International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Q.3902

(01/2008)

SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for the NGN – Testing for NGN networks

Operational parameters to be monitored when implementing NGN technical means in public telecommunication networks

Recommendation ITU-T Q.3902

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Recommendation ITU-T Q.3902

Operational parameters to be monitored when implementing NGN technical means in public telecommunication networks

Summary

Recommendation ITU-T Q.3902 describes the main requirements of an NGN monitoring system which could be used on the model networks for NGN technical means testing and as a part of operations support system (OSS) for monitoring operation flows on the existing provider's networks.

The basic principles of NGN monitoring system building, the common parameters to be monitored and the requirements for NGN monitoring system usages on the public telecommunication networks are given in this Recommendation.

Source

Recommendation ITU-T Q.3902 was approved on 23 January 2008 by ITU-T Study Group 11 (2005-2008) under Recommendation ITU-T A.8 procedure.

Keywords

Model networks, monitoring system, next generation networks (NGN), OSS, PSTN, technical means, testing.

FOREWORD

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Operational parameters to be monitored when implementing NGN technical means in public telecommunication networks

1 Scope

The concept of NGN [ITU-T Y.2001] is an evolutionary tendency in public telecommunication networks development. All stages of NGN evolution could be divided into networks which are realized by PES architecture, which employs interworking between CS and PS networks and networks whose architecture is based on IMS platform with a wide range of services and different types of content.

Independent from the evolutionary state of the networks, network providers need to implement a network monitoring system which can manage the quality of network operations and prevent faults.

The NGN monitoring system (NMS) has to be built in accordance with the NGN functional model and has to control all protocols implemented by it. For example, the control protocol list may include: services layer (SIP, H.323, H.248, MGCP, etc.), transport layer (MPLS, BGP, EGP, Diffserv, etc.), and application layer (Diameter, SIP, AAA, Parlay, etc.). Also in accordance with NGN evolution, the NMS could include protocols implemented by CS networks (SS7, DSS1, etc.).

NMS could be also used as part of the OSS systems and take part in fault management and in performance management systems [b-ITU-T M.3060]. The monitored parameters form the fundamental data about the different layers (LLA) of the OSS architecture [b-ITU-T M.3060]. NMS could control and compare different parameters of protocols and operational interfaces and, in accordance with [ITU-T M.3010] could control all network elements and services.

NMS allows the control of not only stand-alone elements, but also of different types of NGN call scenarios and maintenance parameters, which could be useful for QoS testing.

As a result, NMS is an important and a basic measurement instrument which must be provided in the NGN network. NMS must be used in the model network in accordance with [ITU-T Q.3900] and is a basic requirement for testing of NGN technical means.

This Recommendation describes the basic requirements of an NGN monitoring system and allows to understand what parameters have to be controlled by the NMS.

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.3010] Recommendation ITU-T M.3010 (2000), *Principles for a telecommunications management network*.

[ITU-T Q.752] Recommendation ITU-T Q.752 (1997), *Monitoring and measurements for Signalling System No. 7 networks*.

[ITU-T Q.3900] Recommendation ITU-T Q.3900 (2006), *Methods of testing and model network architecture for NGN technical means testing as applied to public telecommunication networks*.

[ITU-T Y.2001] Recommendation ITU-T Y.2001 (2004), *General overview of NGN*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 model network [b-ITU-T Q.3901]: A network which simulates the capabilities similar to those available in telecommunication networks; it has a similar architecture and functionality and uses the same telecommunication technical means.

3.1.2 NGN technical means [b-ITU-T Q.3901]: The NGN network equipment which serves as a basis for building next generation network solutions, including applications in public telecommunication networks.

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 NGN monitoring systems (NMS): A system which is responsible for online (under payload) measurement values of the NGN protocols carried out on the different NGN strata.

