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TECHNICAL SPECIFICATION

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LTE;
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Information Service (IS)
(3GPP TS 32.392 version 12.0.0 Release 12)**

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650 Route des Lucioles

F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00   Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C

Association à but non lucratif enregistrée à la

Sous-Préfecture de Grasse (06) N° 7803/88

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Contents

Foreword

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

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x the first digit:

1 presented to TSG for information;

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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:

32.391: "Delta Synchronization Integration Reference Point (IRP); Requirements".

32.392: "Delta Synchronization Integration Reference Point (IRP); Information Service (IS)".

32.396: "Delta Synchronization Integration Reference Point (IRP); Solution Set (SS) definitions".

The Itf-N interface is built up by a number of IRPs and a related Name Convention, which realise the functional capabilities over this interface. The basic structure of the IRPs is defined in 3GPP TS 32.101 [1] and 3GPP TS 32.102 [2].

IRPManagers (typically Network Management Systems) and IRPAgents (typically EMs or NEs) synchronize their data concerning alarms or configuration data. In certain scenarios this synchronization is lost or not done. This IRP provides functionality to significantly reduces the amount of data which needs to be transferred in order to re-establish synchronization.

1 Scope

The purpose of Delta Synchronization IRP is to define an interface through which an IRPManager can request only those data which changed (i.e. changed, were created or deleted) from a synchronization point onwards.

The present document is the Information Service of Delta Synchronization IRP. It defines, for the purpose of Delta Synchronization, the information observable and controlled by management system's client and it also specifies the semantics of the interactions used to carry this information.

2 References

The following documents contain provisions that, 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 TS 32.101: "Telecommunication management; Principles and high level requirements".

[2]   3GPP TS 32.102: "Telecommunication management; Architecture".

[3]   3GPP TS 32.302: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Information Service (IS)".

[4]   3GPP TS 32.391: "Telecommunication management; Delta Synchronization Integration Reference Point (IRP): Requirements".

[5]   3GPP TS 32.150: "Telecommunication management; Integration Reference Point (IRP) Concept and definitions".

[6]   3GPP TS 32.622: "Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Network Resource Model (NRM)".

[7]   3GPP TS 32.312: "Telecommunication management; Generic Integration Reference Point (IRP) management; Information Service (IS)".

[8]   3GPP TS 32.602: "Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP): Information Service (IS)".

[9]   3GPP TS 32.662: "Telecommunication management; Configuration Management (CM); Kernel CM; Information Service (IS)".

[10]   3GPP TS 32.342: "Telecommunication management; File Transfer (FT); Integration Reference Point (IRP): Information Service (IS)".

[11]   3GPP TS 32.111-2: "Telecommunication management; Fault Management; Part 2: Alarm 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 3GPP TS 32.101 [1], 3GPP TS 32.102 [2] and 3GPP TS 32.391 [4] apply.

synchPoint Creation Policy: The IRPAgent may create synchronizationPoint in different policies. These policies are called synchPoint creation policies. There are two synchPoint Creation policies:

AgentScheduledPolicy: A new synchronizationPoint is created by the IRPAgent on the IRPAgent's internal decision, that decision is not related to any IRPManager's operations. In this mode, after successful delta synchronization, the IRPAgent does not create a new synchronizationPoint.

ManagerRequestPolicy: The new synchronizationPoint is requested by the IRPManager. The exact time for this synchronizationPoint is determined by the IRPAgent.
The IRPAgent that supports either AgentScheduledPolicy or ManagerRequestPolicy to create a new synchronizationPoint can claim compliance to this specification.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:
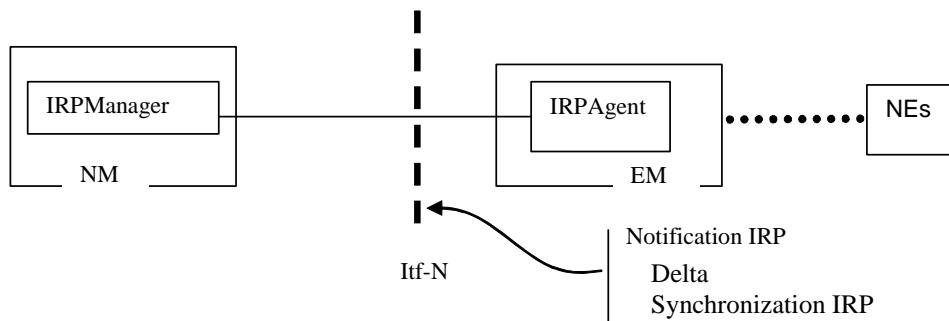
CM	Configuration Management
EM	Element Manager
IOC	Information Object Class
IRP	Integration Reference Point
IS	Information Service (see 3GPP TS 32.101 [1])
Itf-N	Interface N
NE	Network Element

