

I n t e r n a t i o n a l T e l e c o m m u n i c a t i o n U n i o n

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

M.3704

(01/2010)

SERIES M: TELECOMMUNICATION MANAGEMENT,
INCLUDING TMN AND NETWORK MAINTENANCE

Integrated services digital networks

Common management service – Performance management – Protocol neutral requirements and analysis

Recommendation ITU-T M.3704



International
Telecommunication
Union
Documents

Document Sharing Hub

ITU-T M-SERIES RECOMMENDATIONS
TELECOMMUNICATION MANAGEMENT, INCLUDING TMN AND NETWORK MAINTENANCE

Introduction and general principles of maintenance and maintenance organization	M.10–M.299
International transmission systems	M.300–M.559
International telephone circuits	M.560–M.759
Common channel signalling systems	M.760–M.799
International telegraph systems and phototelegraph transmission	M.800–M.899
International leased group and supergroup links	M.900–M.999
International leased circuits	M.1000–M.1099
Mobile telecommunication systems and services	M.1100–M.1199
International public telephone network	M.1200–M.1299
International data transmission systems	M.1300–M.1399
Designations and information exchange	M.1400–M.1999
International transport network	M.2000–M.2999
Telecommunications management network	M.3000–M.3599
Integrated services digital networks	M.3600–M.3999
Common channel signalling systems	M.4000–M.4999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T M.3704

Common management service – Performance management – Protocol neutral requirements and analysis

Summary

Recommendation ITU-T M.3704 provides the requirements and analysis for one of the common management services – performance management. The functional requirements for the performance management interface include the management functions for performance measurement jobs, performance threshold monitor and performance data files. In the analysis part, the detail information model supporting the above function across the management interface is provided.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T M.3704	2010-01-13	2

Keywords

Common management service, measurement job, performance management, PMIRP, threshold monitor.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2010

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

CONTENTS

	Page
1 Scope	1
2 References.....	1
3 Definitions	2
3.1 Terms defined elsewhere	2
3.2 Terms defined in this Recommendation.....	2
4 Abbreviations.....	2
5 Conventions	2
6 Requirements	3
6.1 Concepts and background.....	3
6.2 Business-level requirements	3
6.3 Specification-level requirements	6
7 Analysis	18
7.1 Concepts and background.....	18
7.2 Information object classes	18
7.3 Interface definition	30
7.4 Scenarios.....	52
Bibliography.....	55

Recommendation ITU-T M.3704

Common management service – Performance management – Protocol neutral requirements and analysis

1 Scope

This Recommendation specifies the overall requirements and the analysis for performance management and defines the semantics of operations (and their parameters) visible across the management interface in a protocol and technology neutral way. It does not define the syntax or encoding of the operations and their parameters. The transferring of performance data file is outside the scope of this Recommendation.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T M.3020] Recommendation ITU-T M.3020 (2009), *Management interface specification methodology*.
- [ITU-T M.3160] Recommendation ITU-T M.3160 (2008), *Generic, protocol-neutral management information model*.
- [ITU-T M.3400] Recommendation ITU-T M.3400 (2000), *TMN management functions*.
- [ITU-T M.3700] Recommendation ITU-T M.3700 (2010), *Common management services – Object management – Protocol neutral requirements and analysis*.
- [ITU-T M.3701] Recommendation ITU-T M.3701 (2010), *Common management services – State management – Protocol neutral requirements and analysis*.
- [ITU-T M.3702] Recommendation ITU-T M.3702 (2010), *Common management services – Notification management – Protocol neutral requirements and analysis*.
- [ITU-T Q.822] Recommendation ITU-T Q.822 (1994), *Stage 1, Stage 2 and Stage 3 description for the Q3 Interface – Performance management*.
- [ITU-T X.680] Recommendation ITU-T X.680 (2008) | ISO/IEC 8824-1:2008, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*.
- [ITU-T X.721] Recommendation ITU-T X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology – Open systems Interconnection – Structure of management information: Definition of management information*.
- [ITU-T X.739] Recommendation ITU-T X.739 (1993) | ISO/IEC 10164-11:1994, *Information technology – Open Systems Interconnection – Systems Management: Metric objects and attributes*.