4 Abbreviations

This Recommendation uses the following abbreviations:

AAA	Authentication, Authorization and Accounting
ACE	Application Creation Environment
AS	Application Server
BS	Billing System
CS	Circuit Switching network
GW	Gateway
GW-LTE	Media gateway for Legacy Terminal Equipment
IMS	IP Multimedia Subsystem
IP	Internet Protocol
LLA	Logical Layered Architecture
MeS	Messaging Server
MG	Media Gateway
MGC	Media Gateway Controller
MPLS	MultiProtocol Label Switching
MS	Media Server
NMS	NGN Monitoring System
NGN	Next Generation Network
NGN-IAD	NGN Integrated Access devices
NGN-TD	NGN Terminal Devices
OSS	Operations Support System

PES	PSTN/ISDN Emulation Service
PS	Packet Switching network
PSTN	Public Switched Telephone Network
SG	Signalling Gateway
SIP	Session Initiation Protocol
TM	Technical Means
TNE	Transport Network Environment

5 Conventions

None.

6 Compatibility issues

None.

7 NGN monitoring system requirements

NMS has to be present at all stages of the NGN evolution. Basically, NMS has to be implemented from a hybrid environment: interworking between CS and PS networks. In this case, networks will include a wide range of different types of technical means. In accordance with [ITU-T Q.3900], the set of TM has to include:

– Call session control system:
  - Media gateway controller (MGC)
  - Proxy server SIP (PS)
  - IP multimedia subsystem (IMS)
– Voice and signalling transmit system:
  - Media gateway (GW)
  - Signalling gateway (SG)
  - Transport network environment (TNE)
– Application servers:
  - Application server (AS)
  - Media server (MS)
  - Messaging server (MeS)
  - Application creation environment (ACE)
– Management and billing system:
  - Management system (MS)
  - Billing system (BS)
– Access environment:
  - NGN integrated access devices (NGN-IAD)
  - Media gateway for legacy terminal equipment (GW-LTE)

From its initial installations, NMS, based on PES architecture, has to include measurement modes of both CS protocols and PS protocols. As an example, NMS must allow measurement of CS signalling protocols (SS7, DSS1, etc.) and PS signalling protocols (SIP, H.323, H.248, MGCP, etc.)

For the second step of the NMS evolution, which is based only on the IMS architecture, the NMS must implement all kinds of NGN protocols on all NGN functional architecture strata. For example, the set of protocols could include MPLS, BGP, EGP, Diffserv, Diameter, SIP, AAA, Parlay, etc.

As a result, all NGN TM in accordance with the NMS evolution would be divided into two parts:

PES NGN TM part

– Call session control system:
  - Media gateway controller (MGC)
  - Proxy server SIP (PS)
– Voice and signalling transmit system
– Management and billing system
– Access environment:
  - NGN integrated access devices (NGN-IAD)
  - Media gateway for legacy terminal equipment (GW-LTE)

IMS NGN TM part

– Call session control system:
  - IP multimedia subsystem (IMS)
– Voice and signalling transmit system
– Application servers
– Management and billing system
– Access environment
  - NGN terminal devices (NGN-TD)

Each part could include different types of signalling protocols. The main difference between PES NGN TM and IMS NGN TM is the functionality and type of protocols implemented on it. In the PES part, the call session control system is based on the Softswitch technologies. In this case, the common issue of PES is interworking with the legacy TDM networks. The call session control system based on IMS is, on the other hand, responsible for call control between NGN terminal devices.

The distribution of signalling protocols by different types of TM, which are monitored by NMS, is shown below.

PES NGN TM part

– Call session control system (H.248, MGCP, SIP, SIP-I, SIP-T, BICC)
– Voice and signalling transmit system (H.248, MGCP, SIP, SIGTRAN, SS7, R1, R2, DSS1)
– Management and billing system (AAA, Diameter, SIP)
– Access environment (MGCP, H.248, H.323, SIP)

IMS NGN TM part

– Call session control system (SIP, SIP-I)
– Voice and signalling transmit system (SIP, SS7, R1, R2, DSS1)
– Management and billing system (AAA, Diameter, SIP)
– Access environment (SIP)

As illustrated, the basic set of protocols must be implemented on the initial phase (PES NGN) of NMS.

