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Foreword

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

Introduction

The present document is a consequence of the ETSI BSM report and recommendations on performance, availability and quality of service detailed in [i.1]. It was deemed to be important to have an own document about performance parameters even if this was not foreseen in [i.1].

BSM networks may be stand-alone domains, serving IP end-hosts located behind satellite terminals, but may often be connected to external terrestrial segments. Users of BSM networks require their applications to run satisfactorily over the whole end-to-end path, and thus over the satellite links, as well as over the traversed terrestrial segments. The performance of the user applications can be derived by the network performance levels provided by the underlying networks traversed by the end-to-end path, and since the terrestrial segments connected to the BSM networks, often provide measurable network performance levels, it is fundamental to specify network performance levels for the BSM systems in the same way as for terrestrial networks. In addition a network whose performance is not measurable cannot sell its services, thus the performance levels required from BSM networks need to be formalized in a set of performance parameters that can be used to check fulfilment of contractual agreements.

1   Scope

The present document defines performance parameters which will be used in BSM networks for the four functions mentioned below, i.e. for measuring performance, monitoring, controlling and analysing BSM systems.

Performance management is meant by ITU as one of the five network management categories, FCAPS, as specified by the ITU-T Recommendation M.3400 [i.4]. So, adopting the ITU terminology, the present document focuses on "Performance Parameters" as meant by the ITU and so all parameters relevant for the four remaining network management categories (Fault management, Configuration management, Accounting management and Security management) will not be considered here. ITU-T Recommendation M.3400 [i.4] also defines performance management as consisting of the following functions:

- Performance Quality Assurance.

- Performance Monitoring.

- Performance Management Control.

- Performance Analysis.

These parameters can be used, for example, by a BSM network manager to establish QoS levels for a given service, and monitor the "health" of the BSM, or to "present" the performance of the BSM network in order to assess compliancy to some contractual agreements. The parameters could be used as a basis for one or more MIBs.

According to TR 121 905 [i.23], "Network performance parameter values are usually derived from Quality of Service (QoS) parameter values". Therefore BSM performance parameters will be derived from all QoS parameters relevant to BSM networks, namely from the classical parameters for IP-based services, e.g. proposed by ITU [i.4], as well as from more BSM-specific ones, coming from the definition of the BSM QoS architecture [1],[2] and [3].

Network performance parameters may be used for different purposes: they can be used only inside the BSM network or can be exposed to BSM external interfaces; this will be also clarified in the present document. In the former case they will refer to SI-SAP properties (e.g. related to Queue Identifier (QID)) and thus they are meant for BSM-internal use only; in the latter case they can be presented by the satellite network operator to the outside world (e.g. external terrestrial network operators connected to the BSM), e.g. to prove fulfilment of contractual agreements.

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.

- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:

    - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;

    - for informative references.

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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 102 462: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); QoS Functional Architecture".

[2] ETSI TS 102 463: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Interworking with IntServ QoS".

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

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

2.2 Informative references

The following referenced documents are not essential to the use of the ETSI deliverable 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 102 157: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; IP Interworking over satellite; Performance, Availability and Quality of Service".

[i.2] ITU-T Recommendation Y.1540 (former I.380): "Internet protocol data communication service - IP Packet Transfer and Availability Performance Parameters", November 2007.

[i.3] ETSI TS 102 295: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM) services and architectures; BSM Traffic Classes".

[i.4] ITU-T Recommendation. M.3400: "TMN management functions".

[i.5] ITU-T Recommendation Y.1541 (former I.381): "IP Performance and Availability Objectives and Allocations", January 2001.

[i.6] ITU-T Recommendation M.2301: "Performance objectives and procedures for provisioning and maintenance of IP-based networks", July 2002.

[i.7] IETF RFC 2330: "Framework for IP Performance Metrics".

[i.8] IETF RFC 2678: "IPPM Metrics for Measuring Connectivity".

[i.9] IETF RFC 2679: "A One-way Delay Metric for IPPM".

[i.10] IETF RFC 2680: "A One-way Packet Loss Metric for IPPM".

