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TECHNICAL SPECIFICATION

5G;
Management and orchestration;
Fault Supervision (FS)
(3GPP TS 28.545 version 15.0.0 Release 15)

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Contents

Foreword

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Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project Technical Specification Group Services and System Aspects Management and orchestration of networks, as identified below:

TS 28.545:   Management and orchestration; Fault Supervision (FS)

1   Scope

The present document specifies use cases and requirements for fault supervision of 5G networks and network slicing.

2   References

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

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

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

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

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

[2]   3GPP TS 28.532: "Management and orchestration; Management services".

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

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].

FS	Fault Supervision
ME	Managed Element
MnS	Management Service
NSI	Network Slice Instance
NSSI	Network Slice Subnet Instance
VNF	Virtualized Network Function
VNFC	Virtualized Network Function Component

4   General

4.1   Overview

4.1.1   Alarm related services

The following management services are needed for fault supervision:

Table 4.1.1: Management services for fault supervision

Management Service	Description
Fault supervision data report service for NSI	To support the consumer to get NSI alarm data.
Fault supervision data control service for NSI	To support the consumer to control NSI alarm data.
Fault supervision data report service for NSSI	To support the consumer to get NSSI alarm data.
Fault supervision data control service for NSSI	To support the consumer to control NSSI alarm data.
Fault supervision data report service for NF	To support the consumer to get NF instance alarm data.
Fault supervision data control service for NF	To support the consumer to control NF instance alarm data.

5 Specification level requirements

5.1 Use cases

5.1.1 Report alarm notifications of NSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To report NSI alarm notifications.	
Actors and Roles	An authorized consumer of fault supervision data report service for NSI.	
Telecom resources	Network slice instance	
Assumptions	N/A	
Pre-conditions	An NSI is deployed An authorized consumer has subscribed the alarm notifications of an NSI The producer of fault supervision data report service for NSI has subscribed the alarm notifications of the NSI constituents.	
Begins when	A failure or severe performance degradation of NSI is detected.	
Step 1 (M)	The producer of fault supervision data report service for NSI collects alarm information of NSSIs and/or NF instances associated with the NSI as well as other information if needed.	
Step 2 (M)	The producer of fault supervision data report service for NSI sends the alarm notification to its authorized consumer when a new alarm notification is generated and this alarm notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the alarm notification of the NSI or the authorized consumer unsubscribes the alarm notifications of the NSI or the NSI is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the alarm notification of the NSI	
Traceability	REQ-FSDR_NSI-FUN-1, REQ-FSDR_NSI-FUN-4	

5.1.2 Subscription of alarm notifications of NSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To subscribe NSI alarm notifications	
Actors and Roles	An authorized consumer of fault supervision data report service for NSI.	
Telecom resources	Network slice instance	
Assumptions	N/A	
Pre-conditions	An NSI is deployed	
Begins when	An authorized consumer wants to subscribe the alarm notifications of an NSI	
Step 1 (M)	The authorized consumer sends request to the producer of fault supervision data report service for NSI to subscribe alarm notifications of an NSI.	
Step 2 (M)	The producer of fault supervision data report service for NSI sends the response of the completion of the subscription to the authorized consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	In case any of the mandatory steps in the use case fails.	
Post-conditions	The alarm notifications of an NSI have been subscribed by the authorized consumer.	
Traceability	REQ-FSDR_NSI-FUN-2	

5.1.3 Unsubscription of alarm notifications of NSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To unsubscribe NSI alarm notifications	
Actors and Roles	An authorized consumer of fault supervision data report service for NSI.	
Telecom resources	Network slice instance	
Assumptions	N/A	
Pre-conditions	An NSI is deployed. An authorized consumer has subscribed the alarm notifications of an NSI from a producer of fault supervision data report service for NSI.	
Begins when	The authorized consumer wants to unsubscribe the alarm notifications of an NSI.	
Step 1 (M)	The authorized consumer sends request to the producer of fault supervision data report service for NSI to unsubscribe alarm notifications of an NSI.	
Step 2 (M)	The producer of fault supervision data report service for NSI sends the response of the completion of the unsubscription to the authorized consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	In case any of the mandatory steps in the use case fails.	
Post-conditions	The alarm notifications of the NSI has been unsubscribed by the authorized consumer.	
Traceability	REQ-FSDR_NSI-FUN-3	

5.1.4 Get alarm list of NSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To get alarm list of NSI.	
Actors and Roles	An authorized consumer of the fault supervision data report service for NSI.	
Telecom resources	Network slice instance	
Assumptions	N/A	
Pre-conditions	The NSI has been deployed. The producer of the fault supervision data report service for NSI is in operation.	
Begins when	The authorized consumer decides to get the alarm list of an NSI.	
Step 1 (M)	The authorized consumer requires the producer of the fault supervision data report service for NSI to report the alarm list of the NSI.	
Step 2 (M)	The Producer of the fault supervision data report service for NSI sends the alarm list to the the authorized consumer. The alarm list contains the alarm(s) which satisfy the filter condition if exists.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The authorized consumer has got the alarm list of the NSI.	
Traceability	REQ-FSDR_NSI-FUN-5, REQ-FSDR_NSI-FUN-6	

