ETSI TS 128 550 V15.1.0 (2019-05)

5G;
Management and orchestration;
Performance assurance
(3GPP TS 28.550 version 15.1.0 Release 15)

Reference
RTS/TSGS-0528550vf10

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

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] W3C REC-xmlschema-0-20010502: "XML Schema Part 0: Primer".

[9] W3C REC-xmlschema-1-20010502: "XML Schema Part 1: Structures".

[10] W3C REC-xmlschema-2-20010502: "XML Schema Part 2: Datatypes".

[11] W3C REC-xml-names-19990114: "Namespaces in XML".

[12] 3GPP TS 32.300: "Telecommunication management; Configuration Management (CM); Name convention for Managed Objects".

[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)".

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.
streamInfoList	M	List of < streamId, measObjDn, measTypes, >	Applicable when the reportingMethod is performance data streaming. 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.
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 - streamInfoList - 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'.

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] notifyFilePreparationError (see TS 28.532 [7] listAvailableFiles (see TS 28.532 [7]	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].
Performance data file reporting services for NSSIs	notifyFileReady (see TS 28.532 [7] notifyFilePreparationError (see TS 28.532 [7] listAvailableFiles (see TS 28.532 [7]	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].
Performance data file reporting services for NSIs	notifyFileReady (see TS 28.532 [7] notifyFilePreparationError (see TS 28.532 [7] listAvailableFiles (see TS 28.532 [7]	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].
Performance data file reporting services for sub-networks	notifyFileReady (see TS 28.532 [7] notifyFilePreparationError (see TS 28.532 [7] listAvailableFiles (see TS 28.532 [7]	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].

7.3 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	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	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	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	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].

8 RESTful HTTP-based solution set of performance assurance 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
streamInfoList	response body	streamInfoList	array(streamInfo-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 Assurance Service.

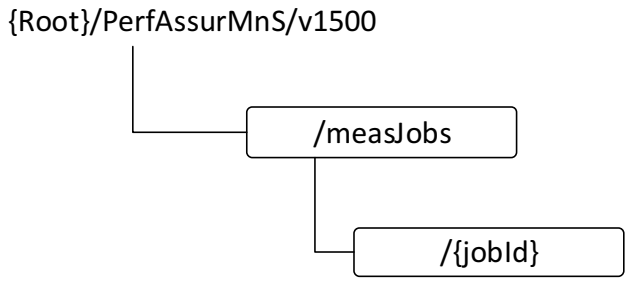

Figure 8.2.0-1: Resource URI structure of the Performance Assurance Service

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}/PerfAssurMnS/v1500/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}/PerfAssurMnS/v1500/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.
streamInfo-Type		This defines the data type for streaming information.
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
streamInfoList	array(streamInfo-Type)	The list of streaming information of the measurement job.	M
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
streamInfoList	array(streamInfo-Type)	The list of streaming information of the measurement job.	
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 Type streamInfo-Type

Table 8.3.7.4-1: Definition of streamInfo-Type

Attribute name	Data type	Description	SQ
streamId	string	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

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.

Annex A (normative): Performance data file definition

A.1 File generation and reporting

The measurement job control related service producer (e.g., NF measurement job control service producer, NSSI measurement job control service producer, NSI measurement job control service producer or network measurement job control service producer) provides the measurement results (i.e. the value of the measurement type(s)) to the performance data reporting related service producer, and the performance data reporting related service producer generates the performance date file(s) for the consumer(s) and emits the "notifyFileReady" or "notifyFilePreparationError" notifications to the subject consumer(s) who have subscribed to these notifications.

How the measurement job control related service producer provides the measurement results to the performance data reporting related service producer is out of scope of the present document.

The performance data reporting related service producer shall be able to allow the consumer to access the file using the following file transfer protocols, and the performance data reporting related service producer shall always act server while the consumer shall always act as the initiator (client) of file transfer actions:

- FTP;
- SFTP.

A.2 Performance data file content description

Table A.2-1 lists all the file content items. It also provides an explanation of the individual items.

Table A.2-1: File Content Description

File Content Item	Description
measDataCollection	This is the top-level tag, which identifies the file as a collection of measurement data. The file content is made up of a header ("measFileHeader"), the collection of measurement result items ("measData"), and a measurement file footer ("measFileFooter").
measFileHeader	This is the measurement result file header to be inserted in each file. It includes a version indicator, the name, type and vendor name of the sending service producer, and a time stamp ("collectionBeginTime").
measData	The "measData" construct represents the sequence of zero or more measurement result items contained in the file. It can be empty in case no measurement data can be provided. The individual "measData" elements can appear in any order. Each "measData" element contains the identifier of the measured entity ("measuredEntityId") and the list of measurement results pertaining to that measured entity ("measInfo").
measFileFooter	The measurement result file footer to be inserted in each file. It includes a time stamp, which refers to the end of the overall measurement collection interval that is covered by the collected measurement results being stored in this file.
fileFormatVersion	This parameter identifies the file format version applied by the sender. The format version defined in the present document shall be the abridged number and version of this 3GPP document (see below). The abridged number and version of a 3GPP document is constructed from its version specific full reference "3GPP […] (yyyy-mm)" by: - removing the leading "3GPP TS"; - removing everything including and after the version third digit, representing editorial only changes, together with its preceding dot character; - from the resulting string, removing leading and trailing white space, replacing every multi character white space by a single space character and changing the case of all characters to uppercase.
senderName	The senderName uniquely identifies performance data reporting related service producer that assembled this measurement file.