4 System overview
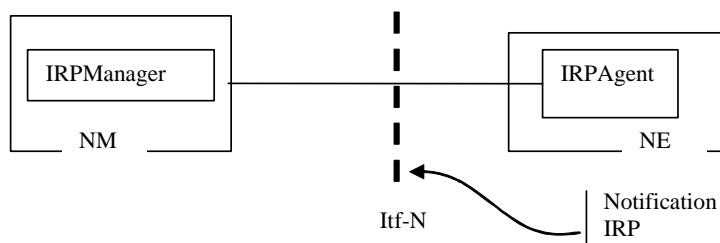
4.1 System context

The general definition of the System Context for the present IRP is found in 3GPP TS 32.150 [5], clause 4.7.

In addition, the set of related IRP(s) relevant to the present IRP is shown in figures 4.1-1 and 4.1-2.

Figure 4.1.1: System Context A

Figure 4.1.2 : System Context B

5 Information Object Classes
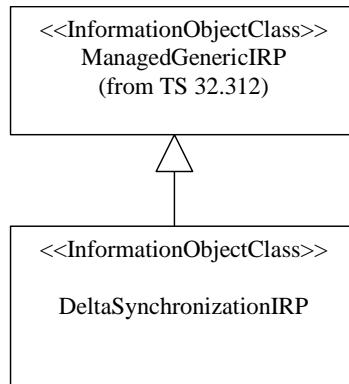
5.1 Information entities imported and local labels

Label reference	Local label
3GPP TS 32.622 [6], information object class, Top	Top
3GPP TS 32.622 [6], information object class, IRPAgent	IRPAgent
3GPP TS 32.622 [6], information object class, GenericIRP	GenericIRP
3GPP TS 32.312 [7], information object class, ManagedGenericIRP	ManagedGenericIRP
3GPP TS 32.302 [3], information object class, NotificationIRP	NotificationIRP

5.2 Class Diagram
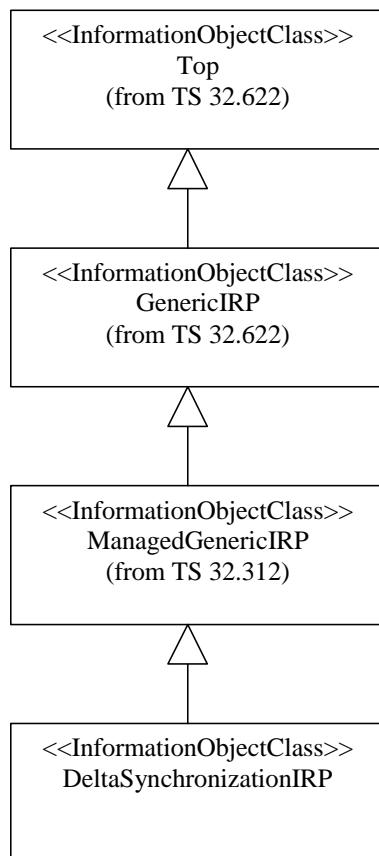
5.2.1 Attributes and relationships

This clause introduces the set of Information Object Classes (IOCs) that encapsulate information within the `IRPAgent`. The intent is to identify the information required for the delta synchronization IRP Agent implementation of its operations and notification emission. This clause provides the overview of all support object classes in UML. Subsequent clauses provide more detailed specification of various aspects of these support object classes.

Figure 5.2.1: Information Object Class (IOC) UML Diagram

5.2.2 Inheritance

Figure 5.2.2: Information Object Class (IOC) Inheritance UML Diagram

5.3   Information Object Class (IOC) definitions

5.3.1   DeltaSynchronizationIRP

5.3.1.1   Definition

`DeltaSynchronizationIRP` is the representation of the delta synchronization capabilities specified by the present document. This IOC inherits from `ManagedGenericIRP` IOC specified in 3GPP TS 32.312 [7].