3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 agent [ITU-T M.3020]: Encapsulates a well-defined subset of management functionality. It interacts with managers using a management interface. From the manager's perspective, the agent behaviour is only visible via the management interface.

3.1.2 information object class [ITU-T M.3020]: Describes the information that can be passed/used in management interfaces and is modelled using the stereotype "Class" in the UML meta-model. For a formal definition of information object class and its structure of specification, see Annex B of [ITU-T M.3020].

3.1.3 manager [ITU-T M.3020]: Models a user of agent(s) and it interacts directly with the agent(s) using management interfaces.

Since the manager represents an agent user, it gives a clear picture of what the agent is supposed to do. From the agent perspective, the manager behaviour is only visible via the management interface.

NOTE – Considered equivalent to IRPManager [b-3GPP TS 32.150].

3.2 Terms defined in this Recommendation

This Recommendation has no new definitions.

4 Abbreviations

This Recommendation uses the following abbreviations:

DN	Distinguished Name
EM	Element Manager
FS	Function Set
FTP	File Transfer Protocol
IOC	Information Object Class
IRP	Integration Reference Point
NE	Network Element
NM	Network Manager
PM	Performance Management
PMIRP	Performance Management Integration Reference Point
UML	Unified Modelling Language (OMG)

5 Conventions

This Recommendation follows the conventions defined in [ITU-T M.3020].

Usage of ProxyClass: a ProxyClass is a stereotype in UML repertoire described in [ITU-T M.3020], which can be used to represent other IOCs listed in the Note under the corresponding UML diagram.

6 Requirements

6.1 Concepts and background

The purpose for performance measurement is for the agent to provide functions to the manager to collect performance measurement data, and to monitor these collected measurement data by setting pre-defined thresholds, so that notifications can be generated and sent from the EMs or NEs to the NM in time.

In this Recommendation, the function for collecting performance measurement against network elements is achieved through creating measurement jobs, which can be used to specify the network entities to be measured, the corresponding performance parameters to be collected against them, and to control the generation of performance measurement data. The detailed performance measurement data will be generated into data files and transferred to the manager periodically. The monitoring of performance data is achieved from setting up threshold monitors, which can scan the collected measurement data against pre-defined thresholds on certain performance parameters, and threshold-crossing alarms can be generated and sent to the manager for processing.

6.2 Business-level requirements

6.2.1 Requirements

Performance measurement is one of the key functions of the network management interface. The manager should be able to request an agent to take measurements on the performance of certain network resources. The performance management requirements can be grouped into one of the following categories:

- Management of network performance measurements, e.g., create measurement job, suspend measurement job, resume measurement job, query measurement job, stop measurement job, delete measurement job, etc.
- Management of PM threshold-cross monitoring, e.g., create threshold monitor, delete threshold monitor, query threshold monitor, modify threshold monitor, suspend notification monitor, resume notification monitor, threshold-crossing alarm report, etc.
- Management of measurement files, e.g., performance data file preparation report, performance data file transfer, etc.

6.2.1.1 Management of network performance measurements

The manager shall be able to request the agent to:

- | | |
|---------------|--|
| REQ-PM-FUN-01 | Collect specific performance measurements on specific network resources. The network resources, whose performance measurements are to be managed or collected, must have been modelled and must be visible via the management interface. |
| REQ-PM-FUN-02 | Collect the performance measurements in a file. The data format of this file will depend on the network technology being measured. |
| REQ-PM-FUN-03 | Emit a notification announcing the availability of file(s) in REQ-PM-FUN-02. |
| REQ-PM-FUN-04 | Create a measurement job. |
| REQ-PM-FUN-05 | Suspend a running or scheduled measurement job. |
| REQ-PM-FUN-06 | Resume a running or scheduled measurement job. |
| REQ-PM-FUN-07 | Stop a running or scheduled measurement job. |

- | | |
|---------------|--|
| REQ-PM-FUN-08 | Query the information and running status of one or more measurement jobs. |
| REQ-PM-FUN-09 | Remove a measurement job. This means the complete set of the PM data files related to this measurement file can be removed from the IRP agent. |
| REQ-PM-FUN-10 | Define a measurement job schedule, including the definition of the recording interval(s), job start time and job stop time. |

It is noted that the agent can only derive or determine the value of a performance measurement at the end of a granularity period. The agent may also have to reset the value of a performance measurement at the beginning of a granularity period. The above agent behaviours are dependent on the nature of the performance measurement types (cumulative counter, gauge).