5.1.5 Acknowledge alarms of NSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To acknowledge one or multiple alarms of NSI.	
Actors and Roles	An authorized consumer of the fault supervision data control service for NSI.	
Telecom resources	Network slice instance	
Assumptions	N/A	
Pre-conditions	The NSI has been deployed. The producer of the fault supervision data control service for NSI is in operation.	
Begins when	The authorized consumer decides to acknowledge one or multiple alarms of an NSI.	
Step 1 (M)	The authorized consumer sends the request to the producer of fault supervision data control service for NSI to acknowledge one or multiple alarms of the NSI.	
Step 2 (M)	The producer of the fault supervision data control service for NSI acknowledges the alarms based on the request.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The alarms of the NSI have been acknowledged.	
Traceability	REQ-FSDC_NSI-FUN-1	

5.1.6 Clear alarms of NSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To clear one or multiple alarms of NSI.	
Actors and Roles	An authorized consumer of the fault supervision data control service for NSI.	
Telecom resources	Network slice instance	
Assumptions	N/A	
Pre-conditions	The NSI has been deployed. The producer of the fault supervision data control service for NSI is in operation.	
Begins when	The authorized consumer decides to clear one or multiple alarms of an NSI.	
Step 1 (M)	The authorized consumer sends the request to the producer of the fault supervision data control service for NSI to clear one or multiple alarms of the NSI.	
Step 2 (M)	The producer of the fault supervision data control service for NSI clears the alarms based on the request.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The alarms of the NSI have been cleared.	
Traceability	REQ-FSDC_NSI-FUN-2	

5.1.7 Report alarm notifications of NSSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To report NSSI alarm notifications.	
Actors and Roles	An authorized consumer of fault supervision data report service for NSSI.	
Telecom resources	Network slice subnet instance	
Assumptions	N/A	
Pre-conditions	An NSSI is deployed An authorized consumer has subscribed the alarm notifications of an NSSI. The producer of fault supervision data report service for NSSI has subscribed the alarm notifications of NSSI constituents.	
Begins when	A failure or severe performance degradation of NSSI is detected.	
Step 1 (M)	The producer of fault supervision data report service for NSSI collects alarm information of constituent NSSIs and/or NF instances associated with the NSSI as well as other information if needed.	
Step 2 (M)	The producer of fault supervision data report service for NSSI sends the alarm notification to its authorized consumer when a new alarm notification is generated and this alarm notification satisfies the filter condition if exists.	
Ends when	An authorized consumer receives the alarm notification of an NSSI or the authorized consumer unsubscribes the alarm notifications of the NSSI or the NSSI is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails.	
Post-conditions	The authorized consumer receives the alarm notification of the NSSI	
Traceability	REQ-FSDR_NSSI-FUN-1, REQ-FSDR_NSSI-FUN-4	

5.1.8 Subscription of alarm notifications of NSSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To subscribe NSSI alarm notifications	
Actors and Roles	An authorized consumer of fault supervision data report service for NSSI.	
Telecom resources	Network slice subnet instance	
Assumptions	N/A	
Pre-conditions	An NSSI is deployed	
Begins when	An authorized consumer wants to subscribe the alarm notifications of an NSSI	
Step 1 (M)	The authorized consumer sends request to the producer of fault supervision data report service for NSSI to subscribe alarm notifications of an NSSI.	
Step 2 (M)	The producer of fault supervision data report service for NSSI sends the response of the completion of the subscription to the authorized consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	In case any of the mandatory steps in the use case fails.	
Post-conditions	The alarm notifications of an NSSI have been subscribed by the authorized consumer.	
Traceability	REQ-FSDR_NSSI-FUN-2	

5.1.9 Unsubscription of alarm notifications of NSSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To unsubscribe NSSI alarm notifications	
Actors and Roles	An authorized consumer of fault supervision data report service for NSSI.	
Telecom resources	Network slice subnet instance	
Assumptions	N/A	
Pre-conditions	An NSSI is deployed An authorized consumer has subscribed the alarm notifications of an NSSI from the producer of fault supervision data report service for NSSI.	
Begins when	An authorized consumer wants to unsubscribe the alarm notifications of an NSSI.	
Step 1 (M)	The authorized consumer sends request to the producer of fault supervision data report service for NSSI to unsubscribe alarm notifications of an NSSI.	
Step 2 (M)	The producer of fault supervision data report service for NSSI sends the response of the completion of the unsubscription to the authorized consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	In case any of the mandatory steps in the use case fails.	
Post-conditions	The alarm notifications of the NSSI has been unsubscribed by the authorized consumer.	
Traceability	REQ-FSDR_NSSI-FUN-3	

5.1.10 Get alarm list of NSSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To get alarm list of NSSI.	
Actors and Roles	An authorized consumer of the fault supervision data report service for NSSI.	
Telecom resources	Network slice subnet instances	
Assumptions	N/A	
Pre-conditions	The NSSI has been deployed. The producer of the fault supervision data report service for NSSI is in operation.	
Begins when	The authorized consumer decides to get the alarm list of an NSSI.	
Step 1 (M)	The authorized consumer requires the producer of the fault supervision data report service for NSSI to report the alarm list of the NSSI.	
Step 2 (M)	The producer of the fault supervision data report service for NSSI sends the alarm list to the the authorized consumer. The alarm list contains the alarm(s) which satisfy the filter condition if exists.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The authorized consumer has got the alarm list of the NSSI.	
Traceability	REQ-FSDR_NSSI-FUN-5, REQ-FSDR_NSSI-FUN-6	

