

3GPP TS 32.532 V11.0.0 (2012-09)

Technical Specification

**3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Telecommunication management;
Software management (SwM);
Integration Reference Point (IRP);
Information Service (IS)
(Release 11)**



The present document has been developed within the 3rd Generation Partnership Project (3GPPTM) and may be further elaborated for the purposes of 3GPP.

The present document has not been subject to any approval process by the 3GPP Organizational Partners and shall not be implemented. This Specification is provided for future development work within 3GPP only. The Organizational Partners accept no liability for any use of this Specification. Specifications and reports for implementation of the 3GPPTM system should be obtained via the 3GPP Organizational Partners' Publications Offices.

Keywords

Management, OAM

3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

<http://www.3gpp.org>

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© 2012, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TTA, TTC).
All rights reserved.

UMTS™ is a Trade Mark of ETSI registered for the benefit of its members
3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners
LTE™ is a Trade Mark of ETSI currently being registered for the benefit of its Members and of the 3GPP Organizational Partners
GSM® and the GSM logo are registered and owned by the GSM Association

Contents

Foreword	7
Introduction	7
1 Scope	8
2 References.....	8
3 Definitions and abbreviations	8
3.1 Definitions	8
3.2 Abbreviations.....	8
4 Information Object Classes.....	9
4.1 Imported information entities and local labels	9
4.2 Class diagram.....	9
4.2.1 Attributes and relationships.....	9
4.2.2 Inheritance.....	10
4.3 Information object class definitions	11
4.3.1 GenManCapability.....	11
4.3.1.1 Definition	11
4.3.1.2 Attributes.....	11
4.3.1.3 Notifications	11
4.3.2 GenManProfile	12
4.3.2.1 Definition	12
4.3.2.2 Attributes.....	12
4.3.2.3 Notifications	12
4.3.3 GenManProcess	13
4.3.3.1 Definition	13
4.3.3.2 Attributes.....	13
4.3.3.3 Notifications	13
4.3.4 SwMCapability.....	14
4.3.4.1 Definition	14
4.3.4.2 Attributes.....	14
4.3.4.3 Attribute constraints	14
4.3.4.4 Notifications	14
4.3.5 SwMProfile	15
4.3.5.1 Definition	15
4.3.5.2 Attributes.....	15
4.3.5.3 Attribute constraints	15
4.3.5.4 Notifications	15
4.3.6 SwMProcess	16
4.3.6.1 Definition	16
4.3.6.2 Attributes.....	16
4.3.6.3 Notifications	16
4.3.7 SwMIRP	17
4.3.7.1 Definition	17
4.3.7.2 Attributes.....	17
4.3.7.3 Notifications	17
4.3.8 SwMManagedEntity	17
4.3.8.1 Definition	17
4.4 Information relationship definitions	17
4.4.1 relation-swMIRP-swMCapability (M).....	17
4.4.1.1 Definition	17
4.4.1.2 Roles.....	17
4.4.1.3 Constraints	17
4.4.2 relation-SwmIRP-swMProfile (M).....	18
4.4.2.1 Definition	18
4.4.2.2 Roles.....	18

4.4.2.3	Constraints	18
4.4.3	relation-swMIRP-swMProcess (M).....	18
4.4.3.1	Definition	18
4.4.3.2	Roles	18
4.4.3.3	Constraints	18
4.4.4	relation-swMCapabilites-swMProfile (M)	19
4.4.4.1	Definition	19
4.4.4.2	Roles	19
4.4.4.3	Constraints	19
4.4.5	relation swMProfile-swMProcess (M).....	19
4.4.5.1	Definition	19
4.4.5.2	Roles	19
4.4.5.3	Constraints	19
4.5	Information attribute definitions	20
4.5.1	Definition and legal values	20
4.5.2	Constraints.....	22
5	IRP descriptions: Interface Definitions	23
5.1	Class diagram representing interfaces.....	23
5.2	Generic rules.....	25
5.3	SwMIRPOperations_1 Interface (M)	26
5.3.1	Operation listSwMCapabilities (M).....	26
5.3.1.1	Definition	26
5.3.1.2	Input parameters.....	26
5.3.1.3	Output parameters.....	26
5.3.1.4	Post-condition.....	26
5.3.1.5	Exceptions.....	26
5.3.1.5.1	operation_failed.....	26
5.3.2	Operation listSwMProfiles (M)	27
5.3.2.1	Definition	27
5.3.2.2	Input parameters.....	27
5.3.2.3	Output parameters.....	27
5.3.3	Operation createSwMProfile (M).....	27
5.3.3.1	Definition	27
5.3.3.2	Input parameters.....	27
5.3.3.3	Output parameters.....	28
5.3.4	Operation deleteSwMProfile (M).....	28
5.3.4.1	Definition	28
5.3.4.2	Input parameters.....	28
5.3.4.3	Output parameters.....	28
5.3.5	Operation listSwMProcesses (M).....	29
5.3.5.1	Definition	29
5.3.5.2	Input parameters.....	29
5.3.5.3	Output parameters.....	29
5.3.6	Operation resumeSwMProcess (M).....	29
5.3.6.1	Definition	29
5.3.6.2	Input parameters.....	29
5.3.6.3	Output parameters.....	30
5.3.7	Operation swFallback (M).....	30
5.3.7.1	Definition	30
5.3.7.2	Input parameters.....	30
5.3.7.3	Output parameters.....	30
5.3.8	Operation terminateSwMProcess (M).....	31
5.3.8.1	Definition	31
5.3.8.2	Input parameters.....	31
5.3.8.3	Output parameters.....	31
5.4	SwMIRPOperations_2 Interface (O).....	32
5.4.1	Operation changeSwMProfile (O).....	32
5.4.1.1	Definition	32
5.4.1.2	Input parameters.....	32
5.4.1.3	Output parameters.....	32

5.4.1.4	Constraints	33
5.5	SwMIRPNotifications_1 Interface (M)	34
5.5.1	Notification notifySwMProfileCreation (M).....	34
5.5.1.1	Definition	34
5.5.1.2	Input parameters.....	34
5.5.2	Notification notifySwMProfileDeletion (M).....	34
5.5.2.1	Definition	34
5.5.2.2	Input parameters.....	34
5.5.3	Notification notifySwMProcessCreation (M).....	35
5.5.3.1	Definition	35
5.5.3.2	Input parameters.....	35
5.5.4	Notification notifySwMProcessStage (M).....	35
5.5.4.1	Definition	35
5.5.4.2	Input parameters.....	35
5.5.5	Notification notifySwMProcessDeletion (M).....	36
5.5.5.1	Definition	36
5.5.5.2	Input parameters.....	36
5.5.6	Notification notifyNewSwAvailability (M).....	36
5.5.6.1	Definition	36
5.5.6.2	Input parameters.....	36
5.6	SwMIRPNotifications_2 Interface (O).....	37
5.6.1	Notification notifySwMProfileChange (C/O).....	37
5.6.1.1	Definition	37
5.6.1.2	Input parameters.....	37
5.7	SwMIRPOperations_3 Interface (M)	37
5.7.1	Operation downloadNESw (M).....	37
5.7.1.1	Definition	37
5.7.1.2	Input parameters.....	38
5.7.1.3	Output parameters.....	38
5.7.1.4	Pre condition.....	39
5.7.1.5	Post-condition.....	39
5.7.1.6	Exceptions.....	39
5.7.2	Operation activateNESw (M).....	39
5.7.2.1	Definition	39
5.7.2.2	Input parameters.....	39
5.7.2.3	Output parameters.....	40
5.7.2.4	Pre condition	40
5.7.2.5	Post-condition.....	40
5.7.2.6	Exceptions	40
5.8	SwMIRPOperations_4 Interface (O).....	41
5.8.1	Operation installNESw (O).....	41
5.8.1.1	Definition	41
5.8.1.2	Input parameters.....	41
5.8.1.3	Output parameters.....	41
5.8.1.4	Pre condition.....	42
5.8.1.5	Post-condition.....	42
5.8.1.6	Exceptions.....	42
5.9	SwMIRPNotifications_3 Interface (M)	43
5.9.1	Notification notifyDownloadNESwStatusChanged (M).....	43
5.9.1.1	Definition	43
5.9.1.2	Input parameters.....	44
5.9.1.3	Triggering Event.....	44
5.9.1.3.1	From State.....	44
5.9.1.3.2	To State.....	44
5.9.1.4	Constraints	44
5.9.2	Notification notifyActivateNESwStatusChanged (M).....	45
5.9.2.1	Definition	45
5.9.2.2	Input parameters.....	45
5.9.2.3	Triggering Event.....	45
5.9.2.3.1	From State.....	45
5.9.2.3.2	To State.....	46

5.9.2.4	Constraints	46
5.10	SwMIRPNotifications_4 Interface (O)	46
5.10.1	Notification notifyInstallNESwStatusChanged (O)	46
5.10.1.1	Definition	46
5.10.1.2	Input parameters	47
5.10.1.3	Triggering Event	47
5.10.1.3.1	From State	47
5.10.1.3.2	To State	47
5.10.1.4	Constraints	47
5.11	SwmOperations_5 Interface (CM)	48
5.11.1	Operation listNaswmProcesses (M)	48
5.11.1.1	Definition	48
5.11.1.2	Input parameters	48
5.11.1.3	Output parameters	48
5.12	SwmOperations_6 Interface (CM)	49
5.12.1	Operation cancelNaswmProcesses (M)	49
5.12.1.1	Definition	49
5.12.1.2	Input parameters	49
5.12.1.3	Output parameters	49
5.12.1.4	Pre condition	49
5.12.1.5	Post-condition	49
5.12.1.6	Exceptions	50
Annex A (informative):	Change history.....	51

Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

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

- 32.531: Telecommunication management; Software management; Concepts and Integration Reference Point (IRP) Requirements
- 32.532: Telecommunication management; **Software management Integration Reference Point (IRP); Information Service (IS)****
- 32.536: Telecommunication management; Software management Integration Reference Point (IRP); Solution Set (SS) definitions

1 Scope

The present document contains the Software Management Interface IRP Information Services descriptions.