6.2.1.2 Management of PM threshold monitoring

The manager shall be able to request the agent to:

- | | |
|---------------|--|
| REQ-PM-FUN-11 | Set threshold values to specific performance measurements of specific network resources. |
| REQ-PM-FUN-12 | Query the threshold values that are set to specific performance measurements of specific network resources. |
| REQ-PM-FUN-13 | Modify the threshold values that are set to specific performance measurements of specific network resources. |
| REQ-PM-FUN-14 | Suspend a threshold monitor on specific network resources. |
| REQ-PM-FUN-15 | Resume a threshold monitor on specific network resources. |
| REQ-PM-FUN-16 | Remove a threshold monitor on specific network resources. |
| REQ-PM-FUN-17 | Emit an alarm notification (including clearing) when the threshold value(s) have been crossed and not just reached, as defined in [ITU-T Q.822]. |

The manager shall be able to:

- | | |
|---------------|---|
| REQ-PM-FUN-18 | Subscribe to notifications that carry threshold-cross alarms and information on the availability of performance measurement data files. |
|---------------|---|

6.2.1.3 Management of measurement files

The agent shall be able to allow the manager to:

- | | |
|---------------|--|
| REQ-PM-FUN-19 | Manage the transfer of data files containing performance measurement data. |
| REQ-PM-FUN-20 | Request a list of available files, including the specification of filter. |

6.2.2 Actor roles

The capabilities described in this Recommendation are available and relevant to all agents and managers.

6.2.3 Telecommunication resources

The performance management functionality is applicable to all types of telecommunication resources.

6.2.4 High-level use case diagrams

The performance management function set contains: Performance measurement management function set, performance threshold management function set, and query history performance data function.

Performance measurement is the activity whereby the agent periodically collects the performance data from physical equipment as well as logical entities and reports them to the manager. Performance measurement management function set is provided to the manager to manage the parameters related to performance measurement, through which performance data can be reported by the agent according to the requests of the manager.

Performance measurement management function set (FS) contains the following functions: Create measurement job, Delete measurement job, Stop measurement job, Suspend measurement job, Resume measurement job, Query measurement jobs, and Performance data report. Figure 6-2 shows the details.

NOTE – The modify measurement job function can actually be achieved by deleting the existing measurement job and creating a new measurement job.

Performance measurement management FS in this Recommendation relates to the functions involving PM data collection and reporting specified in clauses 5.3.4, "Performance administration function set"; and 5.2.9, "Performance monitoring data accumulation function set", of [ITU-T M.3400].

The manager can set up performance threshold monitors, through which a corresponding threshold-crossing alarm may be emitted whenever a performance threshold is crossed. Performance threshold management FS contains the following functions: Create threshold monitor, Delete threshold monitor, Modify threshold monitor, Query threshold monitor, Suspend threshold monitor, Resume threshold monitor and threshold-cross alarm report. Figure 6-3 shows the details.

Performance threshold management function set in this Recommendation relates to the functions involving threshold management specified in clauses 5.3.4, "Performance administration function set"; and 5.4.9 "NE(s) performance characterization function set", of [ITU-T M.3400].

Measurement data are network technology dependent and are thus outside the scope of this Recommendation.

The following three diagrams show the functions involved in the performance management FS. Figure 6-1 illustrates the overview use case diagram of performance management FS, Figure 6-2 shows the performance measurement management FS use-case diagram, and Figure 6-3 shows the threshold management FS use-case diagram.