5.1.11 Acknowledge alarms of NSSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To acknowledge one or multiple alarms of NSSI.	
Actors and Roles	An authorized consumer of the fault supervision data control service for NSSI.	
Telecom resources	Network slice subnet instance	
Assumptions	N/A	
Pre-conditions	The NSSI has been deployed. The producer of the fault supervision data control service for NSSI is in operation.	
Begins when	The authorized consumer decides to acknowledge one or multiple alarms of an NSSI.	
Step 1 (M)	The authorized consumer sends the request to the producer of the fault supervision data control service for NSSI to acknowledge one or multiple alarms of the NSSI.	
Step 2 (M)	The producer of the fault supervision data control service for NSSI acknowledges the alarms based on the request.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The alarms of the NSSI have been acknowledged.	
Traceability	REQ-FSDC_NSSI-FUN-1	

5.1.12 Clear alarms of NSSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To clear one or multiple alarms of NSSI.	
Actors and Roles	An authorized consumer of the fault supervision data control service for NSSI.	
Telecom resources	Network slice subnet instance	
Assumptions	N/A	
Pre-conditions	The NSSI has been deployed. The producer of the fault supervision data control service for NSSI is in operation.	
Begins when	The authorized consumer decides to clear one or multiple alarms of an NSSI.	
Step 1 (M)	The authorized consumer sends the request to the producer of the fault supervision data control service for NSSI to clear one or multiple alarms of the NSSI.	
Step 2 (M)	The procedure of the fault supervision data control service for NSSI clears the alarms based on the request.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The alarms of the NSSI have been cleared.	
Traceability	REQ-FSDC_NSSI-FUN-2	

5.1.13 Report alarm notifications of NF instance

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To report NF instance alarm notifications.	
Actors and Roles	An authorized consumer of fault supervision data report service for NF.	
Telecom resources	Network function instance	
Assumptions	N/A	
Pre-conditions	An NF is deployed An authorized consumer has subscribed the alarm notifications of an NF instance.	
Begins when	A failure or severe performance degradation of NF instance is detected.	
Step 1 (M)	The producer of fault supervision data report service for NF sends the alarm notification to its authorized consumer when a new alarm notification is generated and this alarm notification satisfies the filter condition if exists.	
Ends when	An authorized consumer receives the alarm notification of the NF instance or the authorized consumer unsubscribes the alarm notifications of the NF instance or the NF instance is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails.	
Post-conditions	The authorized consumer receives the alarm notification of the NF instance	
Traceability	REQ-FSDR_NF-FUN-1, REQ-FSDR_NF-FUN-5	

5.1.14 Subscription of alarm notifications of NF instance

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To subscribe NF instance alarm notifications	
Actors and Roles	An authorized consumer of fault supervision data report service for NF.	
Telecom resources	Network function instance	
Assumptions	N/A	
Pre-conditions	An NF is deployed	
Begins when	An authorized consumer wants to subscribe the alarm notifications of an NF instance	
Step 1 (M)	The authorized consumer sends request to producer of fault supervision data report service for NF to subscribe alarm notifications of an NF instance.	
Step 2 (M)	The producer of fault supervision data report service for NF sends the response of the completion of the subscription to the authorized consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	In case any of the mandatory steps in the use case fails.	
Post-conditions	The alarm notifications of an NF instance have been subscribed by the authorized consumer.	
Traceability	REQ-FSDR_NF-FUN-3	

5.1.15 Unsubscription of alarm notifications of NF instance

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To unsubscribe NF instance alarm notifications	
Actors and Roles	An authorized consumer of fault supervision data report service for NF.	
Telecom resources	Network function instance	
Assumptions	N/A	
Pre-conditions	An NF is deployed. An authorized consumer has subscribed the alarm notifications of an NF instance from a producer of fault supervision data report service for NF.	
Begins when	An authorized consumer wants to unsubscribe the alarm notifications of an NF instance.	
Step 1 (M)	The authorized consumer sends request to the producer of fault supervision data report service for NF to unsubscribe alarm notifications of an NF instance.	
Step 2 (M)	The producer of fault supervision data report service for NF sends the response of the completion of the unsubscription to the authorized consumer.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	In case any of the mandatory steps in the use case fails.	
Post-conditions	The alarm notifications of the NF instance has been unsubscribed by the authorized consumer.	
Traceability	REQ-FSDR_NF-FUN-4	

