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Contents

Foreword

This Technical Specification (TS) 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:

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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:

    32.321:   "Test management Integration Reference Point (IRP): Requirements"**;**

    32.322:   "Test management Integration Reference Point (IRP): Information Service (IS)";

    32.326:   "Test management Integration Reference Point (IRP): Solution Set (SS) definitions".

A 3G telecommunication network is composed of a multitude of different network elements (NE). For a successful operation of the network the operator must be provided with mechanisms allowing him to manage the network. These management activities can be grouped into several areas: configuration management, fault management, performance management, accounting management and security management.

A management function assisting in different high level management areas such as fault management and performance management is test management. The purpose of testing is to get information about the functionality and performance of the 3G managed network subject to the test.

The present document is part of a set of technical specifications defining the telecommunication management (TM) of 3G systems. The TM principles are described in 3GPP TS 32.101 [5]. The TM architecture is described in 3GPP TS 32.102 [6]. The other specifications define the interface (ITf-N) between the managing system (manager), which is in general the network manager (NM) and the managed system (agent), which is either an element manager (EM) or the managed NE itself. The Itf-N is composed of a number of integration reference points (IRPs) defining the information in the agent that is visible for the manager, the operations that the manager may perform on this information and the notifications that are sent from the agent to the manager. One of these IRPs is the Test Management IRP.

Each IRP is specified by a set of TSs: Requirements, Information Service, CORBA SS, etc.

1 Scope

The present document describes, in addition to the requirements defined in [1] and [2], the requirements for the Test Management IRP.

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]   ITU-T Recommendation X.745: "Information technology - Open Systems Interconnection - Systems Management: Test management function".

[4]   3GPP TS 32.301: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Requirements".

[5]   Void

[6]   ITU-T Recommendation X.737: "Information technology - Open Systems Interconnection; Systems Management: Confidence and diagnostic test categories".

[7]   IETF RFC2679: "A One-way Delay Metric for IPPM".

[8]   IETF RFC3393: "IP Packet Delay Variation Metric for IP Performance Metrics (IPPM)".

[9]   IETF RFC2680: "A One-way Packet Loss Metric for IPPM".

[10]   IETF RFC2681: "A Round-trip Delay Metric for IPPM".

3   Definitions and abbreviations

3.1   Definitions

For the purposes of the present document, the following terms and definitions apply:

test category: one or more tests sharing a common purpose and similar characteristics

Tester Object (TO): managed object that is instantiated for the purpose of monitoring and controlling a test invocation Each test invocation has one associated TO. TOs are created and deleted by managed objects with TARR functionality.

3.2   Abbreviations

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

    NE   Network Element
    NM   Network Management Center
    TARR   Test Action Request Receiver
    TO   Tester Object

4   Purpose

The purpose of testing is to get information about the functionality and performance of the 3G managed network subject to the test. This information can be used in other network management areas, for instance in fault management.

Testing is an activity that involves the operator, the managing system (the OS) and the managed system (the NE). Generally the operator requests the execution of tests from the OS and the managed NE autonomously executes the tests without any further support from the operator.

In case of intrusive tests it is required that the network resources to be tested are locked prior to test execution. During the test execution the telecommunication service provided by the network resources is interrupted. After completion of the test, depending on the test result, the network resources shall be set to the most appropriate state.

Test management capabilities should be provided over the Itf-N in order to allow the NM operator to perform tests on network resources. This capability is especially important at times when only the NM but not the OMC is attended, which might be the case at night or during weekends.

In the context of fault management the NM operator may use the testing capabilities over the Itf-N for numerous purposes:

-    When a fault has been detected and if the information provided in the alarm report is not sufficient to localise the faulty resource, tests can be executed in order to localise the fault.

-    When a fault has been detected and if the information provided in the alarm report specifies the faulty resource, tests can be executed on that resource in order to determine the required repair action.

-    During normal operation of the NE, tests can be executed for the purpose of discovering undetected faults.

-    After a faulty resource has been repaired or replaced and before it is restored to service, tests can be executed on that resource in order to make sure that it is fault free.

However, regardless of the context where the testing is used, its target is always the same: verify if a system's physical or functional resource performs properly and, in case it happens to be faulty, provide all the information to help the operator to localise and correct the fault.

The requirements for the test management service shall be based on ITU-T Recommendation X.745 [3].

