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Part 1: Performance Management at the SI-SAP

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The present document is part 1 of a multi-part deliverable covering Performance Management aspects in "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM)", as identified below:

Part 1: "Performance Management at the SI-SAP";

Part 2: "Performance Management Information Base".

Introduction

The BSM Technical Reports [i.1], [i.2] and [i.3] outlined the general requirements for performance in BSM networks; Technical Specifications [1] and [2] have subsequently defined the BSM Management Functional Architecture and the BSM Performance Parameters respectively. Outside ETSI, ITU and IETF (in the IPPM working group) have also defined a large number of richly parameterized metrics and protocols to deal with Performance Management (PM); these parameters and protocols have been taken into account in defining BSM performance parameters ([2] gives references to ITU and IETF metrics), and to define the PM strategies specified in the present document for BSM networks.

As a result, the focus of the present document is on setting a clear framework of PM for BSM networks and on trying to present all M-plane functions and instruments that can be used to manage the defined performance parameters.

1 Scope

The present document defines generic Performance Management in BSM networks based on the management architecture given in [1].

The present document provides a framework for the possible Management-plane (M-plane) performance-related strategies, functions, and protocols that can be used to monitor performance parameters in BSM networks.

Performance Management is here understood to be restricted to BSM network performance measurement and monitoring with all associated supporting functions; this is better explained in clause 4.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ETSI TS 102 672: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Management Functional Architecture".

[2] ETSI TS 102 673: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Performance Parameters".

[3] IETF RFC 1213: "Management Information Base for Network Management of TCP/IP-based internets:MIB-II".

[4] IETF RFC 1445: "Administrative Model for version 2 of the Simple Network Management Protocol (SNMPv2)".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] ETSI TR 101 984: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Services and architectures".

[i.2] ETSI TR 101 985: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; IP over Satellite".

[i.3] ETSI TR 102 157: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; IP Interworking over satellite; Performance, Availability and Quality of Service".

[i.4] ETSI TS 102 292: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM) services and architectures; Functional architecture for IP interworking with BSM networks".

[i.5] ETSI TS 102 464: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Interworking with DiffServ Qos".

[i.6] IETF RFC 3289: "Management Information Base for the Differentiated Services Architecture".

[i.7] IETF RFC 3444: "On the Difference between Information Models and Data Models".

[i.8] ITU-T Recommendation M.3400: "TMN management functions".

[i.9] ITU-T Recommendation P.862 (02/2001): "Perceptual evaluation of speech quality (PESQ): An objective method for end-to-end speech quality assessment of narrow-band telephone networks and speech codecs".

[i.10] IETF RFC 2819: "Remote Network Monitoring Management Information Base".

[i.11] IETF RFC 3577: "Introduction to the RMON Family of MIB Modules".

[i.12] IETF RFC 2722: "Traffic Flow Measurement: Architecture".

[i.13] IETF RFC 2720: "Traffic Flow Measurement: Meter MIB".

[i.14] IETF RFC 3917: "Requirements for IP Flow Information Export (IPFIX)".

[i.15] IETF RFC 5101: "Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information".

[i.16] RFC 5102: "Information Model for IP Flow Information Export".

[i.17] IETF RFC 5153: "IPFIX Implementation Guidelines".

[i.18] IETF RFC 5470: "Architecture for IP Flow Information Export".

[i.19] IETF RFC 5476: "Packet Sampling (PSAMP) Protocol Specifications".

[i.20] IETF RFC 5477: "Information Model for Packet Sampling Exports".

[i.21] IETF RFC 4656: "A One-way Active Measurement Protocol (OWAMP)".

[i.22] IETF RFC 1229: "Extensions to the generic-interface MIB".

[i.23] IETF RFC 2206: "RSVP Management Information Base using SMIv2".

[i.24] IETF RFC 2213: "Integrated Services Management Information Base using SMIv2".

[i.25] IETF RFC 2214: "Integrated Services Management Information Base Guaranteed Service Extensions using SMIv2".