File Content Item	Description
senderType	This is a user configurable identifier of the type of performance data reporting related service producer that generated the file, e.g. NF performance data reporting service producer, or NSI performance data reporting service producer. The string may be empty (i.e. string size =0) in case the "senderType" is not configured in the sender.
vendorName	The "vendorName" identifies the vendor of the performance data reporting related service producer that provided the measurement file. The string may be empty (i.e. string size =0) if the "vendorName" is not configured in the sender.
collectionBeginTime	The "collectionBeginTime" is a time stamp that refers to the start of the first measurement collection interval (granularity period) that is covered by the collected measurement results that are stored in this file.
measuredEntityUserName	This is the user definable name ("userLabel") defined for the measured entity in 3GPP TS 28.622 [5]. The string may be empty (i.e. string size =0) if the "measuredEntityUserName" is not configured in the CM applications.
measuredEntityDn	This is the Distinguished Name (DN) defined for the measured entity in 3GPP TS 32.300 [12]. It is unique across an operator's network. The string may be empty (i.e. string size =0) if the "measuredEntityDn" is not configured in the CM applications.
measuredEntitySoftwareVersion	This is the software version ("`swVersion`") defined for the measured entity in 3GPP TS 28.622 [5]. This is an optional parameter which allows post-processing systems to take care of vendor specific measurements modified between software versions.
measInfo	The sequence of measurements, values and related information. It includes a list of measurement types ("measTypes") and the corresponding results ("measValues"), together with the time stamp ("measTimeStamp") and granularity period ("granularityPeriod") pertaining to these measurements.
measInfoId	This attribute associates a tag name with the set of measurements defined by a *measInfo* property. This is an optional parameter that may be used to assign unique names to categories of measurements grouped together by measInfo elements. It allows parsing tools to easily isolate measurement sets by name.
measTimeStamp	Time stamp referring to the end of the granularity period.
jobId	The "jobId" represents the measurement job with which measurement result contained in the file is associated.
granularityPeriod	Granularity period of the measurement(s) in seconds.
reportingPeriod	Reporting period of the measurement(s) in seconds.
measTypes	This is the list of measurement types for which the following, analogous list of measurement values ("measValues") pertains.
measValues	This parameter contains the list of measurement results for the resource being measured, e.g. trunk, cell. It includes an identifier of the resource ("measObjInstId"), the list of measurement result values ("measResults") and a flag that indicates whether the data is reliable ("suspectFlag").
measObjInstId	In case the measuredEntity is a ManagedElement, the "measObjInstId" field contains the local distinguished name (LDN) of the measured object within the scope defined by the "measuredEntityDn" (see 3GPP TS 32.300 [12]). The concatenation of the "measuredEntityDn" and the "measObjInstId" yields the DN of the measured object. The "measObjInstId" is therefore empty if the "measuredEntityDn" already specifies completely the DN of the measured object, which is the case for all measurements specified on measured entity (e.g., NF) level. For example, if the measured object is a "ManagedElement" representing RNC "RNC-Gbg-1", then the "measuredEntityDn" will be for instance "DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,SubNetwork=CountryNN,MeContext=MEC-Gbg-1,ManagedElement=RNC-Gbg-1", and the "measObjInstId" will be empty. On the other hand, if the measured object is a "UtranCell" representing cell "Gbg-997" managed by that RNC, then the "measuredEntityDn" will be for instance the same as above, i.e. "DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,SubNetwork=CountryNN,MeContext=MEC-Gbg-1,ManagedElement=RNC-Gbg-1", and the "measObjInstId" will be for instance "RncFunction=RF-1,UtranCell=Gbg-997". The class of the "measObjInstId" is defined in item F of each measurement definition template. In case the measuredEntity is not a ManagedElement, the value of this attribute is empty (i.e. string size =0).
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 measTypes sequence. The NULL value is reserved to indicate that the measurement item is not applicable or could not be retrieved for the object instance.
suspectFlag	Used as an indication of quality of the scanned data. FALSE in the case of reliable data, TRUE if not reliable. The default value is "FALSE", in case the suspect flag has its default value it may be omitted.

File Content Item	Description
timestamp	This tag carries the time stamp that refers to the end of the measurement collection interval (granularity period) that is covered by the collected measurement results that are stored in this file. The minimum required information within timestamp is year, month, day, hour, minute, and second.

The measInfo contains the sequence of measurements, values and related information, in a table-oriented structure.

The representation of all timestamps in PM files shall follow the representations allowed by the ISO 8601 [6].
The precise format for timestamp representation shall be determined by the technology used for encoding the PM file (e.g. ASN.1, XML DTD, and XML Schema). The choice of technology should ensure that this representation is derived from ISO 8601 [6]. Based on the representation used, the timestamp shall refer to either UTC time or local time or local time with offset from UTC.

A.3 File naming convention

A.3.1 Generic file naming convention

The following generic convention shall be applied for naming the files containing different management data:

<managementData_type><file_ready_date>< file_ready_time><file_expiration_delta_time>
[<specificData_extension>][<separator><RC>]

1) The managementData_type field is the type of the management data contained in the file, the value of managementData_type field including

   "PM" for performance data files,

2) The file_ready_date field is of the form YYYYMMDD, where:

   - YYYY is the year in four-digit notation;
   - MM is the month in two digit notation (01 - 12);
   - DD is the day in two digit notation (01 - 31).

   The file_ready_date is the date when the file was last closed and made available for upload and the file content will not be changed.

3) The file_ready_time field is of the form HHMMshhmm, where:

   - HH is the two digit hour of the day (local time), based on 24 hour clock (00 - 23);
   - MM is the two digit minute of the hour (local time, 00 - 59);
   - s is the sign of the local time differential from UTC (+ or -), in case the time differential to UTC is 0 then the sign may be arbitrarily set to "+" or "-";
   - hh is the two digit number of hours of the local time differential from UTC (00 - 23);
   - mm is the two digit number of minutes of the local time differential from UTC (00 - 59).

   The file_ready_time is the time when the file was last closed and made available for upload and the file content will not be changed.

4) To reduce length of the file name, the file_expiration_delta_time field could be a delta time interval from file ready time. The unit is hour.

5) The specificData_extension field is used to extend the extra file naming convention for a specific type of management data.

6) The RC parameter is a running count, starting with the value of "1", and shall be appended only if the filename is not unique, i.e. more than one file is generated and all other parameters of the file name are identical.

7) The separator field is "_-_", which is an underscore character (_), followed by a minus character (-), followed by an underscore character (_).

A.3.2 Performance data file specific extension

The following convention defined as <specificData_extension> of the generic file naming convention (as defined clause A.3.1) shall be applied for performance data file naming:

<Type><Startdate>.<Starttime>-[<Enddate>.]<Endtime>[_-<jobIdList>][_<UniqueId>][_-_<RC>]

1) The Type field indicates if the file contains measurement results for single or multiple measured objects and/or granularity periods where:

   - "A" means single measured object, single granularity period (this is used when granularity period is equal to reporting period);
   - "B" indicates multiple measured objects, single granularity period (this is used when granularity period is equal to reporting period);
   - "C" signifies single measured object, multiple granularity periods (this is used when reporting period is multiples of the granularity period and will contain multiple measurement reports);
   - "D" stands for multiple measured objects, multiple granularity periods (this is used when reporting period is multiples of the granularity period and will contain multiple measurement reports).

2) The Startdate field indicates the date when the granularity period began if the Type field is set to A or B. If the Type field is either "C" or "D" then Startdate contains the date when the first granularity period of the measurement results contained in the file started. The Startdate field is of the form YYYYMMDD, where:

   - YYYY is the year in four-digit notation;
   - MM is the month in two digit notation (01 - 12);
   - DD is the day in two-digit notation (01 - 31).

3) The Starttime field indicates the time when the granularity period began if the Type field is set to A or B. If the Type field is either "C" or "D" then Starttime contains the time when the first granularity period of the measurement results contained in the file began. The Starttime field is of the form HHMMshhmm, where:

   - HH is the two-digit hour of the day (local time), based on 24-hour clock (00 - 23);
   - MM is the two digit minute of the hour (local time), possible values are 00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, and 55;
   - s is the sign of the local time differential from UTC (+ or -), in case the time differential to UTC is 0 then the sign may be arbitrarily set to "+" or "-";
   - hh is the two-digit number of hours of the local time differential from UTC (00-23);
   - mm is the two digit number of minutes of the local time differential from UTC (00-59).

4) The Enddate field shall only be included if the Type field is set to "C" or "D", i.e. measurement results for multiple granularity periods are contained in the file. It identifies the date when the last granularity period of these measurements ended, and its structure corresponds to the Startdate field.

5) The Endtime field indicates the time when the granularity period ended if the Type field is set to A or B. If the Type field is either "C" or "D" then Endtime contains the time when the last granularity period of the measurement results contained in the file ended. Its structure corresponds to the Starttime field, however, the allowed values for the minute of the hour are 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, and 00.