5.4   Information relationship definitions
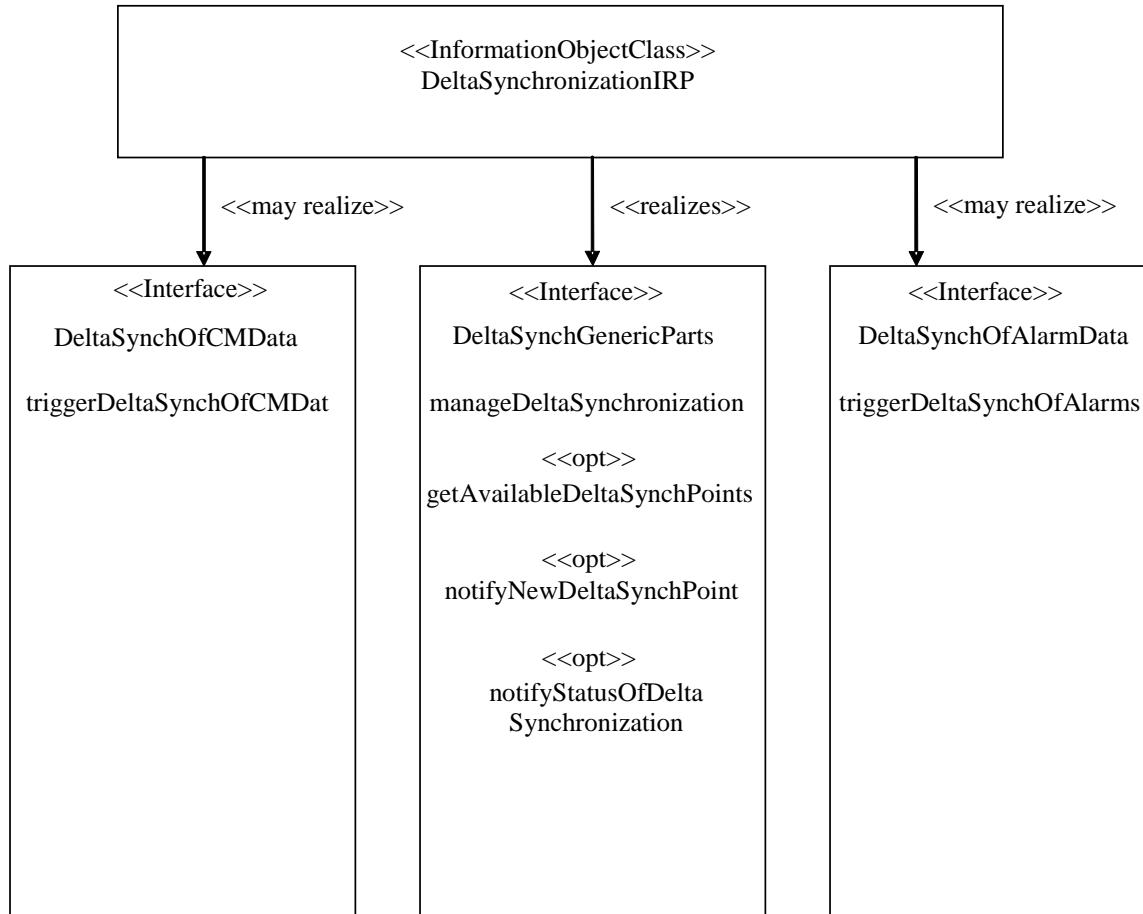
5.5   Information attribute definition

6 Interface definition

6.1 Class diagram

Figure 6.1: Class diagram

6.2 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.

6.3 deltaSynchGenericParts Interface (M)

6.3.1 Operation manageDeltaSynchronization (M)

6.3.1.1 Definition

This operation allows an IRPManager to activate or deactivate the delta synchronization functionality for CMData or/and AlarmData. A change of at least one activation status triggers the sending of `notifyStatusOfDeltaSynchronization`.

As default settings the delta synchronization functionality for both alarms and CM data is deactivated.

6.3.1.2 Input parameters

Parameter Name	Qualifier	Information type	Comment
`managerReference`	M	See 32.302 [3]	See 3GPP TS 32.302 [3]
`manageDeltaSynchForAlarmData`	CM	ENUM (`Activate, Deactivate`)	Constraint: `manageDeltaSynchForCMData` is absent.
`manageDeltaSynchForCMData`	CM	ENUM (`Activate, Deactivate`)	Constraint: `manageDeltaSynchForAlarmData` is absent

6.3.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
`status`	M	ENUM (`Success, Failure`)	If the functionality is already activated/disactivated the output value is `Success` and no `notifyStatusOfDeltaSynchronization` is triggered. Failure reasons are: `DeltaSynchNotSupportedForCMData`, `DeltaSynchNotSupportedForAlarmData` and other unspecified reasons.

6.3.1.4 Pre-condition

`deltaSynchSupported`

Assertion Name	Definition
`deltaSynchSupported`	The IRPAgent supports the delta synchronization functionality.