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 32.101: "Telecommunication management; Principles and high level requirements".
- [3] 3GPP TS 32.102: "Telecommunication management; Architecture".
- [4] Void.
- [5] Void.
- [6] 3GPP TS 32.531: "Telecommunication management; Software management; Concepts and Integration Reference Point (IRP) Requirements".
- [7] 3GPP TS 32.622: "Telecommunication management; Generic network resources Integration Reference Point (IRP); Network Resource Model (NRM)".
- [8] 3GPP TS 32.312: "Telecommunication management; Generic Integration Reference Point (IRP) management: Information Services".
- [9] 3GPP TS 32.302: Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP); Information Service (IS).

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 32.101 [2], TS 32.102 [3] and 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 TS 32.531 [6], TS 32.101 [2], TS 32.102 [3] and TS 21.905 [1], in that order.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], TS 32.531 [6] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 32.531 [6].

4 Information Object Classes

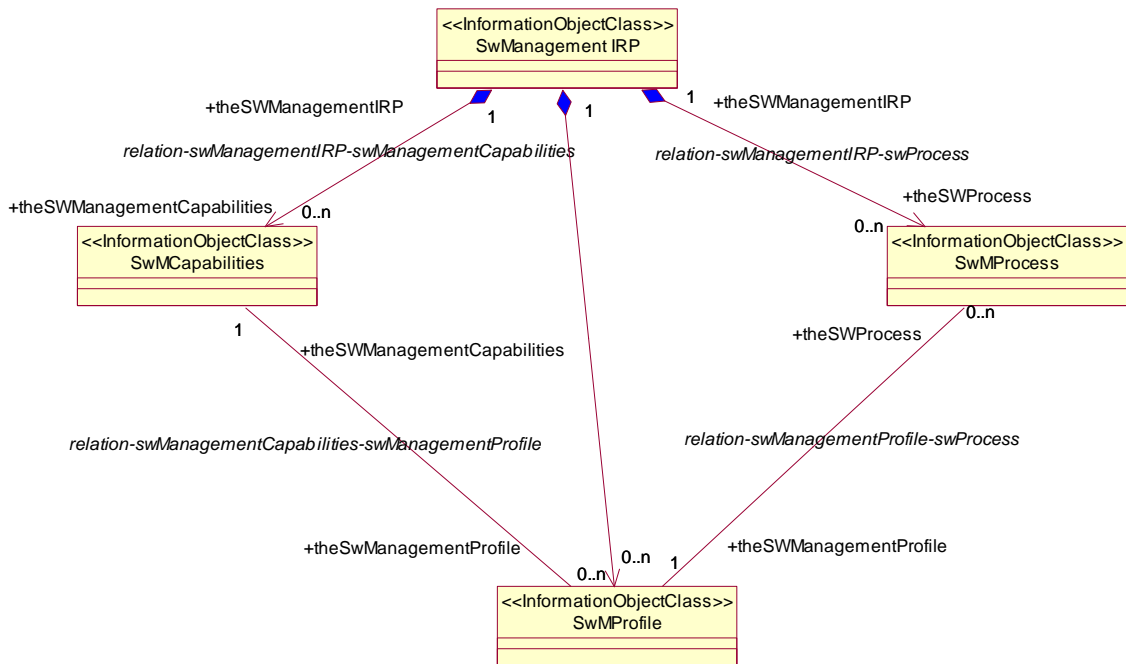
4.1 Imported information entities and local labels

Label reference	Local label
3GPP TS 32.622 [7], information object class, Top	top
3GPP TS 32.312 [8], information object class, managedGenericIRP	managedGenericIRP

4.2 Class diagram

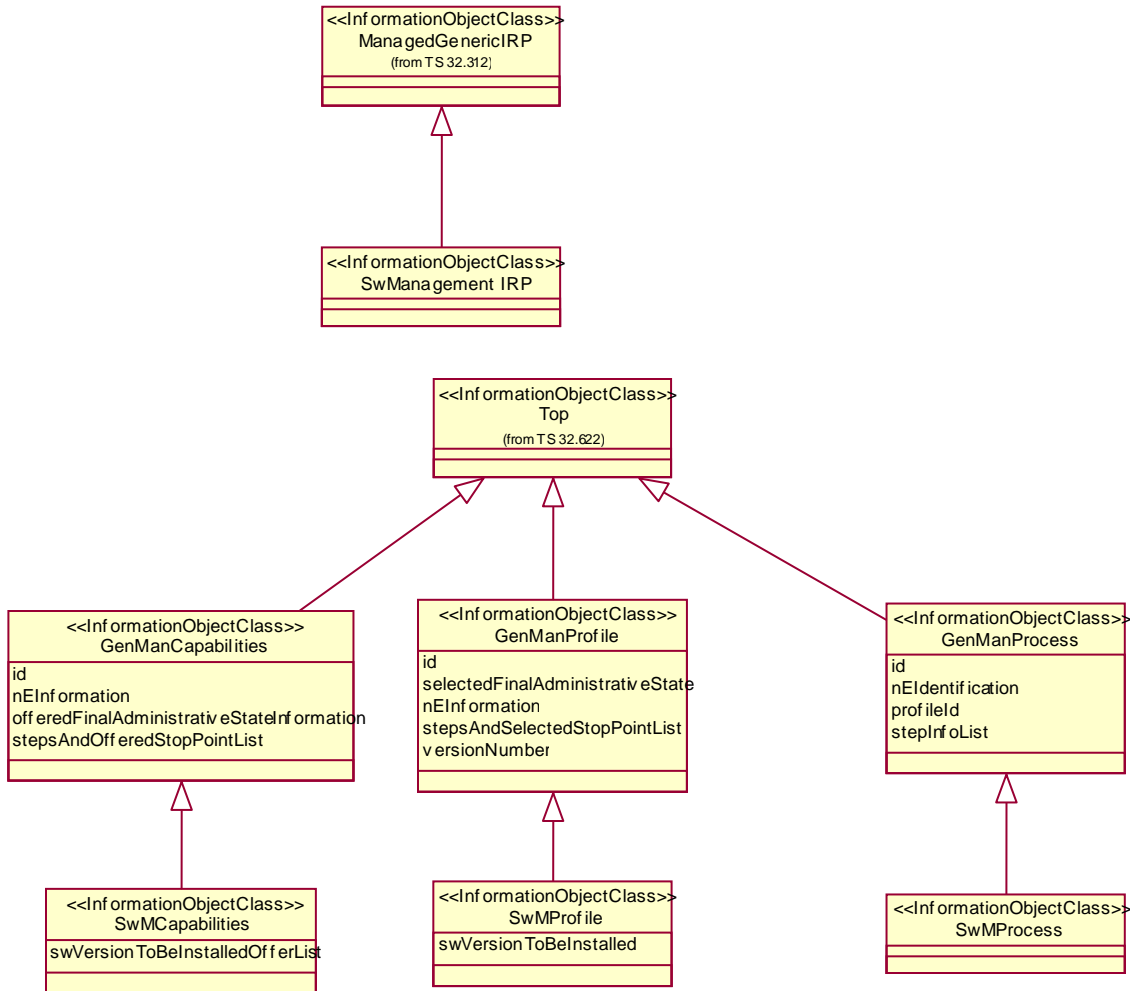
4.2.1 Attributes and relationships

The diagram reflects the definitions in the text of the following clauses. In case of conflict text takes precedence.



4.2.2 Inheritance

The diagram reflects the definitions in the text of the following clauses. In case of conflict text takes precedence.



4.3 Information object class definitions

4.3.1 GenManCapability

4.3.1.1 Definition

This object class is a support object class. Sub-classes of this IOC represent the IRPAgent's capability in support of automated management.

It is created by the IRPAgent and cannot be modified by the IRPManager.

An instance of a sub-class of `genManCapability` object is valid for a certain NE type or a set of NE types.

Multiple `genManCapability` objects may be instantiated in the IRPAgent.

The object identifies:

- a) the sequence of the self-configuration steps and for each step
 - a.1) the possibility, whether before the step a stop point can be selected, such that the self-configuration step is suspended and waits for a request by the IRPManager to resume.
- b) the final `administrativeState` (ITU-T X.731) of the NE after successful self-configuration.

4.3.1.2 Attributes

Attribute name	Support Qualifier	Read Qualifier	Write Qualifier
<code>id</code>	M	M	-
<code>nEInformation</code>	M	M	-
<code>stepsAndOfferedStopPointList</code>	M	M	-
<code>offeredFinalAdministrativeStateInformation</code>	M	M	-

4.3.1.3 Notifications

None.

4.3.2 GenManProfile

4.3.2.1 Definition

This object class is a support object class. Sub-classes of this IOC represent the IRPManager's decision related to automated management.

An instance of a sub-class of `GenManProfile` is valid for a certain NE type or a set of NE types.

For an NE starting its self-configuration process (see `genManProcess`) there shall be no ambiguity which instance of a sub-class of `GenManProfile` is valid for a certain NE type or a set of NE types.

Multiple instances of sub-classes of `GenManProfile` objects may be instantiated in the IRPAgent.

By using an instance of a sub-class of this object the IRPManager decides which of the possible stop points offered in the related instance of a sub-class of `genManCapability` are used to suspend the automated management process of the specified NE type (or set of NE types) and which of the `offeredFinalAdministrativeStateInformation` is selected.