6) UniqueId. This is the DN of the measured NF, NSI, NSSI, or network/subnetwork, as defined in annex A.2 (e.g. a measObjInstId). The field may be omitted only if the distinguishedName is not available from the CM applications.

7) The RC parameter is a running count, starting with the value of "1", and shall be appended only if the filename is otherwise not unique, i.e. more than one file is generated and all other parameters of the file name are identical.

Therefore it may only be used by the EM, since the described situation cannot occur with NE generated files. Note that the delimiter for this field, _-_, is an underscore character (_), followed by a minus character (-), followed by an underscore character (_).

8) jobIdList indicates the measurement job id(s) that the performance data file is associated with.

Some examples describing file-naming convention:

1) file name: A20000626.2315+0200-2330+0200_gNBId,
meaning: file produced for gNB <gNBId> on June 26, 2000, granularity period 15 minutes from 23:15 local to 23:30 local, with a time differential of +2 hours against UTC.

2) file name: B20021224.1700-1130-1705-1130_-job10_S-NSSAI,
meaning: file containing results for multiple measured objects, generated for measurement job job10, produced for NSI <S-NSSAI> on December 24, 2002, granularity period 5 minutes from 17:00 local to 17:05 local, with a time differential of –11:30 hours against UTC.

3) file name: D20050907.1030+0000-20050909.1500+0000_SubnetworkId_-_2,
meaning: file containing results subnetwork <SubnetworkId>, start of first granularity period 07 September 2005, 10:30 local, end of last granularity period 09 September 2005, 15:00 local, with a time differential of 0 against UTC. This is the second file for this subnetwork/granularity period combination.

4) file name: C20050907.1030+0000-20050909.1500+0000_gNBId,
meaning: file produced for the gNB <gNBId>, start of first granularity period 07 September 2005, 10:30 local, end of last granularity period 09 September 2005, 15:00 local, with a time differential of 0 against UTC.

A.4 XML file format definition

A.4.0 Introduction

This clause describes the format of performance data file. The XML file format definition is based on XML schema (see [8], [9], [10] and [11]).

A.4.1 Mapping table

Table A.4.1-1 maps the file content items in the annex A.2 to those used in the XML schema based file format definitions. XML tag attributes are useful where data values bind tightly to its parent element. They have been used where appropriate.

Table A.4.1-1: Mapping of File Content Items to XML tags

File Content Item	XML schema based XML tag	Description
measDataCollection	measDataFile	
measFileHeader	fileHeader	
measData	measData	
measFileFooter	fileFooter	
fileFormatVersion	fileHeader fileFormatVersion	
senderName	fileSender senderName	
senderType	fileSender senderType	For the XML schema based XML format, XML attribute specification "senderType " may be absent in case the "senderType" is not configured in the sender.
vendorName	fileHeader vendorName	For the XML schema based XML format, XML attribute specification "vendorName" may be absent in case the "vendorName" is not configured in the sender.
collectionBeginTime	measData beginTime	
measuredEntityUserName	measuredEntity userLabel	For the XML schema based XML format, XML attribute specification "userLabel" may be absent in case the "nEUserName" is not configured in the CM applications.

File Content Item	XML schema based XML tag	Description
measuredEntityDn	fileHeader dnPrefix and measuredEntity localDn	For the XML schema based XML format, the DN is split into the DN prefix and the Local DN (LDN) (see 3GPP TS 32.300 [12]). XML attribute specification "localDn" may be absent in case the LDN is not configured in the CM applications.
measuredEntitySoftwareVersion	measuredEntity swVersion	For the XML schema based XML format, XML attribute specification "swVersion" may be absent in case the "nESoftwareVersion" is not configured in the CM applications.
measInfo	measInfo	
measInfoId	measInfoId	
measTimeStamp	granPeriod endTime	
jobId	jobId	
granularityPeriod	granPeriod duration	For the XML schema based XML format, the value of XML attribute specification "duration" shall use the truncated representation "PT*n*S" (see [10]).
reportingPeriod	repPeriod duration	For the XML schema based XML format, the value of XML attribute specification "duration" shall use the truncated representation "PT*n*S" (see [10]).
measTypes	measTypes or measType	For the XML schema based XML format, depending on sender's choice for optional positioning presence, either XML element "measTypes" or XML elements "measType" will be used.
measValues	measValue	
measObjInstId	measValue measObjLdn	
measResults	measResults or r	For the XML schema based XML format, depending on sender's choice for optional positioning presence, either XML element "measResults" or XML elements "r" will be used.
suspectFlag	suspect	
timeStamp	measData endTime	
There is no corresponding File Content Item.	measType p	An optional positioning XML attribute specification of XML element "measType" (XML schema based), used to identify a measurement type for the purpose of correlation to a result. The value of this XML attribute specification is expected to be a non-zero, non-negative integer value that is unique for each instance of XML element "measType" that is contained within the measurement data collection file.
There is no corresponding File Content Item.	r p	An optional positioning XML attribute specification of XML element "r", used to correlate a result to a measurement type. The value of this XML attribute specification should match the value of XML attribute specification "p" of the corresponding XML element "measType" (XML schema based).

A.4.2 XML schema

A.4.2.1 Performance data file XML schema

The following XML schema `measData.xsd` is the schema for performance measurements data XML files:

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
  3GPP TS 28.550 Measurements data XML file format definition
  data file XML schema
  measData.xsd
-->
<schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:md="http://www.3gpp.org/ftp/specs/archive/28_series/28.550#measData"
targetNamespace="http://www.3gpp.org/ftp/specs/archive/28_series/28.550#measData"
elementFormDefault="qualified">
    <!-- Measurement collection data file root XML element -->
    <element name="MeasDataFile">
```

```
        <complexType>
            <sequence>
                <element name="fileHeader">
                    <complexType>
                        <sequence>
                            <element name="fileSender">
                                <complexType>
                                    <attribute name="senderName" type="string" use="optional"/>
                                    <attribute name="senderType" type="string" use="optional"/>
                                </complexType>
                            </element>
                            <element name="MeasData">
                                <complexType>
                                    <attribute name="beginTime" type="dateTime" use="required"/>
                                </complexType>
                            </element>
                        </sequence>
                        <attribute name="fileFormatVersion" type="string" use="required"/>
                        <attribute name="vendorName" type="string" use="optional"/>
                            <attribute name="dnPrefix" type="string" use="optional"/>
                    </complexType>
                </element>
                <element name="measData" minOccurs="0" maxOccurs="unbounded">
                    <complexType>
                        <sequence>
                            <element name="measuredEntity">
                                <complexType>
                                    <attribute name="userLabel" type="string" use="optional"/>
                                    <attribute name="localDn" type="string" use="optional"/>
                                    <attribute name="swVersion" type="string" use="optional"/>
                                </complexType>
                            </element>
                            <element name="measInfo" minOccurs="0" maxOccurs="unbounded">
                                <complexType>
                                    <sequence>
                                        <element name="job" minOccurs="0">
                                            <complexType>
                                                <attribute name="jobId" type="string"
use="required"/>
                                            </complexType>
                                        </element>
                                        <element name="granPeriod">
                                            <complexType>
                                                <attribute name="duration" type="duration"
use="required"/>
                                                <attribute name="endTime" type="dateTime"
use="required"/>
                                            </complexType>
                                        </element>
                                        <element name="repPeriod" minOccurs="0">
                                            <complexType>
                                                <attribute name="duration" type="duration"
use="required"/>
                                            </complexType>
                                        </element>
                                        <choice>
                                            <element name="measTypes">
                                                <simpleType>
                                                    <list itemType="Name"/>
                                                </simpleType>
                                            </element>
                                            <element name="measType" minOccurs="0"
maxOccurs="unbounded">
                                                <complexType>
                                                    <simpleContent>
                                                        <extension base="Name">
                                                            <attribute name="p"
type="positiveInteger" use="required"/>
                                                        </extension>
                                                    </simpleContent>
                                                </complexType>
                                            </element>
                                        </choice>
                                        <element name="measValue" minOccurs="0"
maxOccurs="unbounded">
                                            <complexType>
                                                <sequence>
                                                    <choice>
```