6.3.1.5 Post-condition

`requestGranted`

Assertion Name	Definition
`requestGranted`	The delta synchronization functionality is activated or deactivated according to the input parameters `manageDeltaSyncForAlarmData` and `manageDeltaSynchForCMData`.

6.3.1.6   Exceptions

Name	Properties
operation_failed	**Condition:** the pre-condition is false or the post-condition is false. **Returned Information:** The output parameter status. **Exit state:** Entry state.

6.3.2   Operation getAvailableDeltaSynchPoints (O)

6.3.2.1   Definition

This operation allows an IRPManager to request information about the synchronization points for which the IRPManager can request delta synch data from the IRPAgent.

6.3.2.2   Input parameters

Parameter Name	Qualifier	Information type	Comment
`managerReference`	O	See 32.302 [3]	See 3GPP TS 32.302 [3]
`synchPointsForCMDataRequested`	CM	Boolean	Constraint: `synchPointsForAlarmDataRequested` is absent
`synchPointsForAlarmDataRequested`	CM	Boolean	Constraint: `synchPointsForCMDataRequested` is absent

Remark: The constraints allow the simultaneous presence of both `synchPointsForCMDataRequested` and `synchPointsForAlarmDataRequested` in the input.

6.3.2.3   Output parameters

Parameter Name	Qualifier	Matching Information	Comment
`synchPointListForAlarms`	CM	LIST of SynchPoint	Constraint: `synchPointsForAlarmDataRequested` was present in the input and had value TRUE. If `synchPointsForAlarmDataRequested` was not present, then this parameter shall not be present in the output. If delta synchronization for alarm data is deactivated, then this list shall be empty. The content of this list is valid, if the `status` is either `Success` or `DeltaSynchNotSupportedForCMData` or `DeltaSynchForCMDataDeactivated`
`synchPointListForCMData`	CM	LIST of SynchPoint	Constraint: `synchPointsForCMDataRequested` was present in the input and had value TRUE. If `synchPointsForCMDataRequested` was not present, then this parameter shall not be present in the output. If delta synchronization for CM data is deactivated, then this list shall be empty. The content of this list is valid, if the `status` is either `Success` or `DeltaSynchNotSupportedForAlarmData` or `DeltaSynchForAlarmDataDeactivated`
`status`	M	ENUM (`Success`, `Failure`)	If both delta synchronization for CM data and alarm data are deactivated, then `status == DeltaSynchNotActive`. Failure reasons are: `DeltaSynchNotSupportedForCMData`, `DeltaSynchNotSupportedForAlarmData`, `DeltaSynchNotActive`, `DeltaSynchForCMDataDeactivated`, `DeltaSynchForAlarmDataDeactivated`, `Failure` and other unspecified reasons.

6.3.2.4   Pre-condition

`deltaSynchronizationSupported`

Assertion Name	Definition
deltaSynchronizationSupported	The delta synchronization functionality is supported.

6.3.2.5   Post-condition

`synchPointListsReturned`

Assertion Name	Definition
synchPointListsReturned	The available information is returned.

6.3.2.6   Exceptions

Name	Properties
operation_failed	**Condition:** the pre-condition is false or the post-condition is false. **Returned Information:** The output parameter status. **Exit state:** Entry state.

6.3.3 Notification `notifyNewDeltaSynchPoint` (O)

6.3.3.1 Definition

If the IRPAgent has successfully performed the creation of a new delta synchronization point, then this notification is sent out to all subscribed IRPManagers. If an implementation chooses that the new delta synchronization point shall only be valid for specific IRPManagers, it can send the notification only to those.

This notification is triggered by any of the following:

1. An operation `triggerDeltaSynchOfCMData` or `triggerDeltaSynchOfAlarmData returns` the status `== Success` and a new synchronization point is created).

2. An IRPAgent's internal decision to create a new synchronization point and that decision is not related to any IRPManager's operations.

The use of the synchronizationPoint delivered in this notification may result in different views of the managed instances by IRPManager and IRPAgent, in some scenarios. To avoid such pitfall, it is recommended that the IRPManager should do the following:

1. Establish the first synchronizationPoint using the full synchronization; and

2. Use the   operations in the future to a) maintain/track the list of synchronization points and b) to update its view of the CM managed instances and FM alarm information.