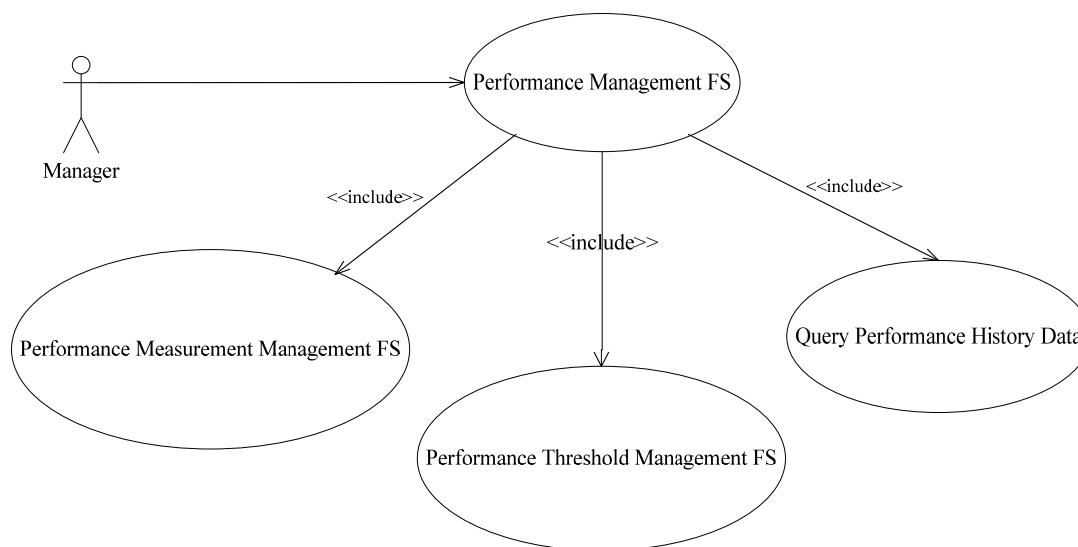


Figure 6-1 – Performance management FS overview

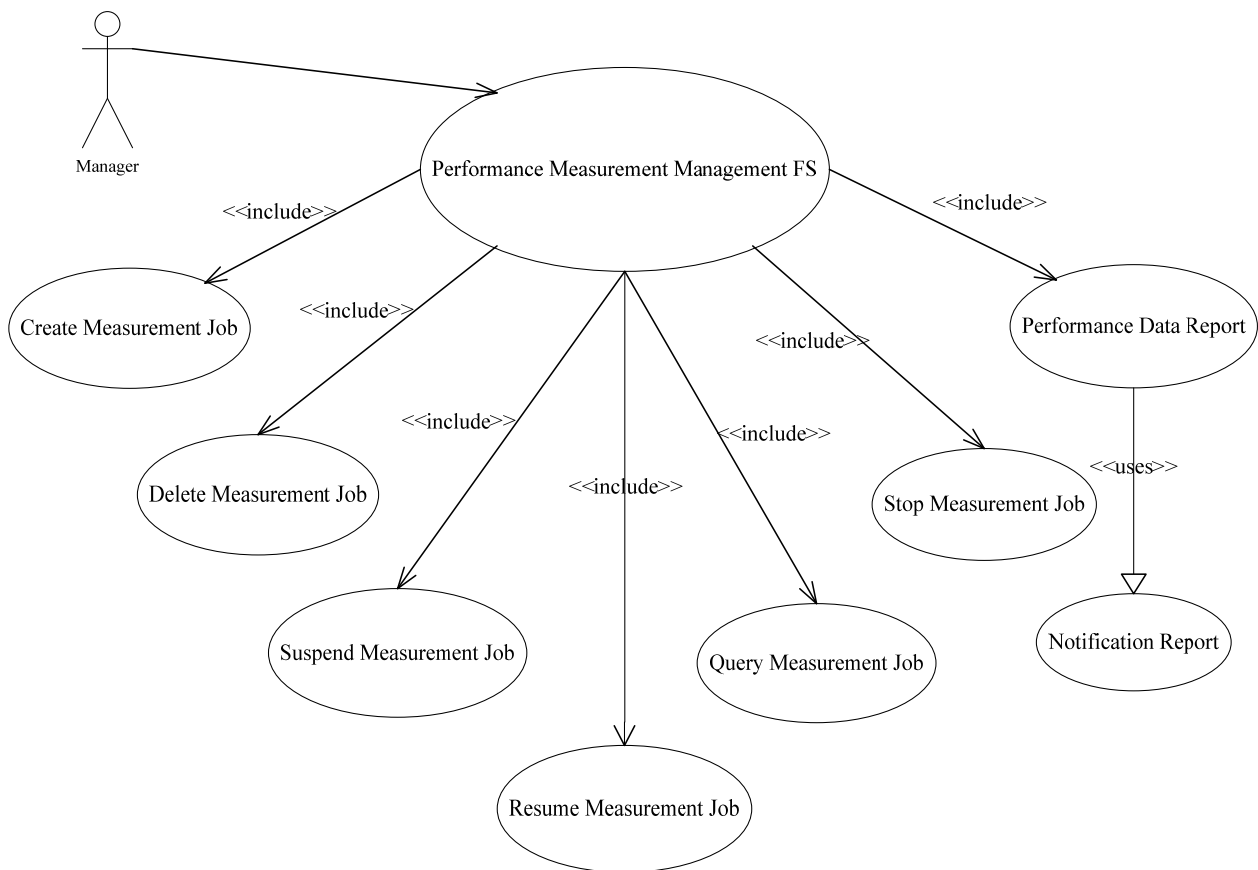


Figure 6-2 – Performance measurement management FS