5.1.16 Get alarm list of NF instance

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To get alarm list of NF instance.	
Actors and Roles	An authorized consumer of the fault supervision data report service for NF.	
Telecom resources	Network function instances	
Assumptions	N/A	
Pre-conditions	The NF instance has been deployed. The producer of the fault supervision data report service for NF is in operation.	
Begins when	The authorized consumer decides to get the alarm list of an NF instance.	
Step 1 (M)	The authorized consumer requires the producer of the fault supervision data report service for NF to report the alarm list of the NF instance.	
Step 2 (M)	The producer of the fault supervision data report service for NF sends the alarm list to the the authorized consumer. The alarm list contains the alarm(s) which satisfy the filter condition if exists.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The authorized consumer has got the alarm list of the NF.	
Traceability	REQ-FSDR_NF-FUN-6, REQ-FSDR_NF-FUN-8	

5.1.17 Acknowledge alarms of NF instance

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To acknowledge one or multiple alarms of NF instance.	
Actors and Roles	An authorized consumer of the fault supervision data control service for NF.	
Telecom resources	Network function instance	
Assumptions	N/A	
Pre-conditions	The NF instance has been deployed. The producer of the fault supervision data control service for NF is in operation.	
Begins when	The authorized consumer decides to acknowledge one or multiple alarms of an NF instance.	
Step 1 (M)	The authorized consumer sends the request to the producer of the fault supervision data control service for NF to acknowledge one or multiple alarms of the NF instance.	
Step 2 (M)	The producer of the fault supervision data control service for NF acknowledges the alarms based on the request.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The alarms of the NF instance have been acknowledged.	
Traceability	REQ-FSDC_NF-FUN-1	

5.1.18 Clear alarms of NF instance

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To clear one or multiple alarms of NF instance.	
Actors and Roles	An authorized consumer of the fault supervision data control service for NF.	
Telecom resources	Network function instance	
Assumptions	N/A	
Pre-conditions	The NF instance has been deployed. The producer of the fault supervision data control service for NF is in operation.	
Begins when	The authorized consumer decides to clear one or multiple alarms of an NF instance.	
Step 1 (M)	The authorized consumer sends the request to the producer of the fault supervision data control service for NF to clear one or multiple alarms of the NF instance.	
Step 2 (M)	The procedure of the fault supervision data control service for NF clears the alarms based on the request.	
Ends when	All the steps identified above are successfully completed.	
Exceptions	One of the steps identified above fails.	
Post-conditions	The alarms of the NF instance have been cleared.	
Traceability	REQ-FSDC_NF-FUN-2	

5.1.19 Notify changed alarms of NSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To notify changed alarms of NSI.	
Actors and Roles	An authorized consumer of fault supervision data report service for NSI.	
Telecom resources	Network slice instance	
Assumptions	N/A	
Pre-conditions	An NSI is deployed An authorized consumer has subscribed the notifications of an NSI.	
Begins when	A change of perceivedSeverity attribute value (except to the value "Cleared") in AlarmInformation in AlarmList of NSI is detected.	
Step 1 (M)	The producer of fault supervision data report service for NSI generates a changed alarm notification.	
Step 2 (M)	The producer of fault supervision data report service for NSI sends the generated notification to its authorized consumer if this notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the changed alarm notification of the NSI or the authorized consumer unsubscribes the notifications of the NSI or the NSI is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the changed alarm notification of the NSI	
Traceability	REQ-FSDR_NSI-FUN-7	

5.1.20 Notify changed alarms of NSSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To notify changed alarms of NSSI.	
Actors and Roles	An authorized consumer of fault supervision data report service for NSSI.	
Telecom resources	Network slice subnet instance	
Assumptions	N/A	
Pre-conditions	An NSSI is deployed An authorized consumer has subscribed the notifications of an NSSI.	
Begins when	A change of `perceivedSeverity` attribute value (except to the value "Cleared") in `AlarmInformation` in `AlarmList` of NSSI is detected.	
Step 1 (M)	The producer of fault supervision data report service for NSSI generates a changed alarm notification.	
Step 2 (M)	The producer of fault supervision data report service for NSSI sends the generated notification to its authorized consumer if this notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the changed alarm notification of the NSSI or the authorized consumer unsubscribes the notifications of the NSSI or the NSSI is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the changed alarm notification of the NSSI	
Traceability	REQ-FSDR_NSSI-FUN-7	

5.1.21 Notify changed alarms of NF instance

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To notify changed alarms of NF instance.	
Actors and Roles	An authorized consumer of fault supervision data report service for NF.	
Telecom resources	Network function instance	
Assumptions	N/A	
Pre-conditions	An NF instance is deployed An authorized consumer has subscribed the notifications of an NF instance.	
Begins when	A change of `perceivedSeverity` attribute value (except to the value "Cleared") in `AlarmInformation` in `AlarmList` of NF instance is detected.	
Step 1 (M)	The producer of fault supervision data report service for NF generates a changed alarm notification of the NF instance.	
Step 2 (M)	The producer of fault supervision data report service for NF sends the generated notification to its authorized consumer if this notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the changed alarm notification of the NF instance or the authorized consumer unsubscribes the notifications of the NF instance or the NF instance is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the changed alarm notification of the NF instance	
Traceability	REQ-FSDR_NF-FUN-9	