6.3.3.2 Input Parameters

Parameter Name	Qualifier	Matching Information	Comment
`newSynchPoint`	M, Y	GeneralizedTime	
`requestedSynchPoint`	M, N	GeneralizedTime	This parameter allows an IRPManager to relate this notification to its `triggerDeltaSynchOfCM/AlarmData` request. In case the newSynchPoint was triggered by an IPRAgent's internal decision this parameter carries the value 0.
`deltaSynchPointType`	M, Y	ENUM (`deltaSynchPointForAlarm,` `deltaSynchPointForCMData`)	
`triggeredByAgentOrManager`	M, Y	ENUM (`iRPAgent,` `iRPManager`)	This parameter indicates whether the creation of the new synchronization point was triggered by an IPRAgent's internal decision or by the request of an IRPManager for an operation `triggerDeltaSynchOfCMData/alarms`
`agentOrManagerReference`	M, Y	String	In case the new synch point was triggered by an IPRAgent's internal decision this parameter carries the reference of the IRPAgent, else the `managerReference` of the IRPManager which requested the operation `triggerDeltaSynchOfCMData/alarms`

6.3.3.3 Triggering Event

6.3.3.3.1 From-state

newSynchPointSuccessfullyCreated

Assertion Name	Definition
newSynchPointSuccessfullyCreated	The IRPAgent has successfully performed the to creation of a new delta synchronization point, see clause 6.3.3.1.

6.3.3.3.2 To-state

irpManagersInformedAboutNewSynchPoint

Assertion Name	Definition
irpManagersInformedAboutNewSynchPoint	The involved IRPManagers are informed about the new synchPoint.

6.3.4   Notification notifyStatusOfDeltaSynchChanged (O)

6.3.4.1   Definition

If the IRPAgent has successfully performed a `manageDeltaSynchronization` request and the status of delta synchronization for alarm data and/or for CM data has changed, then this notification is sent out.

6.3.4.2   Input Parameters

Parameter Name	Qualifier	Information type	Comment
managerReference	M, Y	See 32.302 [3]	See 3GPP TS 32.302 [3]
deltaSynchStatusForCMData	M, Y	ENUM (Activated, Deactivated)	
deltaSynchStatusForAlarmData	M, Y	ENUM (Activated, Deactivated)	

6.3.4.3   Triggering Event

6.3.4.3.1   From-state

statusOfDeltaSynchWasChanged

Assertion Name	Definition
statusOfDeltaSynchWasChanged	The IRPAgent has successfully performed a `manageDeltaSynchronization` request and at least one delta synchronization status changed.

6.3.4.3.2   To-state

irpManagersInformedAboutTheStatusChange

Assertion Name	Definition
irpManagersInformedAboutTheStatusChange	The IRPManagers are informed about the new delta synch status.

6.4 `deltaSynchOfCMData` Interface (O)

6.4.1 Operation triggerDeltaSynchOfCMData (M)

6.4.1.1 Definition

This operation allows an IRPManager to request information about CMData which has changed since the specified synchronization point. The information returned may be filtered/restricted   by the input parameters `baseMOInstance` and `scope`.

If the operation is successful, then a new delta synchronization point for CMData is created, if the IRPAgent supports the ManagerRequestPolicy.

If the IRPAgent only supports AgentScheduledPolicy, the latest synchronizationPoint is returned to the IRPManager as the newSynchPoint.

The Synchronization points created are not related to `baseMOInstance` and `scope` used in operations.   In other words, it is not possible to establish synchronization points for just a subset of the managed objects.

For obtaining an initial synchronization point (e.g. in the case that the IRPManager does not have any valid configuration management information), IRPManager shall use this operation `triggerDeltaSyncOfCMdata` as follows to obtain the first synch point:

-    the input parameter `synchPoint` is present and the value is set to 0.

The IRPAgent responds with `newSynchPoint` a Synchronization point that the IRPManager can use as the input parameter synchPoint for future `triggerDeltaSynchOfCMData` requests.

A Solution Set may choose to split this operation in several operations (e.g. operations to get "iterator" which fulfil the criteria and other operations to retrieve the detailed information of the files from the "iterator").

If in the output of this operation a reference to a file is identified, then the availability of the file shall be announced by a notifyFileReady notification (see [10]).

