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Contents

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Foreword

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

Introduction

The focus of the present document is on the functional architecture of network management for BSM systems, including the management of IP-based services.

Network Management of IP-based broadband satellite multimedia (BSM) systems may be chosen to be similar in many ways to that of terrestrial networks. However there are important differences in emphasis, for example in that the management traffic overhead across a satellite system should be minimised. Also the scalability of satellite networks interconnecting potential many terminals must be considered. Furthermore, integrated management of satellite and terrestrial IP networks has not been widely implemented and a standardised approach is considered desirable.

The BSM network management system (BNMS) should also be designed to cope with the latency and bandwidth asymmetry that are characteristic of satellite links. However the timescale of management operations is usually of an order that does not impose tight time constraints or high data rates.

1 Scope

The present document defines an open specification dealing with scenarios and functional network architectures for the management plane (M-plane) of Broadband Satellite Multimedia (BSM) systems, including any potential interfaces with external or higher level network management functions. The BSM management functions should include, for example, performance management, security management and QoS management, including the associated management functions of Service Level Agreements (SLAs) and Policies.

The BSM management functional architecture will take into account requirements for emerging IP-centric (Internet Protocol) broadband multi-service satellite-based networks, integrated with fixed and wireless (broadband) access networks on one side, and backbone networks on the other. This internetworking and service interoperability scenario is generally within the scope of Next Generation Networks.

The boundaries of the BNMS will be defined as well as the interfaces, protocols and message types on the internal and external interfaces. The specification will include, where appropriate, the BSM SI-SAP protocol stack interface including its interactions with higher and lower layers.

The architecture specified will be concerned mainly with the lower layers of the management functional layers, particularly the service management, network layer management and network element management, which will allow maximum flexibility for compatibility and mediation with OSS equipment as well as for Operators in building functionality as they see fit.

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.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

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

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

[3] IETF RFC 2578: "Structure of Management Information Version 2 (SMIv2)".

[4] IETF RFC 3411: "An Architecture for Describing SNMP Management Frameworks".

[5] ITU-T Recommendation M.3010: "Principles for a telecommunications management network".

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

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 101 984: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Services and architectures".

[i.2] ETSI TS 102 429-4: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Regenerative Satellite Mesh - B (RSM-B); DVB-S/DVB-RCS family for regenerative satellites; Part 4 : Specific Management Information Base".

[i.3] ETSI TS 188 001: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Management; Operations Support Systems Architecture".

[i.4] "Web-based Management of IP Networks and Systems". J-P Martin-Flatin, Wiley.

[i.5] "On the Evolution of Management Approaches, Frameworks and Protocols: A Historical Perspective". George Pavlou, J. Netw Syst Manage (2007) 15:425-445, Springer Science+Business Media, LLC 2007.

[i.6] IETF RFC 1155: "Structure and Identification of Management Information for TCP/IP-based internets".

[i.7] IETF RFC 1156: "Management information base for network management of TCP/IP-based internets".

[i.8] IETF RFC 1157: "Simple Network Management Protocol".

[i.9] IETF RFC 1451: "Manager-To-Manager MIB".

[i.10] IETF RFC 1901: "Introduction to Community-based SNMPv2".

[i.11] IETF RFC 1902: "Structure of Management Information for Version 2 of the Simple Network Management Protocol (SNMPv2)".

[i.12] IETF RFC 2741: "Agent Extensibility (AgentX) Protocol Version 1".

[i.13] IETF RFC 3415: "View-based Access Control Model".

[i.14] IETF RFC 3418: "Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)".

[i.15] IETF RFC 3444: "On the Difference between Information Models and Data Models".

[i.16] IETF RFC 3584: "Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework".

[i.17] IETF RFC 4741: "NETCONF Configuration Protocol".

[i.18] ETSI TR 101 790: "Digital Video Broadcasting (DVB); Interaction channel for Satellite Distribution Systems; Guidelines for the use of EN 301 790".

[i.19] draft-combes-ipdvb-mib-rcs-05.txt: "DVB-RCS MIB".

[i.20] SatLabs System Recommendations Part 3:"Management & Control Planes Specifications v2".

[i.21] ITU-T Recommendation M.3000: "Overview of TMN Recommendations".

[i.22] ITU-T Recommendation M.3050.0: "Enhanced Telecom Operations Map - Introduction".

[i.23] ITU-T Recommendation M.3060: "Principles for the Management of the Next Generation Networks".

[i.24] ITU-T Recommendation X.901-X.904: "Reference Model of Open Distributed Processing: Overview".

[i.25] TeleManagement Forum TMF 053: "NGOSS Technology Neutral Architecture".

[i.26] Telemanagement Forum document number GB921: "eTOM, The Business Process Framework for the Information and Communications Services Industry".

