgrade”	The data type of Connection header of HTTP GET operation (request and response) for establishing the WebSocket connection.
Sec-WebSocket-Key-HeaderType	string	The data type of Sec-WebSocket-Key header of HTTP GET request for establishing the WebSocket connection.
Sec-WebSocket-Version-HeaderType	string	The data type of Sec-WebSocket-Version of HTTP GET request for establishing the WebSocket connection.
Sec-WebSocket-Accept	string	The data type of Sec-WebSocket-Accept of HTTP GET response for establishing the WebSocket connection.
uri-Type	string	The type of a URI

Annex A :
Void

Annex B (informative): Procedures for performance assurance services

B.1 NF measurement job creation

The Figure B.1-1 illustrates an example of procedure for creating a measurement job for NF(s).

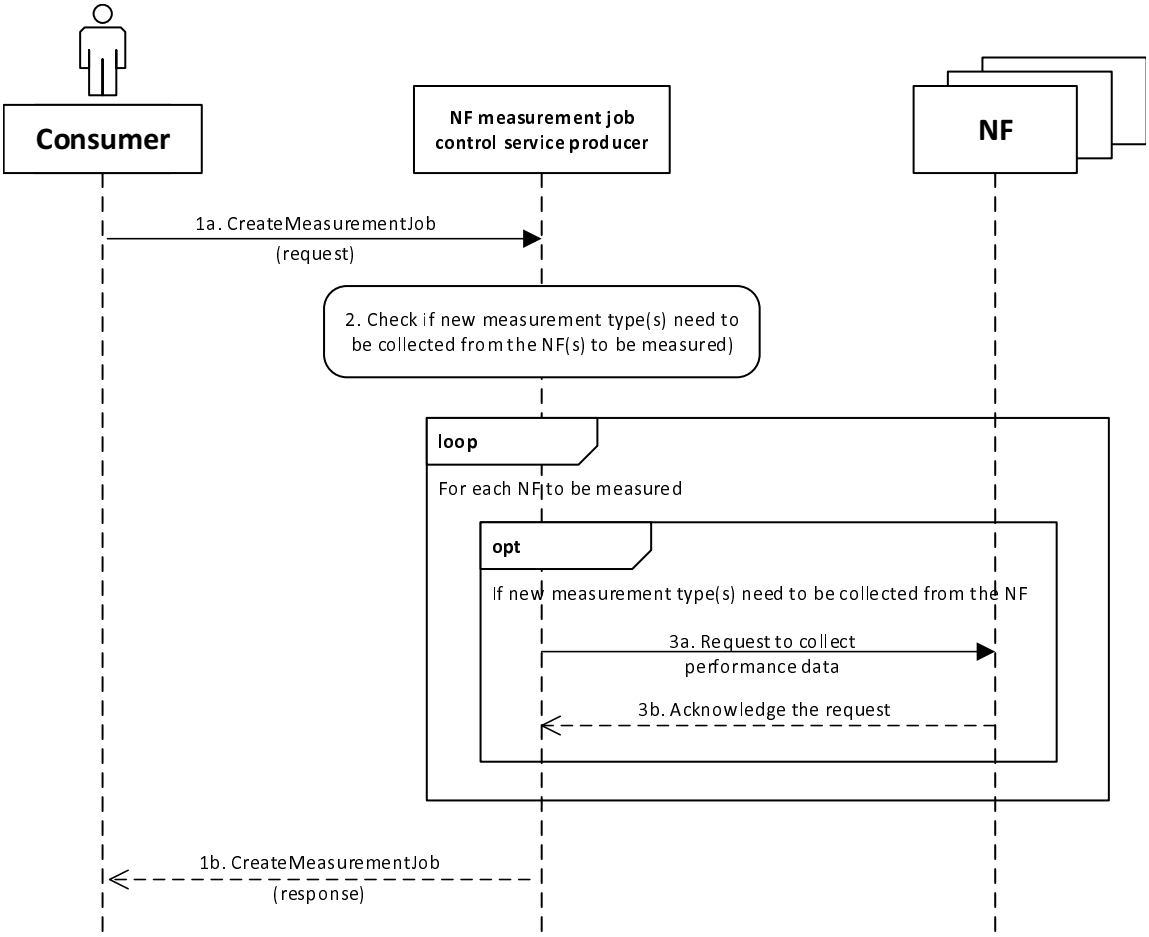

Figure B.1-1: Example of procedure for NF measurement job creation

1a. The authorized consumer invokes the `CreateMeasurementJob` operation (see clause 6.1.1) to NF measurement job control service producer to request creation of a measurement job for NF(s).

2. The NF measurement job control service producer checks if new measurement type(s) need to be collected from the NF(s) to be measured.

3. For each NF to be measured, if new measurements type(s) need to be collected:

   3a. the NF measurement job control service producer requests NF to collect the performance data;

   3b. the NF measurement job control service producer receives the acknowledgement of the request from NF.

1b. The NF measurement job control service producer returns the result of `CreateMeasurementJob` operation (see clause 6.1.1) to the consumer.

If the NF measurement job is successfully created, the NF measurement job control service producer will collect the performance data from the NF(s) accordingly, and make the measurement results available to the NF performance data reporting service producer for each reporting period.

B.2 NSSI measurement job creation

The Figure B.2-1 illustrates an example of procedure for creating a measurement job for NSSI(s).

This procedure is only applicable for the scenario where the NSSI measurement type(s) can be decomposed into the measurement data type(s) of the constituent NSSI(s) and NF(s).

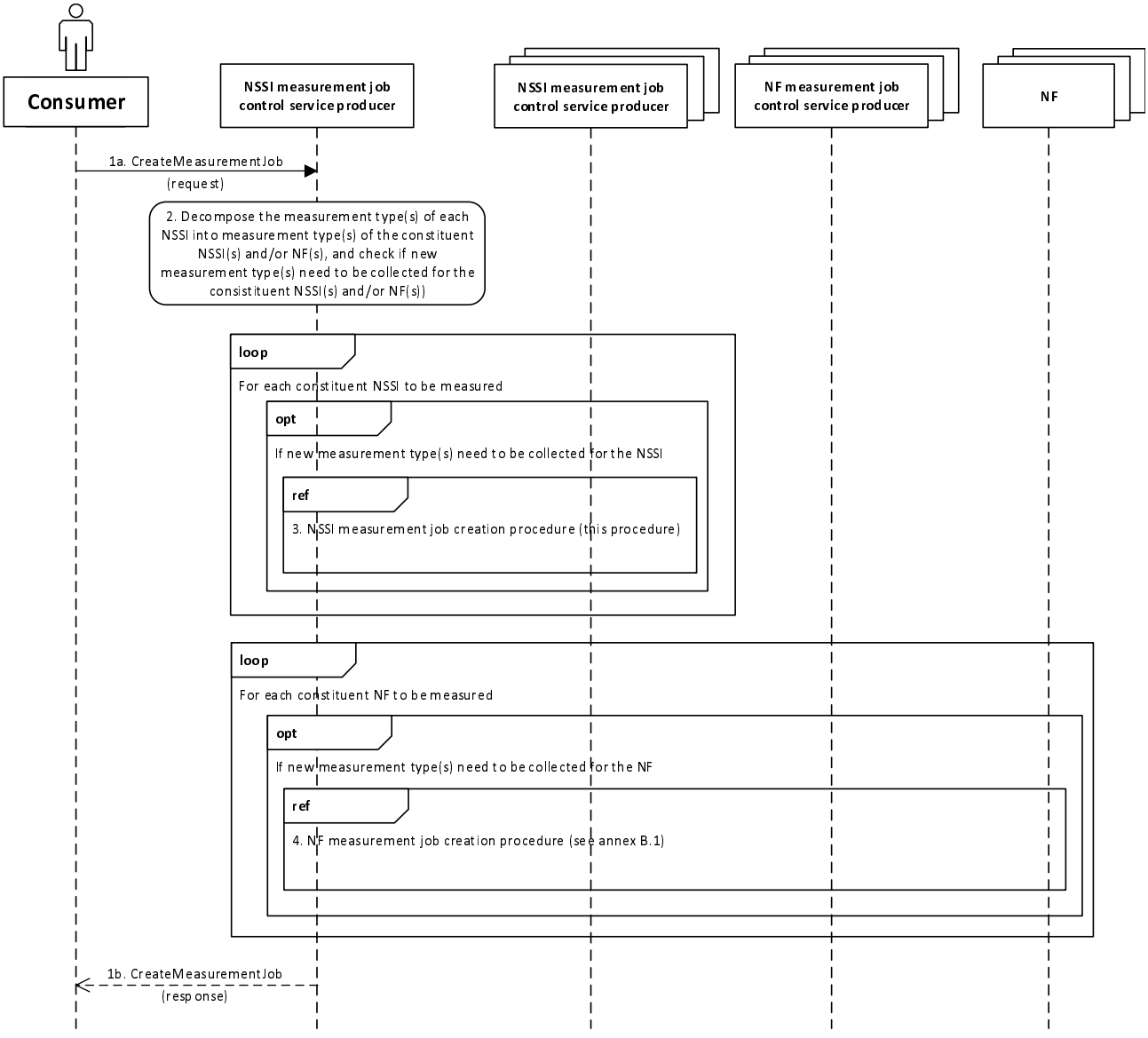

Figure B.2-1: Example of procedure for NSSI measurement job creation

1a. The authorized consumer invokes the `CreateMeasurementJob` operation (see clause 6.1.1) to NSSI measurement job control service producer to request creation of a measurement job for NSSI(s).

2. The NSSI measurement job control service producer decomposes the measurement type(s) of each NSSI to the measurement type(s) of the constituent NSSI(s) and/or NF(s), and checks if new measurement type(s) need to be collected for the constituent NSSI(s) and/or NF(s).

3. For each constituent NSSI to be measured, if new measurements type(s) need to be collected, the NSSI measurement job control service producer acts as consumer of another NSSI measurement job control service instance, and requests the corresponding NSSI measurement job control service producer to request creation of measurement job for the NSSI (following the same procedure as illustrated in this figure).

   It is also possible to create one measurement job to collect the performance data for multiple NSSI(s).