4.3.2.2 Attributes

Attribute name	Support Qualifier	Read Qualifier	Write Qualifier
<code>id</code>	M	M	-
<code>versionNumber</code>	M	M	-
<code>nEInformation</code>	M	M	-
<code>stepsAndSelectedStopPointList</code>	M	M	-
<code>selectedFinalAdministrativeState</code>	M	M	-

4.3.2.3 Notifications

None.

4.3.3 GenManProcess

4.3.3.1 Definition

This object class is a support object class. Sub-classes of this IOC describe the automated management process for an NE. They allow the IRPManager to be informed about the current progress of the process and where stop points are set. No intervention of the IRPManager is foreseen except resume after a stop point was reached or termination of the self-configuration.

When the automated management process for an NE starts, an instance of the sub-class of `genManProcess` is created automatically.

The steps in the `stepInfoList` shall conform to the content of the relevant sub-class of `genManProfile` instance. Example:

If the `stepsAndOfferedStopPointList` of a sub-class instance of `genManProfile` indicates `stopPointCanBeSetBeforeThisStep` for step X, then the entry for step X in the `stepInfoList` of the sub-class instance of `genManProcess` can only have the value `stopPointIsNotSet`.

When there is no relevant `genManProfile` at creation time of `genManProcess`, then the IRPAgent creates the `genManProcess` based on the relevant `genManCapability`. In this case preferably no stop point shall be set in the self configuration process.

When the last step of the self configuration process is completed successfully, the `genManProcess` instance is deleted automatically.

When self configuration process is terminated by the IRPManager, the `genManProcess` instance is deleted automatically.

4.3.3.2 Attributes

Attribute name	Support Qualifier	Read Qualifier	Write Qualifier
<code>id</code>	M	M	-
<code>nEIdentification</code>	M	M	-
<code>profileId</code>	M	M	-
<code>stepInfoList</code>	M	M	-

4.3.3.3 Notifications

None.

4.3.4 SwMCapability

4.3.4.1 Definition

This object class is a sub-class of `genManCapability` and represents the IRPAgent's capability in support of SWM.

It is created by the IRPAgent and cannot be modified by the IRPManager.

A `SwMManagementCapability` object is valid for a certain NE type or a set of NE types with a certain SW version or set of versions. For an NE there shall be no ambiguity which `SwMManagementCapability` object is valid for the NE.

Multiple `SwMManagementCapability` objects may be instantiated in the IRPAgent.

The object identifies:

- a) the sequence of the self-configuration steps

and for each step:

- a.1) the possibility, whether before the step a stop point can be selected, such that the self-configuration step is suspended and waits for a request by the IRPManager to resume.

- b) the final `administrativeState` of the NE after successful self-configuration.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_SWM_FUN_5	
3GPP TS 32.531 [6]	REQ_ASWM_FUN_1	

4.3.4.2 Attributes

All attributes inherited from IOC `GenManCapability`.

Additional attributes:

Attribute name	Support Qualifier	Read Qualifier	Write Qualifier
<code>swVersionToBeInstalledOfferList</code>	CM*)	M	-

*) Condition: `objectClass_is_swMCapability`

4.3.4.3 Attribute constraints

Name	Definition
<code>objectClass_is_swMCapability</code>	<code>objectClass</code> is equal to <code>swMCapabilities</code>

4.3.4.4 Notifications

Name	Qualifier	Notes
<code>notifyNewSwAvailability</code>	M	

4.3.5 SwMProfile

4.3.5.1 Definition

This object class is a sub-class of `genManProfile`. It allows the `IRPManager` to select from the stop points offered in the `swMCapabilities` object those which should be used to stop the SW management process for NEs, which fit to the `neInformation` and `swVersionToBeInstalled`, and which of the `offeredFinalAdministrativeStateInformation` is selected.

For an NE starting its SWM process there shall be no ambiguity which `swMManagementProfile` is valid for the NE. Therefore the `neInformation` of different `swMProfile` instances shall not intersect. Example for a not allowed intersection: profile 1 has `neInformation=(neType=eNB)`, profile 2 has `neInformation=((neType=eNB) and (Id=1))`.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_1	
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	
3GPP TS 32.531 [6]	REQ_ASWM_FUN_3	
3GPP TS 32.531 [6]	REQ_ASWM_FUN_4	
3GPP TS 32.531 [6]	REQ_SWM_FUN_7	The part of the requirement to avoid service impact can be fulfilled by creating a <code>swMProfile</code> with <code>selectedFinalAdministrativeState</code> equal <code>locked</code>

4.3.5.2 Attributes

All attributes inherited from IOC `GenManProfile`.

Additional attributes:

Attribute name	Support Qualifier	Read Qualifier	Write Qualifier
<code>swVersionToBeInstalled</code>	CM	M	-

Condition: `objectClass_is_swMProfile`

4.3.5.3 Attribute constraints

Name	Definition
<code>objectClass_is_swMProfile</code>	<code>objectClass</code> is equal to <code>swMProfile</code>

4.3.5.4 Notifications

Name	Qualifier	Notes
<code>notifySwMProfileCreation</code>	M	
<code>notifySwMProfileChange</code>	CM	Condition: Present if operation <code>changeSwMProfile</code> is supported.
<code>notifySwMProfileDeletion</code>	M	

4.3.6 SwMProcess

4.3.6.1 Definition

This object class is a sub-class of `genManProcess`. It describes the SW management process for an NE. It allows the IRPManager to be informed about the current progress of the SWM process and where stop points are set. No intervention of the IRPManager is foreseen except to provide indication to resume after a stop point was reached or to abort the self-configuration.

When the automated management process for an NE starts, an instance of the `swMProcess` is created automatically.

The `id` of the `swMProcess` shall be identical to the identifier of the NE and identify the `swMProcess` instance uniquely.

The steps in the `stepInfoList` shall conform to the content of the relevant `swMProfile` instance.

Example:

If the `stepsAndOfferedStopPointList` of `swMProfile` indicates `stopPointCanBeSetBeforeThisStep` for step X, then the entry for step X in the `stepInfoList` of `swMProcess` can only have the value `stopPointIsNotSet`.

When there is no relevant `swMProfile` at creation time of `swMProcess`, then the IRPAgent creates the `swMProcess` based on the relevant `swMCapability`. In this case preferably no stop point shall be set in the self configuration process.

When the last step of the self configuration process is completed successfully, the `swMProcess` instance is deleted automatically.

When self configuration process is terminated by the IRPManager, the `swMProcess` instance is deleted automatically.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	
3GPP TS 32.531 [6]	REQ_ASWM_FUN_3	
3GPP TS 32.531 [6]	REQ_ASWM_FUN_4	
3GPP TS 32.531 [6]	REQ_ASWM_FUN_5	
3GPP TS 32.531 [6]	REQ_ASWM_FUN_6	

4.3.6.2 Attributes

All attributes inherited from IOC `GenManProcess`.

Additional attributes: None.

4.3.6.3 Notifications

Name	Qualifier	Notes
<code>notifySwMProcessCreation</code>	M	
<code>notifySwMProcessStage</code>	M	
<code>notifySwMProcessDeletion</code>	M	

4.3.7 SwMIRP

4.3.7.1 Definition

This information object represents a Software Management IRP. It inherits from `IOC managedGenericIRP`.

4.3.7.2 Attributes

All attributes inherited from `IOC managedGenericIRP`.

Additional attributes: None.

4.3.7.3 Notifications

All notifications inherited from `IOC managedGenericIRP`.

Additional notifications: None.

4.3.8 SwMManagedEntity

4.3.8.1 Definition

The proxy IOC, `SwMManagedEntity` represents the role that can be played by an instance of a managed element. The `objectClass` and `objectInstance` identify a managed element instance.

4.4 Information relationship definitions

4.4.1 relation-swMIRP-swMCapability (M)

4.4.1.1 Definition

This represents the relationship between `SwMIRP` and `SwMCapability`.

4.4.1.2 Roles

Name	Definition
<code>theSwmIRP</code>	It represents the <code>SwmIRP</code> .
<code>theSwMCapability</code>	It represents the <code>SwMCapability</code>

4.4.1.3 Constraints

There is no constraint for this relationship.

4.4.2 relation-SwmIRP-swMProfile (M)

4.4.2.1 Definition

This represents the relationship between SwmIRP and SwMProfile.

4.4.2.2 Roles

Name	Definition
theSwmIRP	It represents the SwmIRP.
theSwMProfile	It represents the SwMProfile.

4.4.2.3 Constraints

There is no constraint for this relationship.

4.4.3 relation-swMIRP-swMProcess (M)

4.4.3.1 Definition

This represents the relationship between SwmIRP and SwMProcess.

4.4.3.2 Roles

Name	Definition
theSwMIRP	It represents the SwMIRP.
theSwMProcess	It represents the SwMProcess.

4.4.3.3 Constraints

There is no constraint for this relationship.

4.4.4 relation-swMCapabilites-swMProfile (M)

4.4.4.1 Definition

This represents the relationship between `swMCapability` and `swMProfile`.

4.4.4.2 Roles

Name	Definition
<code>theSwMCapability</code>	It represents the <code>swMCapability</code> .
<code>theSwMProfile</code>	It represents the <code>swMProfile</code> .

4.4.4.3 Constraints

A relation can only exist between a `SwMProfile` and a `SwMCapability` when

- a) all steps which are entries in the `stepsAndSelectedStopPointList` of `SwMProfile` have `stopPointCanBeSetBeforeThisStep = Yes` in the `stepsAndOfferedStopPointList` of the `SwMCapability`.
- b) `nEInformation` of `SwMProfile` is a subset of `nEInformation` of `SwMCapability`.

4.4.5 relation swMProfile-swMProcess (M)

4.4.5.1 Definition

This represents the relationship between `SwMProfile` and `SwMProcess`.