5.1.22 Notify cleared alarms of NSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To notify cleared alarms of NSI.	
Actors and Roles	An authorized consumer of fault supervision data control service for NSI.	
Telecom resources	Network slice instance	
Assumptions	N/A	
Pre-conditions	An NSI is deployed An authorized consumer has subscribed the notifications of an NSI.	
Begins when	An alarm clearing of the NSI is detected.	
Step 1 (M)	The producer of fault supervision data control service for NSI generates a cleared alarm notification.	
Step 2 (M)	The producer of fault supervision data control service for NSI sends the generated notification to its authorized consumer if this notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the cleared alarm notification of the NSI or the authorized consumer unsubscribes the notifications of the NSI or the NSI is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the cleared alarm notification of the NSI	
Traceability	REQ-FSDC_NSI-FUN-3	

5.1.23 Notify cleared alarms of NSSI

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To notify cleared alarms of NSSI.	
Actors and Roles	An authorized consumer of fault supervision data control service for NSSI.	
Telecom resources	Network slice subnet instance	
Assumptions	N/A	
Pre-conditions	An NSSI is deployed An authorized consumer has subscribed the notifications of an NSSI.	
Begins when	An alarm clearing of the NSSI is detected.	
Step 1 (M)	The producer of fault supervision data control service for NSSI generates a cleared alarm notification.	
Step 2 (M)	The producer of fault supervision data control service for NSSI sends the generated notification to its authorized consumer if this notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the cleared alarm notification of the NSSI or the authorized consumer unsubscribes the notifications of the NSSI or the NSSI is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the cleared alarm notification of the NSSI	
Traceability	REQ-FSDC_NSSI-FUN-3	

5.1.24 Notify cleared alarms of NF instance

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To notify cleared alarms of NF instance.	
Actors and Roles	An authorized consumer of fault supervision data control service for NF.	
Telecom resources	Network function instance	
Assumptions	N/A	
Pre-conditions	An NF instance is deployed An authorized consumer has subscribed the notifications of an NF instance.	
Begins when	An alarm clearing of NF instance is detected.	
Step 1 (M)	The producer of fault supervision data control service for NF generates a cleared alarm notification of the NF instance.	
Step 2 (M)	The producer of fault supervision data control service for NF sends the generated notification to its authorized consumer if this notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the cleared alarm notification of the NF instance or the authorized consumer unsubscribes the notifications of the NF instance or the NF instance is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the cleared alarm notification of the NF instance	
Traceability	REQ-FSDC_NF-FUN-3	

5.1.25 Notify acknowledgement state change of NSI alarms

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To notify acknowledgement state change of NSI alarms.	
Actors and Roles	An authorized consumer of fault supervision data control service for NSI.	
Telecom resources	Network slice instance	
Assumptions	N/A	
Pre-conditions	An NSI is deployed An authorized consumer has subscribed the notifications of an NSI.	
Begins when	An acknowledgement state change of the NSI alarms is detected.	
Step 1 (M)	The producer of fault supervision data control service for NSI generates an acknowledgement state change notification.	
Step 2 (M)	The producer of fault supervision data control service for NSI sends the generated notification to its authorized consumer if this notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the acknowledgement state change notification of the NSI or the authorized consumer unsubscribes the notifications of the NSI or the NSI is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the acknowledgement state change notification of the NSI	
Traceability	REQ-FSDC_NSI-FUN-4	

5.1.26 Notify acknowledgement state change of NSSI alarms

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To notify acknowledgement state change of NSSI alarms.	
Actors and Roles	An authorized consumer of fault supervision data control service for NSSI.	
Telecom resources	Network slice subnet instance	
Assumptions	N/A	
Pre-conditions	An NSSI is deployed An authorized consumer has subscribed the notifications of an NSSI.	
Begins when	An acknowledgement state change of the NSSI alarms is detected.	
Step 1 (M)	The producer of fault supervision data control service for NSSI generates an acknowledgement state change notification.	
Step 2 (M)	The producer of fault supervision data control service for NSSI sends the generated notification to its authorized consumer if this notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the acknowledgement state change notification of the NSSI or the authorized consumer unsubscribes the notifications of the NSSI or the NSSI is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the acknowledgement state change notification of the NSSI	
Traceability	REQ-FSDC_NSSI-FUN-4	

5.1.27 Notify acknowledgement state change of NF instance alarms

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	To notify acknowledgement state change of NF instance alarms.	
Actors and Roles	An authorized consumer of fault supervision data control service for NF.	
Telecom resources	Network function instance	
Assumptions	N/A	
Pre-conditions	An NF instance is deployed An authorized consumer has subscribed the notifications of an NF instance.	
Begins when	An acknowledgement state change of the NF instance alarms is detected.	
Step 1 (M)	The producer of fault supervision data control service for NF generates an acknowledgement state change notification of the NF instance.	
Step 2 (M)	The producer of fault supervision data control service for NFsends the generated notification to its authorized consumer if this notification satisfies the filter condition if exists.	
Ends when	The authorized consumer receives the acknowledgement state change notification of the NF instance or the authorized consumer unsubscribes the notifications of the NF instance or the NF instance is terminated.	
Exceptions	In case any of the mandatory steps in the use case fails	
Post-conditions	The authorized consumer receives the acknowledgement state change notification of the NF instance	
Traceability	REQ-FSDC_NF-FUN-4	

5.2 Requirements

5.2.1 Requirements for fault supervision data report service for NSI

REQ-FSDR_NSI-FUN-1   The fault supervision data report service for NSI shall have the capability to provide alarm notifications of an NSI to its authorized consumer.