```
                                                    <element name="measResults">
                                                        <simpleType>
                                                            <list itemType="md:measResultType"/>
                                                        </simpleType>
                                                    </element>
                                                    <element name="r" minOccurs="0"
maxOccurs="unbounded">
                                                        <complexType>
                                                            <simpleContent>
                                                                <extension
base="md:measResultType">
                                                                    <attribute name="p"
type="positiveInteger" use="required"/>
                                                                </extension>
                                                            </simpleContent>
                                                        </complexType>
                                                    </element>
                                                </choice>
                                                <element name="suspect" type="boolean"
minOccurs="0"/>
                                            </sequence>
                                            <attribute name="measObjLdn" type="string"
use="required"/>
                                        </complexType>
                                    </element>
                                </sequence>
                                <attribute name="measInfoId" type="string" use="optional"/>
                            </complexType>
                        </element>
                    </sequence>
                </complexType>
            </element>
            <element name="fileFooter">
                <complexType>
                    <sequence>
                        <element name="MeasData">
                            <complexType>
                                <attribute name="endTime" type="dateTime" use="required"/>
                            </complexType>
                        </element>
                    </sequence>
                </complexType>
            </element>
        </sequence>
    </complexType>
</element>
<simpleType name="measResultType">
    <union memberTypes="integer float string">
        <simpleType>
            <restriction base="string">
                <enumeration value="NULL"/>
            </restriction>
        </simpleType>
    </union>
</simpleType>
</schema>
```

A.4.2.2 Performance data file XML header

The following header shall be used in actual XML measurement result files:

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="MeasData.xsl"?>
<measDataFile
  xmlns=
"http://www.3gpp.org/ftp/specs/archive/28_series/28.550#measData"
>
```

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).

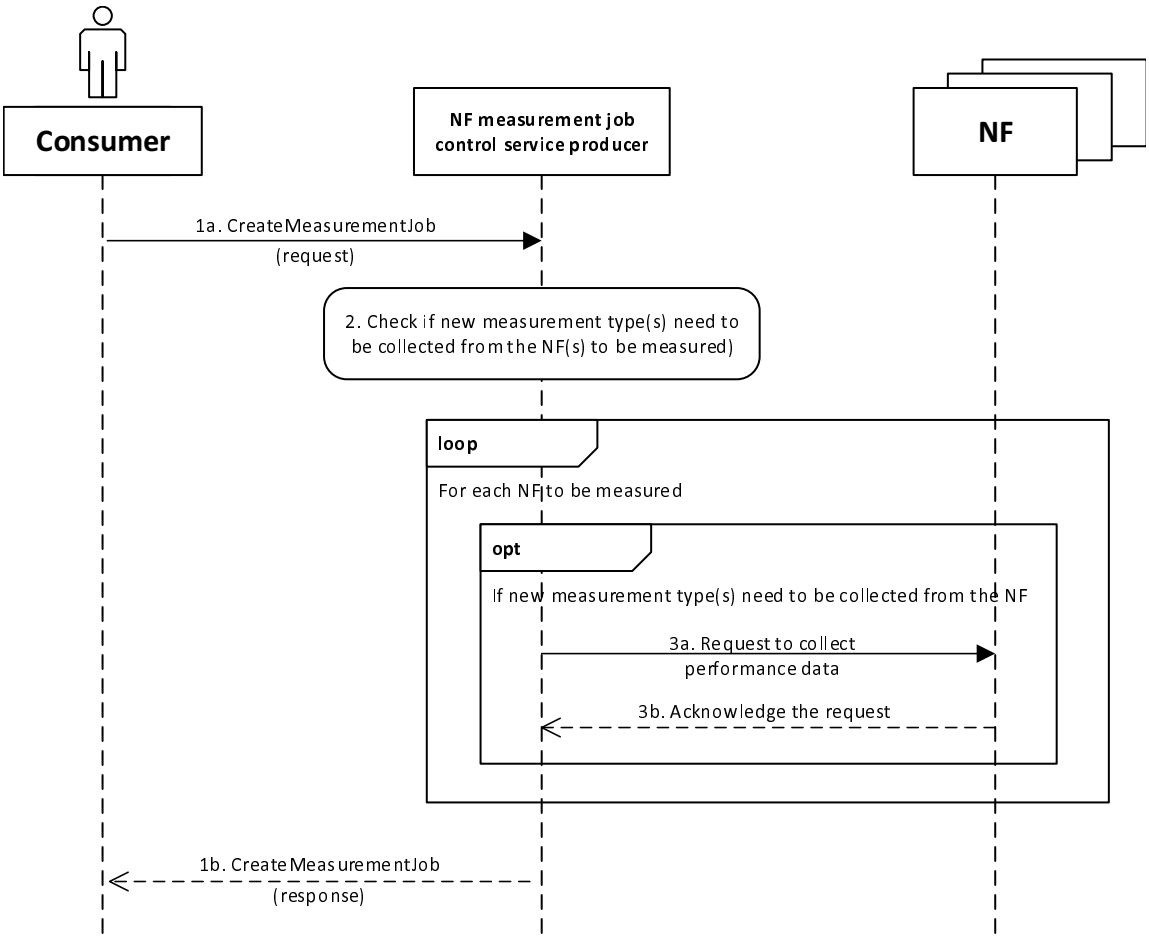

Figure B.1-1: Example of procedure for NF measurement job creation

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).

