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Technical Specification

**3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Telecommunication management;
Software Management (SWM);
Concepts and
Integration Reference Point (IRP) Requirements
(Release 11)**

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Contents

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;

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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 describes the concepts how SWM of NEs works and what IRP requirements need to be met to support this functionality.

In the 3GPP Rel-8 the present document focuses on automated software management of eNBs.

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.

3 Definitions and abbreviations

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

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Software Management: Activities to control which software is available and/or active in a network element.

Automated Software Management: Software Management which is performed without the presence of an IRPManager (SWM). An IRPManager may monitor and /or control the software management activities. An IRPAgent receives information to perform the Software Management activities in an autonomous way.

Non-Automated Software Management: Software Management which requires the presence of IRPManager (SWM) to fully control and monitor the software management activities. The IRPAgent receives explicit instructions from the IRPManager about the SW Management activities which shall be performed.

Software Installation: Installation of software puts it into a form suitable for activation or use.

Software Activation: Activation of software makes it ready to be used and the software starts providing service.

3.2 Abbreviations

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

ASWM	Automated Software Management
NASWM	Non-Automated Software Management
NE	Network Element
SWM	Software Management

4 Concepts and background

4.1 Business Level Requirements

4.1.1 Business Level Requirements 1

REQ_SW_CON_1 The software management functions used during the establishment of a new NE in the network should be usable also for software upgrade.

4.1.1.1 Actor roles

FFS

4.1.1.2 Telecommunications resources

FFS

4.1.1.3 High-level use cases

FFS

4.1.2 Business Level Requirements 2

REQ_SW_CON_2 The IRPManager should have monitoring and interaction capabilities regarding the software download, installation, activation and fallback in/to the NE.

4.1.2.1 Actor roles

FFS

4.1.2.2 Telecommunications resources

FFS

4.1.2.3 High-level use cases

FFS

4.1.3 Business Level Requirements 3

REQ_SW_CON_3 The software installation shall have no or limited service impacts.

4.1.3.1 Actor roles

FFS

4.1.3.2 Telecommunications resources

FFS

4.1.3.3 High-level use cases

FFS

4.1.4 Business Level Requirements 4

REQ_SW_CON_4
The IRPManager shall be able to predefine which specific software version, component or software package shall be downloaded to one or more eNodeBs during automated software management procedure.

4.1.4.1 Actor roles

FFS

4.1.4.2 Telecommunications resources

FFS

4.1.4.3 High-level use cases

FFS

4.2 Specification level requirements

4.2.1 Specification level requirement on general SWM

REQ_SWM_FUN_1
If a software installation/activation fails, a software fallback should be done.

REQ_SWM_FUN_2
It shall be possible for the IRPManager to retrieve information about the SW which is present in an NE or a group of NEs.

REQ_SWM_FUN_3
It shall be possible for the IRPManager to monitor changes in the SW which is present in an NE (newly downloaded/installed/activated/fallback).

REQ_SWM_FUN_4
It shall be possible for the IRPManager to receive alarms in case of failures during the SW-download/installation/activation/fallback.

REQ_SWM_FUN_5
Void.

REQ_SWM_FUN_6
It shall be possible for the IRPManager to instruct the IRPAgent to trigger a SW fallback in an individual NE or groups of NEs.

REQ_SWM_FUN_7
It shall be possible for the IRPManager to instruct the IRPAgent to configure those new mandatory parameters in a new SW version for which no default values are available or are not sufficient, as soon as possible and before any service affecting errors occur that have impact on the customer and the network.

4.2.1.1 Actor roles

FFS

4.2.1.2 Telecommunications resources

FFS

4.2.1.3 Use cases

FFS

4.2.1.3.1 Use case 1

FFS

4.2.2 Specification level requirement on Automated SWM

REQ_ASWM_FUN_1
It shall be possible for an IRPManager to retrieve
- information regarding how an NE or a group of NEs behaves during ASWM, i.e. in which sequence the essential steps of ASWM are executed
- information regarding where the IRPManager can interact with ASWM - by suspending the ASWM process at one or more ASWM stop points.
Steps, their sequence and their stop point qualification are not imposed by the standard.

REQ_ASWM_FUN_2
If choices for stop points to suspend the SWM process are offered, then it shall be possible for an IRPManager to choose/select among them where it will suspend (stop) a SWM process (i.e. to ensure fulfillment of pre-conditions for the step like the fulfillment of the presence of required input data for the step).
The IRPManager shall be able to read or select or de-select the stop points offered.
The IRPManager shall be informed about the availability of new SW, about the creation and deletion of a profile which is a holder of information regarding the offered SWM steps, the offered sequence of the steps and the configuration steps stop points.
The IRPManager should be able to change the content of a created profile and be informed about the change.