4. For each constituent NF to be measured, if new measurements type(s) need to be collected, the NSSI measurement job control service producer acts as consumer of NF measurement job control service, and requests the corresponding NF measurement job control service producer to request creation of measurement job for the NF (according to the NF measurement job creation procedure as illustrated in clause B.1).

   It is also possible to create one measurement job to collect the performance data for multiple NF(s).

1b. The NSSI measurement job control service producer returns the result of `CreateMeasurementJob` operation (see clause 6.1.1) to the consumer.

If the NSSI measurement job is successfully created, the NSSI measurement job control service producer will collect the performance data for the constituent NSSI(s) and/or NF(s) accordingly, generate the measurement results for the measured NSSI(s) and make the measurement results available to the NSSI performance data reporting service producer for each reporting period.

B.3 NSI measurement job creation

This Figure B.3-1 illustrates an example of procedure for creating a measurement job for NSI(s).

This procedure is only applicable for the scenario where the NSI measurement type(s) can be decomposed into the measurement data type(s) of the constituent NSSI(s) or NF(s).

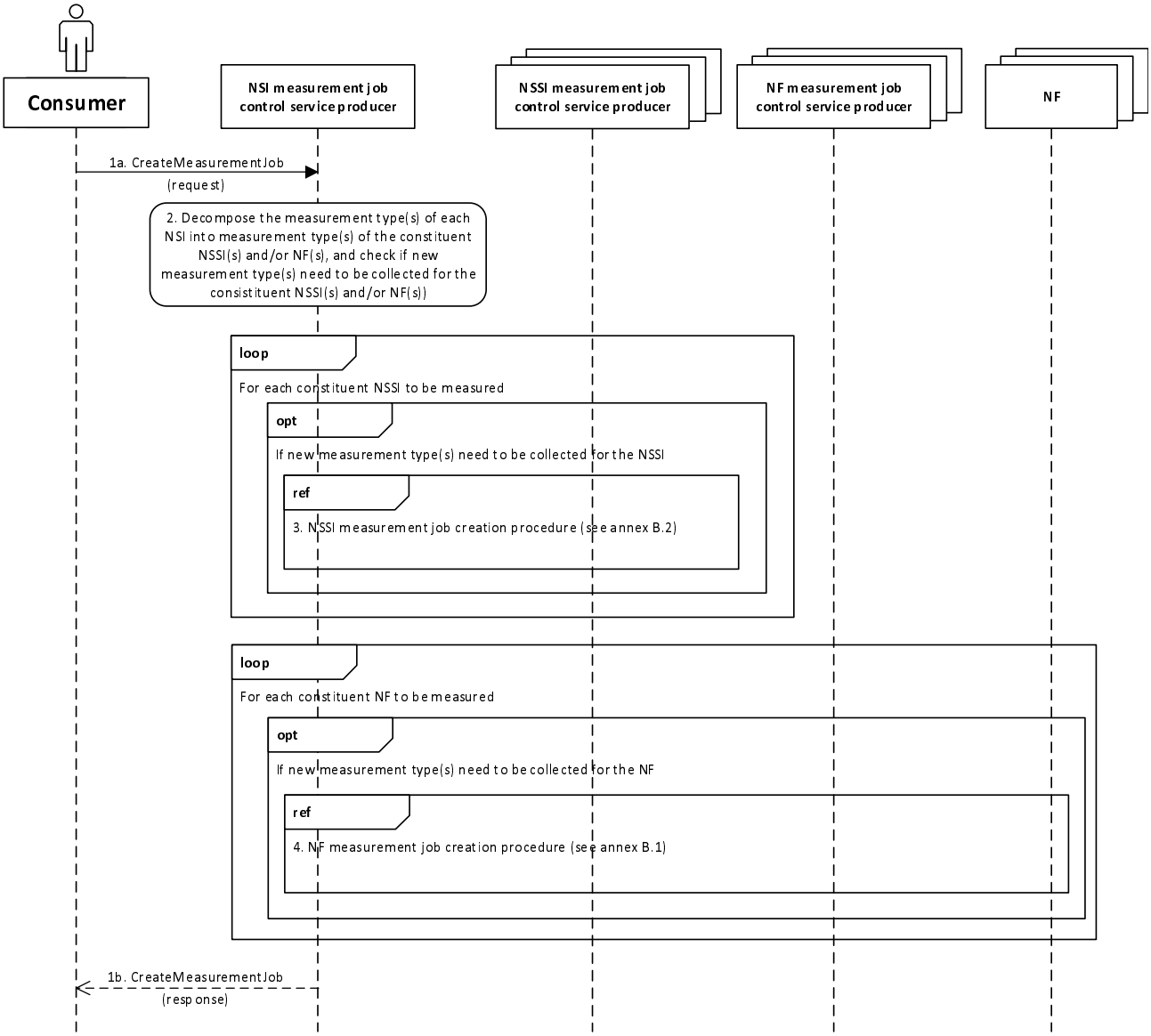

Figure B.3-1: Example of procedure for NSI measurement job creation

1a. The authorized consumer invokes the `CreateMeasurementJob` operation (see clause 6.1.1) to NSI measurement job control service producer to request creation of a measurement job for NSI(s).

2. The NSI measurement job control service producer decomposes the measurement type(s) of each NSI to the measurement type(s) of the constituent NSSI(s) and/or NF(s), and checks if new measurement type(s) need to be collected for the constituent NSSI(s) and/or NF(s).

3. For each constituent NSSI to be measured, if new measurements type(s) need to be collected, the NSI measurement job control service producer acts as consumer of the NSSI measurement job control service, and requests the corresponding NSSI measurement job control service producer to request creation of measurement job for the NSSI (according to the procedure as illustrated in clause B.2).

   It is also possible to create one measurement job to collect the performance data for multiple NSSI(s).

4. For each constituent NF to be measured, if new measurements type(s) need to be collected, the NSI measurement job control service producer acts as consumer of NF measurement job control service, and requests the corresponding NF measurement job control service producer to request creation of measurement job for the NF (according to the NF measurement job creation procedure as illustrated in clause B.1).

   It is also possible to create one measurement job to collect the performance data for multiple NF(s).

1b. The NSI measurement job control service producer returns the result of `CreateMeasurementJob` operation (see clause 6.1.1) to the consumer.

If the NSI measurement job is successfully created, the NSI measurement job control service producer will collect the performance data for the constituent NSSI(s) and/or NF(s) accordingly, generate the measurement results for the measured NSI(s) and make the measurement results available to the NSI performance data reporting service producer for each reporting period.

B.4 Network measurement job creation

This Figure B.4-1 illustrates an example of procedure for creating a measurement job for network/subnetwork(s).

This procedure is only applicable for the scenario where the network/subnetwork measurement type(s) can be decomposed into the measurement data type(s) of the constituent NF(s).

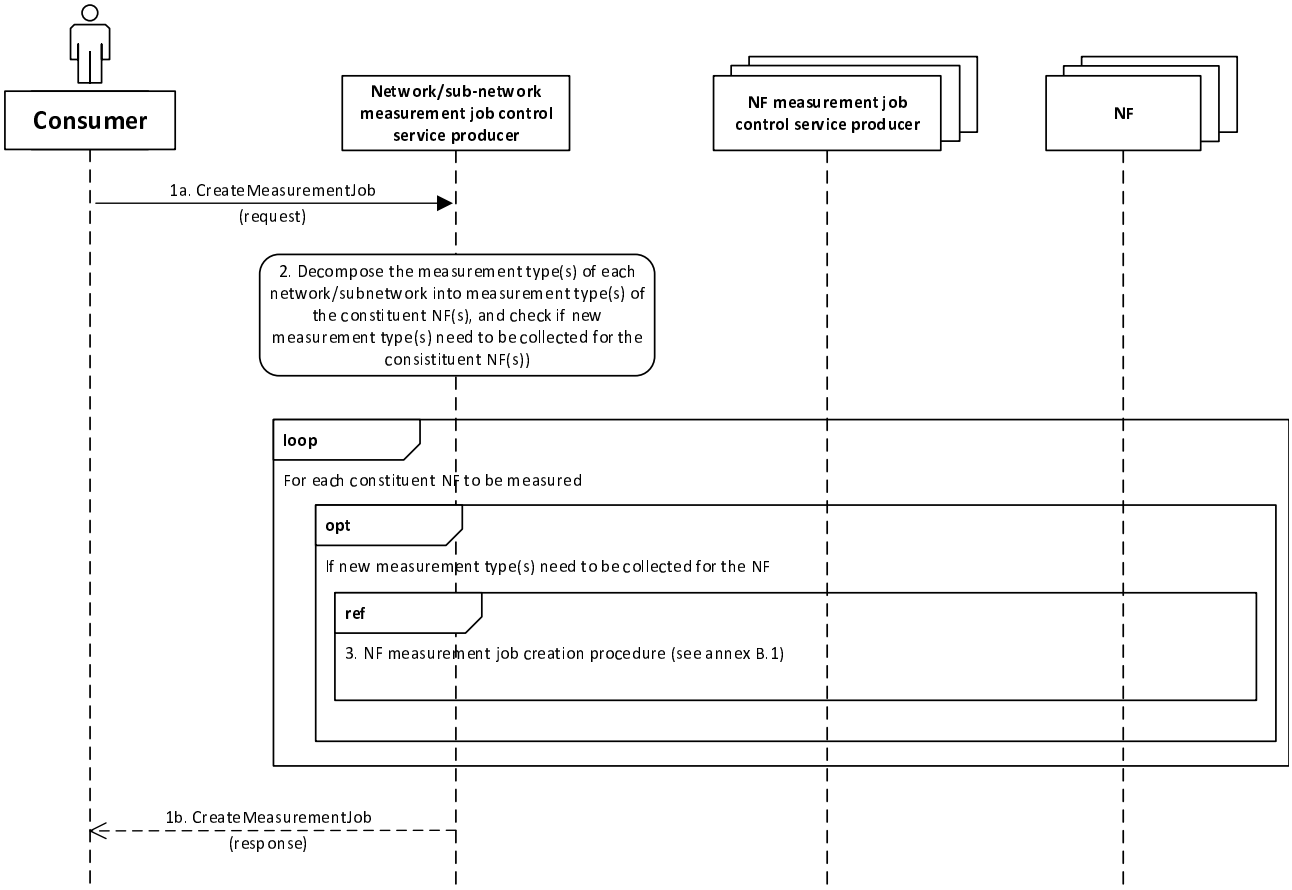

Figure B.4-1: Example of procedure for network measurement job creation

1a. The authorized consumer invokes the `CreateMeasurementJob` operation (see clause 6.1.1) to network measurement job control service producer to request creation of a measurement job for network/subnetwork(s).