[i.26] IETF RFC 2863: "The Interfaces Group MIB".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in [1] and the following apply:

control plane: this has a layered structure and performs the call control and connection control functions; it deals with the signalling necessary to set up, supervise and release calls and connections

management plane: this provides two types of functions, namely layer management and plane management functions:

- **plane management functions:** performs management functions related to a system as a whole and provides co-ordination between all the planes

NOTE: Plane management has no layered structure.

- **layer management functions:** performs management functions (e.g. meta-signalling) relating to resources and parameters residing in its protocol entities

NOTE: Layer Management handles the operation and maintenance (OAM) of information flows specific to the layer concerned.

MIB: (also known as a managed object) one of any number of specific characteristics of a managed device

NOTE: MIBs comprise one or more object instances (identified by their OIDs), which are essentially variables.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in [1] and the following apply:

B-NMS	BSM Network Management System
BSM	Broadband Satellite Multimedia
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
FTP	File Transfer Protocol
HTTP	Hypertext Transfer Protocol
ICMP	Internet Control Message Protocol
ICPIF	Calculated Planning Impairment Factor
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPFIX	IP Flow Information Export
IPPM	IP Performance Metrics
ITU	International Telecommunications Union
MIB	Management Information Base
MP	Measurement Point
MOS	Mean Opinion Score
NAP	Network Access Provider
OID	Object Identifier
OSS	Operations Support System
OWAMP	One-Way Active Measurement Protocol
PESQ	Perceptual Evaluation of Speech Quality
PM	Performance Management
QID	Queue IDentifier
QoS	Quality of Service
RFC	Request For Comments
RMON	Remote Network Monitoring
RTFM	Realtime Traffic Flow Measurement
SLA	Service Level Agreement
SNMP	Simple Network Management Protocol
SNO	Satellite Network Operator

ST	Satellite Terminal
VoIP	Voice over Internet Protocol

4 Objectives of performance management

Network performance management functionalities are shifting from relatively simple availability measurements to those based on detailed Quality-of-Service (QoS) performance assessment. This is because network element availability is generally high and stable, with hardware or software infrastructure failures occurring infrequently, but at the same time increasing variety of traffic (e.g. voice, video and data), and multi-tiered applications have led to an increase in the volume and complexity of network traffic.

Hence network management is moving from the limited perspective of "device-aware" network management to a focus on service delivery - a "service-aware" perspective that is both more comprehensive and more cost-effective. Being service-aware means that it understands the traffic flowing over the network. Once armed with that understanding, traffic flows can be prioritised and devices configured based on the value and priority of the important traffic.

Whereas this is true as well for satellite as for terrestrial networks, normally the satellite link represents, from the performance management point of view, the weak ring in the end-to-end chain; thus one of the key objectives of Performance Management in satellite networks is ultimately to ensure that Service Level Agreements between the satellite service provider (SNO, NAP, etc.) and other service providers are met. Hence the aspects of Performance Management which are of interest to different actors in the network need to be taken into account here.

The objectives of Performance Management can be divided into the following categories (or function set groups according to ITU classification - see [i.8]):

- Performance Quality Assurance.
- Performance Monitoring.
- Performance Management Control.
- Performance Analysis.

These categories will be briefly explained in the following sub-clauses highlighting those which are relevant for the present document. It should be then clear to the reader that the document deals primarily with Performance Monitoring and Performance Analysis (assessment) in BSM networks.

Network performance assessment is, to a greater of lesser extent, included within Performance Monitoring up to the level of monitoring required. Network performance assessment is based on network traffic measurements, which can be performed in two ways:

- with active measurements, which are performed by injecting traffic with known properties into the network; and/or
- with passive measurements, which consist of monitoring the existing traffic flow(s) at one or more measurement points.