6.4.1.2   Input parameters

Parameter Name	Qualifier	Information type	Comment
managerReference	O	See TS 32.302 [3]	See 3GPP TS 32.302 [3]
cmDataRequested	M	ENUM (DNsOnly, CompleteDataSet)	If cmDataRequested==DNsOnly: Only the DNs of MOIs are delivered in the output, not the complete data set of the MOIs. If dataRequested==CompleteDataSet: The complete data set of MOIs (including the attributes and their values) are delivered in the output.
baseMOInstance	O	See TS 32.602 [8]	See 3GPP TS 32.602 [8] This parameter is used to reduce the amount of data which is returned in deltaLists. Remark: The parameter objectInstance of a notifyCMsynchronizationRecommended notification could be used as input here. If this parameter is absent, then the all MOIs are used.
scope	O	See TS 32.662 [9]	See 3GPP TS 32.662 [9] This parameter can be used to reduce the amount of delta data which is returned in deltaLists. If baseMOInstance is present, then this parameter shall be present. If the parameter baseMOInstance is absent, then this parameter must be absent. If the IRP-Agent has no complete view of the requested scope, then it shall deliver all known delta data within the scope.
synchPoint	M	GeneralizedTime	The IRPManager asks for data which changed since this synchPoint.

6.4.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment

deltaLists	CM	`STRUCT <`
		`    STRUCT <`
		`        startTime,`
		`        endTime`
		`        >`
		`    ,`
		`    STRUCT <`
		`listOfCreatedInstances`
		`,`
		`listOfChangedInstances`
		`,`
		`listOfDeletedInstances`
		`>`
		`>`
		
		`listOf…Instances LIST:`
		`either`
		`LIST of STRUCT`
		`<MOInstance [,`
		`attributeList] >`
		`or`
		`a list of file`
		`reference`
			The second STRUCT contains the data which changed between `startTime` and `endTime`.
			
			In case the value of `status` equals "Success" an empty list indicates that the information at `startTime` and the information at `endTime` are identical..
			
			Constraint:
			If `status` is different from `Success` OR input `synchPoint==0`, then this parameter shall be absent, else it shall be present.
			
			Remark: Square brackets indicate optional parts in the data structure. If the IRPManager requested `DNsOnly`, then the attribute list shall be absent.
			
			If the values of a managed object, identified by its DN, at startTime and at endTime are identical, then
			  ▪ either nothing about it shall be reported in `the listOfChangedInstances`
			or
			  ▪ the value at endTime (or startTime) reported, provided that the value has changed between `startTime` and `endTime`
			If the managed object does not exist at `startTime` and `endTime`, then nothing about it shall be reported, if the IRPAgent can fulfil the delta synchronization request exactly, i.e. for exactly the request `synchPoint`.
			If an instance is deleted and a new instance is created with the same identifier as the deleted instance, then both the creation and the deletion shall be reported.
			
			If several file references are used, then IRPManager shall process them in sequence, i.e. first file first, second file as second, etc. .

newSynchPoint	CM	GeneralizedTime	Constraint: `baseMOInstance` and `scope` were absent in the input This parameters defines a new synchronization point which can be used as input to this operation in the future.

Status	M	`ENUM (`
		`Success,`
		`Failure`
		`)`
			Failure reasons are:
			`SynchrPointTooLongAgo,`
			`TooManyChangesFullSynchronizationRecommended,`
			`SynchPointUnknown,`
			`DeltaSynchNotSupportedForCMData,`
			`DeltaSynchForCMDataDeactivated,`
			and other unspecified reasons.
			
			In case the deltaSynchronizationIRP's data has been rebuilt, e.g. after a "crash", `SynchPointUnknown` is used.

6.4.1.4 Pre-condition

`baseMOInstanceExists` AND `deltaSynchronizationOfCMDataIsActive`

Assertion Name	Definition
`baseMOInstanceExists`	`baseMOInstance` does exist (Assertion == TRUE if no `baseMOInstance` was specified).
`deltaSynchronizationOfCMDataIsActive`	The delta synchronization functionality for CMData is active

6.4.1.5 Post-condition

`deltaListsReturned`

Assertion Name	Definition
`deltaListsReturned`	The required information is returned.

6.4.1.6 Exceptions

Name	Properties
`operation_failed`	**Condition:** the pre-condition is false or the post-condition is false. **Returned Information:** The output parameter status. **Exit state:** Entry state.

6.5 deltaSynchOfAlarmData Interface (O)

6.5.1 Operation triggerDeltaSynchOfAlarms (M)

6.5.1.1 Definition

This operation allows an IRPManager to request information about all alarm information which has changed since the specified synchronization point. The information returned may be filtered/restricted by the input parameters `baseMOInstance` and `scope`.

If the operation is successful, then a new delta synchronization point for alarm data is created, if the IRPAgent supports the ManagerRequestPolicy.

If the IRPAgent only supports AgentScheduledPolicy, the latest synchronizationPoint is returned to the IRPManager as the newSynchPoint.