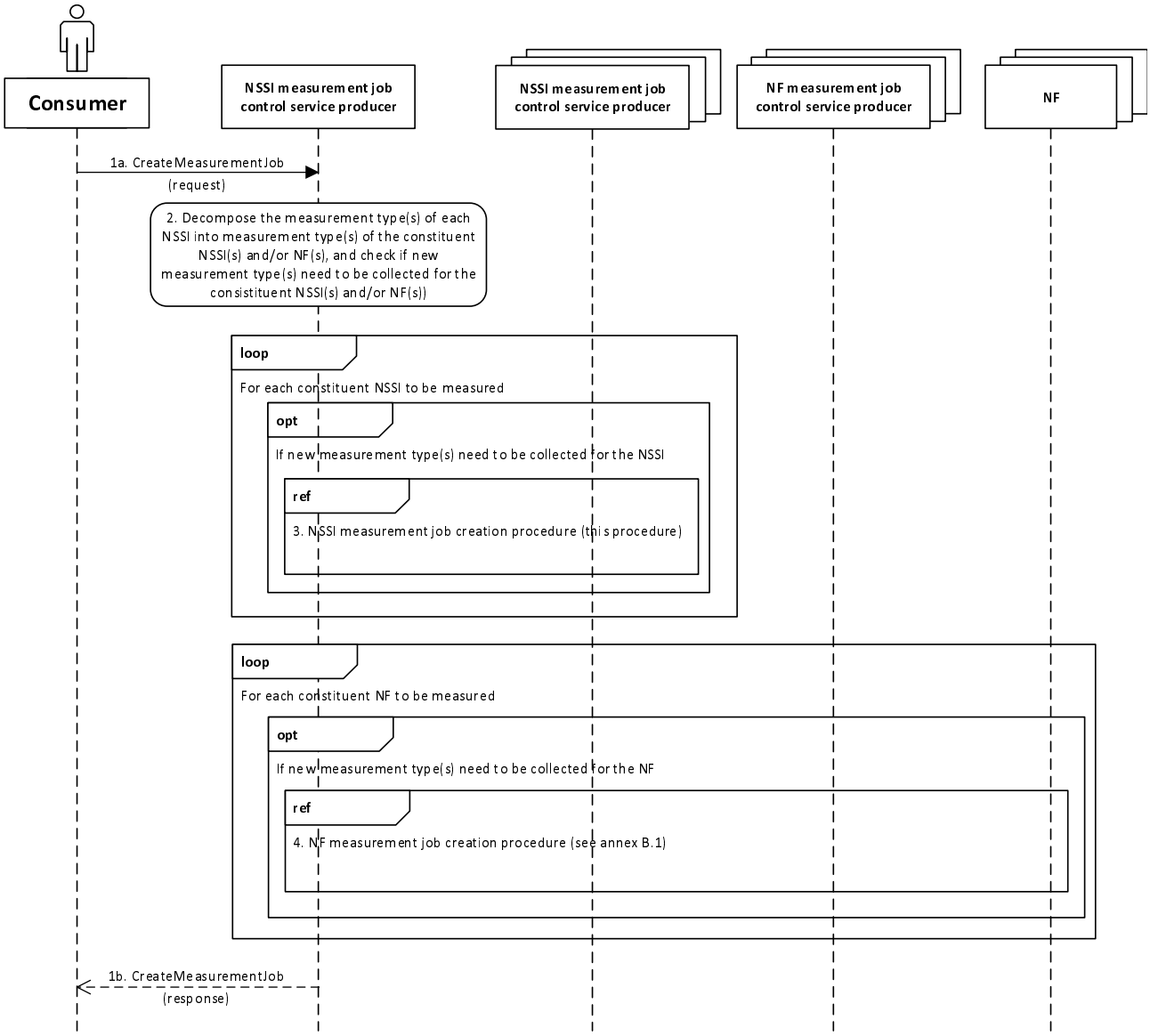

Figure B.2-1: Example of procedure for NSSI measurement job creation

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).

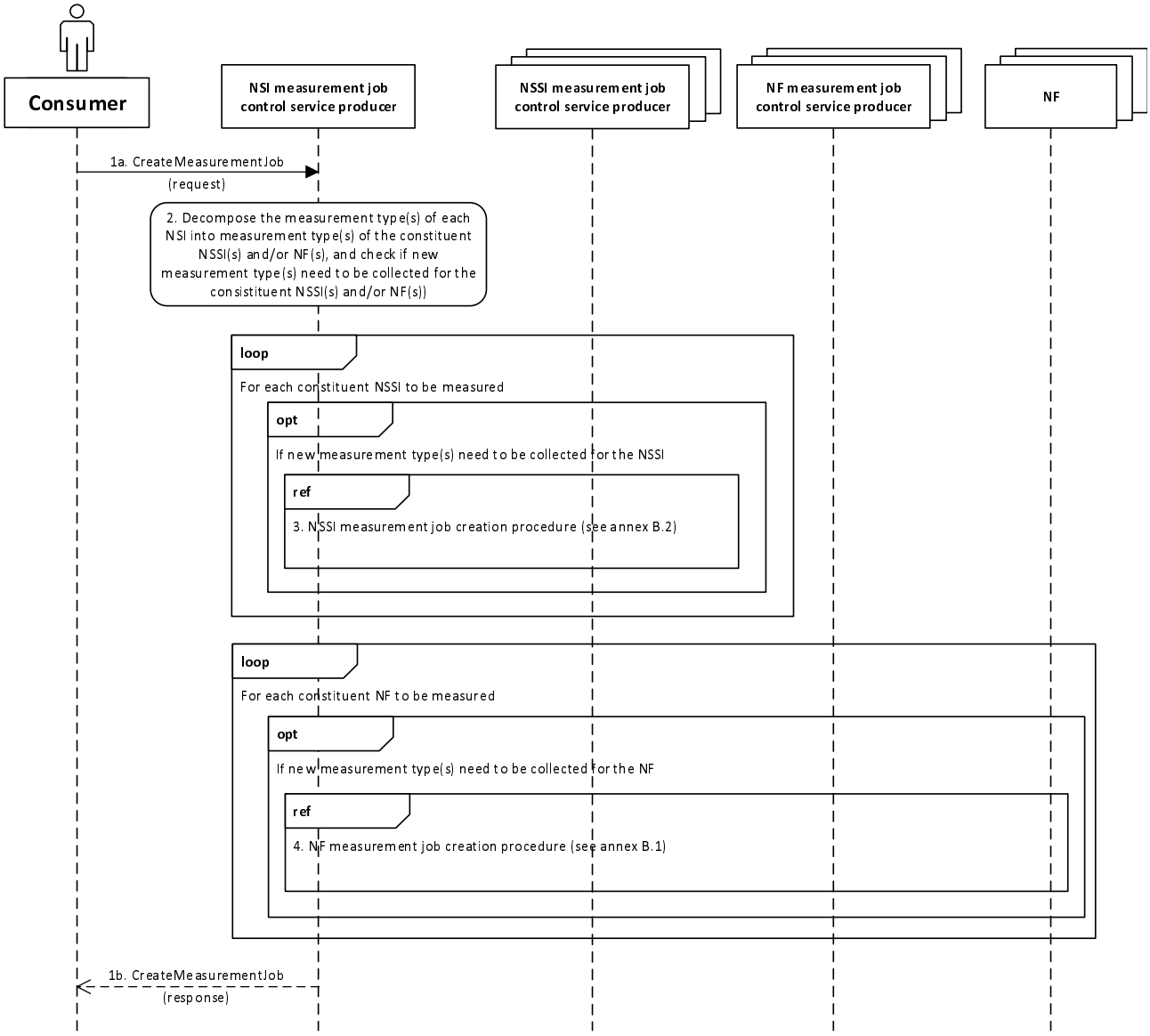

Figure B.3-1: Example of procedure for NSI measurement job creation

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).