[i.11] IETF RFC 2681: "A Round-trip Delay Metric for IPPM".

[i.12] IETF RFC 3148: "A Framework for Defining Empirical Bulk Transfer Capacity Metrics".

[i.13] IETF RFC 3357: "One-way Loss Pattern Sample Metrics".

[i.14] IETF RFC 3393: "IP Packet Delay Variation Metric for IPPM".

[i.15] IETF RFC 4656: "A One-way Active Measurement Protocol (OWAMP)".

[i.16] IETF RFC 4737: "Packet Reordering Metrics".

[i.17] IETF RFC 5136: "Defining Network Capacity".

[i.18] IETF RFC 3418: "Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)".

[i.19]   IETF RFC 3917: "Requirements for IP Flow Information Export (IPFIX)".

[i.20]   IETF RFC 5101: "Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information".

[i.21]   IETF RFC 5102: "Information Model for IP Flow Information Export".

[i.22]   IETF RFC 5153: "IPFIX Implementation Guidelines".

[i.23]   ETSI TR 121 905: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Vocabulary for 3GPP Specifications (3GPP TR 21.905)".

3   Definitions and abbreviations

3.1   Definitions

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

Destination host (DST): host and a complete IP address where end-to-end IP packets are terminated

> NOTE: In general a host may have more than one IP address; however, a destination host is a unique association with a single IP address. Destination hosts also terminate higher layer protocols (e.g. TCP) when such protocols are implemented (taken from [i.2]).

link: point-to-point (physical or virtual) connection used for transporting IP packets between a pair of hosts. It does not include any parts of the hosts or any other hosts; it operates below the IP layer

> NOTE: For example, a link could be a leased line, or it could be implemented as a logical connection over an Ethernet, a frame relay network, an ATM network or any other network technology that functions below the IP layer (taken from [i.2]); in the BSM case the whole satellite connection from the ingress ST to the egress ST can be defined as a link, if the satellite or the hub, connecting the two STs, do not implement the IP layer.

host: computer that communicates using the Internet protocols

> NOTE: A host implements routing functions (i.e. it operates at the IP layer) and may implement additional functions including higher layer protocols (e.g. TCP in a source or destination host) and lower layer protocols (e.g. Ethernet) (taken from [i.2]). An ST is a particular host which does not implement higher layer protocols.

Measurement Point (MP): boundary between a host and an adjacent link at which performance reference events can be observed and measured (taken from [i.2])

> NOTE: In general one Measurement Point (MP) for the performance parameters considered in a BSM network (also defined BSM MP) always coincides with one unique unicast IP address; so, where the SI-SAP is implemented (e.g. in an ST or in the hub), it also coincides with the unicast BSM_ID. Standard IP properties can be observed at BSM MPs, as well as SI-SAP specific properties, which are more related to SD events.

Network Control Centre (NCC): equipment at OSI Layer 2 that controls the access of terminals to a satellite network, including element management and resource management functionality

Network Performance (NP): ability of a network or network portion to provide the functions related to communications between users; it contributes to service accessibility, service retainability and service integrity

> NOTE: Network performance parameter values are usually derived from quality of service (QoS) parameter values (taken from TR 121 905 [i.23]).

Network Section (NS): set of hosts together with all of their interconnecting links that together provide a part of the IP service between a SRC and a DST, and are under a single (or collaborative) jurisdictional responsibility

NOTE: These hosts typically have the same network identifier in their IP addresses. Typically, they have their own rules for internal routing. Global processes and local policies dictate the routing choices to destinations outside of this network section. These network sections are typically bounded by routers that implement the IP exterior gateway protocols (taken from [i.2]). The BSM network is a particular Network Section.

population of interest: total set of packets transmitted between one (or more) ingress ST(s) and one (or more) egress ST(s), which are object of measurement

NOTE: The description of the population of interest, in any statement about measured performance, should normally include associated QoS information, namely which packet type(s) are included in the population, since performance will differ by packet type.

packet transfer reference event: event occurring when a packet crosses a measurement point (MP), so when it enters or leaves an IP level, normally crossing the SI-SAP

router: host that enables communication between other hosts by forwarding IP packets based on the content of their IP destination address field (taken from [i.2])

NOTE: In a BSM network the hub or the satellite may act as routers.