REQ-FSDR_NSI-FUN-2   The fault supervision data report service for NSI shall have the capability to allow its authorized consumer to subscribe the alarm notifications of an NSI.

REQ-FSDR_NSI-FUN-3   The fault supervision data report service for NSI shall have the capability to allow its authorized consumer to unsubscribe the alarm notifications of an NSI.

REQ-FSDR_NSI-FUN-4   The fault supervision data report service for NSI shall have the capability to allow its authorized consumer to provide the filter for alarm notifications.

REQ-FSDR_NSI-FUN-5   The fault supervision data report service for NSI shall have the capability to provide the alarm list of an NSI.

REQ-FSDR_NSI-FUN-6   The fault supervision data report service for NSI shall have the capability to allow its authorized consumer to provide the filter for the alarms.

REQ-FSDR_NSI-FUN-7   The fault supervision data report service for NSI shall have the capability to provide changed alarm notifications of an NSI to its authorized consumer.

5.2.2 Requirements for fault supervision data control service for NSI

REQ-FSDC_NSI-FUN-1   The fault supervision data control service for NSI shall have the capability to satisfy the request to acknowledge one or multiple alarms of an NSI.

REQ-FSDC_NSI-FUN-2   The fault supervision data control service for NSI shall have the capability to satisfy the request to clear one or multiple alarms of an NSI.

REQ-FSDC_NSI-FUN-3   The fault supervision data control service for NSI shall have the capability to provide cleared alarm notifications of an NSI to its authorized consumer.

REQ-FSDC_NSI-FUN-4   The fault supervision data control service for NSI shall have the capability to provide acknowledgement state change notifications of an NSI to its authorized consumer.

5.2.3 Requirements for fault supervision data report service for NSSI

REQ-FSDR_NSSI-FUN-1 The fault supervision data report service for NSSI shall have the capability to provide alarm notifications of a network slice subnet instance to its authorized consumer.

REQ-FSDR_NSSI-FUN-2 The fault supervision data report service for NSSI shall have the capability to allow its authorized consumer to subscribe the alarm notifications of an NSSI.

REQ-FSDR_NSSI-FUN-3 The fault supervision data report service for NSSI shall have the capability to allow its authorized consumer to unsubscribe the alarm notifications of an NSSI.

REQ-FSDR_NSSI-FUN-4 The fault supervision data report service for NSSI shall have the capability to allow its authorized consumer to provide the filter for alarm notifications.

REQ-FSDR_NSSI-FUN-5 The fault supervision data report service for NSSI shall have the capability to provide the alarm list of an NSSI.

REQ-FSDR_NSSI-FUN-6 The fault supervision data report service for NSSI shall have the capability to allow its authorized consumer to provide the filter for the alarms.

REQ-FSDR_NSSI-FUN-7 The fault supervision data report service for NSSI shall have the capability to provide changed alarm notifications of an NSSI to its authorized consumer.

5.2.4 Requirements for fault supervision data control service for NSSI

REQ-FSDC_NSSI-FUN-1 The fault supervision data control service for NSSI shall have the capability to satisfy the request to acknowledge one or multiple alarms of an NSSI.

REQ-FSDC_NSSI-FUN-2 The fault supervision data control service for NSSI shall have the capability to satisfy the request to clear one or multiple alarms of an NSSI.

REQ-FSDC_NSSI-FUN-3 The fault supervision data control service for NSSI shall have the capability to provide cleared alarm notifications of an NSSI to its authorized consumer.

REQ-FSDC_NSSI-FUN-4 The fault supervision data control service for NSSI shall have the capability to provide acknowledgement state change notifications of an NSSI to its authorized consumer.

5.2.5 Requirements for fault supervision data report service for NF

REQ-FSDR_NF-FUN-1 The fault supervision data report service for NF shall have the capability to provide alarm notifications of a network function instance to its authorized consumer.

REQ-FSDR_NF-FUN-2 The fault supervision data report service for NF shall have the capability to provide alarm notifications of virtualized resources correlated with an NF instance to its authorized consumer.

REQ-FSDR_NF-FUN-3 The fault supervision data report service for NF shall have the capability to allow its authorized consumer to subscribe the alarm notifications of an NF instance.

REQ-FSDR_NF-FUN-4 The fault supervision data report service for NF shall have the capability to allow its authorized consumer to unsubscribe the alarm notifications of an NF instance.

REQ-FSDR_NF-FUN-5 The fault supervision data report service for NF shall have the capability to allow its authorized consumer to provide the filter for alarm notifications.

REQ-FSDR_NF-FUN-6 The fault supervision data report service for NF shall have the capability to provide the alarm list of an NF instance.

REQ-FSDR_NF-FUN-7 The fault supervision data report service for NF shall have the capability to provide the alarm list of virtualized resources correlated with an NF instance.

REQ-FSDR_NF-FUN-8 The fault supervision data report service for NF shall have the capability to allow its authorized consumer to provide the filter for the alarms.

REQ-FSDR_NF-FUN-9 The fault supervision data report service for NF shall have the capability to provide changed alarm notifications of an NF instance to its authorized consumer.

