ETSI TS 102 460 V1.2.1 (2015-12)

TECHNICAL SPECIFICATION

**Satellite Earth Stations and Systems (SES);
Broadband Satellite Multimedia (BSM);
Address 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).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The present document defines scenarios and architectures to provide address management functions for a BSM network.

1 Scope

The present document concerns the address management functions that are required to support interworking of a BSM network with an IP network, including use as part of the general Internet, in particular the address management functions related to the BSM SI-SAP.

The SI-SAP is described in the BSM functional architecture [1] and defined in the SI-SAP specification [3]. A key element in the present document is the BSM_Identifier (BSM_ID) which is the SI-SAP address that identifies a BSM subnetwork point of attachment (SNPA). A BSM network uses the BSM_ID when sending and receiving data via the SI-SAP: the BSM_ID is an abstraction of the lower layer address that would otherwise be used.

The present document describes the relationships between IP Addresses and BSM_IDs and also describes how to create, manage, and query the BSM_IDs for the purpose of sending and receiving user data (in particular IP packets) via the SI-SAP.

NOTE 1: In some systems, requesting to pass traffic across the network also causes reservation of bandwidth. This is to be considered out of scope of the present recommendation, but assumptions that a notification (e.g., bandwidth allocation) will be sent by a QoS Manager will be made.

The present document divides into two parts:

- address management scenarios and architectures;

- unicast address resolution at the SI-SAP.

Lower layer address management (i.e. management of addresses below the SI-SAP) is beyond the scope of the present document.

NOTE 2: Examples of lower layer addresses that are out-of-scope include Data Link layer addresses, MAC layer addresses and Physical layer addresses.

The present document elaborates the details of the address management functions, notably the address resolution function, as defined in the SI-SAP specification ETSI TS 102 357 [3]. It also builds on several other reports:

- ETSI TR 101 984 [i.1];

- ETSI TR 101 985 [i.2];

- ETSI TR 102 155 [i.7].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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

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The following referenced documents are necessary for the application of the present document.

[1] 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".

[2]   IEEE 802® (2001): "IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture".

NOTE: Available at https://standards.ieee.org/about/get/802/802.html.

[3]   ETSI TS 102 357 (V1.1.1): "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Common Air interface specification; Satellite Independent Service Access Point SI-SAP".

2.2   Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

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

[i.4]   ETSI TR 102 353: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Guidelines for the Satellite Independent Service Access Point (SI-SAP)".

[i.5]   IETF RFC 1112: "Host extensions for IP Multicasting".

[i.6]   ETSI TR 102 157: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; IP Interworking over satellite; Performance, Availability and Quality of Service".

[i.7]   ETSI TR 102 155: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; IP interworking over satellite; Addressing and routing".

[i.8]   IETF RFC 3022: "Traditional IP Network Address Translator (Traditional NAT)".

[i.9]   IETF RFC 826: "An Ethernet Address Resolution Protocol: or converting network protocol addresses to 48.bit Ethernet address for transmission on Ethernet hardware".

[i.10]   IETF RFC 2131: "Dynamic Host Configuration Protocol".

[i.11]   IETF RFC 3046: "DHCP Relay Agent Information Option".

[i.12]   IETF RFC 4861: "Neighbor Discovery for IP version 6 (IPv6)".

3   Definitions and abbreviations

3.1   Definitions

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

Address Resolution (AR): provides a mechanism that associates L2 information with the IP address of a system

NOTE: Many L2 technologies employ unicast AR at the sender: an IP system wishing to send an IP packet encapsulates it and places it into a L2 frame. It then identifies the appropriate L3 adjacency (e.g. next hop router, end host) and determines the appropriate L2 adjacency (e.g. MAC address in Ethernet) to which the frame should be sent so that the packet gets across the L2 link.

Address Resolution Protocol (ARP): protocol defined in IETF RFC 826 [i.9] that is used to associate network protocol addresses to 48 bit Ethernet addresses for transmission on Ethernet hardware

BSM Address Resolution (B-AR): provides a mechanism that associates a BSM_ID with the IP address of a system

BSM Bearer service: transport service from one SI-SAP to one other SI-SAP (unicast service); or from one SI-SAP to one or more SI-SAPs (multicast service); within the same BSM subnetwork

BSM Subnetwork: infrastructure that provides transport services between STs

> NOTE: The boundary of the BSM subnetwork corresponds to the SI-SAP in those STs; hence the BSM subnetwork includes elements of the STs, the Gateways and the Satellite.

BSM Network: one BSM subnetwork together with the necessary interworking functions that enable that BSM subnetwork to interwork with one or more attached networks at the STs

BSM_Identity (BSM_ID): SI-SAP address that defines the BSM Subnetwork Point of Attachment (SNPA)

> NOTE: The BSM_ID is divided into BSM Unicast IDs (BSM_UID) and BSM Group IDs (BSM_GID).