1b. The network measurement job control service producer returns the result of `CreateMeasurementJob` operation (see clause 6.1.1) to the consumer.

2. The network measurement job control service producer decomposes the measurement type(s) of each network/subnetwork to the measurement type(s) of the constituent NF(s), and checks if new measurement type(s) need to be collected for the constituent NF(s).

3. For each constituent NF to be measured, if new measurements type(s) need to be collected, the network/sub-network measurement job control service producer acts as consumer of NF measurement job control service, and

requests the corresponding NF measurement job control service producer to request creation of measurement job for the NF (according to the NF measurement job creation procedure as illustrated in annex B.1).

It is also possible to create one measurement job to collect the performance data for multiple NF(s).

If the network measurement job is successfully created, the network measurement job control service producer will collect the performance data for the constituent NF(s) accordingly, generate the measurement results for the measured network/subnetwork(s) and make the measurement results available to the network performance data reporting service producer for each reporting period.

B.5 NF measurement job termination

This Figure B.5-1 illustrates an example of procedure for stopping a measurement job for NF(s).

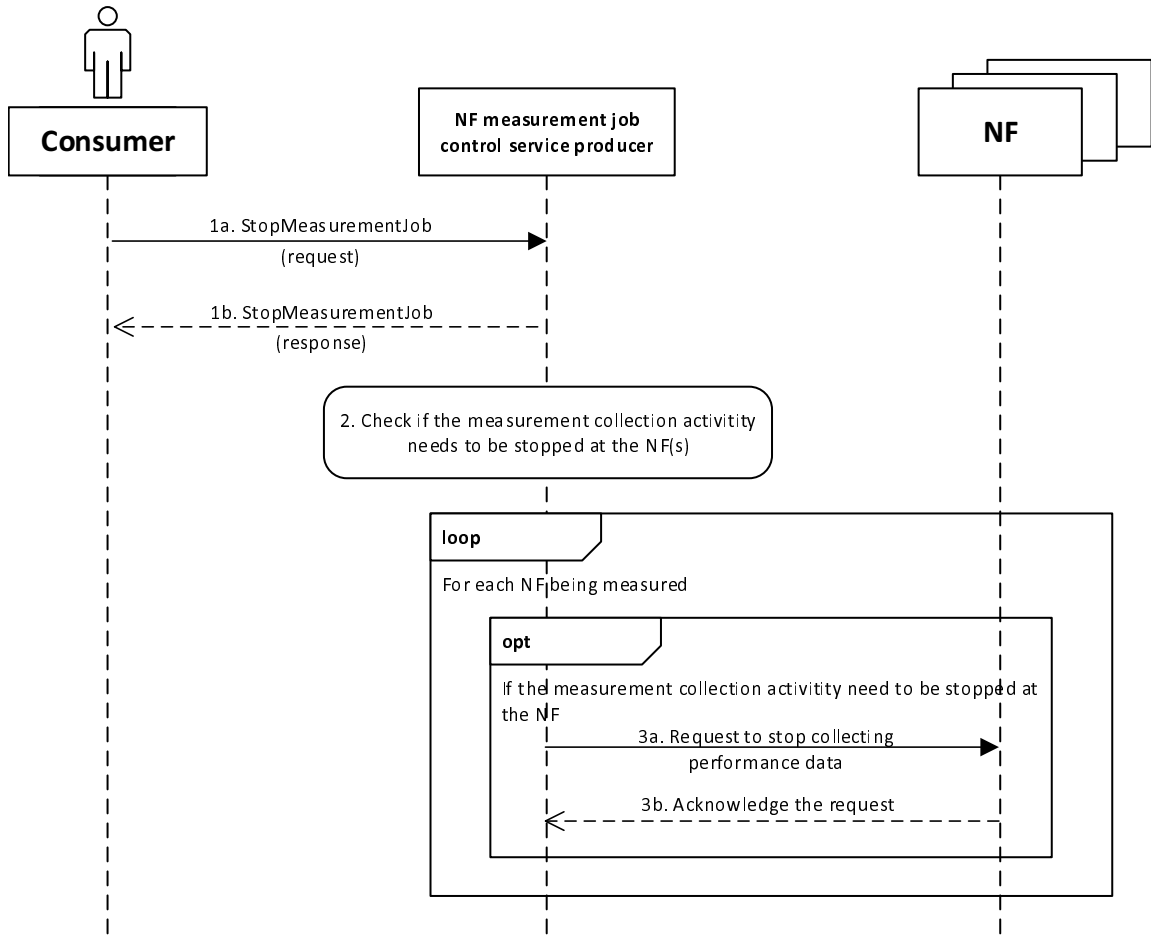

Figure B.5-1: Example of procedure for NF measurement job termination

1a. The authorized consumer invokes the `StopMeasurementJob` operation (see clause 6.1.2) to NF measurement job control service producer to request termination of a measurement job for NF(s).

1b. The NF measurement job control service producer returns the result of `StopMeasurementJob` operation (see clause 6.1.2) to the consumer.

2. The NF measurement job control service producer checks if the measurement collection activity needs to be stopped at the NF(s).

3. For each NF being measured, if the measurement collection activity needs to be stopped at the NF(s),

   3a. the NF measurement job control service producer requests NF to stop collecting the performance data;

3b. the NF measurement job control service producer receives the acknowledgement of the request from NF.

B.6 NSSI measurement job termination

This Figure B.6-1 illustrates an example of procedure for stopping a measurement job for NSSI(s).

This procedure is only applicable for the scenario where the NSSI measurement type(s) can be decomposed into the measurement data type(s) of the constituent NSSI(s) and NF(s).

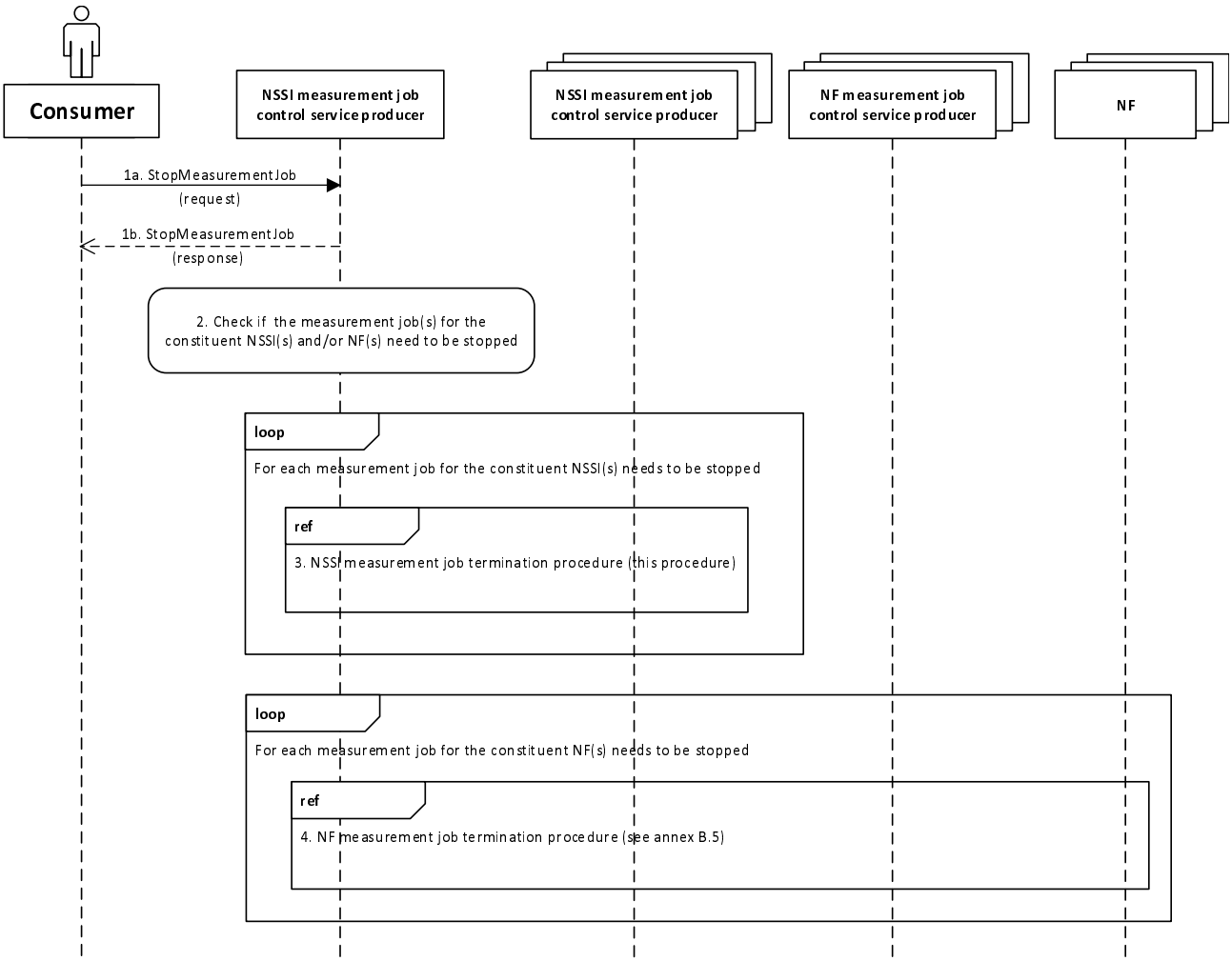

Figure B.6-1: Example of procedure for NSSI measurement job termination

1a. The authorized consumer invokes the `StopMeasurementJob` operation (see clause 6.1.2) to NSSI measurement job control service producer to request termination of a measurement job for NSSI(s).

1b. The NSSI measurement job control service producer returns the result of `StopMeasurementJob` operation (see clause 6.1.2) to the consumer.

2. The NSSI measurement job control service producer checks if the measurement job(s) for the constituent NSSI(s) and/or NF(s) need to be stopped.