The synchronization points created are not related to `baseMOInstance` and `scope` used in operations. In other words, it is is not possible to establish synchronization points for just a subset of the managed objects

For obtaining an initial synchronization point (e.g. in the case that the IRPManager does not have any valid alarm information), IRPManager shall use this operation `triggerDeltaSynchOfAlarms` as follows to obtain the first synch point:

- the input parameter `synchPoint` is present and the value is set to 0.

The IRPAgent responds with `newSynchPoint` a synchronization point that the IRPManager can use as input parameter synchPoint for future `triggerDeltaSynchOfAlarms` requests.

A Solution Set may choose to split this operation in several operations (e.g. operations to get "iterator" which fulfil the criteria and other operations to retrieve the detailed information of the files from the "iterator").

If in the output of this operation a reference to a file is identified, then the availability of the file shall be announced by a notifyFileReady notification (see [10]).

6.5.1.2   Input parameters

Parameter Name	Qualifier	Information type	Comment
managerReference	O	See 3GPP TS 32.302 [3]	See 3GPP TS 32.302 [3]
alarmDataRequested	M	ENUM (AlarmIdsOnly, CompleteAlarmInformation)	If `dataRequested== AlarmIdsOnly`: Only the alarmed values are delivered in the output, not the complete alarm information. If `dataRequested==CompleteDataSet`: The complete alarm information are delivered in the output.
baseMOInstance	O	See 3GPP TS 32.602 [8]	See 3PP TS 32.602 [8] This parameter is used to reduce the amount of data which is returned in `deltaLists`. Remark: The parameter objectInstance of a notifyAlarmListRebuilt notification could be used as input here. If this parameter is absent, then the all MOIs visible via Itf-N is used.
scope	O	See 3PP TS 32.662 [9]	See 3PP TS 32.662 [9] This parameter can be used to reduce the amount of delta data which is returned in `deltaLists`. If the parameter `baseMOInstance` is present, then this parameter shall be present. If the parameter `baseMOInstance` is absent, then this parameter must be absent. If the IRP-Agent has no complete view of the requested scope, then it shall deliver all known delta data within the scope.
synchPoint	M	GeneralizedTime	The IRPManager asks for data which changed since this synchPoint.

6.5.1.3   Output parameters

Parameter Name	Qualifier	Matching Information	Comment

deltaLists	CM	STRUCT <
		   STRUCT <
		     startTime,
		     endTime
		     >
		   ,
		   STRUCT <
		listOfNewAlarms ,
		listOfChangedAlarms,
		listOfDeletedAlarms
		>
		>
		
		listOf…Alarms LIST:
		either
		LIST of STRUCT
		<alarm [,
		parameterList] >
		or
		a filename
			These second STRUCT contains the data which changed between startTime and endTime.
			
			In case the value of status equals "Success" an empty list indicates that the information at startTime and the information at endTime are identical.
			
			Constraint:
			If value of status is different from Success OR input synchPoint==0, then this parameter shall be absent, else it shall be present.
			
			Remark: Square brackets indicate optional parts in the data structure. If the IRPManager requested AlarmIdsOnly, then the parameter list shall be absent.
			
			If an alarm information, identified by its alarmId, at startTime and at endTime is identical, then either
			  ▪ nothing about it shall be reported
			or
			  ▪ the alarm information at endTime (or startTime) reported, provided that the alarm information has changed between startTime and endTime.
			If an alarm is raised and cleared again and acknowledged between startTime and endTime, then these changes should not be reported, if the IRPAgent can fulfil the delta synchronization request exactly
			If an alarm is deleted and a new alarm occurs with the same parameter values as the deleted alarm, then both the occurrence and the deletion shall be reported.
			
			If several file references are used, then IRPManager shall process them in sequence, i.e. first file first, second file as second, etc. .

newSynchPoint	CM	GeneralizedTime	Constraint: baseMOInstance and scope were absent in the input This parameters defines a new synchronization point which can be used as input to this operation in the future.
Status	M	ENUM (Success, Failure)	Failure reasons are: SynchPointTooLongAgo, TooManyChangesFullSynchronizationRecommended, SynchPointUnknown, DeltaSynchNotSupportedForAlarmData, DeltaSynchForAlarmsNotActive, and other unspecified reasons. In case the deltaSynchronizationIRP's data has been rebuilt, e.g. after a "crash", SynchPointUnknown is used.

6.5.1.4   Pre-condition

baseMOInstanceExists AND deltaSynchOfAlarmDataIsActive

Assertion Name	Definition
baseMOInstanceExists	baseMOInstance does exist. (Assertion == TRUE if no baseMOInstance was specified).
deltaSynchOfAlarmDataIsActive	The delta synchronization functionality for alarms is active

6.5.1.5 Post-condition

`deltaListsReturned`

Assertion Name	Definition
deltaListsReturned	The required file information is returned.