4.4.5.2 Roles

Name	Definition
<code>theSwMProfile</code>	It represents the <code>theSwMProfile</code> .
<code>theSwMProcess</code>	It represents the <code>SwMProcess</code> .

4.4.5.3 Constraints

A `SwMProcess` shall perform all self-configuration steps according to `stepsAndOfferedStopPointList` of `SwMProfile`.

A relation can only exist between a `SwMProcess` and a `SwMProfile` when `nEIdentification` of `SwMProcess` falls into `nEInformation` of `SwMProfile`.

4.5 Information attribute definitions

4.5.1 Definition and legal values

Attribute Name	Definition	Legal Values
id	It identifies uniquely an instance of its object class.	
nEIdentification	This attribute identifies the NE for which the self management activity is done.	
nEInformation	This attribute defines the neType or NE instance/s - with optional software identification information - , for which this capability/profile instance is valid.	"NE instance/s" only applies for instance/s already known to the IRPM anager, e.g. in case of re-configuration or SW update.
startStepName	nameOfStep, this attribute defines the start step for resume operation.	The legal value of startStepName could be one of the step which defined in stepsAndOfferedStopPointList
swVersionToBeInstalled	This attribute describes which SW identification information shall be used at the end of self management in NEs for which this swMCapability/swMProfile applies.	
stepsAndOfferedStopPointList	Each entry in the list contains for each step the following information: <ul style="list-style-type: none"> nameOfStep: This list shall be exhaustive; if a certain step is not visible or not supported in the SWM process, then it shall not be shown (listed) in the stepsAndOfferedStopPointList. sequenceNumberInProcess stopPointCanBeSetBeforeThisStep 	nameOfStep: nEHealthCheck, swDownload, swInstallation, swActivation More values for nameOfStep may be used by other IRPs. All steps may be offered as stop points. sequenceNumberInProcess: Positive Integer stopPointCanBeSetBeforeThisStep: Yes, No
stepsAndSelectedStopPointList	Each entry in the list contains for each step the following information: <ul style="list-style-type: none"> nameOfStep: sequenceNumberInProcess stopPointSetIndication 	nameOfSwMStep, sequenceNumberInProcess: see stepsAndOfferedStopPointList stopPointSetIndication: stopPointIsSetBeforeThisStep, stopPointIsNotSet

stepInfoList	<p>This list attribute contains information about all steps and how far they have progressed. Each entry in the list contains:</p> <ul style="list-style-type: none"> • nameOfStep • sequenceNumberInProgress • stopPointSetIndication • stepProgress 	<p>nameOfSwMStep, sequenceNumberInProgress: see stepsAndOfferedStopPointList</p> <p>stopPointSetIndication: see stepsAndSelectedStopPointList</p> <p>stepProgress: notYetStarted, running, completed, awaitingResume, failure, terminated</p>
swMprocessList	<p>This attribute contains information about the instances of swMProcess . Each entry in the list contains (SET OF):</p> <ul style="list-style-type: none"> • id • nEIdentification • stepInfoList 	See individual definitions of the list entry content.
offeredFinalAdministrativeStateInformation	It describes which selection is offered regarding the administrativeState of the NE after successful automated management: If it may have the value locked or unlocked or if the value of the administrativeState may be determined by the configuration data which is uploaded in the course of the automated management.	One or more of the following values: locked, unlocked, determinedByConfigurationData The value unlocked should always be present.
selectedFinalAdministrativeState	Determines which of the offers made regarding the administrativeState of the NE after successful self-configuration is taken.	One of the following values: locked, unlocked, determinedByConfigurationData Default value is value unlocked.
swVersionToBeInstalledOf ferList	This list describes for which SW version/s the capability object is valid. The first element in the list indicates the default software version to be installed.	Minimum size of list: 1 entry
versionNumber	This number is the version number of a profile. Its value is 1 when a profile is created. It is incremented by 1 each time a profile is successfully changed.	Integer
profileId	<p>This parameter records the identification of the profile used by the process. It consists of two data:</p> <ul style="list-style-type: none"> • id (of the profile) • versionNumber 	See versionNumber
matchingNEInformation	This parameter records the information of the NE which was matching with the nEInformation of the profile when determining which profile is to be used for the process.	See nEInformation

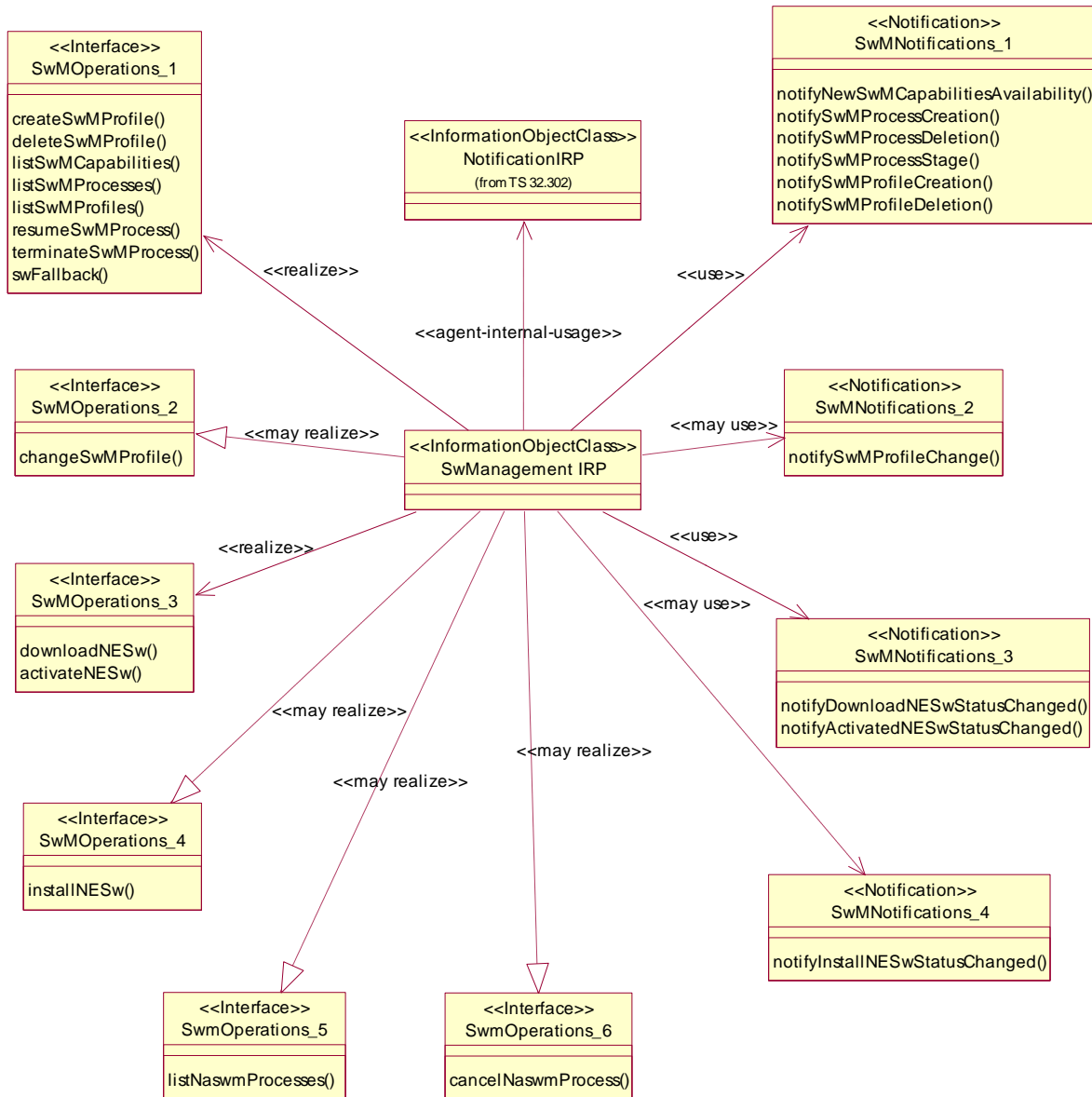
result	This parameter records the result of an operation.	success, failure, stepNameNotMatch: The current process step doesn't match the startStepName in the operation. nEInformationIntersection : There shall be no ambiguity which swMManagementProfile is valid for the NE. Therefore the nEInformation of different swMProfile instances shall not intersect. Example for a not allowed intersection: profile 1 has nEInformation=(neType=eNB), profile 2 has nEInformation=((neType=eNB) and (Id=1)).
--------	--	--

4.5.2 Constraints

None.

5 IRP descriptions: Interface Definitions

5.1 Class diagram representing interfaces



Additionally, the operations and notifications of this document are specified and grouped under Interfaces as shown in the following sections. To allow the flexible support of the necessary and sufficient operations and notifications for software management, the operations and notifications of this specification are packaged into two groups, one related to automatic software management (ASWM) and the other related to non-automated software management (NASWM).

Automatic Software Management requires the following operations and notifications:

1. SwMOperations_1 and SwMNotifications_1 shall be mandatory
2. SwMOperations_2 and SwMNotifications_2 shall be optional

Non Automatic Software Management requires the following operations and notifications:

1. SwMOperations_3 and SwMNotifications_3 shall be mandatory
2. SwMOperations_4 and SwMNotifications_4 shall be optional
3. SwMOperations_5 shall be conditional mandatory; the condition is: progress reporting for or cancellation of NASWM operations is supported.
4. SwMOperations_6 shall be conditional mandatory; the condition is: cancellation of NASWM operations is supported.