The next step of NMS evolution includes the other signalling protocols and takes into account the specific signalling requirements implemented by IMS.

The architecture of NMS includes different types of subsystems. Figure 1 shows the basic functional architecture of NMS. The NMS consists of the following subsystems:

– SS7 monitoring subsystem;
– SIP protocol monitoring subsystem;
– H.248 protocol monitoring subsystem;
– voice (transfer) service level monitoring subsystem;
– streaming video service level monitoring subsystem;
– service level agreements performance monitoring subsystem;
– IP information flows monitoring subsystem (RTP/RTCP protocols level);
– application server monitoring subsystem;
– hardware faults and reconfiguring procedures monitoring subsystem.

The signalling system monitoring subsystems shall be independent from the vendor's NGN TM (for example, MGC, PS, MG, etc.). In order to gather and initially process any other subsystem information, the vendor's NGN TM management systems shall be in use. The SNMP or NetFlow may be used as the interaction protocol among the monitoring system central elements. The message format shall be specified by the Telecommunication Administrations.

The following architecture of NMS includes the two common blocks of NMS evolutionary stages (PES and IMS architecture).

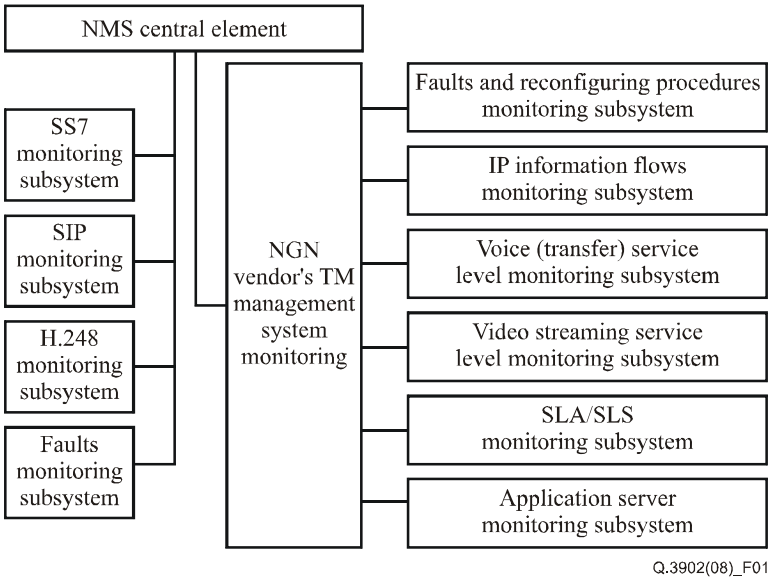

Figure 1 – Basic architecture of NMS

8 NMS common measured values

As mentioned above, NMS must include the CS protocols. In this case, the monitoring system must be built in accordance with [ITU-T Q.752].

According to [ITU-T Q.752], the following categories regarding the measured values should be defined in the NMS based on PES and IMS solutions:

– **fault (F)**: Measurement for reporting processes and detecting problems, as well as for finding out some abnormal situations in the SS7, SIP and H.248 signalling networks, and for NGN hardware, involving its reconfiguring and restarting procedures;

– **quality (Q)**: Measurement for service level parameters intended for different traffic types involving voice and video under different services; for reporting processes; for assuming measures in providing the service level guaranteed, as well as for developing an operator's policy and strategy in the field of providing a certain service level. It should be also used to have the SLA and/or SLS performed and relevant reports drawn up;

– **traffic (T)**: Measurement for real-time traffic parameters based on the IP flows information for the purpose of identifying any unwanted and unauthorized traffic; studying any internal and external impact on network security; finding out any network abnormal events; defining when requesting the user-to-user, user-to-network, network-to-user interaction parameters; studying traffic changes trends; and conducting prevention management;

