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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
Telecommunication management;
Performance Management (PM)
Integration Reference Point (IRP):
Common Object Request Broker Architecture (CORBA)
Solution Set (SS)
(3GPP TS 32.413 version 7.0.0 Release 7)**



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Foreword

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

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where:

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 - 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:

- 32.411: "Performance Management (PM) Integration Reference Point (IRP): Requirements"
- 32.412: "Performance Management (PM) Integration Reference Point (IRP): Information Service (IS)"
- 32.413: "Performance Management (PM) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)"**
- 32.415 "Performance Management (PM) Integration Reference Point (IRP): eXtensible Markup Language (XML) definitions"

The present document is part of a set of TSs which describe the requirements and information model necessary for the Telecommunication Management (TM) of 3G systems. The TM principles and TM architecture are specified in 3GPP TS 32.101 [1] and 3GPP TS 32.102 [2].

A 3G system is composed of a multitude of Network Elements (NE) of various types and, typically, different vendors, which inter-operate in a co-ordinated manner in order to satisfy the network users' communication requirements. Any evaluation of PLMN-system behaviour will require performance data collected and recorded by its NEs according to a schedule established by the EM.

This aspect of the management environment is termed Performance Management. The purpose of any Performance Management activity is to collect performance related data, which can be used to locate potential problems in the network.

1 Scope

The present document specifies the Common Object Request Broker Architecture (CORBA) Solution Set (SS) for the IRP whose semantics is specified in PM (Performance Management) IRP: Information Service 3GPP TS 32.412 [7].

This Solution Set specification is related to 3GPP TS 32.412 V7.0.X.

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 TS 32.101: "Telecommunication management; Principles and high level requirements".
- [2] 3GPP TS 32.102: "Telecommunication management; Architecture".
- [3] 3GPP TS 32.411: "Telecommunication management; Performance Management (PM) Integration Reference Point (IRP): Requirements".
- [4] 3GPP TS 32.311: "Telecommunication management; Generic Integration Reference Point (IRP): Requirements".
- [5] 3GPP TS 32.303: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)".
- [6] 3GPP TS 32.300: "Telecommunication management; Configuration Management (CM); Name convention for Managed Objects".
- [7] 3GPP TS 32.412: "Telecommunication management; Performance Management (PM) Integration Reference Point (IRP): Information Service (IS)".
- [8] 3GPP TS 32.312: "Telecommunication management; Generic Integration Reference Point (IRP) management: Information Service (IS)".
- [9] OMG TC Document telecom/98-11-01: "OMG Notification Service".
<http://www.omg.org/technology/documents/>
- [10] 3GPP TS 32.401: "Telecommunication management; Performance Management (PM); Concept and requirements".

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], 3GPP TS 32.401 [10], 3GPP TS 32.411 [3] and the following apply:

IRP document version number string (or "IRPVersion"): See 3GPP TS 32.311 [4].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CM	Configuration Management
CORBA	Common Object Request Broker Architecture
DN	Distinguished Name
EM	Element Manager
IDL	Interface Definition Language
IS	Information Service
MOC	Managed Object Class
NE	Network Element
OMG	Object Management Group
PM	Performance Management
SS	Solution Set

4 Architectural features

The overall architectural feature of PMIRP is specified in 3GPP TS 32.411 [3].

This clause specifies features that are specific to the CORBA SS.

4.1 Notifications

Notifications are sent according to the Notification IRP: CORBA SS (see 3GPP TS 32.303 [5]).

The contents of the PMIRP notifications are defined in the present document.

4.2 Syntax for distinguished names and versions

The format of a Distinguished Name is defined in 3GPP TS 32.300 [6].

The version of this IRP is represented as a string (see also clause 3 for versions).

5 Mapping

5.1 Operation and Notification mapping

PMIRP: IS 3GPP TS 32.412 [7] defines semantics of operation and notification visible across the PMIRP. Table 5.1.1 indicates mapping of these operations and notifications to their equivalents defined in this SS.

Table 5.1.1: Mapping from IS Operations and Notification to SS equivalents

IS Operations/ notification 3GPP TS 32.412 [7]	SS Method	Qualifier
createMeasurementJob	create_measurement_job	M
stopMeasurementJob	stop_measurement_job	M
suspendMeasurementJob	suspend_measurement_job	O
resumeMeasurementJob	resume_measurement_job	O
listMeasurementJobs	list_measurement_jobs	M
createThresholdMonitor	create_threshold_monitor	O
deleteThresholdMonitor	delete_threshold_monitor	O
listThresholdMonitors	list_threshold_monitors	O
suspendThresholdMonitor	suspend_threshold_monitor	O
resumeThresholdMonitor	resume_threshold_monitor	O
getIRPVersion	get_pm_irp_versions	M
getOperationProfile (see note)	get_pm_irp_operations_profile	O
getNotificationProfile (see note)	get_pm_irp_notification_profile	O
notifyMeasurementJobStatusChanged	push_structured_events(See subclause 6.1)	M
notifyThresholdMonitorObjectCreation	push_structured_events (See subclause 6.1)	O
notifyThresholdMonitorObjectDeletion	push_structured_events (See subclause 6.1)	O
notifyThresholdMonitorStatusChanged	push_structured_events(See subclause 6.1)	O
NOTE: This operation is of ManagedGenericIRP IOC specified in 3GPP TS 32.312 [8]. The PMIRP IOC of [7] inherits from it.		