Figure 5.1-2 Operations and Notifications for ASWM

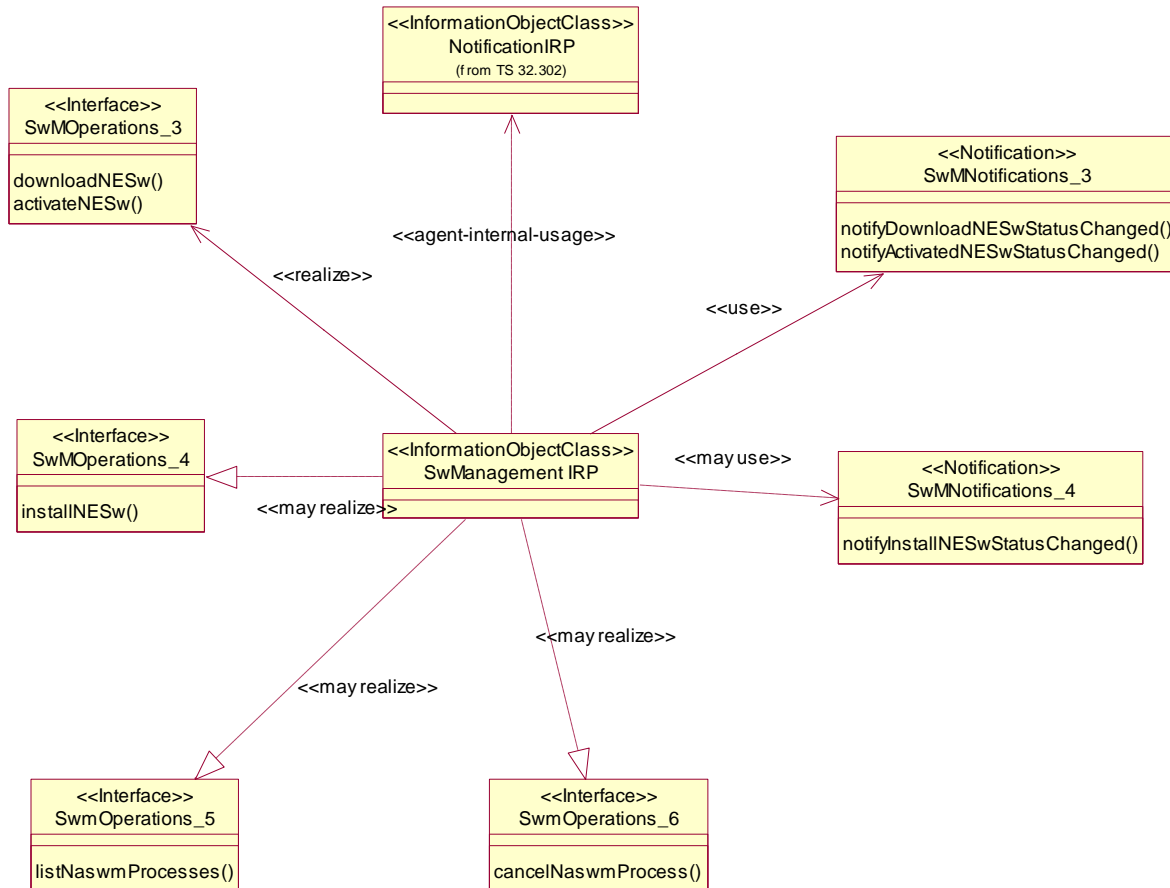


Figure 5.1-3 Operations and Notifications for NASWM

5.2 Generic rules

- **Rule 1:** each operation with at least one input parameter supports a pre-condition `valid_input_parameter` which indicates that all input parameters shall be valid with regards to their information type. Additionally, each such operation supports an exception `operation_failed_invalid_input_parameter` which is raised when pre-condition `valid_input_parameter` is false. The exception has the same entry and exit state.
- **Rule 2:** each operation with at least one optional input parameter supports a set of pre-conditions `supported_optional_input_parameter_xxx` where "xxx" is the name of the optional input parameter and the pre-condition indicates that the operation supports the named optional input parameter. Additionally, each such operation supports an exception `operation_failed_unsupported_optional_input_parameter_xxx` which is raised when (a) the pre-condition `supported_optional_input_parameter_xxx` is false and (b) the named optional input parameter is carrying information. The exception has the same entry and exit state.
- **Rule 3:** each operation shall support a generic exception `operation_failed_internal_problem` which is raised when an internal problem occurs and that the operation cannot be completed. The exception has the same entry and exit state.

NOTE: These rules are mapped at the solution set level. Pre-conditions and exceptions, generated by these rules, need not appear explicitly in the present document.

5.3 SwMIRPOperations_1 Interface (M)

5.3.1 Operation listSwMCapabilities (M)

5.3.1.1 Definition

This operation allows the IRPManager to determine on the Itf-N interface which steps in the SW management are performed in NEs of a certain type, what is done by the NE in case a step does not perform normally and before which steps a stop point can be set, such that the software download halts and waits for a continuation request by the IRPManager.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_1	

5.3.1.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
nEInformation	M	swM.nEInformation	If this input parameter contains no information, all (offered) SwMCapability instances are to be listed in the output.

5.3.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
capabilityList	M	swM.capabilityList	Each entry in the list contains: <ul style="list-style-type: none"> • Id of SwMCapability • nEInformation of SwMCapability • swVersionToBeInstalledOfferList of SwMCapability • stepsAndOfferedStopPointList of SwMCapability • offeredFinalAdministrativeStateInformation of SwMCapability
result	M	swM.result	result=success and empty swMcapabilityList mean: No instance found.

5.3.1.4 Post-condition

Assertion Name	Definition
dataDelivered	The requested data is delivered.

5.3.1.5 Exceptions

5.3.1.5.1 operation_failed

Exception Name	Definition
operation_failed	Condition: Pre-condition is false or post-condition is false. Returned Information: The output parameter result. Exit state: Entry state.

5.3.2 Operation listSwMProfiles (M)

5.3.2.1 Definition

This operation allows the IRPManager to find out which instances of SwMProfile are valid NEs of a certain type.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_1	
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	

5.3.2.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
nEInformation	M	swM.nEInformation	If this input parameter contains no information, all profile instances are to be listed in the output.

5.3.2.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
swMProfileList	M	swM.swMProfileList	Each entry in the list contains: <ul style="list-style-type: none"> • Id of profile • versionNumber of swMprofile • nEInformation of profile • stepsAndSelectedStopPointList of profile • selectedFinalAdministrativeState of profile • conditionally swVersionToBeInstalled of swMprofile
result	M	swM.result	

5.3.3 Operation createSwMProfile (M)

5.3.3.1 Definition

This operation allows the IRPManager to establish an instance of SwMProfile to be valid for NEs of a certain type.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	

5.3.3.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
id	O	swM.id	Identifier of swMprofile
nEInformation	M	swM.nEInformation	See 4.5
swVersionToBeInstalled	M	swM.swVersionToBeInstalled	See 4.5
stepsAndSelectedStopPointList	M	swM.stepsAndSelectedStopPointList	See 4.5
selectedFinalAdministrativeState	M	swM.selectedFinalAdministrativeState	See 4.5

5.3.3.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
id	CM	SwMProfile.id	See the definition of the result field described below
result	M	ENUM { success, failure, nEInformationIntersection, notAllowedBecauseOfOngoingSwmActivity }	If result = success , then parameter id contains the id of the created swMProfile. If result = failure , then parameter id is absent. If result = nEInformationIntersection, then parameter id contains the id of a swMProfile whose nEInformation would intersect with the proposed nEInformation for the new swMProfile, which was not created in this case. If result = notAllowedBecauseOfOngoingSwmOperation, then parameter id is absent.

5.3.4 Operation deleteSwMProfile (M)

5.3.4.1 Definition

This operation allows the IRPManager to delete an instance of swMProfile.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	

5.3.4.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
id	M	swM.id	Identifier of swMprofile

5.3.4.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
result	M	swM.result	

5.3.5 Operation `listSwMProcesses` (M)

5.3.5.1 Definition

This operation allows the IRPManager to find out the status of one or several `swMProcess` instances

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_4	

5.3.5.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
<code>nEIdentification</code>	O	<code>swM.nEIdentification</code>	It describes for which NE the <code>swMprocess</code> is to be listed. If this parameter is not present, all <code>swMprocess</code> instances are to be listed in the output.

5.3.5.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
<code>swMprocessList</code>	M	<code>swM.swMprocessList</code>	See 4.5
<code>result</code>	M	<code>swM.result</code>	<code>result=success</code> and empty <code>swMprocessList</code> mean: No instance found

5.3.6 Operation `resumeSwMProcess` (M)

5.3.6.1 Definition

This operation allows the IRPManager to resume a SW management process which currently has stopped at a stop point step.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_3	

5.3.6.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
<code>id</code>	M	<code>swM.id</code>	Identifier of <code>swMprocess</code>
<code>startStepName</code>	M	<code>swM.NameOfStep</code>	The start step for the resume operation. If the current process step is equal to the <code>startStepName</code> value, the process will start from <code>startStepName</code> . If the current process step does not match the <code>startStepName</code> value, then it will be indicated in the <code>result</code> of the operation. Not matching <code>startStepName</code> value can either be the case that the process has already started from the specified step (i.e. request is too late) or that the process has not yet reached the specified step (i.e. request is too early).

5.3.6.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
result	M	swM.result	

5.3.7 Operation swFallback (M)

5.3.7.1 Definition

This operation enables the IRPManager to initiate a SW fallback.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_SWM_FUN_6	

5.3.7.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
filter	M	swM.filter	To describe properties of the NEs to be selected.