3. For each measurement job for the constituent NSSI(s) needs to be stopped, the NSSI measurement job control service producer acts as consumer of another NSSI measurement job control service instance, and requests the corresponding NSSI measurement job control service producer to terminate the measurement job for the constituent NSSI(s) (following the same procedure as illustrated in this figure).

4. For each measurement job for the constituent NF(s) needs to be stopped, the NSSI measurement job control service producer acts as consumer of NF measurement job control service, and requests the corresponding NF measurement job control service producer to terminate the measurement job for the NF(s) (according to the NF measurement job termination procedure as illustrated in clause B.5).

B.7 NSI measurement job termination

This Figure B.7-1 illustrates an example of procedure for stopping a measurement job for NSI(s).

This procedure is only applicable for the scenario where the NSI measurement type(s) can be decomposed into the measurement data type(s) of the constituent NSSI(s) and NF(s).

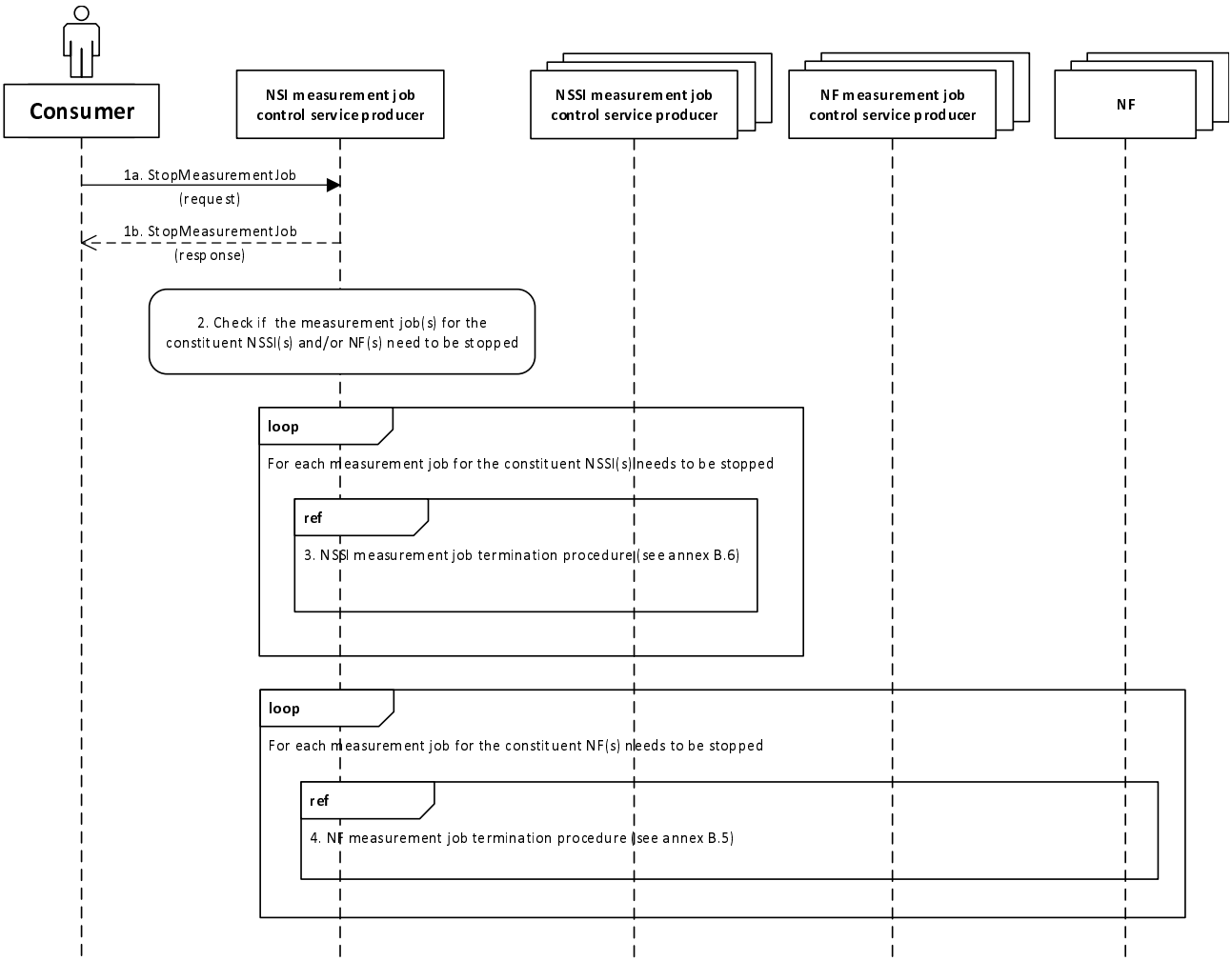

Figure B.7-1: Example of procedure for NSI measurement job termination

1a. The authorized consumer invokes the `StopMeasurementJob` operation (see clause 6.1.2) to NSI measurement job control service producer to request creation of a measurement job for NSI(s).

1b. The NSI measurement job control service producer returns the result of `StopMeasurementJob` operation (see clause 6.1.2) to the consumer.

2. The NSI measurement job control service producer checks if the measurement job(s) for the constituent NSSI(s) and/or NF(s) need to be stopped.

3. For each measurement job for the constituent NSSI(s) needs to be stopped, the NSI measurement job control service producer acts as consumer of the NSSI measurement job control service, and requests the corresponding

NSSI measurement job control service producer to terminate the measurement job for the constituent NSSI(s) (according to the NSSI measurement job termination procedure as illustrated in clause B.6).

4. For each measurement job for the constituent NF(s) needs to be stopped, the NSI measurement job control service producer acts as consumer of NF measurement job control service, and requests the corresponding NF measurement job control service producer to terminate the measurement job for the NF(s) (according to the NF measurement job termination procedure as illustrated in clause B.5).

B.8 Network measurement job termination

This Figure B.8-1 illustrates an example of procedure for stopping a measurement job for network/subnetwork(s).

This procedure is only applicable for the scenario where the network/subnetwork measurement type(s) can be decomposed into the measurement data type(s) of the constituent NF(s).

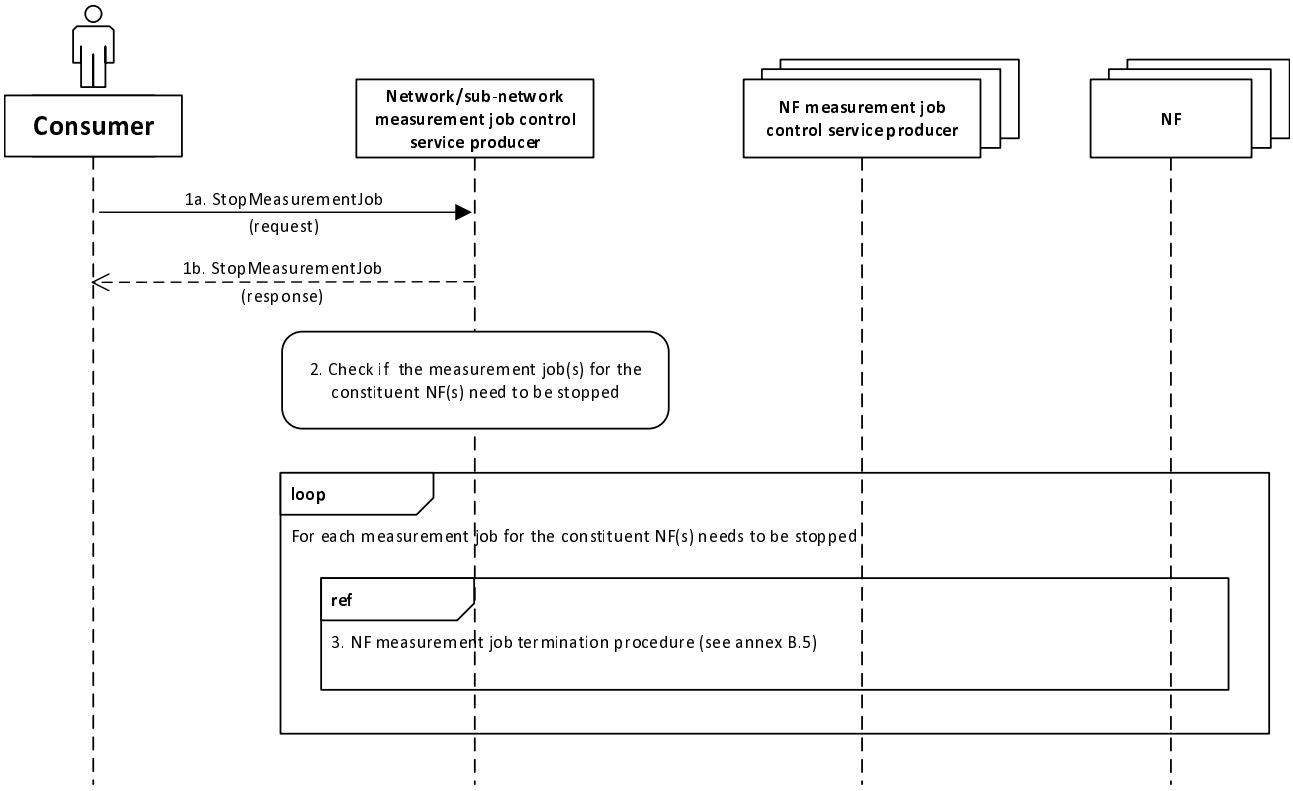

Figure B.8-1: Example of procedure for network measurement job creation

1a. The authorized consumer invokes the `StopMeasurementJob` operation (see clause 6.1.2) to network measurement job control service producer to request termination of a measurement job for network/subnetwork(s).

1b. The network measurement job control service producer returns the result of `StopMeasurementJob` operation (see clause 6.1.2) to the consumer.

2. The network measurement job control service producer checks if the measurement job(s) for the constituent NF(s) need to be stopped.

3. For each measurement job for the constituent NF(s) needs to be stopped, the network measurement job control service producer acts as consumer of NF measurement job control service, and requests the corresponding NF measurement job control service producer to terminate the measurement job for the NF(s) (according to the NF measurement job termination procedure as illustrated in clause B.5).

Annex C (normative): Performance Data Stream Unit content description

Table C-1 lists all the Performance Data Stream Unit content items. It also provides an explanation of the individual items.