5.2 Operation parameter mapping

The PMIRP: IS 3GPP TS 32.412 [7] defines semantics of parameters carried in operations across the PMIRP. The following tables indicate the mapping of these parameters, as per operation, to their equivalents defined in this SS.

Table 5.2.1: Mapping from IS createMeasurementJob parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
iocName	PMIRPConstDefs::MOClassName mo_class	M
iocInstanceList	PMIRPConstDefs::MOInstanceList mo_instance_list	M
measurementCategoryList	PMIRPConstDefs::MeasurementCategoryList measurement_category_list	M
granularityPeriod	PMIRPConstDefs::GranularityPeriod granularity_period	M
reportingPeriod	PMIRPConstDefs::ReportingPeriod reporting_period	M
startTime	PMIRPConstDefs::IRPTimeOpt start_time	O
stopTime	PMIRPConstDefs::IRPTimeOpt stop_time	O
Schedule	PMIRPConstDefs::ScheduleOpt schedule	O
JobId	PMIRPConstDefs::JobId job_id	M
unsupportedList	PMIRPConstDefs::JUnsupportedList unsupported_list	M
priority	PMIRPConstDefs::JobPriorityOpt priority	O
status	Return value of type ManagedGenericIRPConstDefs::Signal Exception: CreateMeasurementJob, ManagedGenericIRPSystem::InvalidParameter, ManagedGenericIRPSystem::ParameterNotSupported, HighWorkLoad	M

Table 5.2.2: Mapping from IS stopMeasurementJob parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
jobId	PMIRPCConstDefs::JobId job_id	M
status	Return value of type PMIRPCConstDefs::Result Exception: StopMeasurementJob, UnknownJob, JobCannotBeStopped	M

Table 5.2.3: Mapping from IS suspendMeasurementJob parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
jobId	PMIRPCConstDefs::JobId job_id	M
status	Return value of type PMIRPCConstDefs::Result Exception: SuspendMeasurementJob, UnknownJob, JobAlreadySuspended, ManagedGenericIRPSystem::OperationNotSupported	M

Table 5.2.4: Mapping from IS resumeMeasurementJob parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
jobId	PMIRPCConstDefs::JobId job_id	M
status	Return value of type PMIRPCConstDefs::Result Exception: ResumeMeasurementJob, UnknownJob, JobsNotSuspended, HighWorkLoad, ManagedGenericIRPSystem::OperationNotSupported	M

Table 5.2.5: Mapping from IS listMeasurementJobs parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
jobIdList	PMIRPCConstDefs::JobIdList job_list_id	M
jobInfoList	PMIRPCConstDefs::JobInfoList job_info_list	M
status	Return value of type PMIRPCConstDefs::Result Exception: ListMeasurementJobs, ManagedGenericIRPSystem::InvalidParameter	M

Table 5.2.6: Mapping from IS createThresholdMonitor parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
iocName	PMIRPCConstDefs::MOClassName mo_class	M
iocInstanceList	PMIRPCConstDefs::MOInstanceList mo_instance_list	M
thresholdInfoList	PMIRPCConstDefs::ThresholdInfoList threshold_info_list	M
monitorGranularityPeriod	PMIRPCConstDefs::MonitorGranularityPeriod monitor_granularity_period	M
monitorId	PMIRPCConstDefs::MonitorId monitor_id	M
unsupportedList	PMIRPCConstDefs::MUnsupportedList unsupported_list	M
status	Return value of type ManagedGenericIRPCConstDefs::Signal Exception: CreateThresholdMonitor, ManagedGenericIRPSystem::InvalidParameter, ManagedGenericIRPSystem::OperationNotSupported	M

Table 5.2.7: Mapping from IS deleteThresholdMonitor parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
monitorId	PMIRPConstDefs::MonitorId monitor_id	M
status	Return value of type PMIRPConstDefs::Result Exception: DeleteThresholdMonitor, UnknownThresholdMonitor, ManagedGenericIRPSystem::OperationNotSupported	M

Table 5.2.8: Mapping from IS listThresholdMonitors parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
monitorIdList	PMIRPConstDefs::MonitorIdList monitor_id_list	M
monitorInfoList	PMIRPConstDefs::MonitorInfoList monitor_info_list	M
status	Return value of type PMIRPConstDefs::Result Exception: ListThresholdMonitors, ManagedGenericIRPSystem::InvalidParameter, ManagedGenericIRPSystem::OperationNotSupported	M

Table 5.2.9: Mapping from IS suspendThresholdMonitor parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
monitorId	PMIRPConstDefs::MonitorId monitor_id	M
status	Return value of type PMIRPConstDefs::Result Exception: SuspendThresholdMonitor, UnknownThresholdMonitor, ThresholdMonitorAlreadySuspended, ManagedGenericIRPSystem::OperationNotSupported	M

Table 5.2.10: Mapping from IS resumeThresholdMonitor parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
monitorId	PMIRPConstDefs::MonitorId monitor_id	M
status	Return value of type PMIRPConstDefs::Result Exception: ResumeThresholdMonitor, UnknownThresholdMonitor, ThresholdMonitorsNotSuspended, ManagedGenericIRPSystem::OperationNotSupported	M

Table 5.2.11: Mapping from IS getIRPVersion parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
versionNumberSet	Return value of type ManagedGenericIRPConstDefs::VersionNumberSet	M
status	Exception: GetPMIRPVersions	M

Table 5.2.12: Mapping from IS getOperationProfile parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
iRPVersion	ManagedGenericIRPConstDefs::VersionNumber pm_irp_version	M
operationNameProfile, operationParameterProfile	Return value of type ManagedGenericIRPConstDefs::MethodList	M