5.3.7.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
nEList	M	swM.nEList	Each entry in the list contains: nEIdentification swFallbackStatus (values: fallbackSuccessful, fallbackUnsuccessful)
result	M	swM.result	<ul style="list-style-type: none"> • Success, • Partly successful - swFallbackStatus is fallbackUnsuccessful for at least one NE and fallbackSuccessful for at least one other NE • Failure <p>Empty nEList and Result=Success means: No NEs fulfilling filter were found.</p>

5.3.8 Operation `terminateSwMProcess` (M)

5.3.8.1 Definition

This operation allows the IRPManager to terminate a SW management process which is currently ongoing.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_6	

5.3.8.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
<code>id</code>	M	<code>swM.id</code>	Identifier of <code>swMprocess</code> .

5.3.8.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
<code>result</code>	M	<code>swM.result</code>	

5.4 SwMIRPOperations_2 Interface (O)

5.4.1 Operation changeSwMProfile (O)

5.4.1.1 Definition

This operation allows the IRPManager to change an instance of SwMProfile.

A change in a profile which was already used at the start of an swMProcess does not affect that swMProcess (which is run to its completion according to the former version of the profile).

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	

5.4.1.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
id	M	swM.id	Identifier of swMprofile
nEInformation	M	swM.nEInformation	See 4.5
swVersionToBeInstalled	M	swM.swVersionToBeInstalled	See 4.5
stepsAndSelectedStopPointList	M	swM.stepsAndSelectedStopPointList	See 4.5
selectedFinalAdministrativeState	M	swM.selectedFinalAdministrativeState	See 4.5

5.4.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
result	M	ENUM { success, failure, nEInformationIntersection, notAllowedBecauseOfOngoingSwmActivity }	If result = success or failure , then parameter id may be absent or contain the id of the changed swMprofile. If result = nEInformationIntersection, then parameter conflictingProfileId contains the id of a SwMProfile "A" whose nEInformation would intersect with the proposed nEInformation for the SwMProfile "B" = input parameter id. SwMProfile "B" will not be changed in this case. If result = notAllowedBecauseOfOngoingSwmActivity, (which means that the operation is rejected because another SWM activity is ongoing for at least one NE covered by input parameter nEInformation), then parameter conflictingProfileId is absent.
versionNumber	M	SwMProfile.versionNumber	See 4.5. This parameter has value 0 when result <> success.
conflictingProfileId	C*)	SwMProfile.id	See definition of result above.

Editor Note: whether this parameter needs to be conditional or mandatory needs further discussion. The condition:
result_is_nEInformationIntersection

5.4.1.4 Constraints

Name	Definition
result_is_nEInformationIntersection	result is equal to nEInformationIntersection

5.5 SwMIRPNotifications_1 Interface (M)

5.5.1 Notification notifySwMProfileCreation (M)

5.5.1.1 Definition

This notification conveys information about the creation of an instance of IOC swMProfile.

5.5.1.2 Input parameters

Parameter Name	Qualifiers	Matching Information	Comment
id	M,Y	swM.id	Identifier of swMprofile
versionNumber	M, Y	swM.versionNumber	See 4.5
nEInformation	M,Y	swM.nEInformation	See 4.5
swVersionToBeInstalled	M,Y	swM.swVersionToBeInstalled	See 4.5
stepsAndSelectedStopPointList	M,N	swM.stepsAndSelectedStopPointList	See 4.5
selectedFinalAdministrativeState	M,N	swM.selectedFinalAdministrativeState	See 4.5

5.5.2 Notification notifySwMProfileDeletion (M)

5.5.2.1 Definition

This notification conveys information about the deletion of an instance of IOC swMProfile.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	

5.5.2.2 Input parameters

Parameter Name	Qualifiers	Matching Information	Comment
id	M,Y	swM.id	Identifier of swMprofile

5.5.3 Notification notifySwMProcessCreation (M)

5.5.3.1 Definition

This notification conveys information about the creation of an instance of IOC `swMProcess`.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	

5.5.3.2 Input parameters

Parameter Name	Qualifiers	Matching Information	Comment
<code>id</code>	M,Y	<code>swM.id</code>	Identifier of <code>swMprocess</code>
<code>nEIdentification</code>	M,Y	<code>swM.nEIdentification</code>	see 4.5
<code>profileId</code>	M,N	<code>swM.profileId</code>	see 4.5
<code>matchingNEInformation</code>	M,N	<code>swM.matchingNEInformation</code>	see 4.5
<code>stepInfoList</code>	M,N	<code>swM.stepInfoList</code>	see 4.5

5.5.4 Notification notifySwMProcessStage (M)

5.5.4.1 Definition

This notification conveys information about the stage of an instance of IOC `swMProcess` that has been completed or at which that process has been stopped (based on pre-set stop points).

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_5	

5.5.4.2 Input parameters

Parameter Name	Qualifiers	Matching Information	Comment
<code>id</code>	M,Y	<code>swM.id</code>	Identifier of <code>swMprocess</code>
<code>stepInfoList</code>	M,N	<code>swM.stepInfoList</code>	see 4.5

5.5.5 Notification `notifySwMProcessDeletion` (M)

5.5.5.1 Definition

This notification conveys information about the deletion of an instance of IOC `swMProcess`

IRP Agent shall also send out this notification in case of a process termination caused by an exception, for example IRP Agent terminates the process because it had to wait too long after a suspend operation.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	

5.5.5.2 Input parameters

Parameter Name	Qualifiers	Matching Information	Comment
<code>id</code>	M, Y	<code>swM.id</code>	Identifier of <code>swMprocess</code>
<code>triggerForDeletion</code>	M, Y	<code>swM.triggerForDeletion</code>	This parameter describes what triggered the deletion of the <code>swMprocess</code> instance: <code>triggerForDeletion</code> : <code>irpAgentTermination</code> , <code>irpManagerTermination</code> , <code>automatedSWMSuccessfullyConcluded</code>
<code>additionalInformation</code>	O, N	<code>swM.additionalInformation</code>	

5.5.6 Notification `notifyNewSwAvailability` (M)

5.5.6.1 Definition

This notification conveys information about the availability of new SW.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	

5.5.6.2 Input parameters

Parameter Name	Qualifiers	Matching Information	Comment
<code>nEandSWversion</code>	M, Y	<code>swM.NEandSWversion</code>	Informs about new available SW, SW version and NE / NE version (types) for which it is valid

5.6 SwMIRPNotifications_2 Interface (O)

5.6.1 Notification notifySwMProfileChange (C/O)

5.6.1.1 Definition

This notification conveys information about a change of an instance of IOC `swMProfile`.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_ASWM_FUN_2	

5.6.1.2 Input parameters

Parameter Name	Qualifiers	Matching Information	Comment
id	M,Y	swM.id	Identifier of swMprofile
versionNumber	M,Y	swM.versionNumber	See 4.5
nEInformation	M,Y	swM.nEInformation	See 4.5
swVersionToBeInstalled	M,N	swM.swVersionToBeInstalled	See 4.5
stepsAndSelectedStopPointList	M,N	swM.stepsAndSelectedStopPointList	See 4.5
selectedFinalAdministrativeState	M	swM.selectedFinalAdministrativeState	See 4.5

5.7 SwMIRPOperations_3 Interface (M)

5.7.1 Operation downloadNESw (M)

5.7.1.1 Definition

This operation allows IRPManager to request an IRPAgent to download network element software entities from a specified location. IRPManager provides a unique reference where IRPAgent can download NE software from.

NOTE: The file transfer may not happen over Itf-N and the details on how to transfer file from IRPAgent to NE(s) is vendor specific and outside the scope of this specification.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_NASWM_FUN_1	
3GPP TS 32.531 [6]	REQ_NASWM_FUN_2	

5.7.1.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
swToBeDownloaded	M	List of STRUCT < swLocation, swFileSize, swFileCompression, swFileFormat >	<p>These attributes represent information about the NE software which will be downloaded by IRPAgent.</p> <p><i>swLocation</i>: Denotes a unique location of software. This attribute includes the name of the software or a software version.</p> <p><i>swFileSize</i>: It identifies the size of the file. Its value is positive Integer (the unit is byte). It is optional to fill in this attribute value.</p> <p><i>swFileCompression</i>: It identifies the name of the compression algorithm used for the file. An empty fileCompression means that there is no compression on the file. Choice of compression algorithm is vendor-specific but is encouraged to use industrial standard algorithm such as GZIP. It is optional to fill in this attribute value.</p> <p><i>swFileFormat</i>: It identifies the encoding technique used by the file. It is optional to fill in this attribute value</p>
neIdentifier	M	Distinguished Name (DN)	Identifies the destination where the software can be downloaded and can include network element, managed element or managed functionality etc. The information is represented using a full Distinguished Name according to 3GPP TS 32.300.

5.7.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
downloadProcessId	M	Integer	An Identifier generated by IRPAgent upon receiving a non-automated software management request from IRPManager. In this case, it identifies the NE software download operation request.
result	M	ENUM { requestAccepted, requestFailed, notAllowedBecauseOfOngoingSwmActivity }	Indicates whether SwMIRP has accepted or rejected the download request. It can have any one of the three possible values: <ul style="list-style-type: none"> - "requestAccepted" which means that IRPAgent would perform the NE software download operation - "requestFailed" which means that IRPAgent has failed to initiate the NE software download operation. Specific error condition can be captured in reason field - notAllowedBecauseOfOngoingSwmActivity which means that the operation is rejected because another SWM activity is ongoing for the requested NE..
reason	O	String	To capture detailed error reason. The field is empty when there is no error.
listOfStepNumbersAnd-Durations	CM Note 1)	List of { Integer; (Integer;Integer;Integer) }	This identifies a list of steps of the non-automated software management process and for each step the estimated duration (hours, minutes, seconds) for its completion.

Note 1:Condition: Progress reporting of NASWM operations is supported.

5.7.1.4 Pre condition

Assertion Name	Definition
swDownloadable	NE software is available which IRPAgent can download

5.7.1.5 Post-condition

Assertion Name	Definition
swDownloadInProgress	The SwMIRP has accepted the download request to perform the requested operation.
swAvailable	This is the final state when downloadNESw operation is complete and notifyDownloadNESwStatusChanged has been generated.