REQ_ASWM_FUN_3
It shall be possible for an IRPManager to resume a suspended ASWM process.

REQ_ASWM_FUN_4
It shall be possible for IRPManager to retrieve information about the progress of ASWM.

REQ_ASWM_FUN_5
The IRPAgent should send a notification when the ASWM process
 - was suspended
 - was resumed
 - was terminated

REQ_ASWM_FUN_6
It shall be possible for an IRPManager to terminate a currently ongoing ASWM process for one or multiple NEs. After a termination it is not possible to resume the ASWM process.

REQ_ASWM_FUN_7
In order to declare the SW activation succeeded, a self test should have been completed.

REQ_ASWM_FUN_8
If the software activation fails, information documenting the reasons for the failure should be logged, to support the trouble shooting.

4.2.2.1 Actor roles

FFS

4.2.2.2 Telecommunications resources

FFS

4.2.2.3 Use cases

4.2.2.3.1 Use case Self-Configuration

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal (*)	Supply an eNodeB with the latest applicable software in the course of self-configuration	
Actors and Roles (*)	IRPManager	
Telecom resources	The E-UTRAN/EPC network including its OSS.	
Assumptions	IP network connectivity exists between the eNodeB and the OAM (sub) systems providing support for the self-configuration process and for automated software management.	
Pre conditions	The eNodeB is physically installed and physically connected to an IP network.	
Begins when	The self-configuration process reaches the point where the software version for the new eNB was be determined and needs to be delivered to the eNB.	
Step 1 (*) (M|O)	[SU1] The software is downloaded into the eNodeB. [SU2] The SW is installed on the eNB. [SU3] The SW is activated on the eNB. [at least one of SU2/3 shall be done] [SU4] The inventory system in the OAM is informed that a new software for this eNodeB is in the field. [SU5] The network resource models visible over Itf-N are updated	
Ends when (*)	Ends when all steps identified above are successfully completed or when an exception occurs.	
Exceptions		
Post Conditions	The software is ready for usage in the eNB.	
Traceability (*)		

4.2.2.3.1 Use case Automated Software Update

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal (*)	Supply the latest applicable software to an eNB which is already running in the network.	
Actors and Roles (*)	FFS	
Telecom resources	The E-UTRAN/EPC network including its OSS.	
Assumptions	IP network connectivity exists between the eNodeB and the OAM (sub) systems providing support for the automated software update process.	
Pre conditions	FFS	
Begins when	New software is provided for an eNB.	
Step 1 (*) (M|O)	[SU1] Information about the availability of new software is provided to the OAM (sub)system. [SU2] The software is downloaded into the eNodeB. [SU3] The SW is installed on the eNB. [SU4] The SW is activated on the eNB. [at least one of SU3/4 shall be done] [SU5] The inventory system in the OAM is informed that a new software for this eNodeB is in the field. [SU6] The network resource models visible over Itf-N are updated	
Step n (M|O)		
Ends when (*)	Ends when all mandatory steps identified above are successfully completed or when an exception occurs.	
Exceptions	FFS.	
Post Conditions	The eNodeB can use the new software.	
Traceability (*)		

4.2.3 Specification level requirement on Non-Automated SWM

REQ_NASWM_FUN_1

It shall be possible for an IRPManager to request to download software units to one or multiple network elements. A notification shall be generated at the end of download operation for both success and failure scenarios. The notification may optionally contain specific error conditions (e.g. insufficient disk space, communication error etc.) in case of failures.

REQ_NASWM_FUN_2

The IRPAgent should support a capability for the IRPManager to request the IRPAgent to cancel an ongoing download operation to one or multiple network elements. If download is not complete, software units that had been downloaded between the time download operation was invoked and the time when download operation was cancelled shall be deleted.

REQ_NASWM_FUN_3

It may be possible for an IRPManager to initiate installation of NE software to one or multiple network elements. A notification shall be generated at the end of installation operation for both success and failure scenarios. The notification may optionally contain specific error conditions in case of failures.

REQ_NASWM_FUN_4

The IRPAgent should support a capability for the IRPManager to request the IRPAgent to cancel an ongoing installation process to one or multiple network elements. If an install operation is cancelled by IRPManager before it is complete, software units that had been installed between the time install operation was invoked and the time when install operation was cancelled shall be uninstalled.