IS Operation parameter	SS Method parameter	Qualifier
status	Exception: GetPMIRPOperationsProfile, ManagedGenericIRPSystem::OperationNotSupported, ManagedGenericIRPSystem::InvalidParameter	M

Table 5.2.13: Mapping from IS `getNotificationProfile` parameters to SS equivalents

IS Operation parameter	SS Method parameter	Qualifier
iRPVersion	ManagedGenericIRPConstDefs::VersionNumber pm_irp_version	M
notificationNameProfile, notificationParameterProfile	Return value of type ManagedGenericIRPConstDefs::MethodList	M
status	Exception: GetPMIRPNotificationProfile, ManagedGenericIRPSystem::OperationNotSupported, ManagedGenericIRPSystem::InvalidParameter	M

5.3 Notification parameter mapping

The PMIRP: IS 3GPP TS 32.412 [7] defines semantics of parameters carried in notifications. The following table indicates the mapping of these parameters to their OMG CORBA Structured Event (defined in OMG Notification Service [9]) equivalents. The composition of OMG Structured Event, as defined in the OMG Notification Service [9], is:

```
Header
  Fixed Header
    domain_name
    type_name
    event_name
  Variable Header
Body
  filterable_body_fields
  remaining_body
```

The following tables list all OMG Structured Event attributes in the second column. The first column identifies the PMIRP: IS 3GPP TS 32.412 [7] defined notification parameters.

Table 5.3.1: Mapping for notifyMeasurementJobStatusChanged

IS Parameters	OMG CORBA Structured Event attribute	Qualifier	Comment
There is no corresponding IS attribute.	domain_name	M	It carries the IRP document version number string. See subclause 3.1. It indicates the syntax and semantics of the Structured Event as defined by the present document.
notificationType	type_name	M	This is constant string "notifyMeasurementJobStatusChanged".
There is no corresponding IS attribute.	event_name	M	It carries no information.
There is no corresponding IS attribute.	Variable Header		
objectClass, objectInstance	One NV pair of filterable_body_fields	M	NV stands for name-value pair. Order arrangement of NV pairs is not significant. The name of NV-pair is always encoded in string. Name of this NV pair is the MANAGED_OBJECT_INSTANCE of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is a string. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
notificationId	One NV pair of remaining_body	M	Name of NV pair is the NOTIFICATION_ID of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is a long. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
eventTime	One NV pair of filterable_body_fields	M	Name of NV pair is the EVENT_TIME of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is IRPTime. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
systemDN	One NV pair of filterable_body_fields	M	Name of NV pair is the SYSTEM_DN of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is a string. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
jobId	One NV pair of filterable_body_fields	M	Name of NV pair is the JOB_ID of PMIRPNotifications::notifyMeasurementJobStatusChanged. Value of NV pair is JobId of module PMIRPConstDefs.
jobStatus	One NV pair of remaining_body	M	Name of NV pair is the JOB_STATUS of PMIRPNotifications::notifyMeasurementJobStatusChanged. Value of NV pair is JobStatus of module PMIRPConstDefs.
reason	One NV pair of remaining_body	O	Name of NV pair is the REASON of PMIRPNotifications::notifyMeasurementJobStatusChanged. Value of NV pair is a string.

Table 5.3.2: Mapping for notifyThresholdMonitorObjectCreation

IS Parameters	OMG CORBA Structured Event attribute	Qualifier	Comment
There is no corresponding IS attribute.	domain_name	M	It carries the IRP document version number string. See subclause 3.1. It indicates the syntax and semantics of the Structured Event as defined by the present document.

IS Parameters	OMG CORBA Structured Event attribute	Qualifier	Comment
notificationType	type_name	M	This is constant string "notifyThresholdMonitorObjectCreation".
There is no corresponding IS attribute.	event_name	M	It carries no information.
There is no corresponding IS attribute.	Variable Header		
objectClass, objectInstance	One NV pair of filterable_body_fields	M	NV stands for name-value pair. Order arrangement of NV pairs is not significant. The name of NV-pair is always encoded in string. Name of this NV pair is the MANAGED_OBJECT_INSTANCE of interface AttributeNameValue of module NotificationIRPCConstDefs. Value of NV pair is a string. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
notificationId	One NV pair of remaining body	M	Name of NV pair is the NOTIFICATION_ID of interface AttributeNameValue of module NotificationIRPCConstDefs. Value of NV pair is a long. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
eventTime	One NV pair of filterable_body_fields	M	Name of NV pair is the EVENT_TIME of interface AttributeNameValue of module NotificationIRPCConstDefs. Value of NV pair is IRPTime. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
systemDN	One NV pair of filterable_body_fields	M	Name of NV pair is the SYSTEM_DN of interface AttributeNameValue of module NotificationIRPCConstDefs. Value of NV pair is a string. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
monitorId	One NV pair of remaining body	M	Name of NV pair is the MONITOR_ID of module PMIRPNotifications::notifyThresholdMonitorObjectCreation. Value of NV pair is MonitorId of module PMIRPCConstDefs.
monitorGranularityPeriod	One NV pair of remaining body	M	Name of NV pair is the MONITOR_GRANULARITY_PERIOD of module PMIRPNotifications::notifyThresholdMonitorObjectCreation. Value of NV pair is MonitorGranularityPeriod of module PMIRPCConstDefs.
thresholdMonitorStatus	One NV pair of remaining body	M	Name of NV pair is the MONITOR_STATUS of module PMIRPNotifications::notifyThresholdMonitorObjectCreation. Value of NV pair is MonitorStatus of module PMIRPCConstDefs.