Table C-1: Performance Data Stream Unit content description

Performance Data Stream Unit Content	Description
streamId	The streamId of the performance data stream.
granularityPeriodEndTime	Time stamp referring to the end of the granularity period.
measResults	This parameter contains the sequence of result values for the observed measurement types. The "measResults" sequence shall have the same number of elements, which follow the same order as the measurement types presented in "`measTypes`" for the subject stream in the output parameter `streamInfoList` of the `establishStreamingConnection` operation (see clause 6.2.1.2).

Annex D (informative): Performance data streaming holistic sequence

D.1 Performance data streaming for starting measurement collection

D.1.1 Sequence flow

This annex shows the holistic sequence for performance data streaming, starting from starting the measurement collection (by job or configuration) to sending the performance data to the performance data streaming consumer (stream target).

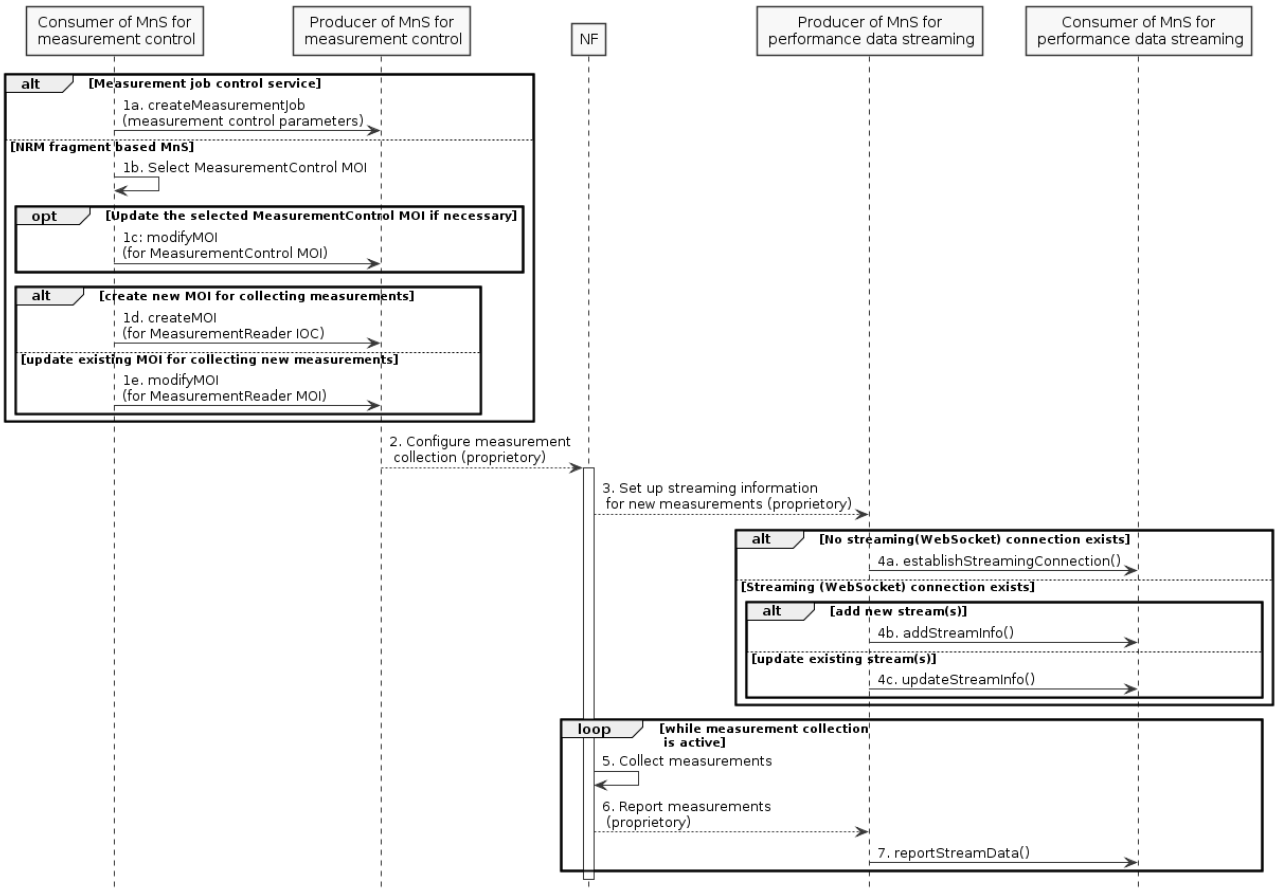

Figure D.1.1-1

1. The consumer of MnS for measurement control requests the MnS producer to start the measurement collection by the following two alternatives:

   1) by the measurement job control service

      1a. The MnS consumer invokes the `createMeasurementJob` operation towards the MnS producer;

   2) by the NRM fragment-based measurement control service

      1b. The MnS consumer selects the correct `MeasurementControl` MOI for new measurement collection, as a system may have multiple `MeasurementControl` MOIs;

1c. If necessary, the MnS consumer modifies the `MeasurementControl` MOI by invoking the `modifyMOI` operation towards the MnS producer;

1d. The MnS consumer creates a new `MeasurementReader` MOI under the selected `MeasurementControl` MOI for collecting the measurements, by invoking the `createMOI` operation towards the MnS producer; or

1e. The MnS consumer modifies an existing `MeasurementReader` MOI under the selected `MeasurementControl` MOI to add new measurements to be collected, by invoking the `modifyMOI` operation towards the MnS producer.

2. The producer of MnS for measurement control configures the NF to collect the measurements. The mechanism of this step is vendor specific. If producer of MnS for measurement control is in the NF, this step can be skipped.

3. The NF triggers the producer of MnS for performance data streaming to set up the streaming information for the new measurements to be collected. The mechanism of this step is vendor specific. If producer of MnS for performance data streaming is in the NF, this step can be skipped.

4. The producer of MnS for performance data streaming communicates with the consumer to:

   4a. establish the streaming (WebSocket) connection containing the stream information if it does not exist yet, by invoking the `establishStreamingConnection` operation;

   4b. add the stream information for the new measurements if they will be reported by new streams, by invoking the `addStreamInfo` operation;

   4c. update the stream information for the new measurements if they will be reported by existing streams, by invoking the `updateStreamInfo` operation.

5. The NF collects the measurements. This step is the internal behaviour of the NF.

6. The NF report the collected measurements to the producer of MnS for performance data streaming. The mechanism of this step is vendor specific. If producer of MnS for performance data streaming is in the NF, this step can be skipped.

7. The producer of MnS for performance data streaming sends the collected measurements to the consumer via performance data streams, by invoking the `reportStreamData` operation.

D.1.2 PlantUML codes

```
@startuml
skinparam shadowing false
skinparam monochrome true
hide footbox

participant "Consumer of MnS for\n measurement control" as MC
participant "Producer of MnS for\n measurement control" as MP
participant "NF" as NF
participant "Producer of MnS for\n performance data streaming" as SP
participant "Consumer of MnS for\n performance data streaming" as SC

alt Measurement job control service
MC -> MP : 1a. createMeasurementJob\n(measurement control parameters)
else NRM fragment based MnS
MC –> MC: 1b. Select MeasurementControl MOI
Opt Update the selected MeasurementControl MOI if necessary
MC -> MP: 1c: modifyMOI\n(for MeasurementControl MOI)
end
alt create new MOI for collecting measurements
MC -> MP : 1d. createMOI\n(for MeasurementReader IOC)
Else update existing MOI for collecting new measurements
MC -> MP : 1e. modifyMOI\n(for MeasurementReader MOI)
end
end

MP --> NF: 2. Configure measurement\n collection (proprietory)

activate NF
NF --> SP: 3. Set up streaming information\n for new measurements (proprietory)
```

```
alt No streaming(WebSocket) connection exists
SP->SC: 4a. establishStreamingConnection()

else Streaming (WebSocket) connection exists
alt add new stream(s)
SP->SC: 4b. addStreamInfo()
else update existing stream(s)
SP->SC: 4c. updateStreamInfo()
end
end

Loop while measurement collection\n is active
NF->NF: 5. Collect measurements
NF --> SP: 6. Report measurements\n (proprietory)
SP -> SC: 7. reportStreamData()
end

@enduml
```

D.2 Performance data streaming for stopping measurement collection

D.2.1 Sequence flow

This annex shows the holistic sequence for performance data streaming in connection with the measurement collection termination.