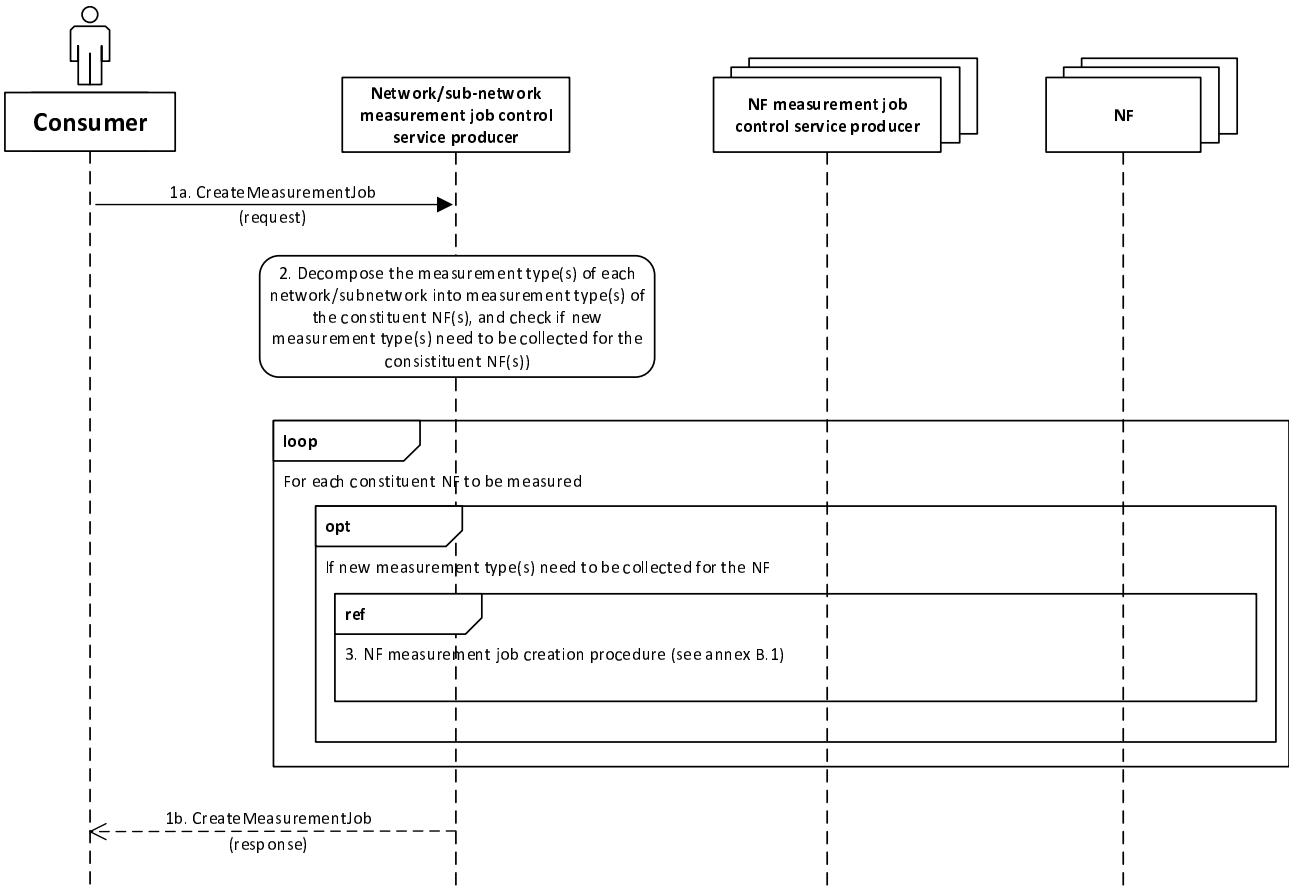

Figure B.4-1: Example of procedure for network measurement job creation

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).

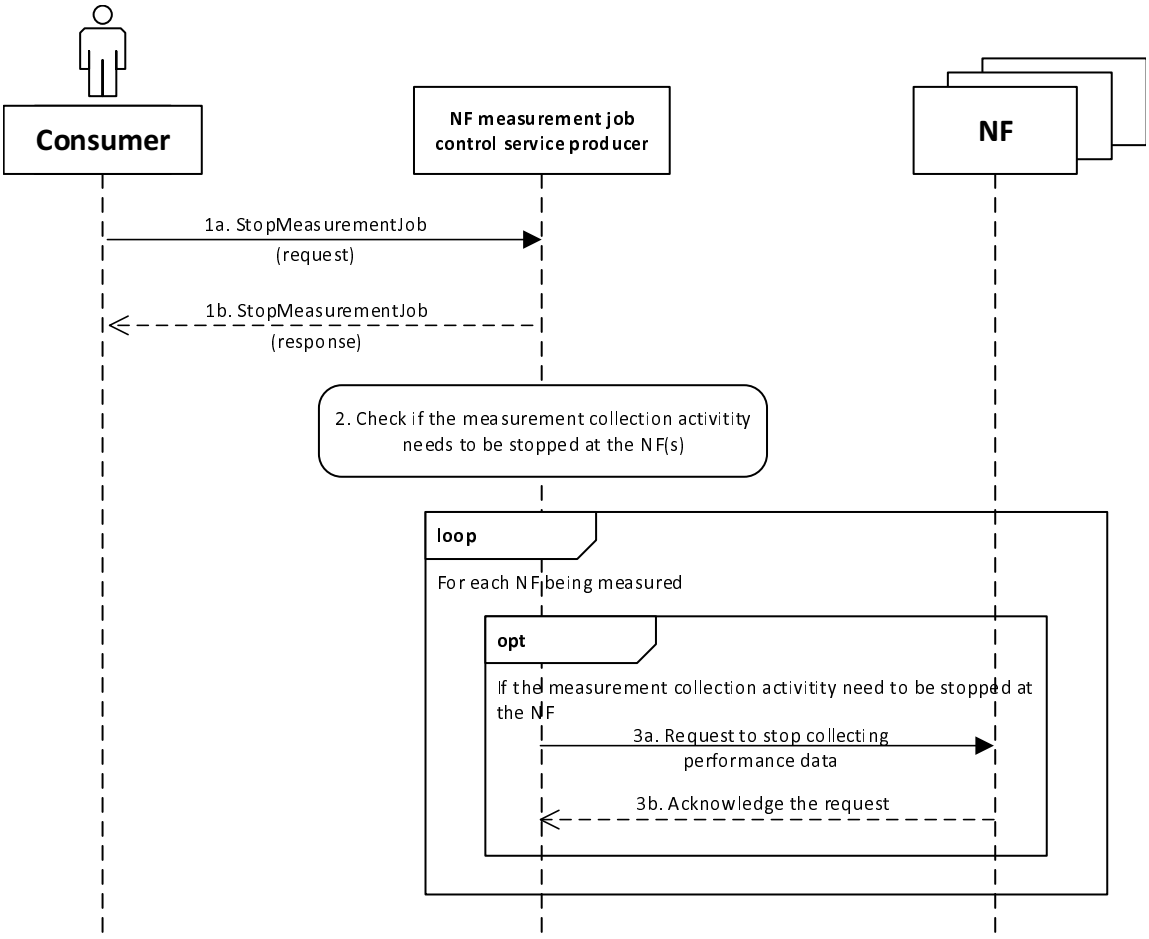

Figure B.5-1: Example of procedure for NF measurement job termination

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).