Table 5.3.3: Mapping for notifyThresholdMonitorObjectDeletion

IS Parameters	OMG CORBA Structured Event attribute	Qualifier	Comment
There is no corresponding IS attribute.	domain_name	M	It carries the IRP document version number string. See subclause 3.1. It indicates the syntax and semantics of the Structured Event as defined by the present document.
notificationType	type_name	M	This is constant string "notifyThresholdMonitorObjectDeletion".
There is no corresponding IS attribute.	event_name	M	It carries no information.
There is no corresponding IS attribute.	Variable Header		
objectClass, objectInstance	One NV pair of filterable_body_fields	M	NV stands for name-value pair. Order arrangement of NV pairs is not significant. The name of NV-pair is always encoded in string. Name of this NV pair is the MANAGED_OBJECT_INSTANCE of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is a string. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
notificationId	One NV pair of remaining body	M	Name of NV pair is the NOTIFICATION_ID of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is a long. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
eventTime	One NV pair of filterable_body_fields	M	Name of NV pair is the EVENT_TIME of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is IRPTime. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
systemDN	One NV pair of filterable_body_fields	M	Name of NV pair is the SYSTEM_DN of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is a string. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
monitorId	One NV pair of filterable_body_fields	M	Name of NV pair is the MONITOR_ID of PMIRPNotifications::notifyThresholdMonitorObjectDeletion. Value of NV pair is MonitorId of module PMIRPConstDefs.

Table 5.3.4: Mapping for notifyThresholdMonitorStatusChanged

IS Parameters	OMG CORBA Structured Event attribute	Qualifier	Comment
There is no corresponding IS attribute.	domain_name	M	It carries the IRP document version number string. See subclause 3.1. It indicates the syntax and semantics of the Structured Event as defined by the present document.
notificationType	type_name	M	This is constant string "notifyThresholdMonitorStatusChanged".
There is no corresponding IS attribute.	event_name	M	It carries no information.
There is no corresponding IS attribute.	Variable Header		
objectClass, objectInstance	One NV pair of filterable_body_fields	M	NV stands for name-value pair. Order arrangement of NV pairs is not significant. The name of NV-pair is always encoded in string. Name of this NV pair is the MANAGED_OBJECT_INSTANCE of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is a string. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
notificationId	One NV pair of remaining_body	M	Name of NV pair is the NOTIFICATION_ID of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is a long. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
eventTime	One NV pair of filterable_body_fields	M	Name of NV pair is the EVENT_TIME of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is IRPTime. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
systemDN	One NV pair of filterable_body_fields	M	Name of NV pair is the SYSTEM_DN of interface AttributeNameValue of module NotificationIRPConstDefs. Value of NV pair is a string. See corresponding table in Notification IRP: CORBA SS (3GPP TS 32.303 [5]).
monitorId	One NV pair of filterable_body_fields	M	Name of NV pair is the MONITOR_ID of PMIRPNotifications::notifyThresholdMonitorStatusChanged Value of NV pair is MonitorId of module PMIRPConstDefs.
monitorStatus	One NV pair of remaining_body	M	Name of NV pair is the MONITOR_STATUS of PMIRPNotifications::notifyThresholdMonitorStatusChanged Value of NV pair is MonitorStatus of module PMIRPConstDefs.
reason	One NV pair of remaining_body	O	Name of NV pair is the REASON of PMIRPNotifications::notifyThresholdMonitorStatusChanged Value of NV pair is a string.

6 PMIRPNotification Interface

OMG CORBA Notification push operation is used to realise the notification of PMIRP Notifications. All the notifications in this interface are implemented using this `push_structured_event` method.

6.1 Method `push` (M)

```
module CosNotifyComm {  
  ...  
  Interface SequencePushConsumer : NotifyPublish {  
    void push_structured_events(  
      in CosNotification::EventBatch notifications)  
        raises( CosEventComm::Disconnected);  
  };  
  // SequencePushConsumer  
  ...  
}; // CosNotifyComm
```

NOTE 1: The `push_structured_events` method takes an input parameter of type `EventBatch` as defined in the `OMG CosNotification` module (OMG Notification Service [9]). This data type is the same as a sequence of Structured Events. Upon invocation, this parameter will contain a sequence of Structured Events being delivered to `IRPManager` by `IRPAgent` to which it is connected.

NOTE 2: The maximum number of events that will be transmitted within a single invocation of this operation is controlled by `IRPAgent` wide configuration parameter.

NOTE 3: The amount of time the supplier (`IRPAgent`) of a sequence of Structured Events will accumulate individual events into the sequence before invoking this operation is controlled by `IRPAgent` wide configuration parameter as well.

NOTE 4: `IRPAgent` may push `EventBatch` with only one Structured Event.