6.5.1.6 Exceptions

Name	Properties
operation_failed	**Condition:** the pre-condition is false or the post-condition is false. **Returned Information:** The output parameter status. **Exit state:** Entry state.

7 Operation Modes

Several modes of operation for delta Synchronization are possible. An implementation supporting at least one of them can claim compliance to this specification.

For each mode of operation, the `DeltaSynchronizationIRP` needs to support CMData delta Synchronization or AlarmData delta Synchronization or both.

Further details to the operation modes and examples how to use them are supplied in Annex A.

7.1 Delta Synchronization Mode DSM1

In this operation mode DSM1 the `DeltaSynchronizationIRP` only needs to support the following operations and notifications:

- `triggerDeltaSynchOfCMData`

- `triggerDeltaSyncOfAlarmData`

- optionally `notifyNewDeltaSynchPoint`

In this mode of operation, the `DeltaSynchronizationIRP` may ignore the use of `managerReference` input parameter.

7.2 Delta Synchronization Mode DSM2

In this operation mode DSM2, the use of `managerReference` is mandatory.

Otherwise, in this mode of operation the `DeltaSynchronizationIRP` supports all operations and notifications and their parameters which are qualified as M(andatory) in this specification.

7.3 Delta Synchronization Mode DSM3

In this mode of operation DSM3, the `DeltaSynchronizationIRP` supports all operations and notifications and their parameters as defined in this specification.

Annex A (informative):
Modes of operation for delta synchronization

The following two modes of operations are possible. IRPAgent can claim compliance if only one is supported.

A.1   Operation Mode DSM1

Example for this mode of operation:

Suppose t0, t1, t2, t3, t4 and so on are the synchPoints.

Suppose an IRPManager invokes a trigger with synchPoint==0 (requesting full sync data) at tx where t2<tx<t3, the `DeltaSynchronizationIRP` will return all data up to t2 and return the t2 as the newSynchPoint.

This IRPManager should use t2 as the synchPoint for future trigger.

Suppose this IRPManager invokes a trigger with synchPoint==t2 at ty where t4<ty<t5, the `DeltaSynchronizationIRP` will return delta data between t2 and t4.

This mode of operation is suitable for IRPManagers that do not require synchronization of data at all time.

In this mode of operation, the `DeltaSynchronizationIRP` may pre-assign the synch points based on a fixed frequency. In the example above, the durations between sync points t0, t1, t2 and so on would be identical. This frequency can be a system configuration time parameter and made known to IRPManager via non-standard means.

A.2   Operation Mode DSM2

This mode of operation supports to handle requests of individual IRPManagers individually.

This mode of operation is suitable for an IRPManager that require synchronization of data at any time, i.e. not requiring synchronization of data at some predefined fixed intervals.

A.3   Operation Mode DSM3

This mode of operation provides all options of delta Synchronization.

Annex B (informative):
Change history

Change history								
Date	**TSG #**	**TSG Doc.**	**CR**	**R**	**Subject/Comment**	**Cat**	**Old**	**New**
Dec 2006	SA_34	SP-060735	--	--	Submitted to SA#34 for Information	--	1.0.0	
Mar 2007	SA_35	SP-070053	--	--	Submitted to SA#35 for Approval	--	2.0.0	7.0.0
Jun 2007	SA_36	SP-070276	0001	--	Correct the information type of the input parameter	F	7.0.0	7.1.0
Jun 2007	SA_36	SP-070276	0002	--	Add missing mode of operations	F	7.0.0	7.1.0
Sep 2007	SA_37	SP-070612	0003	--	Add missing type definition	F	7.1.0	7.2.0
Sep 2007	SA_37	SP-070675	0004	1	Correct the parameter definitions of operation getAvailableDeltaSynchPoints	F	7.1.0	7.2.0
Dec 2008	SA_42	--	--	--	Upgrade to Release 8	--	7.0.0	8.0.0
Dec 2009	-	-	-	-	Update to Rel-9 version	--	8.0.0	9.0.0
2011-03	-	-	-	-	Update to Rel-10 version (MCC)		9.0.0	10.0.0
2012-09	-	-	-	-	-	Update to Rel-11 version (MCC)	10.0.0	**11.0.0**
2014-10	-	-	-	-	-	Update to Rel-12 version (MCC)	11.0.0	**12.0.0**

History

Document history		
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