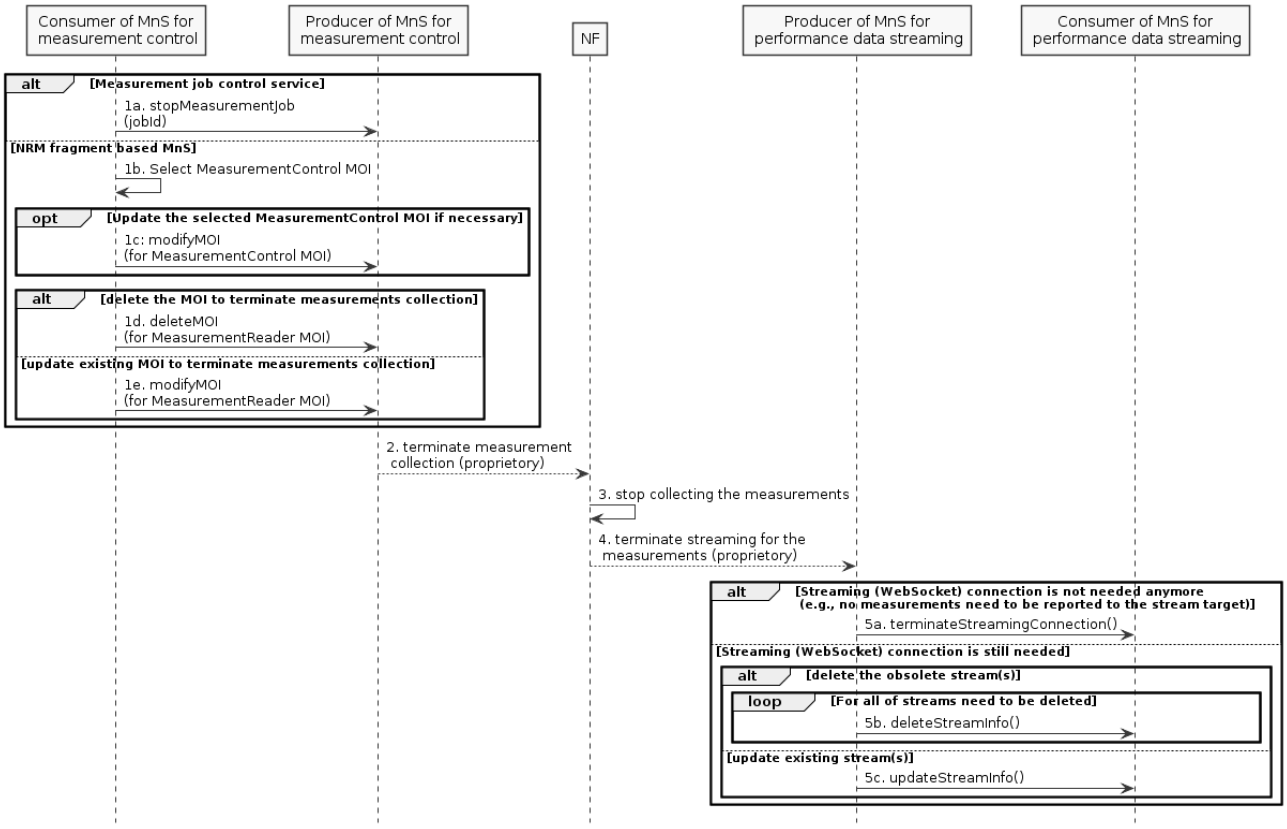

Figure D.2.1-1

1. The consumer of MnS for measurement control requests the MnS producer to stop the measurement collection by the following two alternatives:

   1) by the measurement job control service

1a. The MnS consumer invokes the `stopMeasurementJob` operation towards the MnS producer;

2) by the NRM fragment-based measurement control service

1b. The MnS consumer selects the correct `MeasurementControl` MOI for terminating the measurement collection, as a system may have multiple `MeasurementControl` MOIs;

1c. If necessary, the MnS consumer modifies the `MeasurementControl` MOI by invoking the `modifyMOI` operation towards the MnS producer;

1d. The MnS consumer deletes an `MeasurementReader` MOI under the selected `MeasurementControl` MOI for terminating the measurements collection, by invoking the `deleteMOI` operation towards the MnS producer;

1e. The MnS consumer modifies an `MeasurementReader` MOI with deletion of the measurements that do not need to be collected anymore, by invoking the `modifyMOI` operation towards the MnS producer.

2. The producer of MnS for measurement control requests the NF to stop collecting the measurements. The mechanism of this step is vendor specific. If producer of MnS for measurement control is in the NF, this step can be skipped.

3. The NF stops collecting the measurements. This step is the internal behaviour of the NF.

4. The NF triggers the producer of MnS for performance data streaming to terminate streaming for the measurements. The mechanism of this step is vendor specific. If producer of MnS for performance data streaming is in the NF, this step can be skipped.

5. The producer of MnS for performance data streaming communicates with the consumer to:

5a. terminate the streaming (WebSocket) connection if no measurements need to be reported to the consumer anymore, by invoking the `terminateStreamingConnection` operation;

5b. delete the information for the stream(s) obsoleted due to the termination of the measruements collection if the streaming connection still needs to be retained, by invoking the `deleteStreamInfo` operation;

5c. update the information for the stream(s) partially affected by the termination of the measurements collection, by invoking the `updateStreamInfo` operation.

D.2.2 PlantUML codes

```
@startuml
skinparam shadowing false
skinparam monochrome true
hide footbox

participant "Consumer of MnS for\n measurement control" as MC
participant "Producer of MnS for\n measurement control" as MP
participant "NF" as NF
participant "Producer of MnS for\n performance data streaming" as SP
participant "Consumer of MnS for\n performance data streaming" as SC

alt Measurement job control service
MC -> MP : 1a. stopMeasurementJob\n(jobId)
else NRM fragment based MnS
MC –> MC: 1b. Select MeasurementControl MOI
Opt Update the selected MeasurementControl MOI if necessary
MC -> MP: 1c: modifyMOI\n(for MeasurementControl MOI)
end
alt delete the MOI to terminate measurements collection
MC -> MP : 1d. deleteMOI\n(for MeasurementReader MOI)
Else update existing MOI to terminate measurements collection
MC -> MP : 1e. modifyMOI\n(for MeasurementReader MOI)
end
end

MP --> NF: 2. terminate measurement\n collection (proprietory)

NF -> NF: 3. stop collecting the measurements
NF --> SP: 4. terminate streaming for the\n measurements (proprietory)
```

```
alt Streaming (WebSocket) connection is not needed anymore\n (e.g., no measurements need to be
reported to the stream target)
SP->SC: 5a. terminateStreamingConnection()

else Streaming (WebSocket) connection is still needed
alt delete the obsolete stream(s)
loop For all of streams need to be deleted
SP->SC: 5b. deleteStreamInfo()
end
else update existing stream(s)
SP->SC: 5c. updateStreamInfo()
end
end

@enduml
```

Annex E (normative): OpenAPI specification

E.1 Introduction

This clause describes the capabilities of the Management Services in the structure of the OpenAPI Specification Version 3.0.1. The OpenAPI document is represented in the JSON format option.

E.2 Performance assurance service

```
{
  "openapi": "3.0.1",
  "info": {
    "title": "TS 28.550 Performance Measurement Job Control Service",
    "version": "15.1.0",
    "description": "OAS 3.0.1 specification of the Performance Measurement Job Control Service"
  },
  "servers": [
    {
      "url": "http://{DN_prefix_authority_part}/{DN_prefix_remainder}/PerfMeasJobCtrlMnS/v1520",
      "variables": {
        "DN_prefix_authority_part": {
          "description": "See subclause 4.4 of TS 32.158",
          "default": "example.com"
        },
        "DN_prefix_remainder": {
          "description": "See subclause 4.4 of TS 32.158",
          "default": ""
        }
      }
    }
  ],
  "paths": {
    "/measJobs": {
      "post": {
        "summary": "Create a measurement job",
        "description": "To create a measurement job the representation of the measurement job is
POSTed on the /measJobs collection resource.",
        "requestBody": {
          "required": true,
          "content": {
            "application/json": {
              "schema": {
                "$ref": "#/components/schemas/measJobCreation-RequestType"
              }
            }
          }
        },
        "responses": {
          "201": {
            "description": "Success case (\"201 Created\"). The representation of the newly created
measurement job resource shall be returned.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/measJobCreation-ResponseType"
                }
              }
            }
          },
          "202": {
            "description": "Partial success case (\"202 Partically created\"). The representation of
the newly created measurement job resource with unsupported list shall be returned.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/measJobCreation-ResponseType"
                }
              }
            }
          },
```

```
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      },
      "get": {
        "summary": "Read resources of measurement jobs",
        "description": "With HTTP GET, resources of measurement jobs are read. The resources to be
read are identified with the path component (base resource) and the query component (jobIdList) of
the URI. The fields query component allows to select the resource properties to be returned.",
        "parameters": [
          {
            "name": "jobIdList",
            "in": "query",
            "description": "This parameter identifies the list of jobId to select the resources from
the collection resources identified with the path component of the URI.",
            "required": true,
            "schema": {
              "type": "array",
              "items": {
                "type": "string"
              }
            }
          },
        ],
        "responses": {
          "200": {
            "description": "Success case (\"200 OK\"). The resources identified in the request for
retrieval are returned in the response message body. In case the fields query parameter is used, the
selected resources are returned.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/measJobsRetrieval-ResponseType"
                }
              }
            }
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      }
    },

    "/measJobs/{jobId}": {
      "get": {
        "summary": "Read resource of a single measurement job",
        "description": "With HTTP GET, resource of a measurement job is read. The resource to be
read is identified with the path component of the URI.",
        "parameters": [
          {
            "name": "jobId",
            "in": "path",
            "description": "Identifies the measurement job to be read.",
            "required": true,
            "schema": {
              "$ref": "#/components/schemas/uri-Type"
            }
          }
        ],
        "responses": {
          "200": {
```

```
            "description": "Success case (\"200 OK\"). The resource identified in the path for
retrieval is returned in the response message body. ",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/measJobsRetrieval-ResponseType"
                }
              }
            }
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      },
      "delete": {
        "summary": "Delete a single measurement job",
        "description": "The measurement job is deleted by deleting the corresponding measurement job
resource. The resource to be deleted is identified with the path component of the URI.",
        "parameters": [
          {
            "name": "jobId",
            "in": "path",
            "description": "Identifies the measurement job to be deleted.",
            "required": true,
            "schema": {
              "$ref": "#/components/schemas/uri-Type"
            }
          }
        ],
        "responses": {
          "204": {
            "description": "Success case (\"204 No Content\"). The measurement job resource has been
deleted. The response message body is absent."
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      }
    }
  },
  "components": {
    "schemas": {
      "dateTime-Type": {
        "type": "string",
        "format": "date-Time"
      },
      "uri-Type": {
        "type": "string"
      },
      "measJobCreation-RequestType": {
        "type": "object",
        "properties": {
          "iOCName": {
            "type": "string"
          },
          "iOCInstanceList": {
            "type": "array",
            "items": {
              "$ref": "#/components/schemas/uri-Type"
            }
          },
          "measurementCategoryList": {
```

```
        "type": "array",
        "items": {
          "type": "string"
        }
      },
      "reportingMethod": {
        "$ref": "#/components/schemas/reportingMethod-Type"
      },
      "granularityPeriod": {
        "type": "integer"
      },
      "reportingPeriod": {
        "type": "integer"
      },
      "startTime": {
        "$ref": "#/components/schemas/dateTime-Type"
      },
      "stopTime": {
        "$ref": "#/components/schemas/dateTime-Type"
      },
      "schedule": {
        "$ref": "#/components/schemas/schedule-Type"
      },
      "streamTarget": {
        "type": "string"
      },
      "priority": {
        "$ref": "#/components/schemas/priority-Type"
      },
      "reliability": {
        "type": "string"
      }
    }
  },
  "measJobCreation-ResponseType": {
    "type": "object",
    "properties": {
      "unsupportedList": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/unsupportedMeas-Type"
        }
      }
    }
  },
  "measJobsRetrieval-ResponseType": {
    "type": "object",
    "properties": {
      "jobInfoList": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/measJobInfo-ResourceType"
        }
      }
    }
  },
  "error-ResponseType": {
    "type": "object",
    "properties": {
      "error": {
        "type": "object",
        "properties": {
          "errorInfo": {
            "type": "string"
          }
        }
      }
    }
  },
  "measJobInfo-ResourceType": {
    "type": "object",
    "properties": {
      "href": {
        "$ref": "#/components/schemas/uri-Type"
      },
      "iOCName": {
        "type": "string"
      },
```

```
      "iOCInstanceList": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/uri-Type"
        }
      },
      "measurementCategoryList": {
        "type": "array",
        "items": {
          "type": "string"
        }
      },
      "reportingMethod": {
        "$ref": "#/components/schemas/reportingMethod-Type"
      },
      "granularityPeriod": {
        "type": "integer"
      },
      "reportingPeriod": {
        "type": "integer"
      },
      "startTime": {
        "$ref": "#/components/schemas/dateTime-Type"
      },
      "stopTime": {
        "$ref": "#/components/schemas/dateTime-Type"
      },
      "schedule": {
        "$ref": "#/components/schemas/schedule-Type"
      },
      "streamTarget": {
        "type": "string"
      },
      "priority": {
        "$ref": "#/components/schemas/priority-Type"
      },
      "reliability": {
        "type": "string"
      }
    }
  },
  "schedule-Type": {
    "type": "object",
    "properties": {
      "scheduleOption": {
        "$ref": "#/components/schemas/scheduleOption-Type"
      },
      "dailySchedule": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/timeInterval-Type"
        }
      },
      "weeklySchedule": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/scheduleOfDay-Type"
        }
      }
    }
  },
  "timeInterval-Type": {
    "type": "object",
    "properties": {
      "intervalStart": {
        "type": "string",
        "format": "Time"
      },
      "intervalEnd": {
        "type": "string",
        "format": "Time"
      }
    }
  },
  "scheduleOfDay-Type": {
    "type": "object",
    "properties": {
      "dayOfWeek": {
```

```
            "$ref": "#/components/schemas/dayOfWeek-Type"
          },
          "intervalsOfDay": {
            "type": "array",
            "items": {
              "$ref": "#/components/schemas/timeInterval-Type"
            }
          }
        }
      },

      "unsupportedMeas-Type": {
        "type": "object",
        "properties": {
          "iOCInstance": {
             "$ref": "#/components/schemas/uri-Type"
          },
          "measurementTypeName": {
            "type": "string"
          },
          "reason": {
            "type": "string"
          }
        }
      },
      "reportingMethod-Type": {
        "type": "string",
        "enum": [
          "file",
          "streaming"
        ]
      },
      "priority-Type": {
        "type": "string",
        "enum": [
          "low",
          "medium",
          "high"
        ]
      },
      "scheduleOption-Type": {
        "type": "string",
        "enum": [
          "daily",
          "weekly"
        ]
      },
      "dayOfWeek-Type": {
        "type": "string",
        "enum": [
          "Monday",
          "Tuesday",
          "Wednesday",
          "Thursday",
          "Friday",
          "Saturday",
          "Sunday"
        ]
      }
    }
  }
}
```