Annex A (normative): IDL specifications

A.1 IDL specification (file name "PMIRPConstDefs.idl")

```
//File: PMIRPConstDefs.idl
#ifndef _PM_IRP_CONST_DEFS_IDL_
#define _PM_IRP_CONST_DEFS_IDL_

#include <TimeBase.idl>

// This statement must appear after all include statements
#pragma prefix "3gppsa5.org"

/* ## Module: PMIRPConstDefs
This module contains commonly used definitions for PM IRP
=====
*/
module PMIRPConstDefs
{
    enum Result {OK, FAILURE};

    typedef string MOClassName;
    typedef string MOInstance;
    typedef sequence<MOInstance> MOInstanceList;
    typedef string MeasurementCategory;
    typedef sequence<MeasurementCategory> MeasurementCategoryList;
    typedef unsigned long GranularityPeriod; //The unit is minute.
    typedef unsigned long ReportingPeriod; //The unit is minute.
    typedef TimeBase::UtcT UTCTime;

    union IRPTimeOpt switch(boolean)
    {
        case TRUE: UTCTime value;
    };

    struct Time24
    {
        unsigned short hour; // 0-23
        unsigned short minute; // 0-59
    };

    struct IntervalOfDay
    {
        Time24 interval_start_time;
        Time24 interval_stop_time;
    };
    typedef sequence<IntervalOfDay> DailyScheduling;

    const short SUNDAY = 1;
    const short MONDAY = 2;
    const short TUESDAY = 4;
    const short WEDNESDAY = 8;
    const short THURSDAY = 16;
    const short FRIDAY = 32;
    const short SATURDAY = 64;

    typedef short DaysOfWeek;
    // Bit mask of week days,
    // e.g. "SUNDAY(1) and WEDNESDAY(8)" is encoded as 9.

    struct WeeklySchedulingElement
    {
        DaysOfWeek days;
        DailyScheduling intervals_of_day;
    };
    typedef sequence<WeeklySchedulingElement> WeeklyScheduling;
    enum ScheduleType { DAILY, WEEKLY };
    union Schedule switch (ScheduleType)
    {
        case DAILY: DailyScheduling daily_scheduling;
    };
};
```

```

    case WEEKLY: WeeklyScheduling weekly_scheduling;
};
union ScheduleOpt switch(boolean)
{
    case TRUE: Schedule value;
};

typedef unsigned long JobId;
typedef sequence<JobId> JobIdList;
struct JUnsupported
{
    MOInstance mo_instance;
    MeasurementCategory measurement_category;
    string reason;
};
typedef sequence<JUnsupported> JUnsupportedList;

/**
 * Defines the name of an attribute of a Managed Object
 */
typedef string MOAttributeName;

enum JobStatus {SCHEDULED, ACTIVE, SUSPENDED, STOPPED};
enum JobPriority {LOW, MEDIUM, HIGH};
union JobPriorityOpt switch (boolean)
{
    case TRUE: JobPriority value;
};

struct JobInfo
{
    JobId job_id;
    MOClassName mo_class;
    MOInstanceList mo_instance_list;
    MeasurementCategoryList measurement_category_list;
    GranularityPeriod granularity_period;
    ReportingPeriod reporting_period;
    IRPTimeOpt start_time;
    IRPTimeOpt stop_time;
    ScheduleOpt schedule;
    JobStatus job_status;
    JobPriorityOpt job_priority;
};
typedef sequence<JobInfo> JobInfoList;

typedef string MeasurementTypeName;
typedef string SubCounterName;
typedef short ProbableCause; //THRESHOLD_CROSSED = 351;

typedef string SpecificProblem;
typedef any ThresholdValue;
enum Severity {WARNING, MINOR, MAJOR, CRITICAL};
union Hysteresis switch(boolean)
{
    case TRUE: long long_value;
    case FALSE: float float_value;
};
enum Direction { INCREASING, DECREASING};
struct ThresholdPackElement
{
    ThresholdValue threshold_value;
    Severity severity_;
    Hysteresis hysteresis_;
};
typedef sequence<ThresholdPackElement> ThresholdPack;
struct ThresholdInfo
{
    MeasurementTypeName measurement_type_name;
    SubCounterName sub_counter_name;
    ProbableCause probable_cause;
    SpecificProblem specific_problem;
    Direction direction_;
    ThresholdPack threshold_pack;
};
typedef sequence<ThresholdInfo> ThresholdInfoList;
typedef GranularityPeriod MonitorGranularityPeriod;// time period is based on 5 minutes.
typedef unsigned long MonitorId;
struct MUnsupported

```

```
{
    MOInstance mo_instance;
    MeasurementTypeName measurement_type_name;
    SubCounterName sub_counter_name;
    string reason;
};
typedef sequence<MUnsupported> MUnsupportedList;
enum MonitorStatus {M_SUSPENDED, M_ACTIVE};

typedef sequence<MonitorId> MonitorIdList;
typedef string _EventType; // The value is "Quality of Service Alarm"
struct MonitorInfo
{
    MonitorId monitor_id;
    MOClassName mo_class;
    MOInstanceList mo_instance_list;
    MonitorGranularityPeriod monitor_granularity_period;
    ThresholdInfoList threshold_info_list;
    MonitorStatus threshold_monitor_status;
    _EventType event_type;
};
typedef sequence<MonitorInfo> MonitorInfoList;
/**
 * This block identifies attributes which are included as part of the
 * PMIRP. These attribute values should not
 * clash with those defined for the attributes of notification
 * header (see IDL of Notification IRP).
 */
interface AttributeNameValue
{
    const string JOB_ID = "JOB_ID";
    const string JOB_STATUS = "JOB_STATUS";
    const string REASON = "REASON";
    const string MONITOR_ID = "MONITOR_ID";
    const string MONITOR_STATUS = "MONITOR_STATUS";
    const string MONITOR_GRANULARITY_PERIOD = "MONITOR_GRANULARITY_PERIOD";
    const string MONITOR_EVENT_TYPE = "MONITOR_EVENT_TYPE";
    const string PROBABLE_CAUSE = "PROBABLE_CAUSE";
    const string SPECIFIC_PROBLEM = "SPECIFIC_PROBLEM";
    const string DIRECTION = "DIRECTION";
};
#endif // _PM_IRP_CONST_DEFS_IDL_
```