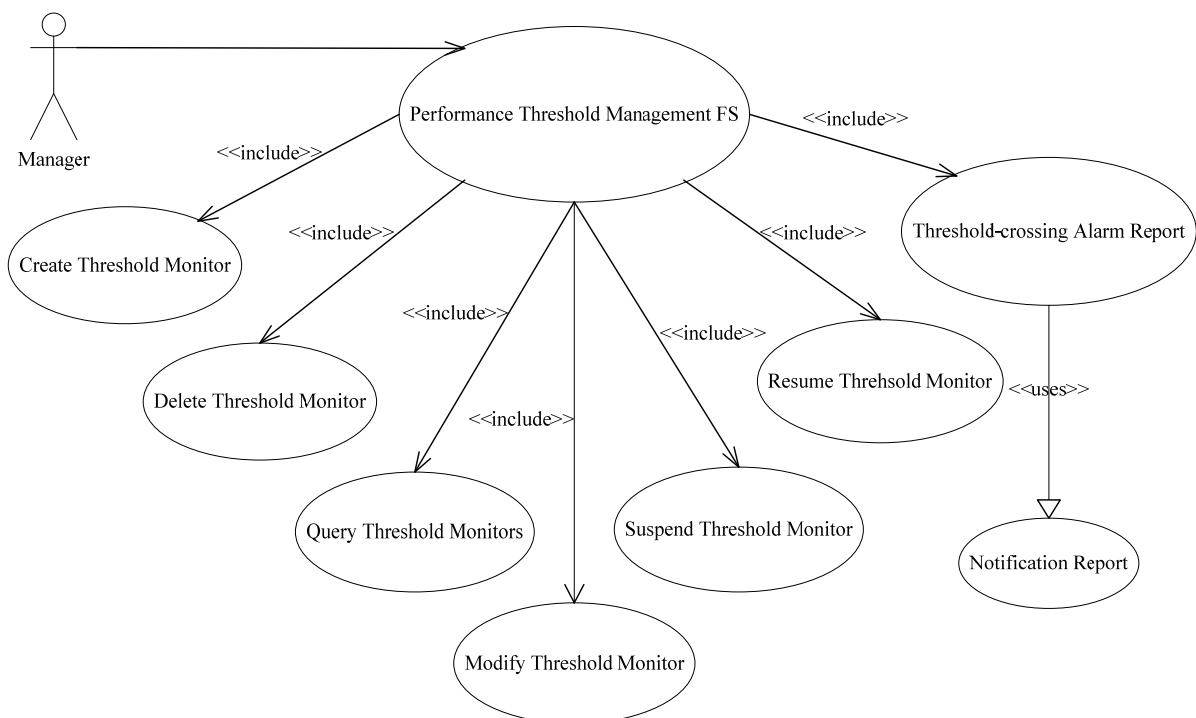


Figure 6-3 – Performance threshold management FS

6.3 Specification-level requirements

6.3.1 Requirements

There are no specification-level requirements.