5 Requirements

5.1 Overview

The IRPManager (test conductor) must be able to initiate and terminate tests. For this purpose special test initiation and termination requests may be used. The IRPAgent (test performer) must be able to receive and react upon these requests. Special objects may be created for the purpose of monitoring and control of the test execution. During test execution the IRPManager shall be able to monitor the test.

Test results shall be made available to the IRPManager by test result reports (notifications). It shall be possible to log these test result reports.

This gives rise to the following requirements for the test management function to be satisfied:

- the ability for the manager to initiate tests;

- the ability for the manager to terminate tests;

- the ability for the manager to monitor the test execution;

- the specification of a mechanism to report the test results to the manager;

- the specification of a mechanism to log test results in the agent.

These capabilities are outlined in the following sections in more detail.

5.2 Test

5.2.1 Test Initiation

The IRPManager shall be able to initiate a test in the IRPAgent by sending a test request to the IRPAgent. The IRPAgent must have at least one object instance capable of receiving these test requests. In response to a test request one or more tests shall be initiated. Each test shall be controlled and monitored individually by special objects instantiated exclusively for this purpose. These objects are called Tester Objects (TOs). Each of the tests initiated in response to a test request shall have a single associated TO.

The test request shall include the following information:

- The network resources to be tested.

- Information about the managed objects (e.g. TOs) assisting in the test execution.

- Any other information useful for the test execution.

In response to the test request the IRPAgent shall send a test request response to the IRPManager. For a successful test request this response shall contain the following information:

- A unique identifier for each test initiated by the test request.

- Information about the managed objects assisting to execute the test.

For a failed test request the response shall contain the following information:

- Information about the reason for the failure.

5.2.2   Test Termination

A test may terminate in two different ways, either by request (explicit test termination) or spontaneously (implicit test termination).

5.2.2.1   Explicit Test Termination

During the lifetime of a test explicit test termination may be requested by the IRPManager by:

-     Emission of a test termination request.

The test termination request must be directed to the object in the IRPAgent which received the test request. The test termination request shall provide the following information:

•   The identifiers of the tests to be terminated.

All TO(s) related to the tests to be terminated shall be deleted.

After reception of a test termination request a test termination response shall be generated by the IRPAgent and forwarded to the IRPManager. In case the test termination request is successful the test termination response shall contain the following information:

-     The identifiers of all tests that have been successfully terminated.

If one or more of the tests specified in the test termination request cannot be terminated a test termination request failure response shall be generated. This response shall contain the following information:

-     The identifiers of the tests that could not be deleted.

-     Information about the reason for the failure.

5.2.2.2   Implicit Test Termination

Implicit test termination may be triggered by three events:

-     Fulfilment of conditions for a successful completion of the test.

-     Fulfilment of conditions for a premature termination of the test, e.g. expiry of a time-out period.

-     Occurrence of abnormal conditions, e.g. fault situations.

5.2.3   Test Monitoring

The IRPManager shall be able to monitor the tests, i. e. get information about the tests while they are still executing. For this purpose the IRPManger shall be able to inquire the values of attributes containing specific information about the test execution.

5.2.4 Test Result Reporting

Test results shall be made available to the IRPManager by one or more notifications emitted by the TO that is related to the test. These notifications shall be generated in an automatic manner upon occurrence of predefined triggering events without that any action of the IRPManager is required (unsolicited reporting). The triggering events depend on the test category and shall be defined by the TO class behaviour.

Depending on the nature of the test and the amount of test result data to be transferred to the IRPManager it may be beneficial to capture some test result data in a file and to transfer this file to the IRPManager. It is up to the TO to decide whether the file based transfer of test result data shall be used in addition to the emission of test result notifications.

Test result notifications may be emitted during the test execution (intermediate test result reporting) and at the end of the test execution (final test result reporting).

The event triggering the emission of final test result reports is the termination of the test execution, irrespective of if the test terminates by request or spontaneously except for the case where the test is terminated by deleting its related TO. This applies to all test categories.

The events triggering intermediate test result reporting depend on the test category. They may include:

- Arrival of the test execution at specified points, for example at the end of test phases.

- Expiry of specified reporting time intervals.

- Fulfilment of certain predefined criteria.

A test result notification shall include the following information:

- The identifier of the test for which the results are reported.

- Information about the outcome of the test, e.g. if the test terminated successfully upon test completion or prematurely.