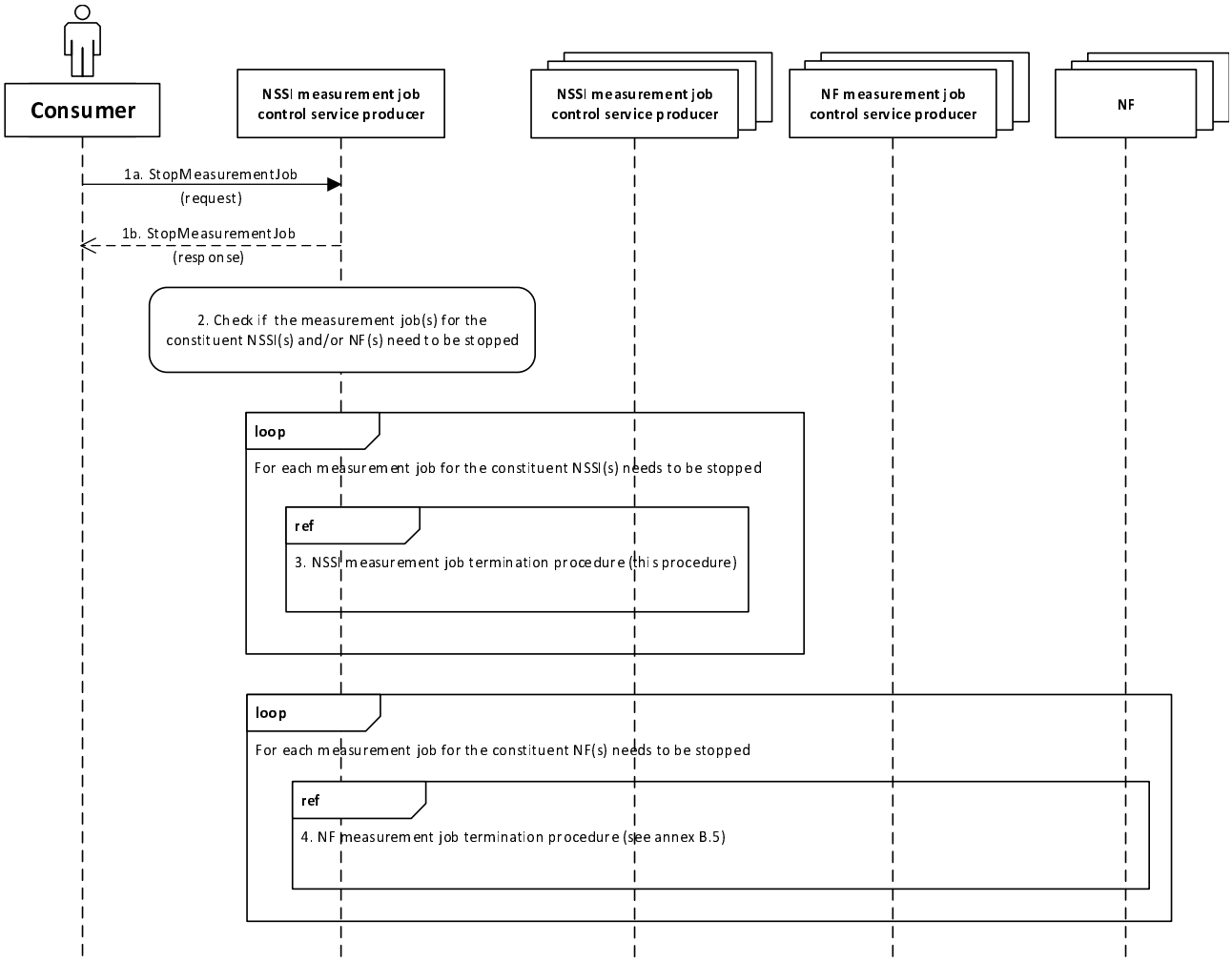

Figure B.6-1: Example of procedure for NSSI measurement job termination

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).

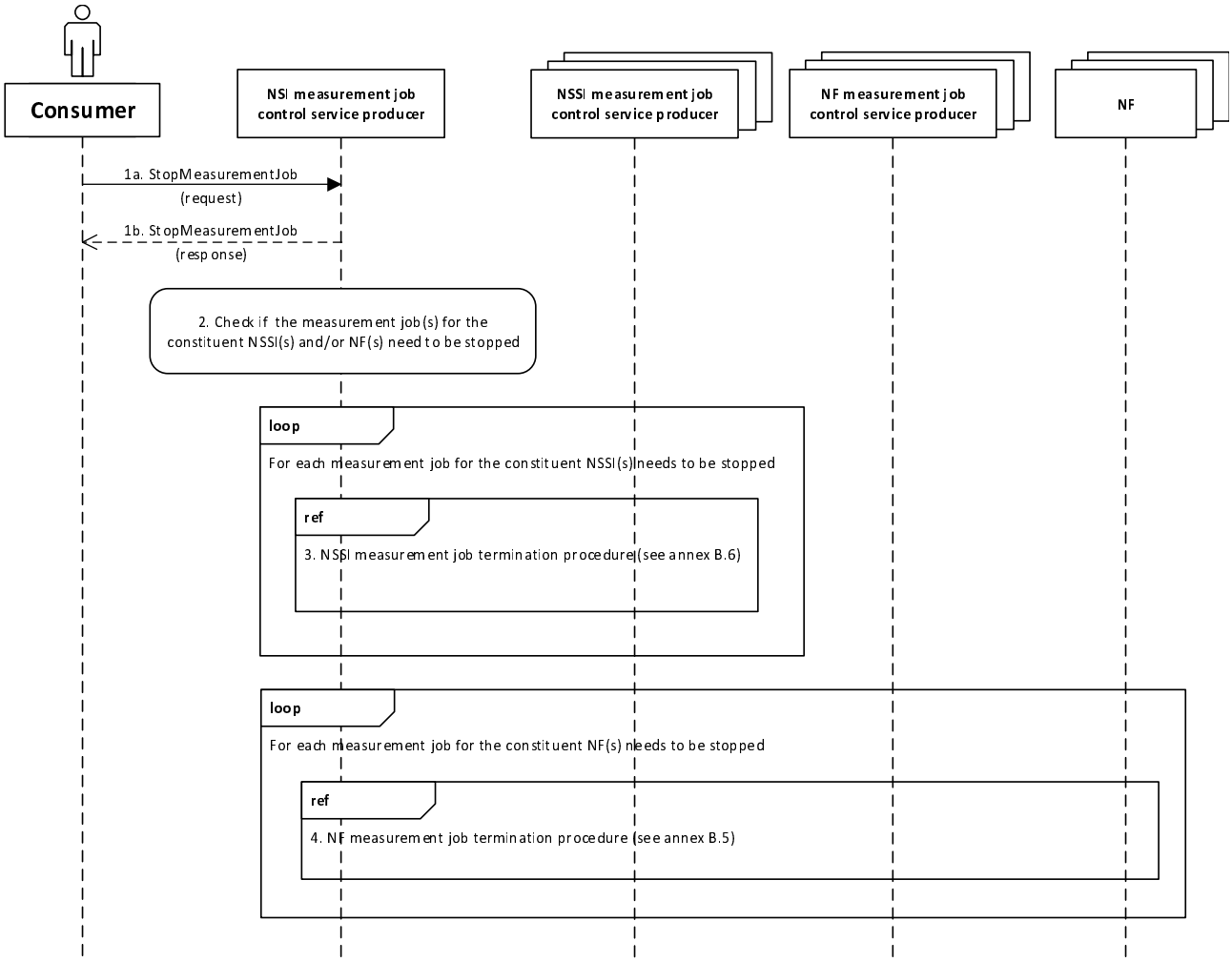

Figure B.7-1: Example of procedure for NSI measurement job termination

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).