6.3.2 Actor roles

See clause 6.2.2.

6.3.3 Telecommunication resources

See clause 6.2.3.

6.3.4 Use cases

The general exceptions (e.g., Communication error, Processing error) related to all use cases will not be described in the following use cases, and will only be handled in design phases.

6.3.4.1 Create a measurement job

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to create a performance measurement job through the management interface	
Actor and roles	The manager invokes operation on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	–	
Begins when	The manager sends a request to the agent to start a measurement job for collecting performance data from one or more managed entity instances.	
Step 1	The manager sends a request to the agent to start a performance measurement job. The parameters may contain: – the ID or criteria for the managed entities in which performance data will be collected, – the start time of the collection task (optional), – the stop time of the collection task (optional), – the collection interval of the job, – the report interval of the job, – the schedule of the job (optional), – and the performance parameters to be collected (optional).	
Step 2.1	If the measurement job is started successfully, the job ID will be returned to the manager, and the agent will start the performance collection on the specified network resources according to the parameters of the request. Performance data files are stored in files, and on each reporting interval, the file information will be reported to the manager.	
Step 2.2	Otherwise, it will return error information to the manager.	
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	
Exceptions	Invalid parameter	
Post conditions	A measurement job is started on request, and it starts to collect and report the corresponding performance data according to their intervals, respectively. The agent may send an object creation notification to the manager.	
Traceability	REQ-PM-FUN-01, REQ-PM-FUN-02, REQ-PM-FUN-04, REQ-PM-FUN-10	

6.3.4.2 Suspend a measurement job

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to suspend a performance measurement job through the management interface.	
Actor and roles	The manager invokes an operation on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	The specified measurement job exists in the agent and it is not suspended.	
Begins when	The manager sends a request to suspend a measurement job.	
Step 1	The manager sends a request to the agent to suspend a performance measurement job. The request parameter is the identifier of the measurement job.	
Step 2	If the operation succeeds, the measurement job will no longer collect and report the corresponding performance data until resumed.	
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	
Exceptions	– unknown measurement job; – measurement job already suspended.	
Post conditions	The specified measurement job is suspended on request. The agent may send a state change notification to the manager.	
Traceability	REQ-PM-FUN-05	

6.3.4.3 Resume a measurement job

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to resume a suspended performance measurement job through the management interface.	
Actor and roles	The manager invokes an operation on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	The specified measurement job exists in the agent and it is suspended.	
Begins when	The manager sends a request to resume a measurement job.	
Step 1	The manager sends a request to the agent to resume a performance measurement job. The request parameter is the identifier of the measurement job.	
Step 2.1	If the operation succeeds, the measurement job will continue collecting and reporting the corresponding performance data specified for this job.	
Step 2.2	If the operation fails, it will return error information to the manager.	
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	

Use case stage	Evolution/Specification	<<Uses>> Related use
Exceptions	– unknown measurement job; – measurement job not suspended.	
Post conditions	The specified measurement job is resumed on request, and it continues to collect and report performance measurement data. The agent may send a state change notification to the manager.	
Traceability	REQ-PM-FUN-06	

6.3.4.4 Query measurement jobs

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to query the parameter values of one or more performance measurement job(s) through the management interface.	
Actor and roles	The manager invokes operations on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	The specified measurement job exists in the agent.	
Begins when	The manager sends a request to query the information of a measurement job.	
Step 1	The manager sends a request to the agent to query the parameters of a performance measurement job, which include: – the job ID(s), – the identifier(s) for the managed objects in which performance data are collected, – the start time and stop time of the measurement job, – the collection interval of the job, – the report interval of the job, – the schedule for the job, – the administrative state, – the performance parameters to be collected.	
Step 2.1	If the operation succeeds, the agent will return the attribute information of the performance measurement job.	
Step 2.2	If the operation fails, it will return error information to the manager.	
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	
Exceptions	Unknown measurement job.	
Post conditions	The corresponding attribute information is returned by the agent as requested.	
Traceability	REQ-PM-FUN-08	