Source host (SRC): host and a complete IP address where end-to-end IP packets originate

NOTE: In general a host may have more than one IP address; however, a source host is a unique association with a single IP address. Source hosts also originate higher layer protocols (e.g. TCP) when such protocols are implemented (taken from [i.2]).

3.2   Abbreviations

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

BSM MP	Measurement Point for the performance parameters considered in a BSM networks
BSM	Broadband Satellite Multimedia
CRA	Constant Rate Assignment
CRA	Constant Rate Assignment
DST	Destination host
DVB-RCS	Digital Video Broadcasting Return Channel via Satellite
FCA	Free Capacity Assignment
FCA	Free Capacity Assignment
GPS	Global Positioning System
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPDV	IP Packet Delay Variation
IPER	IP Packet Error Ratio
IPFIX	IP Flow Information Export
IPLR	IP Packet Loss Ratio
IPPG	IP Packet Goodput
IPPM	IP Performance Metrics
IPPT	IP Packet Throughput
IPRR	IP Packet Reordered Ratio
IPSA	IP Service Availability
IPTD	IP Packet Transfer Delay
MIB	Management Information Base
MP	Measurement Point
NCC	Network Control Centre
NMC	Network Management Centre
NP	Network Performance
NS	Network Section
OSI	Open Standards Institute
OWAMP	One-Way Active Measurement Protocol

QID	Queue IDentifier
QoS	Quality of Service
RFC	Request For Comments
RSCT	DVB-RSC Terminal
RSCT	DVB-RSC Terminal
RTT	Round Trip Time
SD	Satellite Dependent
SIPR	Spurious IP Packet Rate
SI-SAP	Satellite Independent-Service Access Point
SLA	Service Level Agreement
SNMP	Simple Network Management Protocol
SNR	Signal-to-Noise Ratio
SNR	Signal-to-Noise Ratio
SRC	Source host
ST	Satellite Terminal

4   Overview

There are similarities between the ETSI, ITU and IETF definitions which allow us to decide that BSM performance parameters will be derived mainly from QoS parameters, and in addition from other aspects needed to establish and maintain BSM network operation.

The network layer (i.e. IP layer) parameters are considered to be independent of the BSM and to be well-known for typical IP hosts. These are the parameters that may have to be presented by the BSM network operator to external parties, they can be specified following ITU recommendation (e.g. [i.2]).

Instead there are other parameters, which will be specific to the BSM, they will be available at the SI-SAP and relate to lower protocol layers; they will be used for BSM-internal use.

The parameters presented in the present document represent real-time measured properties of a selected BSM entity (an ST or a QID); specification of numerical objectives or monitoring thresholds for these BSM performance parameters is left to implementers and operators.

5   BSM Performance Parameters Context

The BSM performance parameters always refer to BSM elements (e.g. STs) or to portions of the BSM network. Measurement Points (MPs) for these performance parameters (the BSM MPs) are in general associated to unique unicast IP addresses: A BSM MP can be defined at every layer-2 service access point in an IP host belonging to a BSM network (e.g. an ST, a hub, or even the satellite if it implements on-board routing). As a consequence BSM MPs coincide with SI-SAPs, in the hosts where the SI-SAP is implemented. This means that standard IP properties can be observed at BSM MPs, as well as SI-SAP specific properties, which are more related to SD events.

More formally a BSM MP is the boundary between a host and an adjacent satellite link at which performance reference events can be observed and measured (taken from [i.2]). In general a BSM MP always coincides with one unique unicast IP address; so, where the SI-SAP is implemented (e.g. in an ST or in the hub), it also coincides with the unicast BSM_ID. Standard IP properties can be observed at BSM MPs, as well as SI-SAP specific properties, which are more related to SD events.