5.2.6 Requirements for fault supervision data control service for NF

REQ-FSDC_NF-FUN-1 The fault supervision data control service for NF shall have the capability to satisfy the request to acknowledge one or multiple alarms of an NF instance.

REQ-FSDC_NF-FUN-2 The fault supervision data control service for NF shall have the capability to satisfy the request to clear one or multiple alarms of an NF instance.

REQ-FSDC_NF-FUN-3 The fault supervision data control service for NF shall have the capability to provide cleared alarm notifications of an NF instance to its authorized consumer.

REQ-FSDC_NF-FUN-4 The fault supervision data control service for NF shall have the capability to provide acknowledgement state change notifications of an NF instance to its authorized consumer.

6   Fault Supervision management services components

6.1   Management services for network slice fault supervision

The management services for network slice fault supervision are listed in table 6.1-1.

Table 6.1-1: Management services for network slice fault supervision

Management service	MnS Component Type A	MnS Component Type B	MnS Component Type C	Note
FS Data Report for NSI	Following operations and notifications defined in TS 28.532[2]: getAlarmList subscribe unsubscribe notifyNewAlarm notifyAlarmListRebuilt notifyChangedAlarm	NSI information model defined in TS 28.541[3]	Alarm information defined in TS 28.532[2]	This management service enables its consumer to get NSI alarm data.
FS Control for NSI	Following operations and notifications defined in TS 28.532[2]: acknowledgeAlarms clearAlarms notifyAckStateChanged notifyClearedAlarm unacknowledgeAlarms	NSI information model defined in TS 28.541[3]	Alarm information defined in TS 28.532[2]	This management service enables its consumer to control NSI alarm data.

6.2 Management services for network slice subnet fault supervision

The management services for network slice subnet fault supervision are listed in table 6.2-1.

Table 6.2-1: Management services for network slice subnet fault supervision

Management service	MnS Component Type A	MnS Component Type B	MnS Component Type C	Note
FS Data Report for NSSI	Following operations and notifications defined in TS 28.532[2]: getAlarmList subscribe unsubscribe notifyNewAlarm notifyAlarmListRebuilt notifyChangedAlarm	NSSI information model defined in TS 28.541[3]	Alarm information defined in TS 28.532[2]	This management service enables its consumer to get NSSI alarm data.
FS Control for NSSI	Following operations and notifications defined in TS 28.532[2]: acknowledgeAlarms clearAlarms notifyAckStateChanged notifyClearedAlarm unacknowledgeAlarms	NSSI information model defined in TS 28.541[3]	Alarm information defined in TS 28.532[2]	This management service enables its consumer to control NSSI alarm data.

6.3 Management services for network function fault supervision

The management services for network function fault supervision are listed in table 6.3-1.

Table 6.3-1: Management services for NF fault supervision

Management service	MnS Component Type A	MnS Component Type B	MnS Component Type C	Note
FS Data Report for NF	Following operations and notifications defined in TS 28.532[2]: getAlarmList subscribe unsubscribe notifyNewAlarm notifyAlarmListRebuilt notifyChangedAlarm	NF(s)/ME(s) information model defined in TS 28.541 and TS 28.541[3]	Alarm information defined in TS 28.532[2]	This management service enables its consumer to get NF alarm data.
FS Control for NF	Following operations and notifications defined in TS 28.532[2]: acknowledgeAlarms clearAlarms notifyAckStateChanged notifyClearedAlarm unacknowledgeAlarms	NF(s)/ME(s) information model defined in TS 28.541 and TS 28.541[3]	Alarm information defined in TS 28.532[2]	This management service enables its consumer to control NF alarm data.

7 Alarm loss detection

The present document does not specify methods for a management service consumer to detect alarm loss. The use of alarmId to detect alarm loss is an arrangement made between management service producer and management service consumer. The use of such arrangement is outside the scope of the present document. For example, management service producer may use integer sequence (e.g. 1, 2, 3, 4, 5, …) as alarmId instances for its alarms. Based on this knowledge, the management service consumer can detect alarm loss.

The present document does not specify how a management service producer can determine if management service consumer has received alarms correctly.

The present document does not specify methods for a management consumer and a management service producer to recover alarm loss. The only mechanism recommended to deal with alarm loss is the use of getAlarmList operation. The present document does not specify conditions under which the management service consumer should invoke this operation.