REQ_NASWM_FUN_5

It shall be possible for an IRPManager to activate NE software for one or multiple network elements. A notification shall be generated at the end of activation operation for both success and failure scenarios. The notification may optionally contain specific error conditions in case of failures.

REQ_NASWM_FUN_6

IRPManager shall be able to invoke fallback operation for one or multiple network elements after software installation or after software activation to fallback to a configuration it was in prior to software installation or software activation respectively.

REQ_NASWM_FUN_7

It shall be possible for IRPManager to retrieve information about the progress of NASWM.

REQ_NASWM_FUN_8

The IRPAgent should support a capability for the IRPManager to cancel an ongoing activation process to one or multiple network elements. If an activation operation is cancelled by IRPManager before it is complete, software units that had been not been activated between the time activation operation was invoked and the time when activation operation was cancelled shall be ready for later retry of activation.

4.2.3.1 Actor roles

FFS

4.2.3.2 Telecommunications resources

FFS

4.2.3.3 Use cases

4.2.3.3.1 Use case Non-Automated Software Update

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal (*)	Supply the new software to a Network Element (NE) which is already running in the network.	
Actors and Roles (*)	IRPManager	
Telecom resources	The E-UTRAN/EPC network	
Assumptions	IP network connectivity exists between the IRPManager and IRPAgent (i.e. DM or Network Element under system context A & B respectively) providing support for the non-automated software update process.	
Pre conditions	Software is available	
Begins when	NE software is identified and ready to be downloaded	
Step 1 (*) (M|O)	Editor's Note: Some of the steps mentioned below may be combined. The details of whether an operation is optional or mandatory is for further study [SU1A] IRPManager initiates a request over Itf-N to download software [SU1B] The software is successfully downloaded into the NE. [SU2A] IRPManager requests over Itf-N to install the downloaded software [SU2B] Software is successfully installed on the NE. [SU3A] IRPManager requests over Itf-N to activate the installed software [SU3B] The software is successfully activated on the NE. [SU4] The IRPManager is informed about the inventory change that new software for this NE is activated and ready to be used	
Ends when (*)	Ends when software is successfully activated or when an exception occurs.	
Exceptions	FFS.	
Post Conditions	The new software is operational.	
Traceability (*)		

4.2.3.3.2 Fallback during Non-Automated Software Update

Fallback during NE Software Installation:

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal (*)	To allow IRPManager to initiate fallback for Network Element(s) undergoing a software update	
Actors and Roles (*)	IRPManager	
Telecom resources	The E-UTRAN/EPC network	
Assumptions		
Pre conditions	Software has been successfully downloaded on the NE	
Begins when	IRPManager has initiated fallback request	
Step 1 (*) (M|O)	Editor's Note: Some of the steps mentioned below may be combined. The details of whether an operation is optional or mandatory is for further study [SU1A] IRPManager requests over Itf-N to install the downloaded software [SU1B] Installation of the NE software fails [SU2] IRPManager decides to initiate fallback [SU3] The software may be uninstalled on the NE (non-service affecting) but it is not always necessary [SU4] The IRPManager is informed that fallback is successful. A fallback is also allowed under success scenarios as mentioned below. [SU1A] IRPManager requests over Itf-N to install the downloaded software [SU1B] Software is successfully installed on the NE (non-service affecting) [SU2] IRPManager decides to initiate fallback [SU3] The software may be uninstalled on the NE (non-service affecting) [SU4] The IRPManager is informed that fallback is successful.	
Ends when (*)	NE continues to use the software version it was in before the fallback operation was invoked or when there is an exception	
Exceptions	FFS.	
Post Conditions	The NE remains in same version it was in before fallback was invoked	
Traceability (*)		

Fallback during NE Software Activation:

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal (*)	To allow IRPManager to initiate fallback for Network Element(s) undergoing a software update	
Actors and Roles (*)	IRPManager	
Telecom resources	The E-UTRAN/EPC network	
Assumptions		
Pre conditions	Software has been successfully downloaded and installed on the NE	
Begins when	IRPManager has initiated fallback request	
Step 1 (*) (M|O)	Editor's Note: Some of the steps mentioned below may be combined. The details of whether an operation is optional or mandatory is for further study [SU1A] IRPManager requests over Itf-N to install the downloaded software [SU1B] Software is successfully installed on the NE [SU2A] IRPManager requests over Itf-N to activate the installed software [SU2B] Activation of the NE software fails [SU3] IRPManager decides to initiate fallback [SU4] Changes made during activation are successfully reverted on the NE [SU5] The IRPManager is informed that fallback is successful. A fallback is also allowed under success scenarios as mentioned below. [SU1A] IRPManager requests over Itf-N to install the downloaded software [SU1B] Software is successfully installed on the NE [SU2A] IRPManager requests over Itf-N to activate the installed software [SU2B] The software is successfully activated on the NE [SU3] IRPManager decides to initiate fallback on the NE [SU4] Changes during activation are successfully reverted on the NE [SU5] The IRPManager is informed that fallback is successful.	
Ends when (*)	NE uses the software version it was in before the activation operation was invoked or when there is an exception	
Exceptions	FFS.	
Post Conditions	The NE has successfully gone back to the version it was in before activation of software	
Traceability (*)		

4.2.3.3.3 Backup Network Element Software Configuration Data

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal (*)	To allow IRPManager backup network element software configuration data	
Actors and Roles (*)	IRPManager	
Telecom resources	The E-UTRAN/EPC network	
Assumptions		
Pre conditions	None specific. NE is up and running	
Begins when	IRPManager initiates backup request and indicates the software to be backed up	
Step 1 (*) (M|O)	[SU1] IRPManager requests via Itf-N to backup one or multiple NE software configuration data (e.g. parameters which influence the usage/performance of software and can be changed by the software user without changing the software itself, data files that have these parameters etc) from one or multiple Network Elements. A location may also be specified (e.g. a preconfigured place or user defined location). [SU2] IRPAgent initiates backup of NE software configuration data. [SU3] NE software configuration data is successfully backed up in the location specified. [SU4] The IRPManager is informed that backup is successful.	
Ends when (*)	Ends when backup is successful or when there is an exception	
Exceptions		
Post Conditions	The NE software configuration data is successfully backed up	
Traceability (*)		

4.2.3.3.4 Restore Network Element Software Configuration Data

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal (*)	To allow IRPManager restore software configuration data for Network Element(s) from a backed up software entity	
Actors and Roles (*)	IRPManager	
Telecom resources	The E-UTRAN/EPC network	
Assumptions		
Pre conditions	A backup of software configuration data to be restored is available	
Begins when	IRPManager initiates a restore request	
Step 1 (*) (M|O)	[SU1] IRPManager requests over Itf-N to restore one or multiple NE software configuration data for one or multiple Network Elements from previously backed up software. [SU1B] The restore operation is initiated [SU2] The software is successfully restored [SU3] The IRPManager is informed that software configuration data restore is successful.	
Ends when (*)	Ends when backup is successful or when there is an exception	
Exceptions	FFS.	
Post Conditions	The NE software is successfully restored	
Traceability (*)		

Annex A (informative): Change history

Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
					Change history		
2008-12	SP-42	SP-080715	--	--	Submitted to SA#42 for information and approval	1.0.0	8.0.0
2009-03	SP-43	SP-090213	001	--	Correction of clause numbering	8.0.0	8.1.0
2009-03	SP-43	SP-090217	002	1	Generic use case for Non-Automated Software Management	8.1.0	9.0.0
2009-03	SP-43	SP-090217	003	1	Use case for backup and restore of network element software	8.1.0	9.0.0
2009-03	SP-43	SP-090217	004	1	Use case for Fallback during Non-Automated Software Management	8.1.0	9.0.0
2009-06	SP-44	SP-090290	005	2	Requirements for Non-Automated Software Management	9.0.0	9.1.0
2009-06	SP-44	SP-090290	006	--	To include the definitions of Non	9.0.0	9.1.0
2009-09	SP-45	SP-090627	007	--	Add missing Requirement	9.1.0	9.2.0
2010-01	--	--	--	--	Removal of track changes	9.2.0	9.2.1
2010-03	SP-47	SP-100035	008	--	Modify software management requirements to be reused by software upgrade	9.2.1	9.3.0
2010-03	SP-47	SP-100035	009	--	Rapporteur's cleanup	9.2.1	9.3.0
2010-09	SP-49	SP-100489	010	--	Correct the inconsistency with the IS	9.3.0	10.0.0
2010-12	SP-50	SP-100831	014	--	Add missing requirement to indicate availability of new SW	10.0.0	10.1.0
2012-09	SP-57	SP-120558	018	--	Correction on TS-family members in introduction	10.1.0	10.2.0
2012-09	SP-57	SP-120645	017	2	Addition of cancellation of Non-Automated Software Management operations	10.2.0	11.0.0