Figure 5.1 shows the terminology to be used for BSM performance parameters according to the definitions given in clause 3.1.
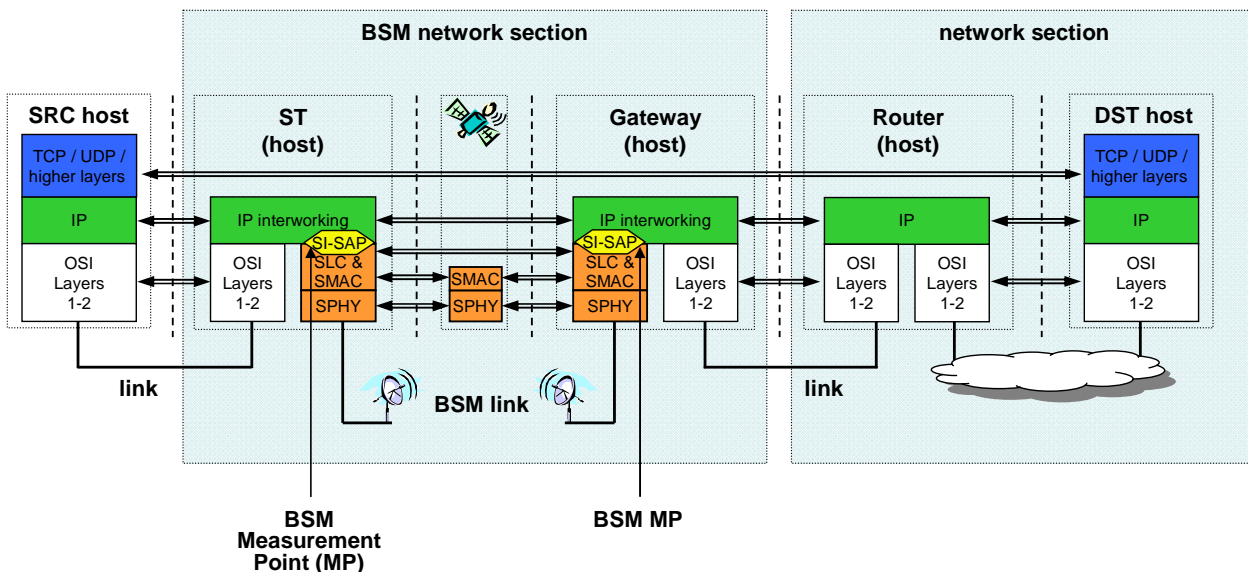
Figure 5.1: Terminology for BSM performance parameters

The BSM parameters can be classified in two groups, which are more clearly described in the next two clauses and listed in detail in clauses 6 and 7 respectively:

- **BSM SI-SAP parameters:** They are specific to the BSM, i.e. will be available at the SI-SAP and relate to lower protocol layers; they do not refer to IP-level performance, but to more specific properties of one terminal, or of one service class being provided on one particular link.

- **BSM IP parameters:** They are the typical IP-layer parameters, defined in a way similar to ITU [i.2], but with respect to a specific BSM section or a BSM link between two given devices (e.g. between two STs).

Considering this classification, each BSM MP may be interpreted as two virtual measurement points, one for QIDs (at the SI-SAP), which is to be considered for BSM SI-SAP parameters, and which does not exist is the SI-SAP is not implemented, and one for IP (immediately above the SI-SAP), which is to be considered for BSM IP parameters, and which always exists. Anyway, since physically these two virtual MPs are co-located at the ST layer-2 service access point, this distinction will not be done in the following.

5.1 BSM SI-SAP performance parameters

The BSM SI-SAP parameters are referred to a single MP, and can only be defined where the ingress (or transmitting) SI-SAP is implemented, so they are referred to a single ingress SI-SAP (and thus equivalently to a single unicast BSM_ID, being the source BSM_ID always the unicast BSM_ID of the ST). These parameters are not measured on a network section but on an MP at the uplink ST.

These performance parameters describe some SD characteristics of the ST, so they are very BSM specific. They are used for BSM internal purposes, in particular for the management of the QoS and of the QIDs [2] and [3], since in BSM networks performance is usually directly linked to the characteristics of the satellite transmission (physical and link layer) that directly affect the BSM capabilities to operate.