A.2 IDL specification (file name "PMIRPSystem.idl")

```
//File: PMIRPSystem.idl
#ifndef _PM_IRP_SYSTEM_IDL_
#define _PM_IRP_SYSTEM_IDL_

#include <ManagedGenericIRPSystem.idl>
#include <ManagedGenericIRPConstDefs.idl>
#include <PMIRPConstDefs.idl>

// This statement must appear after all include statements
#pragma prefix "3gppsa5.org"

/* ## Module: PMIRPSystem
This module contains the specification of all operations of PM IRP Agent.
=====
*/
module PMIRPSystem
{
    /**
    * The reason specifies whether EM or NE has high workload. The value shall be one
    * of following: emCpuBusy; emHDSshortage, emLowMemory, {neCpuBusy, neObjectInstList},
    * {neHDSshortage neObjectInstList}, {neLowMemory, neObjectInstList}, maxJobReached,
    * otherReason.
    * In the case the reason is a tuple, the first element is the string such as
    * "NE_CPU_BUSY" followed by a comma, then followed by a sequence of DN where
    * each DN is separated by its adjacent DN, if any, by a colon. The DN is formatted
    * as described in 32.300.
    */
    exception HighWorkLoad { string reason; };
    interface HighWorkLoadExceptionReason
    {
        const string EM_CPU_BUSY = "EM_CPU_BUSY";
        const string EM_HD_SHORTAGE = "EM_HD_SHORTAGE";
        const string EM_LOW_MEMORY = "EM_LOW_MEMORY";
        const string NE_CPU_BUSY = "NE_CPU_BUSY";
        const string NE_HD_SHORTAGE = "NE_HD_SHORTAGE";
        const string NE_LOW_MEMORY = "NE_LOW_MEMORY";
        const string MAX_JOB_REACHED = "MAX_JOB_REACHED";
        const string OTHER_REASON = "OTHER_REASON";
    };

    exception UnknownJob { string reason; };
    exception JobCannotBeStopped { string reason; };
    exception JobAlreadySuspended { string reason; };
    exception JobIsNotSuspended { string reason; };
    exception UnknownThresholdMonitor { string reason; };
    exception ThresholdMonitorAlreadySuspended { string reason; };
    exception ThresholdMonitorIsNotSuspended { string reason; };

    /**
    * System fails to complete the operation. System can provide reason
    * to qualify the exception. The semantics carried in reason
    * is outside the scope of this IRP.
    */
    exception GetPMIRPVersions { string reason; };
    exception GetPMIRPOperationsProfile { string reason; };
    exception GetPMIRPNotificationProfile { string reason; };
    exception CreateMeasurementJob { string reason; };
    exception StopMeasurementJob { string reason; };
    exception SuspendMeasurementJob { string reason; };
    exception ResumeMeasurementJob { string reason; };
    exception ListMeasurementJobs { string reason; };
    exception CreateThresholdMonitor { string reason; };
    exception DeleteThresholdMonitor { string reason; };
    exception ListThresholdMonitors { string reason; };
    exception SuspendThresholdMonitor { string reason; };
    exception ResumeThresholdMonitor { string reason; };

    interface PMIRP
    {
        readonly attribute string iRPId;

        /**
        * Return the list of all supported PM IRP versions.

```

```

*/
ManagedGenericIRPConstDefs::VersionNumberSet get_pm_irp_versions (
)
raises (GetPMIRPVersions);

/**
* Return the list of all supported operations and their supported
* parameters for a specific PM IRP version.
*/
ManagedGenericIRPConstDefs::MethodList get_pm_irp_operations_profile (
    in ManagedGenericIRPConstDefs::VersionNumber pm_irp_version
)
raises (GetPMIRPOperationsProfile,
        ManagedGenericIRPSystem::OperationNotSupported,
        ManagedGenericIRPSystem::InvalidParameter);

/**
* Return the list of all supported notifications and their supported
* parameters for a specific PM IRP version.
*/
ManagedGenericIRPConstDefs::MethodList get_pm_irp_notification_profile
(
    in ManagedGenericIRPConstDefs::VersionNumber pm_irp_version
)
raises (GetPMIRPNotificationProfile,
        ManagedGenericIRPSystem::OperationNotSupported,
        ManagedGenericIRPSystem::InvalidParameter);

/**
* Request to create a MeasurementJob through Itf-N.
*/
ManagedGenericIRPConstDefs::Signal create_measurement_job (
    in PMIRPConstDefs::MOClassName mo_class,
    in PMIRPConstDefs::MOInstanceList mo_instance_list,
    in PMIRPConstDefs::MeasurementCategoryList measurement_category_list,
    in PMIRPConstDefs::GranularityPeriod granularity_period,
    in PMIRPConstDefs::ReportingPeriod reporting_period,
    in PMIRPConstDefs::IRPTimeOpt start_time,
    in PMIRPConstDefs::IRPTimeOpt stop_time,
    in PMIRPConstDefs::ScheduleOpt schedule,
    in PMIRPConstDefs::JobPriorityOpt priority,
    out PMIRPConstDefs::JobId job_id,
    out PMIRPConstDefs::JUnsupportedList unsupported_list
)
raises (CreateMeasurementJob,
        ManagedGenericIRPSystem::InvalidParameter,
        ManagedGenericIRPSystem::ParameterNotSupported,
        HighWorkLoad);

/**
* Request to stop a MeasurementJob through Itf-N, after which,
* the MeasurementJob will still be visible via Itf-N. Whether
* the MeasurementJob is thoroughly removed immediately from
* the managed system is vendor specific.
*/
PMIRPConstDefs::Result stop_measurement_job (
    in PMIRPConstDefs::JobId job_id)
raises (StopMeasurementJob,
        UnknownJob,
        JobCannotBeStopped);

/**
* Request to suspend a MeasurementJob
*/
PMIRPConstDefs::Result suspend_measurement_job (
    in PMIRPConstDefs::JobId job_id)
raises (SuspendMeasurementJob,
        UnknownJob,
        JobAlreadySuspended,
        ManagedGenericIRPSystem::OperationNotSupported);

/**
* Request to resume a MeasurementJob
*/
PMIRPConstDefs::Result resume_measurement_job (
    in PMIRPConstDefs::JobId job_id)
raises (ResumeMeasurementJob,
        UnknownJob,

