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3rd Generation Partnership Project;

Technical Specification Group Services and System Aspects;

Telecommunication management;

Delta synchronization Integration Reference Point (IRP); Information Service (IS)

(Release 16)

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# 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:

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

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

32.396: "Delta SynchronizationIntegration 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 SynchronizationIRP 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 SynchronizationIRP. 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.



Delta Synchronization IRP

Figure 4.1.1: System Context A



Delta Synchronization IRP

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

none

## 5.5 Information attribute definition

none

# 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 Successand 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** |
| 2016-01 | - | - | - | - | Update to Rel-13 version (MCC) |  | 12.0.0 | **13.0.0** |
| 2017-03 | SA#75 | - | - | - | Promotion to Release 14 without technical change |  | 13.0.0 | **14.0.0** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2018-06 |  |  |  |  |  | Update to Rel-15 version (MCC) | 15.0.0 |
| 2020-07 | - | - | - | - | - | Update to Rel-16 version (MCC) | **16.0.0** |