6.3.4.5 Stop a measurement job

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to permanently stop a performance measurement job through the management interface. When a measurement job is stopped, it does not collect performance data any more, but it still holds the performance data files.	
Actor and roles	The manager invokes an operation on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	The specified measurement job exists in the agent.	
Begins when	The manager sends a request to stop a measurement job.	
Step 1	The manager sends a request to the agent to stop a performance measurement job.	
Step 2.1	If the operation succeeds, the specified measurement job will stop working and the agent will return success information.	
Step 2.2	Otherwise, it will return error information to the manager.	
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	
Exceptions	– unknown measurement job; – measurement job already stopped.	
Post conditions	The measurement job is stopped on request but the measurement data files are still maintained by this measurement job, which can be retrieved by the manager. The agent may send a state change notification to the manager.	
Traceability	REQ-PM-FUN-07	

6.3.4.6 Delete a measurement job

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to delete a performance measurement job through the management interface. When a measurement job is deleted, the associated measurement data files are not required to be maintained in the agent.	
Actor and roles	The manager invokes an operation on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	The specified measurement job exists in the agent and it is stopped or suspended. The history performance data files related to the job in the agent will no longer be used.	
Begins when	The manager sends a request to delete a measurement job.	

Use case stage	Evolution/Specification	<<Uses>> Related use
Step 1	The manager sends a request to the agent to delete a performance measurement job. The request parameter is the identifier of the measurement job.	
Step 2.1	If the operation succeeds, the specified measurement job will stop working and the related collecting resources, including the data files, will be released, and the agent will return success information.	
Step 2.2	Otherwise, it will return error information to the manager.	
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	
Exceptions	– unknown measurement job; – measurement job not suspended or stopped.	
Post conditions	The specified measurement job is deleted on request. The agent may send an object deletion notification to the manager.	
Traceability	REQ-PM-FUN-09	

6.3.4.7 Performance data report

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Performance data are stored in files. At each report interval, the corresponding performance data file(s) will be prepared by the agent and a "Bulk Data Transfer Ready" notification will be sent to the manager, and then the prepared files will be transferred from the agent to the manager using FTP service. Performance data report may use the functions provided in the "bulk data transfer FS", which is outside the scope of this Recommendation.	
Actor and roles	The agent sends file preparation notifications to the manager.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	A measurement job has been created in the agent.	
Begins when	The agent prepares the performance data file at the end of a report interval, or on the request of a manager.	
Step 1	The agent prepares the performance data file.	
Step 2.1	If the performance data file(s) are ready, a notification "Bulk Data Transfer Ready" will be sent to the manager.	Notification report
Step 2.2	If some errors occurred during the preparation of the performance data file(s), a notification "Bulk Data Preparation Error" will be sent to the manager.	
Ends when	Either "Bulk Data Transfer Ready" or "Bulk Data Preparation Error" is sent to the manager.	
Exceptions	–	
Post conditions	The "Bulk Data Transfer Ready" or "Bulk Data Preparation Error" notification is received by the manager.	
Traceability	REQ-PM-FUN-03	