BSM Subnetwork Point of Attachment (B-SNPA): SI-SAP endpoint of the BSM data transport services

> NOTE: The BSM_ID is used to address data sent to and received from the BSM Subnetwork Point of Attachment.

dynamically assignable: may be reassigned during normal operations

dynamically assigned: assigned at a well-defined point in an operation, such as at log-in

forwarding: process of relaying an IP Packet from a source to a destination through intermediate network segments and nodes

> NOTE: The forwarding decision is based on information that is already available in the routing table. The decision on how to construct that routing table is the routing decision - see below.

IP datagram (datagram): self-contained, independent entity of data that conforms to the IP protocol

IP Packet (Packet): IP packet is identical to an IP datagram

> NOTE: An IP packet contains sufficient information to be routed from the source to the destination computer without reliance on earlier exchanges between this source and destination computer and the transporting network.

Network Access Provider (NAP): provides transmission resources to the Service Providers (SP) for accessing their subscribers

Network Address Translation (NAT): process of mapping between a set of IP addresses in one IP network to/from another set of IP addresses in another IP network

> NOTE: NAT is defined in IETF RFC 3022 [i.8]. NAT is typically used to map between internal IP addresses and officially assigned external addresses.

Private IP address: address assigned from one of the IETF defined private addressing blocks

Queue Identifier (QID): SI-SAP parameter that identifies an abstract queue at the SI-SAP

> NOTE: The QID is used to identify a specific lower layer resource when sending (submitting) data via the SI-SAP.

routing: process of selecting paths for packets to take based on a routing table

> NOTE: The routing table can be created through different routing protocols, some of which include automatic discovery.

Satellite Network Operator (SNO): owns and is responsible for maintaining, managing, deploying and operating the Satellite Network (i.e. the BSM network) excluding terminals (STs and Hubs)

SI-SAP Instance (SAPI): specific independent instance of the SI-SAP in one ST

NOTE: A single unicast BSM_ID (UID) is associated with each instance of the SI-SAP (each SAPI). In addition, one or more group BSM_IDs (GIDs) may be associated with each instance of the SI-SAP.

3.2 Abbreviations

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

AAA	Authorisation, Authentication, and Accounting
AAL5	ATM Adaption Layer 5
AM	Address Management
API	Application Protocol Interface
AR	Address Resolution
ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
B-AR	BSM Address Resolution
BAS	Broadband Access Server
B-DSPC	BSM Dynamic ST Port Configuration
BGP	Border Gateway Protocol
BOOTP	Bootstrap Protocol
BSM	Broadband Satellite Multimedia
BSM_GID	BSM Group Identity
BSM_ID	BSM Identity
BSM_UID	BSM Unicast Identity
C2P	Connection Control Protocol
CHAP	Challenge HAndshake Protocol
CPE	Customer Premises Equipment
CPN	Customer Premises Network
DHCP	Dynamic Host Configuration Protocol
DSL	Digital Subscriber Loop
DSPC	Digital Signal Processing and Control
DVB-RCS	Digital Video Broadcasting - Return Channel via Satellite
DVB-S	Digital Video Broadcasting - Satellite
FLSS	Forward Link SubSystem
GID	Group ID
GW	Gateway
GW/ST	Gateway/ Satellite Terminal
IANA	Internet Assigned Numbers Authority
ID	IDentity
IP	Internet Protocol
IPCP	IP Control Protocol
IPoA	IP over ATM
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISP	Internet Service Providers
L2TP	Layer 2 Tunnelling Protocol
LAA	L2TP Access Aggregation
LAC	L2TP Access Concentrator
LAN	Local Area Network
LLC	Logical Link Control
LNS	L2TP Network Server
MAC	Medium Access Control
MPE	Multi-Protocol Encapsulation
MPEG	Moving Picture Experts Group
MS	Management Station
NAP	Network Access Provider
NAPT	Network Address and Port Translation
NAT	Network Address Translation
NCC	Network Control Centre
ND	Neighbour Discovery
NHR	Next Hop Router