E.3 Performance data streaming service

```
{
  "openapi": "3.0.1",
  "info": {
    "title": "TS 28.550 Performance Data Streaming Service",
    "version": "15.3.0",
    "description": "OAS 3.0.1 specification of the Performance Data Streaming Service"
  },
  "servers": [
    {
      "url": "http://{streamTarget}/PerfDataStreamMnS/v1530",
```

```
      "description": "This URL is used for posting the set of information about streams supported on
the connection between the producer and the consumer.",
      "variables": {
        "streamTarget": {
          "description": "The open API server of the performance data streaming service is located
in the consumer side,and the “streamTarget” part corresponds to the streamTarget parameter provided
in the createMeasurementJob operation (see clause 6.1.1.2) or the streamTarget attribute of the MOI
of MeasurementControlor MeasurementReader, see 3GPP TS 28.622 [5]).",
          "default": "example.com"
        }
      }
    },
    {
      "url": "wss://{streamTarget}/PerfDataStreamingMnS/v1530/streamingConnection",
      "description": "This URL is used for establishing the WebSocket connection for the performance
data streaming service.",
      "variables": {
        "streamTarget": {
          "description": "The open API server of the performance data streaming service is located
in the consumer side,and the “streamTarget” part corresponds to the streamTarget parameter provided
in the createMeasurementJob operation (see clause 6.1.1.2) or the streamTarget attribute of the MOI
of MeasurementControlor MeasurementReader, see 3GPP TS 28.622 [5]).",
          "default": "example.com"
        }
      }
    }
  ],
  "paths": {
    "/streamInfoList": {
      "post": {
        "summary": "The set of information about the streams sent from the producer to the
consumer",
        "description": "To send the streamInfoList from the producer to the consumer",
        "requestBody": {
          "required": true,
          "content": {
            "application/json": {
              "schema": {
                "$ref": "#/components/schemas/streamInfoListPost-RequestType"
              }
            }
          }
        },
        "responses": {
          "201": {
            "description": "Success case (\"201 Posted\"). The streamInfoList is successfully
posted.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/streamInfoListPost-ResponseType"
                }
              }
            }
          },
          "202": {
            "description": "Partial success case (\"202 Partially posted\"). The representation of
the posted resource on stream information.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/streamInfoListPost-ResponseType"
                }
              }
            }
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      }
```

```
    },
      "get": {
        "summary": "Read resources of stream information from the streaming consumer",
        "description": "With HTTP GET, resources of stream information are read. The resources to be
read are identified with the path component (base resource) and the query component (streamIdList)
of the URI. The fields query component allows to select the resource properties to be returned.",
        "parameters": [
          {
            "name": "streamIdList",
            "in": "query",
            "description": "This parameter identifies the list of streamId to select from the
collection resources identified with the path component of the URI.",
            "required": true,
            "schema": {
              "type": "array",
              "items": {
                "type": "integer"
              }
            }
          },
        ],
        "responses": {
          "200": {
            "description": "Success case (\"200 OK\"). The resources identified in the request for
retrieval are returned in the response message body. In case the fields query parameter is used, the
selected resources are returned.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/listOfStreamInfoRetrieval-ResponseType"
                }
              }
            }
          },
          "202": {
            "description": "Partial success case (\"202 Partially retrieved\"). The representation
of the retrieved resources on stream information.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/listOfStreamInfoRetrieval-ResponseType"
                }
              }
            }
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      },
      "patch": {
        "summary": "Update resources of stream information to the streaming consumer",
        "description": "With HTTP PATCH, resources of stream information are to be updated. The
resources to be updated are identified with the path component (base resource) and the query
component (streamIdList) of the URI. The fields query component allows to select the resource
properties to be updated.",
        "parameters": [
          {
            "name": "streamIdList",
            "in": "query",
            "description": "This parameter identifies the list of streamId to select from the
collection resources identified with the path component of the URI.",
            "required": true,
            "schema": {
              "type": "array",
              "items": {
                "type": "integer"
              }
            }
          },
        ],
```

```
        "requestBody": {
          "required": true,
          "content": {
            "application/json": {
              "schema": {
                "$ref": "#/components/schemas/listOfStreamInfoToUpdate-RequestType"
              }
            }
          }
        },
        "responses": {
          "200": {
            "description": "Success case (\"200 OK\"). The resources selected by the query parameter
are updated and returned in the response message body.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/listOfStreamInfoUpdate-ResponseType"
                }
              }
            }
          },
          "202": {
            "description": "Partial success case (\"202 Partially updated\"). The representation of
the updated resources on stream information",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/listOfStreamInfoUpdate-ResponseType"
                }
              }
            }
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      },
      "delete": {
        "summary": "The information of streams to be deleted by the producer to the consumer",
        "description": "With HTTP DELETE, resources of stream information are to be deleted. The
resources to be deleted are identified with the path component (base resource) and the query
component (streamIdList) of the URI. The fields query component allows to select the resource
properties to be deleted.",
        "parameters": [
          {
            "name": "streamIdList",
            "in": "query",
            "description": "This parameter identifies the list of streamId to select from the
collection resources identified with the path component of the URI.",
            "required": true,
            "schema": {
              "type": "array",
              "items": {
                "type": "integer"
              }
            }
          },
        ],
        "responses": {
          "204": {
            "description": "Success case (\"204 No Content\"). The stream information resource has
been deleted. The response message body is absent."
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
```

```
              }
            }
          }
        }
      }
    },
    "/streamInfoList/{streamId}": {
      "get": {
        "summary": "Read resource of the stream information from the streaming consumer",
        "description": "With HTTP GET, resource of stream information is read. The resource to be
read is identified with the path component the URI.",
        "parameters": [
          {
            "name": "streamId",
            "in": "path",
            "description": "Identifies the stream for which the information is to be retrieved.",
            "required": true,
            "schema": {
              "$ref": "#/components/schemas/uri-Type"
            }
          }
        ],
        "responses": {
          "200": {
            "description": "Success case (\"200 OK\"). The resource identified in the request for
retrieval is returned in the response message body.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/listOfStreamInfoRetrieval-ResponseType"
                }
              }
            }
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      },
      "patch": {
        "summary": "Update the resource of stream information to the streaming consumer",
        "description": "With HTTP PATCH, resource of stream information is to be updated. The
resource to be updated is identified by the path component of the URI. ",
        "parameters": [
          {
            "name": "streamId",
            "in": "path",
            "description": "Identifies the stream for which the information is to be updated.",
            "required": true,
            "schema": {
              "$ref": "#/components/schemas/uri-Type"
            }
          }
        ],
        "requestBody": {
          "required": true,
          "content": {
            "application/json": {
              "schema": {
                "$ref": "#/components/schemas/streamInfoToUpdate-RequestType"
              }
            }
          }
        },
        "responses": {
          "200": {
            "description": "Success case (\"200 OK\"). The resources identified by the path of the
URI is updated and returned in the response message body.",
            "content": {
              "application/json": {
                "schema": {
```

```
                  "$ref": "#/components/schemas/streamInfoUpdate-ResponseType"
                }
              }
            }
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }      },
      "delete": {
        "summary": "The stream information to be deleted by the producer to the consumer",
        "description": "With HTTP DELETE, resource of stream information identified by the path
component of the URI is to be deleted.",
        "parameters": [
          {
            "name": "streamId",
            "in": "path",
            "description": "Identifies the stream for which the information is to be deleted",
            "required": true,
            "schema": {
              "$ref": "#/components/schemas/uri-Type"
            }
          }
        ],
        "responses": {
          "204": {
            "description": "Success case (\"204 No Content\"). The stream information resource has
been deleted. The response message body is absent."
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      }
    },
    "/streamConnection": {
      "get": {
        "summary": "The connection for streaming from the producer to the consumer",
        "description": "To establish the WebSocket connection between the producer and the consumer.
The HTTP version of this operation shall not be earlier than HTTP/1.1",
        "parameters": [
           {
           "in": "header",
           "name": "Upgrade",
           "required": true,
           "schema": {
                "$ref": "#/components/schemas/Upgrade-HeaderType"
              }
           },
           {
           "in": "header",
           "name": "Connection",
           "required": true,
           "schema": {
                "$ref": "#/components/schemas/Connection-HeaderType"
              }
           },
           {
           "in": "header",
           "name": "Sec-WebSocket-Key",
           "required": true,
           "schema": {
                "$ref": "#/components/schemas/Sec-WebSocket-Key-HeaderType"
              }
```

```
          },
          {
          "in": "header",
          "name": "Sec-WebSocket-Version",
          "required": true,
          "schema": {
               "$ref": "#/components/schemas/Sec-WebSocket-Version-HeaderType"
             }
          }
        ],
        "responses": {
          "101": {
           "description": "Success case (\"101 Switching Protocols \"). The connection has been
successfully switched to WebSocket. The response message body is absent.",
           "headers": {
             "Upgrade": {
                "schema": {
                  "$ref": "#/components/schemas/Upgrade-HeaderType"
                }
             },
             "Connection": {
                "schema": {
                  "$ref": "#/components/schemas/Connection-HeaderType"
                 }
             },
            "Sec-WebSocket-Accept-HeaderType": {
               "schema": {
                  "$ref": "#/components/schemas/Sec-WebSocket-Accept-HeaderType"
               }
             }
           }
          },
          "default": {
            "description": "Error case.",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/error-ResponseType"
                }
              }
            }
          }
        }
      }
    }
  },
  "components": {
    "schemas": {
      "uri-Type": {
        "type": "string"
      },
      "streamInfoIn-Type": {
        "type": "object",
        "properties": {
          "streamId": {
            "type": "integer"
          },
          "iOCInstance": {
              "$ref": "#/components/schemas/uri-Type"
          },
          "measTypes": {
            "type": "array",
            "items": {
              "type": "string"
            }
          }
        }
      },
      "streamInfoOut-Type": {
        "type": "object",
        "properties": {
          "streamId": {
            "$ref": "#/components/schemas/uri-Type"
          },
          "iOCInstance": {
            "$ref": "#/components/schemas/uri-Type"
          },
          "measTypes": {
```

```
        "type": "array",
        "items": {
          "type": "string"
        }
      }
    }
  },
  "error-ResponseType": {
    "type": "object",
    "properties": {
      "error": {
        "type": "object",
        "properties": {
          "errorInfo": {
            "type": "string"
          }
        }
      }
    }
  },
  "streamInfoListPost-RequestType": {
    "type": "object",
    "properties": {
      "streamInfoList": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/streamInfoIn-Type"
        }
      }
    }
  },
  "streamInfoListPost-ResponseType": {
    "type": "object",
    "properties": {
      "streamInfoListPosted": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/streamInfoOut-Type"
        }
      }
    }
  },
  "streamInfoRetrieval-ResponseType": {
    "type": "object",
    "properties": {
      "streamInfoOut": {
          "$ref": "#/components/schemas/streamInfoOut-Type"
      }
    }
  },
  "listOfStreamInfoRetrieval-ResponseType": {
    "type": "object",
    "properties": {
      "listOfStreamInfoOut": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/streamInfoOut-Type"
        }
      }
    }
  },
  "streamInfoToUpdatePropertyType": {
    "type": "object",
    "properties": {
      "iOCInstance": {
        "description": "The updated measured object instance, empty value means no update.",
        "allOf": [
          "$ref": "#/components/schemas/uri-Type"
        ]
      },
      "measTypes": {
        "description": "The updated list of measurement type, empty value means no update.",
        "type": "array",
        "items": {
          "type": "string"
        }
      }
    }
```

```
      },
      "streamInfoToUpdate-RequestType": {
        "type": "object",
        "properties": {
          "streamInfoToUpdate": {
             "$ref": "#/components/schemas/streamInfoToUpdatePropertyType"
          }
        }
      },
      "listOfStreamInfoToUpdate-RequestType": {
        "type": "object",
        "properties": {
          "listOfStreamInfoToUpdate": {
            "type": "array",
            "items": {
              "$ref": "#/components/schemas/streamInfoToUpdatePropertyType"
            }
          }
        }
      },
      "streamInfoUpdate-ResponseType": {
        "type": "object",
        "properties": {
          "streamInfoUpdated": {
              "$ref": "#/components/schemas/streamInfoOut-Type"
          }
        }
      },
      "listOfStreamInfoUpdate-ResponseType": {
        "type": "object",
        "properties": {
          "listOfStreamInfoUpdated": {
            "type": "array",
            "items": {
              "$ref": "#/components/schemas/streamInfoOut-Type"
            }
          }
        }
      },
      "Upgrade-HeaderType": {
        "type": "string",
        "enum": [
          "websocket",
        ]
      },
      "Connection-HeaderType": {
        "type": "string",
        "enum": [
          "Upgrade",
        ]
      },
      "Sec-WebSocket-Key-HeaderType": {
        "type": "string"
      },
      "Sec-WebSocket-Version-HeaderType": {
        "type": "string"
      },
      "Sec-WebSocket-Accept-HeaderType": {
        "type": "string"
      }
    }
  }
}
```