```

```
        JobIsNotSuspended,  
        HighWorkLoad,  
        ManagedGenericIRPSystem::OperationNotSupported);  
  
/**  
 * Request to list the information of all or of specified  
 * MeasurementJobs  
 */  
PMIRPConstDefs::Result list_measurement_jobs (  
    in PMIRPConstDefs::JobIdList job_list_id,  
    out PMIRPConstDefs::JobInfoList job_info_list)  
raises (ListMeasurementJobs,  
        ManagedGenericIRPSystem::InvalidParameter);  
  
/**  
 * Request to create a ThresholdMonitor to define the threshold  
 * for some specific measurementTypes or subCounters  
 */  
ManagedGenericIRPConstDefs::Signal create_threshold_monitor (  
    in PMIRPConstDefs::MOClassName mo_class,  
    in PMIRPConstDefs::MOInstanceList mo_instance_list,  
    in PMIRPConstDefs::ThresholdInfoList threshold_info_list,  
    in PMIRPConstDefs::MonitorGranularityPeriod monitor_granularity_period,  
    out PMIRPConstDefs::MonitorId monitor_id,  
    out PMIRPConstDefs::MUnsupportedList unsupported_list)  
raises (CreateThresholdMonitor,  
        ManagedGenericIRPSystem::InvalidParameter,  
        ManagedGenericIRPSystem::OperationNotSupported);  
  
/**  
 * Request to delete a specified ThresholdMonitor  
 */  
PMIRPConstDefs::Result delete_threshold_monitor (  
    in PMIRPConstDefs::MonitorId monitor_id)  
raises (DeleteThresholdMonitor,  
        UnknownThresholdMonitor,  
        ManagedGenericIRPSystem::OperationNotSupported);  
  
/**  
 * Request to list detailed information about all or  
 * specified ThresholdMonitors  
 */  
PMIRPConstDefs::Result list_threshold_monitors (  
    in PMIRPConstDefs::MonitorIdList monitor_id_list,  
    out PMIRPConstDefs::MonitorInfoList monitor_info_list)  
raises (ListThresholdMonitors,  
        ManagedGenericIRPSystem::InvalidParameter,  
        ManagedGenericIRPSystem::OperationNotSupported);  
  
/**  
 * Request to suspend a ThresholdMonitor  
 */  
PMIRPConstDefs::Result suspend_threshold_monitor (  
    in PMIRPConstDefs::MonitorId monitor_id)  
raises (SuspendThresholdMonitor,  
        UnknownThresholdMonitor,  
        ThresholdMonitorAlreadySuspended,  
        ManagedGenericIRPSystem::OperationNotSupported);  
  
/**  
 * Request to resume a ThresholdMonitor  
 */  
PMIRPConstDefs::Result resume_threshold_monitor (  
    in PMIRPConstDefs::MonitorId monitor_id)  
raises (ResumeThresholdMonitor,  
        UnknownThresholdMonitor,  
        ThresholdMonitorIsNotSuspended,  
        ManagedGenericIRPSystem::OperationNotSupported);  
};  
  
};  
  
#endif // _PM_IRP_SYSTEM_IDL_
```