NMC   Network Management Centre
NOCC   Network Operations Control Centre
OBP   On-Board Processing
OSPF   Open Shortest Path First
PAP   Password Authentication Protocol
PC   Premises Customer
PPP   Point-to-Point Protocol
PPPoA   PPP over ATM
PPPoE   PPP over Ethernet
PPPoEoA   PPP over Ethernet over ATM
PSTN   Public Switched Telephone Network
PTA   PPP Terminated Aggregation
PVC   Permanent Virtual Channel
QID   Queue Identifier
QoS   Quality of Service
RADIUS   Remote Access Dial-In User Service
RAR   Reverse Address Resolution
RARP   Reverse Address Resolution Protocol
RCST   Return Channel Satellite Terminal
RIP   Routing Information Protocol
RLSS   Return Link SubSystem
RSCT   DVB-RSC Terminal
RSGW   Regenerative Satellite GateWay
RSM   Regenerative Satellite Mesh
RSM-A   Regenerative Satellite Mesh - A
RSM-B   Regenerative Satellite Mesh - B
SAP   Service Access Point
SAPI   SI-SAP Instance
SCN   Satellite Communication Network
SD   Satellite Dependent
SDAF   Satellite Dependent Adaptation Functions
SDU   Service Data Unit
SI   Satellite Independent
SIAF   Satellite Independent Adaptation Functions
SI-SAP   Satellite Independent Service Access Point
SLA ID   Site-Level Aggregation IDentifier
SLA   Service Level Agreement
SME   Small and Medium Enterprise
SNHA   Satellite Next Hop Address
SNMP   Simple Network Management Protocol
SNO   Satellite Network Operator
SNPA   Subnetwork Point of Attachment
SOHO   Small Office - Home Office
SP   Service Provider
SPC   ST Port Configuration
ST   Satellite Terminal
ST/GW   Satellite Terminal/ Gateway
TSS-A   Transparent Satellite Star - A
UID   Unicast ID
UP   Upper Protocols
VC   Virtual Channel
VPN   Virtual Private Network
WAN   Wide Area Network

4 Scenarios and service requirements

4.0 Introduction

The task of an ST is to forward IP packets over a BSM network to the next hop node as part of the process of forwarding the IP packet to the final destination Host for which the IP packet is intended. There may be alternative routes over the satellite network to provide link diversity or to increase the overall capacity of the satellite link.

The unicast scenario concerns a point-to-point link, either one-way or two way. The associated BSM Bearer Service topology can be a mesh such that two STs exchange user data directly, or a star such that the user data passes via a gateway.

Control and management information, corresponding to the C and M planes of the SI-SAP, would normally pass through a Network Control Centre (NCC) even if the user data is passed directly between STs. Systems with distributed control and management systems, i.e. where C and M plane data does not pass through the NCC, can be built but this architecture is not considered further in the present document.

4.1 Address Management (AM)

By definition (see ETSI TR 102 155 [i.7]) a BSM network is designed to transport IP packets and provides, as a minimum, the address management services required to support IP forwarding from a source BSM network node (or ingress ST) to a destination BSM network node (or egress ST).

The present document focuses on unicast address management, but some of these functions may also be applicable to multicast address management.

This clause specifies the IP address management services required in different scenarios. In a satellite network, IP address management services are closely associated with resource management (see ETSI TR 102 155 [i.7]) and excessive traffic over the satellite network should be avoided.

> NOTE 1: In the context of the present document, address management does not include any routing functions and IP routing protocols (e.g. RIP, OSPF, and BGP) are not considered further in the present document.

It is assumed that protocol layers are independent and thus layer 2 addresses may be managed independently of layer 3 addresses.

> NOTE 2: Layer 2 addresses may be derived from the layer 3 addresses in some cases. For example, IETF RFC 1112 [i.5] defines how layer 2 group addresses may be directly derived from Layer 3 multicast addresses.

BSM Identity (BSM_ID) is a general term that includes both Unicast and Group Identities. Above the SI-SAP, BSM_IDs are associated with IP (Layer 3) addresses and below the SI-SAP BSM_IDs are typically associated with MAC (Layer 2) addresses. More specifically, the BSM Unicast ID (BSM_UID) is associated with Unicast addresses while the BSM Group Identity (BSM_GID) is associated with multicast addresses.