Quality of Service (QoS) is one of the main objectives for network services and is often a main constituent of the SLA of a given NAP. QoS is directly related to network performance. QoS measurement or assessment lies logically above network traffic measurements, and relate to the performance of networking applications; they exploit the measurement data to derive quantitative considerations on the "health" of the network:

- Objective QoS relates to something concrete and quantitative (e.g. packet loss, delay, jitter, connection break length, etc.);
- Subjective QoS corresponds to the service quality from the user perspective (Mean Opinion Score (MOS) tests are often used), subjective QoS can be estimated within certain limits from the basis of objective QoS (e.g. PESQ algorithm [i.9]).

In any case the performance parameters to be considered in BSM networks for performance monitoring and assessment are those described in [2]; they refer to layer-3 (IP-layer) parameters and only indirectly, through the BSM SI-SAP parameters (which are generalized representations of specific SD features), to lower-layer parameters.

4.1 Performance Quality Assurance

Performance Quality Assurance supports decision processes that establish, according to current state-of-the-art, SLAs, and customer needs, the quality measures that are appropriate for a correct performance management. It concerns setting the alert thresholds, selecting the types of test to perform, the frequency with which to perform tests, etc.

It is up to the BSM network operator how to deal with these decisions and these functions will not be elaborated further in the present document.

4.2 Performance Monitoring

Performance Monitoring involves the continuous collection of data from the BSM network elements. The basic function of Performance Monitoring is to track system, network or service activities in order to gather the appropriate data for determining performance of the BSM network.

The operation is designed to measure the overall quality of the network connections, using monitored parameters in order to detect service degradation in a timely way. It may also be designed to detect characteristic patterns of impairment before service quality has dropped below an acceptable level.

These are key operations to be considered when defining the M-plane functions in BSM networks; they will be addressed in clauses 6 and 7.

4.3 Performance Management Control

Performance Management Control has two main functional areas: on one side it supports the transfer of information to control the monitoring functions within the network; on the other side it includes the application of traffic controls to guarantee a proper network operation in terms of performance.

For the former area, the Performance Management Control deals, for example, with configuration of measurement schedules, sampling intervals, alert thresholds, and other attributes for monitoring and for test traffic, etc. These are also key operations to be considered when defining the M-plane functions in BSM networks; they will be addressed in clauses 6 and 7. The present document will mainly refer to this set of functionalities as "Performance Monitoring Configuration".

The second functional area (enforcement of traffic control policies) may affect the shaping and/or routing of traffic and the processing of flows. It is very much linked to BSM network operator strategies, so it is considered out of the scope of the present document and it will not be elaborated further in the present document.

4.4 Performance Analysis

Performance Analysis processes the measurement data and evaluates the performance level of the network and its elements.

This kind of analysis depends on, and it is in fact derived from, the type of measurement performed. It is up to the BSM network operator how to define the necessary analysis to be applied on the performed measurements and this will not be elaborated in details in the present document. Anyway since performance assessment is necessary up to a certain level and it is part of Performance Analysis some considerations will be given in the clauses 6 and 7.

5 Information model for performance management

BSM Performance Management takes into account measurements at the IP-layer and at the SI-SAP interface between the BSM and lower layers. Layer-2 issues and layer-2 Measurement Point s (MPs) will not be considered here; so satellites with On-Board Processing (OBP), as layer-2 MPs, will not be considered in the present document.

Considering the BSM management functional architecture in [1], to simplify the discussion in the present document, it is assumed that every BSM ST implements a standard MIB-II [3] and SNMPv2 agent [4] (or later versions). It is further assumed that two types of database (D/B), D/B_1 and D/B_2 (see also figure 5.1), will be normally used in BSM networks. D/B_1 and D/B_2 are understood to be combinations of databases (e.g. MIBs), both standard and proprietary ones, as it will be explained in the following.

The internal format of D/B_1 and D/B_2 is not relevant for the scope of the present document. The present document is only concerned with the type of information transferred between management functions to populate these databases, or in other words the relationships (associations) between these entities and the roles identified in a BSM network.

D/B_1 may contain a newly specified BSM-specific MIB, or MIB modules, as defined in part 2 of this multipart deliverable. Part of these MIB modules are based on the BSM SI-SAP performance parameters defined in [2] and or more basic QID elementary attributes identified in the present document. In addition D/B_1 may contain other data structures, e.g. technology or vendor specific ones.