- Information about the test and the test execution, e.g. tested network resources, proposed repair actions in case of fault detection.

- Any other useful information pertaining to the test.

For test result reporting the Notification IRP as defined in 3GPP TS 32.301 [4] to 3GPP TS 32.304 [5] shall be used. According to the operations provided by the Notification IRP the IRPManager is able to specify filter conditions selecting the notifications that are forwarded over the Itf-N to the IRPManager. Notifications not satisfying the filter conditions are discarded.

5.3 Test States

For the purpose of monitoring tests TOs shall provide information about the current state of a test. Therefore each TO shall support a special test state attribute. The test state may assume one of the following values: not initialised, idle, initialising, testing, terminating, disabled. The actual test state value shall be derived from the actual operational state and procedural status according to the mapping table specified in ITU-T Recommendation X.745 [3].

Any state change shall be reported to the NM using the Notification IRP.

5.4 Test Categories

Most tests can be classified into test categories. In ITU-T Recommendation X.737 [6] eight different test categories are defined.

In case a certain test does not fit in any of the test categories defined in ITU-T Recommendation X.737 [6] vendors shall define new vendor-specific-extended (VSE) test categories.

5.4.1 Resource Self Test

Resource self tests are used to investigate the ability of a simple resource in the managed network (e.g. a hardware board) to perform its allotted function. For the specification of the resource to be tested a single MORT is required. No associated objects are necessary.

The resource self test may be intrusive or non-intrusive. In case of intrusive tests the MORT has to be placed in the appropriate state before the test may start. If this is not possible the test request is rejected.

5.4.2 Connection Test

The connection test allows investigation of the ability of a communications path in the IP network to support a desired service or level of functionality. Both the MORT(s) and AOs are required in the connection test. The MORT(s) represent the communications path to be tested. Two AOs are defined that reference the resources at the ends of the communications path.

The following parameters should be returned:

- the time delay in the communications path [7];

- the time delay variation in the communications path [8];

- The packet loss ratio in the communications path [9].

In the ITU-T Recommendation X.737 [6], the definition of the above parameters is not given.

In the IP network, the definition of these parameters is given in the IETF RFC [7], [8], [9].

5.4.3 Loopback Test

The Loopback test is used to verify that data may be sent and received over a communications path within a specified loopback time-out period with an acceptable error ratio. Both the MORT(s) and AOs are required in the loopback test. The MORTs represent the resources that are being tested by the loopback test. The AOs references the resources providing the loopback points.

The following parameters should be returned.

- the time delay in the communications path [10].

- the time delay variation in the communications path.

- the packet loss ratio detected in the tested communications path.

In ITU-T Recommendation X.737 [6] the definition of the above parameters is not given.

In the IP network the definition of time delay in the loopback test is given in the IETF RFC [10].
The definitions of time delay variation and loss ratio in the loopback test are similar to the definitions in the connection test in the IETF RFC [8], [9].

Annex A (informative):
Change history

Change history								
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Cat**	**Old**	**New**
Jun 2002	SA_16	SP-020328	--	--	Submitted to TSG SA #16 for Information	--	1.0.0	
Sep 2002	SA_17	SP-020456	--	--	Submitted to TSG SA #17 for Approval	--	2.0.0	5.0.0
Dec 2002	--	--	--	--	Cosmetics	--	5.0.0	5.0.1
Mar 2004	SA_23	SP-040105	--	--	Automatic upgrade to Rel-6 (no CR)	--	5.0.1	6.0.0
Sep 2006	SA_33	SP-060549	0001	--	Add new test categories of network performance measurement	B	6.0.0	7.0.0
Mar 2007	--	--	--	--	Delete reference to the 32.324 CMIP SS. Reason: SA#35 endorsed the SA5 decision to not propagate the CMIP Solution Sets to Rel-7 (TS 32.3x4, TS 32.4x4, TS 32.6x4)	--	7.0.0	7.0.1
Dec 2007	SA_38	SP-070743	0002	--	R8 CR 32.321-701 Add new output parameters (time delay, time delay variation and packet loss ratio in connection and loopback test categories)	B	7.0.1	8.0.0
Dec 2009	-	-	-	-	Update to Rel-9 version (MCC)	-	8.0.0	9.0.0
Mar 2011	-	-	-	-	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**
2022-04	-	-	-	-	-	Update to Rel-17 version (MCC)	**17.0.0**

History

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