As shown in figure 4.1, Address Management is used to coordinate the requirements for managing the addresses that are used for transporting user data between the ISP/Customer, Network Access Provider and Satellite Operator.
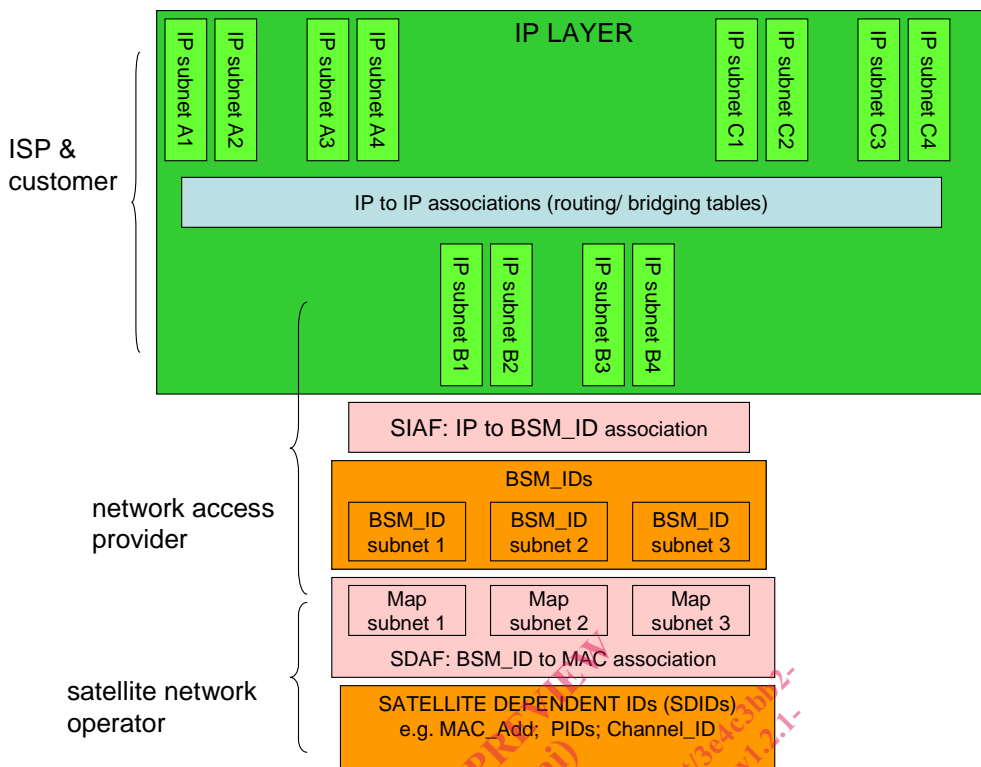
Figure 4.1: BSM Address Management layers

4.2 Address Management functions

4.2.1 IP layer Address Management functions

Figure 4.2 shows the BSM network as the middle network of three concatenated IP networks (A, B, C). In this example, the IP networks A and C are external local area networks or wide area networks, and the IP network B is the BSM Network. The IP networks A and C could be the Internet, a corporate internet, corporate intranet, a SOHO network or any enterprise network that needs to use the BSM network as an access network. Address Management will support functions consistent with IP forwarding between IP networks A and C via the BSM network.
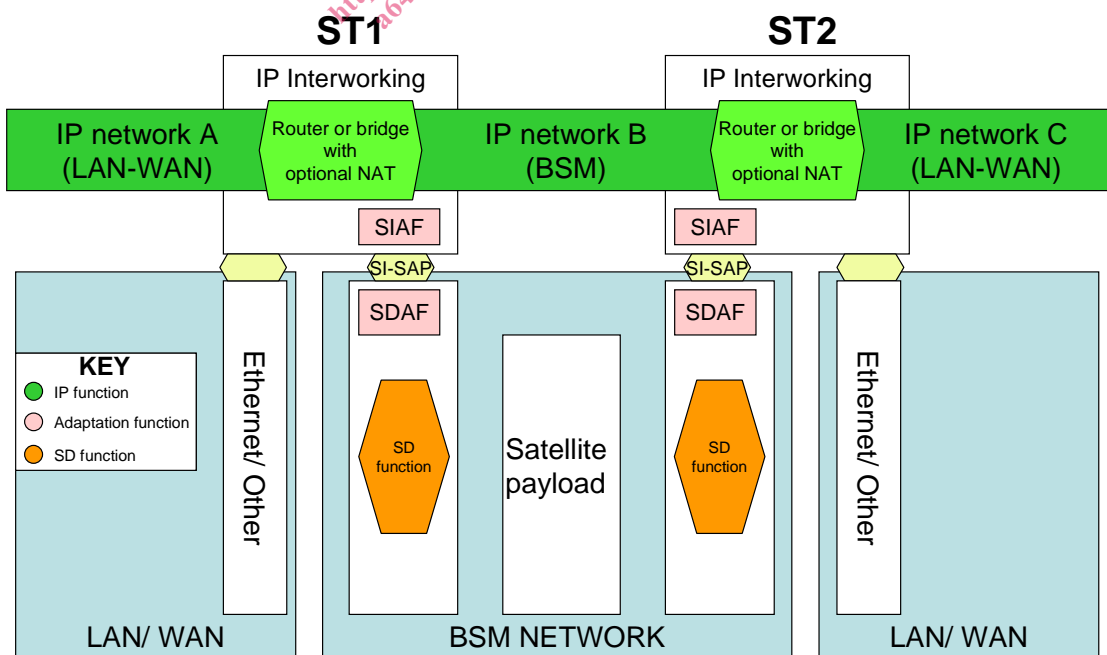

Figure 4.2: A BSM network and interworking with other IP networks