5.7.1.6 Exceptions

Exception Name	Definition
operationFailed	Condition: Pre-condition is false or post-condition is false. Returned Information: The output parameter status. Exit state: Entry state.
resourceLimitation	Condition: Operation not performed due to resource limitation. Returned Information: The output parameter status. Exit state: Entry state.

5.7.2 Operation activateNESw (M)

5.7.2.1 Definition

This operation allows IRPManager to activate network element software entity which has been previously downloaded or installed on the request of IRPManager. This operation may be service affecting.

NOTE: activateNESw can be triggered through automatic or manual ways.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_NASWM_FUN_5	
3GPP TS 32.531 [6]	REQ_NASWM_FUN_8	

5.7.2.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
swVersionToBeActivated	M	swVersion	swVersion denotes the software version which would be activated. The details on how to activate a software version is vendor specific.
neIdentifier	M	Distinguished Name (DN)	Identifies the destination where software has to be activated. This is a full Distinguished Name according to 3GPP TS 32.300

5.7.2.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
activateProcessId	M	Integer	An Identifier is generated by IRP Agent upon receiving a non-automated software management request from IRPManager. In this case, it identifies the NE software activation operation request. This id is unique for activateNESw operations.
result	M	ENUM { requestAccepted, requestFailed, notAllowedBecauseOfOngoingSwmActivity }	Indicates whether SwMIRP has accepted or rejected the NE software activation request. It can have any one of the three possible values: - "requestAccepted" which means that IRP Agent would perform the NE software activation operation - "requestFailed" which means that IRP Agent has failed to initiate the NE software activation operation. Specific error condition can be captured in reason field - notAllowedBecauseOfOngoingSwmActivity which means that the operation is rejected because another SWM activity is ongoing for the requested NE..
reason	O	String	To capture specific error conditions. The field is empty when there is no error.
listOfStepNumbersAnd-Durations	CM Note 1)	See 5.7.1.3	See 5.7.1.3

Note 1:Condition: Progress reporting of NASWM operations is supported.

5.7.2.4 Pre condition

swAvailable or swInstalled

Assertion Name	Definition
swAvailable	The NE software has been successfully downloaded
swInstalled	The NE software has been installed

5.7.2.5 Post-condition

Assertion Name	Definition
swActivationInProgress	The SwMIRP has accepted the request to perform the requested activation operation.
swActivated	This is the final state when activateNESw operation is complete and notifyActivateNESwStatusChanged has been generated

5.7.2.6 Exceptions

Exception Name	Definition
operationFailed	Condition: Pre-condition is false or post-condition is false. Returned Information: The output parameter status. Exit state: Entry state.
resourceLimitation	Condition: Operation not performed due to resource limitation. Returned Information: The output parameter status. Exit state: Entry state.

5.8 SwMIRPOperations_4 Interface (O)

5.8.1 Operation installNESw (O)

5.8.1.1 Definition

This operation allows IRPManager to initiate installation of NE software entity which has been previously downloaded on the request of IRPManager. Installation may also be initiated from a remote location.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_NASWM_FUN_3	
3GPP TS 32.531 [6]	REQ_NASWM_FUN_4	

5.8.1.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
swTobeInstalled	M	swLocation	swLocation denotes a unique location (local or remote) of software which can be a directory path or a URL and includes 1) the name of software or 2) a software version
neIdentifier	M	Distinguished Name (DN)	Identifies the destination where the NE software needs to be installed. This is a full Distinguished Name according to 3GPP TS 32.300

5.8.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
installProcessId	M	Integer	An Identifier generated by IRP Agent upon receiving a non-automated software management request from IRPManager. In this case, it identifies the NE software installation operation request. This id is unique for installNESw operations.
result	M	ENUM { requestAccepted, requestFailed, notAllowedBecauseOfOngoingSwmActivity }	Indicates whether SwMIRP has accepted or rejected the installation request. It can have any one of the three possible values: - "requestAccepted" which means that IRP Agent will perform the NE software installation operation - "requestFailed" which means that IRP Agent has failed to initiate the NE software installation operation. Specific error condition can be captured in reason field - notAllowedBecauseOfOngoingSwmActivity which means that the operation is rejected because automatic SWM is ongoing for the requested NE..
reason	O	String	To capture detailed error conditions. The field is empty when there is no error.
listOfStepNumbersAnd-Durations	CM Note 1)	See 5.7.1.3	See 5.7.1.3

Note 1: Condition: Progress reporting of NASWM operations is supported..

5.8.1.4 Pre condition

Assertion Name	Definition
swAvailable	NE software is available

5.8.1.5 Post-condition

Assertion Name	Definition
swInstallationInProgress	The SwMRP has successfully accepted the request to perform the requested installation operation
swInstalled	This is the final state when installNESw operation is complete and notifyInstallNESwStatusChanged has been generated

5.8.1.6 Exceptions

Exception Name	Definition
operationFailed	Condition: Pre-condition is false or post-condition is false. Returned Information: The output parameter status. Exit state: Entry state.
resourceLimitation	Condition: Operation not performed due to resource limitation. Returned Information: The output parameter status. Exit state: Entry state.
swNotAvailable	Condition: NE software is not available. Returned Information: The output parameter status. Exit state: Entry state.

5.9 SwMIRPNotifications_3 Interface (M)

5.9.1 Notification notifyDownloadNESwStatusChanged (M)

5.9.1.1 Definition

This notification, generated by IRPAgent conveys information about the status of the downloadNESw operation.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_NASWM_FUN_1	

5.9.1.2 Input parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M, Y	SwMManagedEntity.objectClass	Represents the network element object class generating this event. Also refer to Notification header [9].
objectInstance	M, Y	SwMManagedEntity.objectInstance	Represents the network element instance generating the event. Also refer to Notification header [9].
notificationId	O, N	--	Refer to Notification header [9].
eventTime	M, Y	--	Refer to Notification header [9].
systemDN	C, Y	--	Refer to Notification header [9].
notificationType	M, Y	"notifyDownloadNESwStatusChanged"	
downloadProcessId	M, Y	Integer	To allow IRPManager correlate this notification with the downloadNESw operation request. Also refer to section 5.7.1
downloadOperationStatus	M, Y	enum { NE_SWDOWNLOAD_SUCCESSFUL, NE_SWDOWNLOAD_FAILED, NE_SWDOWNLOAD_PARTIALLY_SUCCESSFUL }	Provides information on the status of downloadNESw operation for the network element involved. Note: When only one software entity has to be downloaded, downloadOperationStatus can be either NE_SWDOWNLOAD_SUCCESSFUL or NE_SWDOWNLOAD_FAILED.
downloadedNESwInfo	O, N	LIST<DownloadedNESw>	Information on where the software or version got downloaded on the NE
failedSwInfo	O, N	LIST<FailedSw, FailureReason>	Information on software not able to be downloaded and the corresponding failure reason.

5.9.1.3 Triggering Event

5.9.1.3.1 From State

neSwDownloadInProgress

Assertion Name	Definition
neSwDownloadInProgress	IRPAgent has accepted the request to download software and downloadProcessId is available

5.9.1.3.2 To State

neSwDownloadSuccessful or neSwDownloadFailed or neSwDownloadPartiallySuccessful.

Assertion Name	Definition
neSwDownloadSuccessful	Software has been successfully downloaded. When multiple software have to be downloaded, it means that all software entities have been downloaded successfully
neSwDownloadFailed	Software has not been downloaded. When multiple software have to be downloaded, it means that no software has been downloaded
neSwDownloadPartiallySuccessful	At least one of the software has not been downloaded (hence can be used only when multiple software need to be downloaded)

5.9.1.4 Constraints

None

5.9.2 Notification notifyActivateNESwStatusChanged (M)

5.9.2.1 Definition

This notification, generated by IRPAgent conveys information about the status of the activateNESw operation.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_NASWM_FUN_5	

5.9.2.2 Input parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M, Y	SwMManagedEntity.objectClass	Represents the network element object class generating this event. Also refer to Notification header [9].
objectInstance	M, Y	SwMManagedEntity.objectInstance	Represents the network element instance generating the event. Also refer to Notification header [9].
notificationId	O,N	--	Refer to Notification header [9].
eventTime	M,Y	--	Refer to Notification header [9].
systemDN	C,Y	--	Refer to Notification header [9].
notificationType	M,Y	"notifyActivateNESwStatusChanged"	
activateProcessId	M, Y	Integer	To allow IRPManager correlate this notification with the activateNESw operation request. Also Refer to section 5.7.2
activateOperationStatus	M,Y	ENUM{ NE_SWACTIVATION_SUCCESSFUL, NE_SWACTIVATION_FAILED, NE_SWACTIVATION_PARTIALLY_SUCCESSFUL }	Provides information on the status of activateNESw operation for the network element involved. When the activation could get completed to only a certain extent, partial success may be used.
swVersion	M, Y	swVersion	The software version which the activateNESw operation has tried to activate, no matter the activateNESw operation is successful or failed or partially successful.
failureReason	CM,N	String	The error reason when the activateNESw operation is not successful. Condition: activateOperationStatus <> NE_SWACTIVATION_SUCCESSFUL

5.9.2.3 Triggering Event

5.9.2.3.1 From State

neSwActivationInProgress

Assertion Name	Definition
neSwActivationInProgress	IRPAgent has accepted the request to activate software and activateProcessId is available

5.9.2.3.2 To State

neSwActivationSuccessful or neSwActivationFailed or neSwActivationPartiallySuccessful.

Assertion Name	Definition
neSwActivationSuccessful	Software has been successfully activated.
neSwActivationFailed	Software has not been activated.
neSwActivationPartiallySuccessful	When activation can be completed only to a certain extent, partial success may be used.