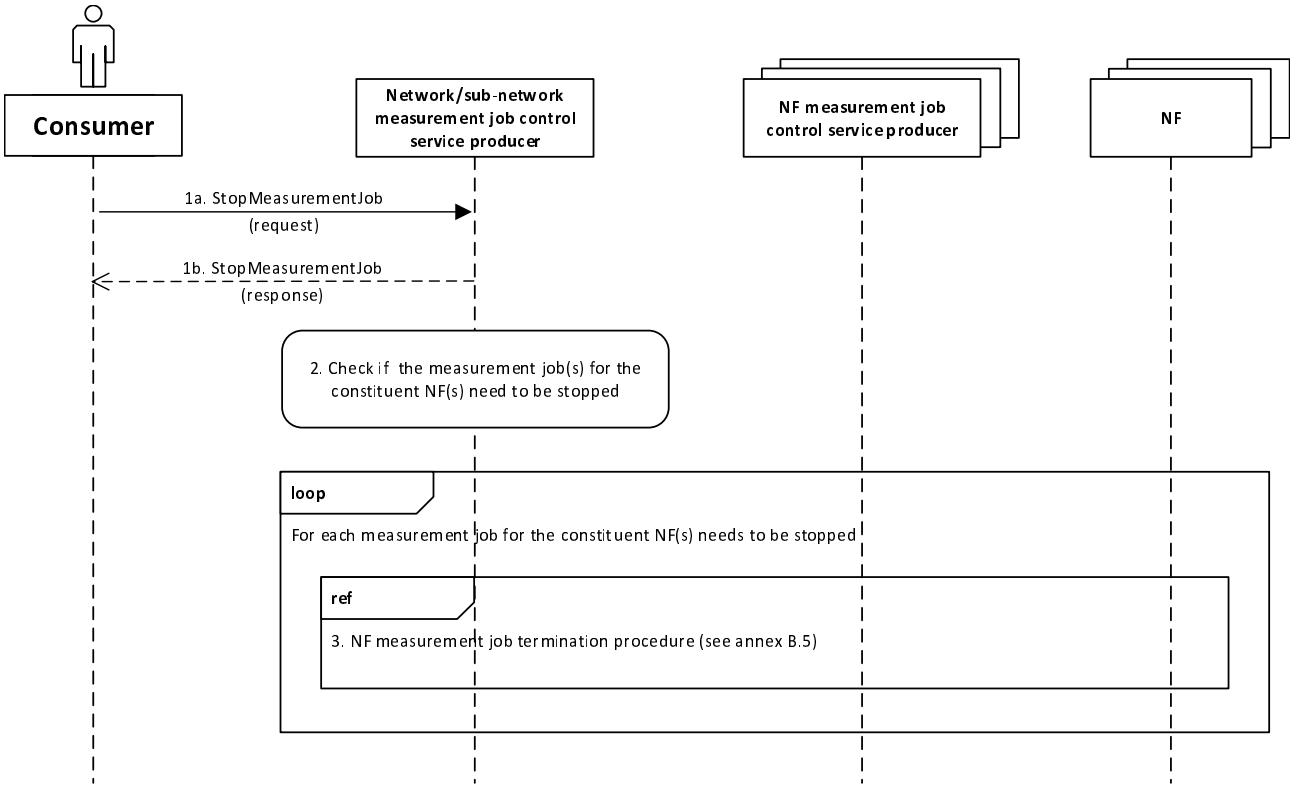

Figure B.8-1: Example of procedure for network measurement job creation

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 createMeasurementJob operation (see clause 6.1.1.3).

Annex D (informative): Performance data streaming holistic sequence

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

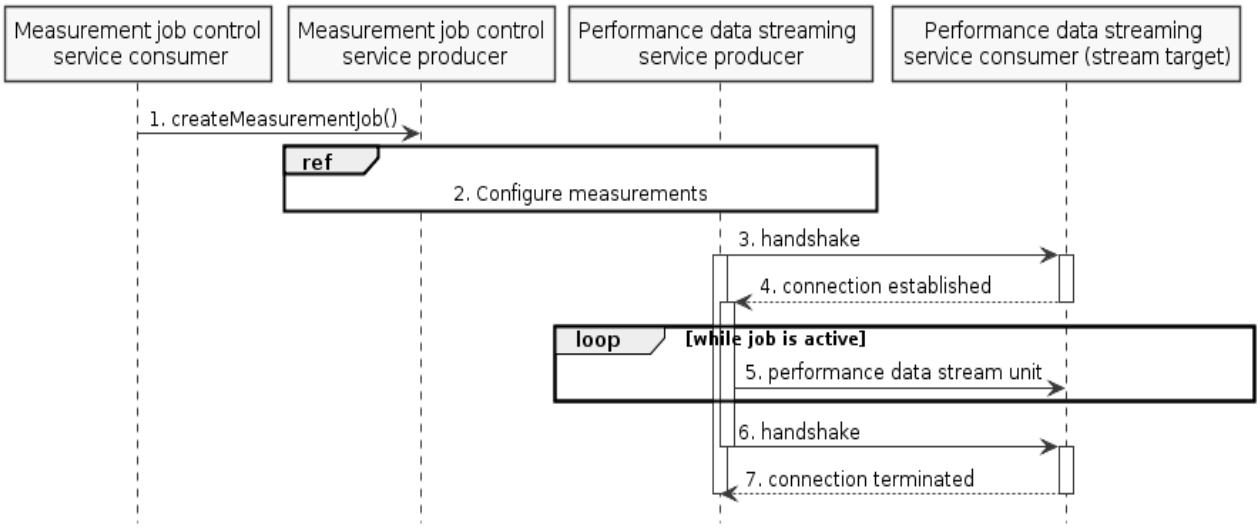

Figure D-1

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 Assurance Service",
    "version": "15.1.0",
    "description": "OAS 3.0.1 specification of the Performance Assurance Service"
  },
  "servers": [
    {
      "url": "http://{DN_prefix_authority_part}/{DN_prefix_remainder}/PerfAssurMnS/v1500",
      "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": {
        "$ref": "#/components/schemas/priority-Type"
      },
      "reliability": {
        "type": "string"
      }
    }
  },
  "measJobCreation-ResponseType": {
    "type": "object",
    "properties": {
      "streamInfoList": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/streamInfo-Type"
        }
      },
      "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": {
        "$ref": "#/components/schemas/schedule-Type"
      },
      "streamTarget": {
        "type": "string"
      },
      "streamInfoList": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/streamInfo-Type"
        }
      },
      "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"
        }
      }
    }
  },
  "streamInfo-Type": {
    "type": "object",
    "properties": {
      "streamId": {
        "type": "string"
      },
      "iOCInstance": {
          "$ref": "#/components/schemas/uri-Type"
      },
      "measTypes": {
        "type": "array",
        "items": {
          "type": "string"
        }
      }
    }
  },
  "unsupportedMeas-Type": {
    "type": "object",
    "properties": {
      "iOCInstance": {
          "$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"
        ]
      }
    }
  }
}
```

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

History

Document history		
V15.0.0	April 2019	Publication
V15.1.0	May 2019	Publication