[i.27] ISO/IEC 9595: "Information technology - Open Systems Interconnection - Common management information service definition".

[i.28] ISO/IEC 9596-1: "Information technology - Open Systems Interconnection - Common management information protocol".

[i.29] Distributed Management Task Force: "Common Information Model (CIM) Infrastructure Specification, DSP0004".

[i.30] The Object Management Group (OMG): "MDA Specifications".

NOTE: See http://www.omg.org/mda/specs.htm.

[i.31] ITU-T Recommendation Y.2001: "General overview of NGN".

[i.32] IETF RFC 4022: "Management Information Base for the Transmission Control Protocol (TCP)".

[i.33] IETF RFC 4113: "Management Information Base for the User Datagram Protocol (UDP)".

[i.34] IETF RFC 4293: "Management Information Base for the Internet Protocol (IP)".

[i.35] IETF RFC 2863: "The Interfaces Group MIB".

[i.36] IETF RFC 4133: "Entity MIB (Version 3)".

[i.37] IETF RFC 4268: "Entity State MIB".

[i.38] IETF RFC 3877: "Alarm Management Information Base (MIB)".

[i.39] IETF RFC 1441: "Introduction to version 2 of the Internet-standard Network Management Framework".

[i.40] IETF RFC 1452: "Coexistence between version 1 and version 2 of the Internet-standard Network Management Framework".

3 Definitions and abbreviations

3.1 Definitions

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

agent: entity that acts in a managed role

architecture: abstract representation of a communications system

NOTE: Three complementary types of architecture are defined:

- **functional architecture:** discrete functional elements of the system and the associated logical interfaces
- **network architecture:** discrete physical (network) elements of the system and the associated physical interfaces
- **protocol architecture:** protocol stacks involved in the operation of the system and the associated peering relationships

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

Customer Premise Network (CPN): customer's private network

NOTE: In the simplest case, the CPN is just a single end-host or TE.

data link layer: second layer of the OSI model it provides connectivity between segments of the network (bridging); in addition the data link may perform session control and some configuration

data model: description of a specific data structure, with the way the data elements (in the structure) are defined and the relationship to each other

NOTE: It is normally used in software engineering to describe how data is represented and accessed (see also RFC 3444 [i.15]).

eTOM: business process model or framework that has the objective of describing and classifying the business processes required for a Service Provider; it analyses the processes to different levels of detail according to their significance and priority for the business

NOTE: eTOM uses hierarchical decomposition to structure the business processes according to which all of the processes of the enterprise are successively decomposed. Process elements are formalized by means of a name, a description, inputs/outputs, etc.

flow: flow of packets is the traffic associated with a given connection or connectionless stream having the same source host, destination host, class of service, and session identification

information model: formal representation of real-world objects and concepts, with associated relationships, constraints, rules, and operations, used to specify semantics in a given domain

NOTE: It includes things of interest (entities), relationships between these entities (associations), and details/characteristics of these entities (attributes). An information model provides formalism to the description of a problem domain without constraining how that description is mapped to an actual implementation in software. The possible mappings of the information model are the data models (see also RFC 3444 [i.15]).

management plane: 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. 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. Layer Management handles the Operation And Maintenance (OAM) of information flows specific to the layer concerned.

Management Information Base (MIB): virtual information store containing managed objects

NOTE: Objects in the MIB (identified by their OIDs) are essentially variables, and are typically defined using Abstract Syntax Notation One format (ASN.1).

Manager: entity that acts in a managing role

Network Control Centre (NCC): equipment that controls the access of terminals at the lower protocol layers (OSI Layer 2 and below) to a BSM network

Network Management Centre (NMC: equipment that manages the lower protocol layers (OSI Layer 2 and below) of a BSM network

Network Management System (NMS): equipment that manages a network at several or all protocol layers

Next Generation Network (NGN): (from ITU-T Recommendation Y.2001 [i.31]) packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies

NOTE: It offers unrestricted access by users to different service providers. It enables unfettered access for users to networks and to competing service providers and/or services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users.

Next Generation Operations Support System (NGOSS): Telecommunications Management Forum's (TMF's) core framework for developing, procuring and deploying operational and business support systems and software

NOTE: The term is also used elsewhere e.g. as the basis for TISPAN OSS standards.

Operations Support System (OSS): generic term for a suite of management functions that enable an enterprise to monitor, analyse and manage systems, resources and services

Service Level Agreement (SLA) (SP and ANO): SLA between a Service Provider and an Access Network Operator is usually characterized by a forward link guaranteed capacity for SP aggregated traffic expressed in kb/s and a return link guaranteed capacity for SP aggregated traffic expressed in kb/s

NOTE: It can also include other elements related to traffic policy and availability.