5.9.2.4 Constraints

None.

5.10 SwMIRPNotifications_4 Interface (O)

5.10.1 Notification notifyInstallNESwStatusChanged (O)

5.10.1.1 Definition

This notification, generated by IRPAgent conveys information about the status of the installNESw operation.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_NASWM_FUN_3	

5.10.1.2 Input parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M, Y	SwMManagedEntity.objectClass	Represents the network element object class generating this event. Also refer to Notification header [9].
objectInstance	M, Y	SwMManagedEntity.objectInstance	Represents the network element instance generating the event. Also refer to Notification header [9].
notificationId	O, N	--	Refer to Notification header [9].
eventTime	M, Y	--	Refer to Notification header [9].
systemDN	C, Y	--	Refer to Notification header [9].
notificationType	M, Y	"notifyInstallNESwStatusChanged"	
installProcessId	M, Y	Integer	To allow IRPManager correlate this notification with the installNESw operation request. Also refer to section 5.8.1
installOperationStatus	M, Y	ENUM{ NE_SWINSTALLATION_SUCCESSFUL, NE_SWINSTALLATION_FAILED, NE_SWINSTALLATION_PARTIALLY_SUCCESSFUL }	Provides information on the status of installNESw operation for the network element involved.
installedNESwInfo	O, N	LIST<InstalledNESw>	Information on where the software or version got installed on the NE
failedSwInfo	O, N	LIST<FailedSw, FailureReason>	It provides information on the software which failed in installation

5.10.1.3 Triggering Event

5.10.1.3.1 From State

neSwInstallationInProgress

Assertion Name	Definition
neSwInstallationInProgress	IRPAgent has accepted the request to install software and installProcessId is available

5.10.1.3.2 To State

neSwInstallationSuccessful or neSwInstallationFailed or neSwInstallationPartiallySuccessful.

Assertion Name	Definition
neSwInstallationSuccessful	Software has been successfully installed
neSwInstallationFailed	Software has not been installed
neSwInstallationPartiallySuccessful	At least one of software has not been installed

5.10.1.4 Constraints

None.

5.11 SwmOperations_5 Interface (CM)

5.11.1 Operation listNaswmProcesses (M)

5.11.1.1 Definition

This operation allows the IRPManager to find out the status of one or several downloadNESw, installNESw or activateNESw operations which have not yet been completed.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_NASWM_FUN_7	

5.11.1.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
naswmProcessId	O	swM.naswmProcessId	It identifies the ongoing downloadProcessId or installProcessId or activateProcessId of the operation about which information is to be listed in the output. If this parameter is not present, all processes of the input naswmOperationType are to be listed in the output.
naswmOperationType	M	swM.naswmOperationType	It describes whether information is requested about an ongoing downloadNESw, installNESw or activateNESw operation.

5.11.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
naswmProcessList	M	swM.naswmProcessList	Each entry of this list contains: naswmProcessId (M), see 5.11.1.2 neIdentification (M), see 4.5.1 naswmOperationType (M), see 5.11.1.2 estimatedRemainingCompletionTime (M) – indicating the estimated remaining time until completion of the operation in hours, minutes, seconds listOfStepNumbersAndDurations (O), see 5.7.1.3 numberOfCurrentProcessStep (O) - indicating which of the steps is currently performed estimatedRemainingCompletionTimeForTheCurrentStep (O) – indicating the estimated remaining time until completion of the current process step in hours, minutes, seconds
result	M	swM.result	result=success and empty naswmProcessList mean: No ongoing NASWM process found
reason	O	String	To capture detailed error conditions. The field is empty when there is no error.

5.12 SwmOperations_6 Interface (CM)

5.12.1 Operation cancelNaswmProcesses (M)

5.12.1.1 Definition

This operation allows the IRPManager to request from the IRPAgent to cancel a downloadNESw or installNESw or activateNESw operation.

Information on Requirements Traceability:

Referenced TS	Requirement label	Comment
3GPP TS 32.531 [6]	REQ_NASWM_FUN_2, REQ_NASWM_FUN_4, REQ_NASWM_FUN_8	

5.12.1.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
processId	M	Integer	It describes which download/activate/installNESw operation is to be cancelled, i.e. gives its download/install/activationProcessId as provided in the output parameters of download/activate/installNESw operation.
naswmOperationType	M	swM.naswmOperationType	It describes whether cancellation is requested of a ongoing downloadNESw, installNESw or activateNESw operation.

5.12.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
result	M	swM.result	success or operationIsAlreadyCompleted or noSuchProcess or failure
reason	O	String	To capture detailed error conditions. The field is empty when there is no error.

5.12.1.4 Pre condition

Assertion Name	Definition
operationStoppable	The specified operation is ongoing and can be terminated

5.12.1.5 Post-condition

downloadedSWIsDeleted or swCanBeActivatedLater or swUninstalled

Assertion Name	Definition
downloadedSWIsDeleted	This post-condition applies if the operation to be cancelled has naswmOperationType downloadNESw: If software has been downloaded before the download operation was cancelled, then it is deleted.
swCanBeActivatedLater	This post-condition applies if the operation to be cancelled has naswmOperationType activateNESw: The software which was not activated can be activated at another later time.
swUninstalled	This post-condition applies if the operation to be cancelled has naswmOperationType installNESw: The software which was not completely installed is completely uninstalled.

5.12.1.6 Exceptions

Exception Name	Definition
operationFailed	Condition: Pre-condition is false or post-condition is false. Returned Information: The output parameter status . Exit state: Entry state.
resourceLimitation	Condition: Operation not performed due to resource limitation. Returned Information: The output parameter status . Exit state: Entry state.

Annex A (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2008-12	SP-42	SP-080717			Submitted to SA#42 for information and approval	1.0.0	8.0.0
2009-06	SP-44	SP-090408	001	--	Correction of naming errors	8.0.0	8.1.0
2009-06	SP-44	SP-090408	002	--	Add missing start step parameter for resume operation	8.0.0	8.1.0
2009-06	SP-44	SP-090290	003	--	To add a Non-Automated Software Management operation, downloadNESw	8.1.0	9.0.0
2009-06	SP-44	SP-090290	004	--	To add a Non-Automated Software Management operation, activateNESw	8.1.0	9.0.0
2009-06	SP-44	SP-090290	005	--	To add a Non-Automated Software Management operation, installNESw	8.1.0	9.0.0
2009-06	SP-44	SP-090290	006	--	Editorial cleanup and correction of various qualifiers for TS 32.532	8.1.0	9.0.0
2009-06	SP-44	SP-090290	007	--	To update SWM Class diagram to include Non-Automated Software Management interfaces	8.1.0	9.0.0
2009-09	SP-45	SP-090627	008	-	Adding missing Editor's Notes on Automatic software management	9.0.0	9.1.0
2009-09	SP-45	SP-090627	009	-	Remove duplication of SWM functionalities	9.0.0	9.1.0
2009-09	SP-45	SP-090627			To rephrase the definitions of installNESw and activateNESw operations	9.0.0	9.1.0
2009-09	SP-45	SP-090627	010	-			
2009-09	SP-45	SP-090627	011	-	Addition of a new NASWM notification notifyInstallNESw StatusChanged	9.0.0	9.1.0
2009-09	SP-45	SP-090627	012	-	Addition of a new NASWM notification notifyActivateNESw StatusChanged	9.0.0	9.1.0
2009-09	SP-45	SP-090627	013	-	Adding error reason	9.0.0	9.1.0
2009-09	SP-45	SP-090627	014	-	Addition of a new NASWM notification notifyDownloadNESw StatusChanged	9.0.0	9.1.0
2009-09	SP-45	SP-090627	015	-	To update Software Management Class Diagram to include NASWM notifications	9.0.0	9.1.0
2009-12	SP-46	SP-090719	016	--	To move editor notes related to NASWM operations	9.1.0	9.2.0
2009-12	SP-46	SP-090719	017	--	Extend requirements traceability table for IOC sw mProfile	9.1.0	9.2.0
2009-12	SP-46	SP-090719	018	--	To update Sw Management IRP Class Diagram	9.1.0	9.2.0
2010-01	--	--	--	--	Formatting changes (removal of bold for notAllowedBecauseOfOngoingSw mActivity)	9.2.0	9.2.1
2010-03	SP-47	SP-100035	019	--	Remove editor notes	9.2.1	9.3.0
2010-03	SP-47	SP-100035	020	--	Add clarification to parameter sw VersionToBeInstalledOfferList	9.2.1	9.3.0
2010-03	SP-47	SP-100035	021	--	Correct the input parameters of notifyActivateNESw StatusChanged	9.2.1	9.3.0
2010-03	SP-47	SP-100035	022	--	Rapporteur's cleanup	9.2.1	9.3.0
2010-09	SP-49	SP-100489	023	--	Modify the Class diagram representing interfaces	9.3.0	10.0.0
2010-12	SP-50	SP-100833	024	2	Modify the input parameters of notifyActivateNESw StatusChanged	10.0.0	10.1.0
2010-12	SP-50	SP-100833			Add NE health check step in automatic software management - Align with NGMN	10.0.0	10.1.0
2010-12	SP-50	SP-100831	030	1	Correcting requirements traceability and presence qualifier of notifyNewSw Availability	10.0.0	10.1.0
2010-12	SP-50	SP-100833	026	1	Correcting the traced requirement of NotifyNewSw Availability - Align with 32.531	10.0.0	10.1.0
2012-09	SP-57	SP-120558	035	--	Correction on TS-family members in introduction	10.1.0	10.2.0
2012-09	SP-57	SP-120645	037	1	Addition of progress reporting and cancellation of Non-Automated Software Management operations	10.2.0	11.0.0