A.3 IDL specification (file name "PMIRPNotifications.idl")

```
// File: PMIRPNotifications.idl
#ifndef _PM_IRP_NOTIFICATIONS_IDL_
#define _PM_IRP_NOTIFICATIONS_IDL_

#include <PMIRPConstDefs.idl>
#include <NotificationIRPNotifications.idl>

// This statement must appear after all include statements
#pragma prefix "3gppsa5.org"

/* ## Module: PMIRPNotifications
This module contains the specification of all notifications of PM IRP Agent.
=====
*/
module PMIRPNotifications
{
    /**
    * Constant definitions for the notifyMeasurementJobStatusChanged notification
    */
    interface NotifyMeasurementJobStatusChanged: NotificationIRPNotifications::Notify
    {
        const string EVENT_TYPE = "notifyMeasurementJobStatusChanged";

        /**
        * This constant defines the name of the jobId property.
        * The data type for the value of this property
        * is PMIRPConstDefs::JobId.
        */
        const string JOB_ID = PMIRPConstDefs::AttributeNameValue::JOB_ID;

        /**
        * This constant defines the name of the jobStatus property.
        * The data type for the value of this property
        * is PMIRPConstDefs::JobStatus.
        */
        const string JOB_STATUS = PMIRPConstDefs::AttributeNameValue::JOB_STATUS;

        /**
        * This constant defines the name of the reason property.
        * The data type for the value of this property is string.
        */
        const string REASON = PMIRPConstDefs::AttributeNameValue::REASON;
    };

    /**
    * Constant definitions for the notifyThresholdMonitorObjectCreation notification
    */
    interface NotifyThresholdMonitorObjectCreation:
        NotificationIRPNotifications::Notify
    {
        const string EVENT_TYPE = "notifyThresholdMonitorObjectCreation";
        /**
        * This constant defines the name of the monitorId property,
        * which is transported in the filterable_body fields.
        * The data type for the value of this property
        * is PMIRPConstDefs::MonitorId.
        */
        const string MONITOR_ID = PMIRPConstDefs::AttributeNameValue::MONITOR_ID;
        /**
        * This constant defines the name of the monitorGranularityPeriod property,
        * which is transported in the filterable_body fields.
        * The data type for the value of this property
        * is PMIRPConstDefs::MonitorGranularityPeriod.
        */
        const string MONITOR_GRANULARITY_PERIOD =
            PMIRPConstDefs::AttributeNameValue::MONITOR_GRANULARITY_PERIOD;
        /**
        * This constant defines the name of the thresholdMonitorStatus property,
        * which is transported in the filterable_body fields.
        * The data type for the value of this property
        * is PMIRPConstDefs::MonitorStatus.
        */
        const string MONITOR_STATUS =
            PMIRPConstDefs::AttributeNameValue::MONITOR_STATUS;
    };
};
```

```
/**
 * Constant definitions for the notifyThresholdMonitorObjectDeletion notification
 */
interface NotifyThresholdMonitorObjectDeletion:
  NotificationIRPNotifications::Notify
{
  const string EVENT_TYPE = "notifyThresholdMonitorObjectDeletion";

  /**
   * This constant defines the name of the monitorId property,
   * which is transported in the filterable_body fields.
   * The data type for the value of this property
   * is PMIRPConstDefs::MonitorId.
   */
  const string MONITOR_ID = PMIRPConstDefs::AttributeNameValue::MONITOR_ID;
};

/**
 * Constant definitions for the notifyThresholdMonitorStatusChanged notification
 */
interface NotifyThresholdMonitorStatusChanged: NotificationIRPNotifications::Notify
{
  const string EVENT_TYPE = "notifyThresholdMonitorStatusChanged";

  /**
   * This constant defines the name of the monitorId property.
   * The data type for the value of this property
   * is PMIRPConstDefs::MonitorId.
   */
  const string MONITOR_ID = PMIRPConstDefs::AttributeNameValue::MONITOR_ID;

  /**
   * This constant defines the name of the monitorStatus property.
   * The data type for the value of this property
   * is PMIRPConstDefs::MonitorStatus.
   */
  const string MONITOR_STATUS = PMIRPConstDefs::AttributeNameValue::MONITOR_STATUS;

  /**
   * This constant defines the name of the reason property.
   * The data type for the value of this property is string.
   */
  const string REASON = PMIRPConstDefs::AttributeNameValue::REASON;
};

};

#endif // _PM_IRP_NOTIFICATIONS_IDL_
```


Annex B (informative): Change history

Change history								
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Cat	Old	New
Mar 2004	SA_23	SP-040136	--	--	Submitted to TSG SA#23 for Approval	--	2.0.0	6.0.0
Jun 2004	SA_24	SP-040273	0001	--	Correction and enhancement of data type definitions in IDL files	F	6.0.0	6.1.0
Sep 2004	SA_25	SP-040557	0002	--	Align to latest PM IRP Information Service (IS) 32.412 version number	F	6.1.0	6.2.0
Sep 2004	SA_25	SP-040558	0003	--	Add Measurement Job Overload Management function – Align with 32.412	B	6.1.0	6.2.0
Dec 2004	SA_26	SP-040784	0004	--	Add missing exception & filter to PM IRP CORBA SS, Align with IDL Style Guide in 32.150	F	6.2.0	6.3.0
Mar 2005	SA_27	SP-050041	0005	--	IDL incompliant to the style guide	F	6.3.0	6.4.0
Mar 2005	SA_27	SP-050041	0006	--	Remove the ambiguity that a PM IRP compliant system necessarily contains functionalities defined in Kernel CM IRP – Align with TS 32.412	F	6.3.0	6.4.0
Mar 2005	SA_27	SP-050041	0007	--	Apply the Generic System Context, update of reference to IS specification – Align with TS 32.412	F	6.3.0	6.4.0
Jun 2005	SA_28	SP-050293	0008	--	Add missing IDL constants in PMIRPConstDefs.idl	F	6.4.0	6.5.0
Sep 2005	SA_29	SP-050461	0009	--	Align the CORBA SS IDL with TS 32.150 Style Guide	F	6.5.0	6.6.0
Dec 2005	SA_30	SP-050706	0010	--	IDL errors causing Compilation errors in PM IRP CORBA solution set	F	6.6.0	6.7.0
Jun 2006	SA_32	SP-060251	0011	--	Correct parameter usage in notifyThresholdMonitorCreation	F	6.7.0	6.8.0
Dec 2006	SA_34	SP-060710	0012	--	Correct IDL definition in PMIRPConstDefs.IDL to avoid keyword conflict with CORBA Releases beyond 2.3	F	6.8.0	6.9.0
Jun 2007	SA_36	--	--	--	Automatic upgrade to Rel-7 (no CR) at freeze of Rel-7. Deleted reference to CMIP SS, discontinued from R7 onwards.	--	6.9.0	7.0.0

History

Document history		
V7.0.0	June 2007	Publication