D/B_2 may also contain a newly specified BSM-specific MIB, or MIB modules, as defined in part 2 of this multipart deliverable. Most likely this database will be based on the BSM IP performance parameters defined in [2]. In addition D/B_2 may contain other data structures, at wish of the BSM network operator. D/B_2 is in fact the interface between the BSM-internal and external worlds; it will most likely be a combination of data elements or data structures (some standard ones, some proprietary ones, and some BSM-specific ones, as defined in part 2 of this multipart deliverable).

Visibility (read/write access rights) of the databases should be regulated by the BSM network operator; e.g. D/B_2 may or may not be made visible to external parties. In any case it should be noted that for specific data elements it may not be possible to prevent external parties from directly polling D/B_1.

The set of element management data specified in part 2 of this multipart deliverable may be in the future formally standardized as MIBs; in this case they should be provided by all BSM-compliant systems, so they will thus be accessed by means of standard SNMP through the NMC (see figure 5.1). So service and network performance considerations can be derived from it by aggregation and/or other types of analysis.

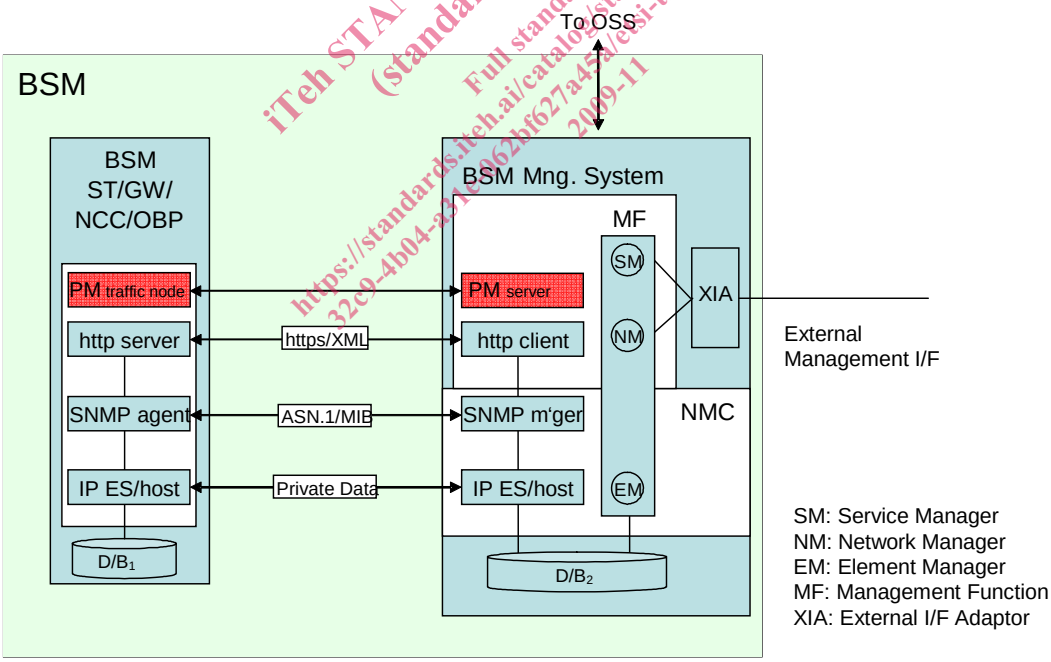

Figure 5.1: BSM Management Functional Architecture

The BSM network should also foresee a central PM server which accomplishes its tasks interacting with PM modules (or PM traffic nodes) located in the Satellite Terminals (STs). The server is responsible for selecting measurements to be performed, configuring the PM nodes to perform them, for collecting the data, and for the final performance assessment. The PM server may or may not be involved in the measurement as it is shown in figure 5.2. This centralized architecture, where a central server is responsible for the PM in the network, seems quite suitable to a satellite network.