Service Level Agreement (SLA) (Subscriber and Service Provider): SLA between a SP and its subscriber is characterised by the choice of one data transfer capability and the allocation attribute related to this transfer capability

NOTE: The SLA is agreed upon by the subscriber at the initiation of the contract with the SP and will remain the same for all the contract duration.

Service-Oriented Architecture (SOA): (ITU-T) Service-Oriented Architecture (SOA) is a software architecture of services, policies, practices and frameworks in which components can be reused and repurposed rapidly in order to achieve shared and new functionality

NOTE: This enables rapid and economical implementation in response to new requirements thus ensuring that services respond to perceived user needs. SOA uses the object-oriented principle of encapsulation in which entities are accessible only through interfaces and where those entities are connected by well-defined interface agreements or contracts.

user: entity that uses the network services requested by the subscriber

user plane: layered structure and provides user information transfer, along with associated controls (e.g. flow control, recovery from errors, etc.)

3.2 Abbreviations

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

3GPP	Third Generation Partnership Project
ANO	Access Network Operator
API	Application Program Interfaces
BNMS	BSM Network Management System
BSM	Broadband Satellite Multimedia
CIM	Common Information Model
CLI	Command Line Interface
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CORBA	Common Object Request Broker Architecture
COTS	Commercial Off The Shelf
CPE	Customer Premise Equipment
CPN	Customer Premise Network
DEN	Directory Enabled Networks
DMTF	Distributed Management Task Force
DTD	Document Type Definition
eTOM	enhanced Telecom Operations Map
FAB	Fulfilment, Assurance and Billing
FCAPS	Fault, Configuration, Accounting, Performance and Security
HTTP	HyperText Transfer Protocol
IDL	Interface Definition Language
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISO	International Organisation for Standardization
ISP	Internet Service Provider
ITU	International Telecommunications Union
JRMI	Java Remote Method Invocation
LAN	Local Area Network
LDAP	Lightweight Directory Access Protocol
LLA	Logical Layered Architecture
MIB	Management Information Base
NAP	Network Access Providers
NCC	Network Control Centre
NGN	Next Generation Network
NGOSS	Next Generation Operations Support System
NM	Network Management
NMC	Network Management Centre
NMS	Network Management System
NNI	Network to Network Interface
NOC	Network Operations Centre
OAM	Operation And Maintenance
OBP	On Board Processing
OID	Object Identifier
OMA	Object Management Architecture
OMG	Object Management Group
OSI	Open Standards Interconnection
OSS	Operations Support System
OSS/J	OSS through Java initiative
QID	Queue IDentifier
QoS	Quality of Service
RFC	Request For Comments
RMI	Remote Method Invocation
RM-ODP	Reference Model of Open Distributed Processing
RMON	Remote Monitoring
RSVP	Resource ReserVation Protocol
SD	Satellite Dependent
SI	Satellite Independent

SI-SAP	Satellite Independent-Service Access Point
SLA	Service Level Agreement
SMI	Structure of Management Information
SMIv2	Structure of Management Information version 2
SNMP	Simple Network Management Protocol
SNO	Satellite Network Operators
SO	Satellite Operator
SOA	Service-Oriented Architecture
SP	Service Provider
ST	Satellite Terminal
TCP	Transmission Control Protocol
TMF	Telecommunications Management Forum
TMN	Telecommunications Management Network
TOM	Telecom Operations Map
TR	Technical Report
TS	Technical Specification
UDP	User Datagram Protocol
UML	Universal Modelling Language
WBEM	Web-Based Enterprise Management
XML	eXtensible Markup Language

4 Overview and Background

Network Management should be seen as a means of enabling operators to configure their networks easily, quickly and cost-effectively, in order to provide users with flexible and efficient services which can be adapted to their needs in the latest service environments (e.g. compatible with a Service-Oriented Architecture (SOA)). This should include fast addition and deletion of users, monitoring and management of QoS, network topology management, fault diagnosis and billing.

Network Management is taken to mean all layers of the management stack, from element layer at the bottom to business layer at the top, whether the network being managed is a sub network or a complete end-to-end network. This is distinct from the network layer protocol (in the user and control plane) which is concerned with end-to-end communications.

Operational Support Systems (OSS) is the term usually given to the suite of management application functions that provide the manager with high level support and control interface to lower level management data from network elements. In practice an OSS is often a complex and heterogeneous assembly of equipment and implementations due to the number of functions they must support, and due to their potential incremental historical implementation and organisation in hardware and software, owing to legacy and business constraints.

There is a range of alternative potential NM standards and solutions as described in annex B. The choice of approach depends on for example:

- cost -effectiveness;
- flexibility (scalability, ease of update, modularity for additional functions);
- reliability (redundancy, reconfigurability);
- security;
- transmission bandwidth;
- legacy entity compatibility.

The present document focuses on the network management system outside the OSS and is concerned with extraction and configuration of management data.