– **accounting (A)**: Measurement to estimate the reliability of accounting data;

– **network administration and planning (N)**: Measurement for SS7 and NGN networks administration including the SIP and H.248 signalling systems; make decisions on networks development and further network planning; optimizing network infrastructure enhancement investment; planning applications and services; preparing traffic data to allow planning of future networks;

– **near-real-time measurements (R)**: Measurement for finding out any faults in the network. It shall be considered supplementary to the above-mentioned measurements.

8.1 SS7 MS NMS measured values

The SS7 monitoring subsystem should provide the implementation of all the functions submitted for NMS based on PES and should be compatible with [ITU-T Q.752]. According to [ITU-T Q.752], the following categories of values measured by the SS7 monitoring subsystem NMS processes are selected:

– **fault (F)**: Measurements carried out to issue reports and detect faults as well as to reveal emergency situations in the SS7 signalling system;

– **configuration (C)**: Measurements carried out in the course of dynamic reconfiguration due to faults elimination or administrative actions;

– **performance (P)**: Measurements carried out to estimate a stability and a reliability of the SS7 signalling network when providing services;

– **accounting (A)**: Measurements carried out to ensure the reliability of accounting, by comparison with subscribers billing data;

– **network administration and planning (N)**: Measurements carried out to administer the SS7 signalling network, make decisions on its development and further planning;

– **near-real-time measurements (R)**: Measurements carried out to reveal emergencies in network operation; they are considered as additional to those listed above.

8.2 SIP MS NMS measured values

The SIP monitoring subsystem should provide implementation in accordance with the basic NMS architecture based on PES solutions too. As a result, the SIP monitoring subsystem has to include:

– **fault (F)**: All, except for reconfiguring and restarting processes;

– **quality (Q)**: All, except for the functions concerning the SLA and/or SLS execution monitoring;

– **traffic (T)**: Detecting any unauthorized traffic, analysing internal and external impact on network security, finding out abnormal situations in the network;

– **accounting (A)**: All;

– **network administration and planning (N)**: All.

8.3 H.248 MS NMS measured values

The H.248 monitoring subsystem should provide implementation in accordance with the basic NMS architecture based on PES solutions too. As a result, the H.248 monitoring subsystem has to include:

– **fault (F)**: All, except for reconfiguring and restarting processes;

– **quality (Q)**: All, except for the SLA and/or SLS execution;

– **network administration and planning (N)**: All;

– **near-real-time measurements (R)**: All.

8.4 IP MS NMS measured values

The IP monitoring subsystem should provide implementation in accordance with the basic NMS architecture based on PES and IMS solutions too. IP monitoring subsystem specifies **traffic (T)** and **network administration and planning (N)** functions.

8.5 Requirements of monitoring NGN management system

Based on the functional division of the goals concerning the next generation network operations support system (NGN OSS) networks management and operation, the following functions may be provided in the monitoring systems:

– service level monitoring both at the network management level and the resource management level;

– problems monitoring related to problem detection and problem response. Problem detection shall be related to the resource management level, and problem response shall meet the network management level requirements;

– Service level agreement (SLA) and service level specification (SLS) implementation monitoring;

– IP information and traffic performance flows monitoring.

Quality of service monitoring subsystem for voice transmission should ensure execution of function **Q** as per voice data transmission.

Quality of service monitoring subsystem for video bit rates should ensure execution of function **Q** as per video data transmission.

SLA/SLS monitoring subsystem should ensure execution of function **Q** as per SLA/SLS performance and the relevant reporting. Application server monitoring subsystem should ensure execution of functions **F** and **R**.

Failure and reconfiguration monitoring subsystems should ensure execution of functions **F** and **R**.

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Printed in Switzerland
Geneva, 2009