Annex F (normative): ASN.1 definition for performance data stream units

F.1 ASN.1 definition rule

For performance data streaming, the type of WebSocket Data frame shall be binary (with opcode of 0x2).

This subclause specifies the abstract syntax notation one (ASN.1) definition for the Performance Data Stream Units as Payload data of WebSocket Data frame.

The Performance Data Stream Units are described using ASN.1 as specified in ITU-T Rec. X.680 [15] and X.681 [16]. Transfer syntax for Performance Data Stream Units is derived from their ASN.1 definitions by use of Packed Encoding Rules (PER), aligned as specified in ITU-T Rec. X.691 [17].

The following encoding rules apply in addition to what has been specified in ITU-T Rec. X.691 [17]:

- When a bit string value is placed in a bit-field as specified in clause 15.6 to 15.11 in ITU-T Rec X.691 [17], the leading bit of the bit string value shall be placed in the leading bit of the bit-field, and the trailing bit of the bit string value shall be placed in the trailing bit of the bit-field;
- When decoding a BIT STRING or OCTET STRING constrained with a Contents Constraint, PER decoders are required to never report an error if there are extraneous zero or non-zero bits at the end of the BIT STRING or OCTET STRING.

NOTE: The terms 'leading bit' and 'trailing bit' are defined in ITU-T Rec. X.680 [15]. When using the 'bstring' notation, the leading bit of the bit string value is on the left, and the trailing bit of the bit string value is on the right.

F.2 ASN.1 definition

```
-- ASN1START
PerformanceDataStreamUnits-Schema DEFINITIONS AUTOMATIC TAGS ::=
BEGIN
-- PDSUs-START

PDSUs ::=                       SEQUENCE OF PDSU

PDSU ::=  SEQUENCE {
    streamId                    INTEGER,
    granularityPeriodEndTime    DATE-TIME,
    standardizedMeasResults     SEQUENCE OF MeasValue,
    vendorSpecificMeasResults   SEQUENCE OF MeasValue OPTIONAL -- may be omitted
}

MeasValue ::= CHOICE {
    integerValue   INTEGER,
    realValue      REAL,
    stringValue    VisibleString,
    subCounters    SubCounterListType,
    ...                                             -- allow extension in futher version
}

-- uses recursion for the value to support multi-dimensional measurements
SubCounterListType ::= SEQUENCE {
    subCounterIndex   SubCounterIndexType,
    subCounterValue   MeasValue OPTIONAL            -- "empty" bins are allowed
}

SubCounterIndexType ::= CHOICE {
    sum       VisibleString ("SUM"),
    binIndex  INTEGER,
    qOS-5QI   INTEGER,
    qOS-QCI   INTEGER,
    cause     INTEGER,
    stringIndex   VisibleString,
```

```
    plMN      OCTET STRING (SIZE(3)),              -- definition from TS 38.413
    sNSSAI    SEQUENCE {                           -- definition from TS 38.413
        sst   OCTET STRING (SIZE(1)),
        sd    OCTET STRING (SIZE(3))
    },
    ...                                            -- allow extension in futher version
}

-- PDSUs-STOP
END
-- ASN1STOP
```

Annex F (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2019-03	SA#83	SP-190122	0003	1	F	Add the missing RESTFul API definitions	15.1.0
2019-03	SA#83	SP-190122	0007	1	F	Correction on MDAS	15.1.0
2019-03	SA#85	SP-190748	0011	-	F	Correction on performance data file reporting service components	15.2.0
2019-03	SA#85	SP-190748	0014	3	F	Add the missing stage 3 solutions for performance data streaming	15.2.0
2019-03	SA#85	SP-190748	0015	1	F	Remove the PM file format	15.2.0
2019-03	SA#85	SP-190748	0024	1	F	Add the missing stage 2 for performance data streaming	15.2.0
2019-12	SA#86	SP-191174	0032	2	F	Add stream information management related operations	15.3.0
2020-03	SA#87E	SP-200181	0043	1	F	Update the peformance data streaming procedure	15.4.0
2020-03	SA#87E	SP-200181	0045	1	F	Add streaming procedure for measurement collection termination	15.4.0

History

Document history		
V15.0.0	September 2019	Publication
V15.1.0	March 2019	Publication
V15.2.0	July 2019	Publication
V15.3.0	January 2020	Publication
V15.4.0	March 2020	Publication