6.3.4.8 Create a threshold monitor

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to create a performance threshold monitor through the management interface. The manager can monitor some performance measurement parameters collected from managed entities in order to know whether or not there are any performance degradation or service-related performance problems in time.	
Actor and roles	The manager invokes an operation on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	The measurement job(s) containing the measurement parameters to be monitored have been started.	
Begins when	The manager sends a request to create a threshold monitor.	
Step 1	The manager sends a request to the agent to create a performance threshold monitor. The input parameters in the request contain: – the ID or criteria for the managed entities to be monitored, – the monitoring granularity period, – a set of the sequence of names of the measurement parameters, – corresponding threshold value, – the notifyOnOff switch of alarm notifications, – the related alarm severity (optional).	
Step 2.1	If the creation succeeds, the agent will return success information, and the output parameter is: – threshold monitor ID.	
Step 2.2	If the operation fails, it will return error information to the manager.	
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	
Exceptions	Invalid parameter.	
Post conditions	A performance threshold monitor is created by the agent on request, and an object creation notification may be reported to the manager. The agent starts to monitor the performance parameters according to the specified threshold values. When a threshold value is crossed, a threshold-cross alarm will be raised.	
Traceability	REQ-PM-FUN-11	

6.3.4.9 Delete a threshold monitor

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to delete a performance threshold monitor through the management interface.	
Actor and roles	The manager invokes operations on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	

Use case stage	Evolution/Specification	<<Uses>> Related use
Preconditions	The specified threshold monitor exists in the agent and it is suspended.	
Begins when	The manager sends a request to delete a threshold monitor.	
Step 1	The manager sends a request to the agent to delete a performance threshold monitor. The parameter is the identifier of the performance threshold monitor. According to the request, the agent will delete the specified performance threshold monitor.	
Step 2.1	If the deletion succeeds, the agent will return success information and no longer monitor the corresponding performance parameters.	
Step 2.2	If the operation fails, it will return error information to the manager.	
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	
Exceptions	– unknown threshold monitor; – threshold monitor not suspended.	
Post conditions	The specified performance threshold monitor is deleted by the agent on request, and an object deletion notification may be reported to the manager. The agent will no longer monitor the corresponding performance parameters. If the operation fails, it will return error information to the manager.	
Traceability	REQ-PM-FUN-16	

6.3.4.10 Suspend a threshold monitor

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to suspend a performance threshold monitor through the management interface. When the manager temporarily does not want the threshold monitor to raise any threshold-cross alarms for the performance parameters, or the manager needs to change some attribute values of the monitor, this function can be invoked.	
Actor and roles	The manager invokes operations on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	The specified threshold monitor exists in the agent and it is not suspended.	
Begins when	The manager sends a request to suspend a threshold monitor.	
Step 1	In this use case, the manager sends a request to suspend a performance threshold monitor, and the input parameter is the threshold monitor id.	
Step 2.1	If the suspension succeeds, the agent will return success information and the performance threshold monitor will not act on the corresponding performance parameters and no threshold-cross alarms on the performance parameters will be raised.	
Step 2.2	If the operation fails, it will return error information to the manager.	

Use case stage	Evolution/Specification	<<Uses>> Related use
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	
Exceptions	– unknown threshold monitor; – threshold monitor already suspended.	
Post conditions	The performance threshold monitor is suspended on request, and it does not monitor the corresponding performance parameters until resumed. A state change notification may be sent to the manager.	
Traceability	REQ-PM-FUN-14	

6.3.4.11 Resume a threshold monitor

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The manager can request the agent to resume a suspended performance threshold monitor through the management interface. When the manager needs a threshold monitor to act on the performance parameters again, this function can be invoked.	
Actor and roles	The manager invokes operations on the agent.	
Telecom resource	All types of telecommunication resources.	
Assumptions	The communication between the manager and the agent is available.	
Preconditions	The specified threshold monitor exists in the agent and it is suspended.	
Begins when	The manager sends a request to resume a threshold monitor.	
Step 1	In this use case, the manager sends a request to resume a suspended performance threshold monitor, and the input parameter is the threshold monitor id.	
Step 2.1	If the resumption succeeds, the agent will return success information and the performance threshold monitor will continue to act on the corresponding performance parameters.	
Step 2.2	If the operation fails, it will return error information to the manager.	
Ends when	Requested information or an exception is returned to the manager, or the operation is cancelled by the manager.	
Exceptions	– unknown threshold monitor; – threshold monitor not suspended.	
Post conditions	The performance threshold monitor is resumed on request, and it continues to monitor the corresponding performance parameters. A state change notification may be sent to the manager.	
Traceability	REQ-PM-FUN-15	