8 Virtualized resource alarm correlation

The authorized consumer invokes the FM control service to subscribe NF application alarms and NF instance alarm related to virtualized resource. The FM data report service can correlate the NF application alarms and the VNF and/or VNFC alarms related to virtualized resource according to affected VNF instance identifier and/or VNFC instance identifiers.
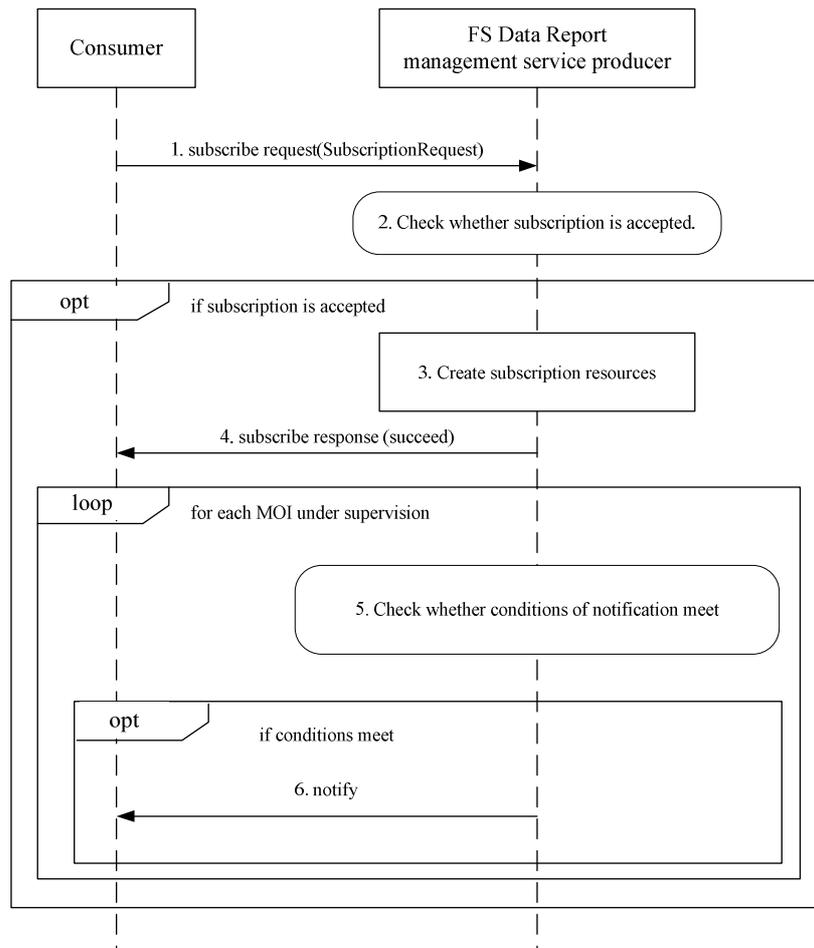
The authorized consumer invokes the FM control service for subscribing to NSSI alarms including alarm reports related to virtualized resource. The FM data report service should collect alarm report related to virtualized resource according to affected VNF instance identifier corresponding to the NF instance in the NSSI.

9. Procedures for fault supervision management services

9.1 Alarm subscription and notification

The Figure 9.1-1 illustrates procedures of alarm subscription, supervision and notification for MOI(s).

Figure 9.1-1 Procedures for MOI alarm subscription, supervision and notification

1. The authorized consumer sends subscribe request to FS Data Report management service producer to establish subscription to alarm notifications. The authorized consumer includes subscriber's URI and filter in the subscribe request message.

2. The FS Data Report management service producer checks whether the subscribe request is accepted.

3. If the subscription is accepted, the FS Data Report management service producer creates the subscription resources for the subscriber. If the subscribe request requires the FS Data Report management service producer to collect new types of alarm from the constituent MOI(s), it includes the new alarm type and identifier of MOI into the filter and acts as consumer to request the subscription operation for each constituent MOI.

4. When FS Data Report management service producer successfully creates the subscription resources, it sends success response to authorized consumer.

5. For each MOI under fault supervision monitored, FS Data Report management service producer supervises if the conditions are matched by new or changed alarm(s) as indicated in filter in subscribe request, including the received alarm notification of constituent MOI(s). When the FS Data Report management service producer receives the alarms of the constituent MOI(s), it generates the alarm information for the subscription or adds them to the correlated notification related to the alarm information for the subscription.

6. The FS Data Report management service producer notifies the alarms to the authorized consumer.

Annex A (informative):
Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
12-2017	SA5#116	S5-176540					0.0.0
02-2018	SA5#117					Apply the pCR email approved after SA5-116 meeting (S5-176541) Apply the pCRs approved at SA5-117 meeting(S5-181534, S5-181396, S5-181397, S5-181398, S5-181399, S5-181537, S5-181538)	0.1.0
04-2018	SA5#118					Apply the pCRs approved at SA5-118 meeting(S5-182220, S5-182406, S5-182407, S5-182408)	0.2.0
05-2018	SA5#119					Apply the pCR approved at SA5-119 meeting(S5-183440)	0.3.0
06-2018	SA5#119 AH					Apply the pCRs approved at SA5-119AH meeting (S5-184265, S5-184266, S5-184267, S5-184268, S5-184269)	0.4.0
07-2018	SA5-Conference Call					Merge TS 28.546-0.3.0 Clause 4.1.1, 4.1.2, 4.1.3, 4.1.5, 4.1.7	0.5.0
07-2018	SA5-Conference Call					Remove d1 from the file name	0.5.1
08-2018						Edit help	0.5.2
08-2018	SA5#120					Apply the pCRs approved at SA5-120 meeting (S5-185270, S5-185271, S5-185441, S5-185443, S5-185444)	0.6.0
2018-09	SA#81	SP-180803				Presented for information and approval	1.0.0
2018-09	SA#81					Upgrade to change control version	15.0.0

History

Document history		
V15.0.0	October 2018	Publication