ATIS-1000005

SERVICE DESCRIPTION OF ETS

TECHNICAL REPORT

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ATIS-1000005, *Service Description of ETS*

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ATIS-1000005

Technical Report for Telecommunications

SERVICE DESCRIPTION OF ETS

Secretariat

Alliance for Telecommunications Industry Solutions

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Abstract

This Technical Report contains a service description of the Emergency Telecommunications Service (ETS). ETS is intended for use in a variety of networks and provides priority call/session setup capabilities that are used to support emergency response/recovery activities and disaster responders. ETS provides priority connectivity for any authorized user from any originating point in the public network and to any destination point in the public network. It includes support of priority connectivity and communications across multiple network types (e.g., circuit-switched networks, wireless network/mobile radio access, cable, satellite, or packet-based multi-media networks). ETS provides priority handling for all access types, network call setup, and delivery of the call, including priority handling of all associated signaling generated in conjunction with an ETS call (including queries and corresponding responses).

This Technical Report includes an overview of ETS, descriptions of ETS from the end user perspective and in various types of networks. Information flows are included describing the access, intranetwork signaling, and internetwork signaling. A high-level description of security aspects of ETS is also included.

FOREWORD

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Packet Technologies and Systems Committee (PTSC) -- formerly T1S1 -- develops and recommends standards and technical reports related to services, architectures, and signaling, in addition to related subjects under consideration in other North American and international standards bodies. PTSC coordinates and develops standards and technical reports relevant to telecommunications networks in the U.S., reviews and prepares contributions on such matters for submission to U.S. ITU-T and U.S. ITU-R Study Groups or other standards organizations, and reviews for acceptability or per contra the positions of other countries in related standards development and takes or recommends appropriate actions.

ATIS guidelines specify two categories of requirements: mandatory and recommendation. The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, PTSC Secretariat, and 1200 G Street NW, Suite 500, Washington, DC 20005.

The Signalling, Architecture, and Control (SAC) Subcommittee was responsible for the development of this document.

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1 SCOPE

This Technical Report (TR) contains a service description of the Emergency Telecommunications Service (ETS). ETS is intended for use in a variety of networks and provides preferential call/session setup capabilities that are used to support emergency response/recovery activities and disaster responders. ETS provides preferential connectivity for any authorized user from any originating point in the public network and to any destination point in the public network. It includes support of preferential connectivity and communications across multiple network types (e.g., circuit-switched networks, wireless network/mobile radio access, cable, satellite, or packet-based multi-media networks). ETS includes priority for all access types, network call setup, and delivery of the call. In addition, ETS requires specific non-call associated signaling and higher priority handling of all related non-call associated signaling.

In addition to providing a common service description across multiple types of networks, this TR is intended to provide a snapshot for different network types of:

1. Internetwork interfaces,
2. Network architectures,
3. Information flows,
4. High-level descriptions of the associated protocol and procedures, and
5. Interactions with other services/capabilities (e.g., IEPS, HPC).

The specific features of ETS communications include, but are not limited to:

1. Ubiquitous Access: This allows ETS to be accessible by authorized users from any location and any terminal equipment.
2. Selection of multimedia and telephony services: This includes providing the calling party with access to both multimedia and telephony services. This feature is limited within this Technical Report to telephony services.
3. International connectivity where supported by law and agreement: This includes the capability to interconnect to other similar national services as well as the capability to interwork with the International Emergency Preference Scheme (IEPS).
4. Rapid authentication of authorized ETS users, early in the call/session setup process and indicated in the forward direction to subsequent networks: This is intended to protect the network from corruption and from intrusion.
5. Security protection of ETS traffic: This includes providing security at least at the level of an ordinary call.
6. Preferential access to telecommunications facilities: This facilitates delivering a request for ETS service to a network when available access resources are scarce.
7. Preferential establishment of ETS communications through multiple network types.
8. Preferential routing of ETS traffic: This may include features such as queuing for available resources, exemption from certain restrictive network management functions and reservation of some routes specifically for ETS traffic.

9. Preferential completion of ETS traffic to the destination end user.
10. Optional preemption of non-emergency traffic (where consistent and compliant with local, national and regulatory provisions, for example, not interfering with E911 calls, etc.).
11. Allowable degradation of service quality requested for an ETS call/session to increase the probability that it will be successfully set up. This feature does not apply in the PSTN.
12. Allowable degradation of service quality for established traffic to increase the probability that a new ETS call/session will be successfully set up. This feature does not apply in the PSTN.
13. Interchange of critical telecommunications service management information, e.g., to facilitate restoring service levels for ETS traffic on a priority basis.
14. OAM&P functionality, e.g., to facilitate restoring service levels for ETS traffic on a priority basis.

2 REFERENCES

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SCTE 24-1 2001, *IPCablecom Part 1: Architecture Framework for the Delivery of Time-Critical Services Over Cable Television Networks Using Cable Modems.* [3]

SCTE 24-3 2001, *IPCablecom Part 3: Network Call Signaling Protocol for the Delivery of Time-Critical Services Over Cable Television Networks Using Cable Modems.*[3]

SCTE 24-9 2001, *IPCablecom Part 9: Event Message Requirements.* [3]

SCTE 24-11 2001, *IPCablecom Part 11: Internet Signaling Transport Protocol (ISTP).* [3]

SCTE 24-12 2001, *IPCablecom Part 12: Trunking Gateway Control Protocol (TGCP).* [3]

ITU-T Recommendation H.460.4, *Call Priority Designation for H.323 Calls.*[4]

ITU-T Recommendation H.323, *Packet-Based Multimedia Communications Systems.*[4]

ITU-T Recommendation H.246, *Interworking of H-Series Multimedia Terminals with H-Series Multimedia Terminals and Voice/Voiceband Terminals on GSTN and ISDN.* [4]

IETF RFC 3372, *Session Initiation Protocol for Telephones (SIP-T): Context and Architectures.*[5]

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[1] This document is available from the Third Generation Partnership Project (3GPP) at < http://www.3gpp.org/specs/specs.htm >.

[2] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005. < https://www.atis.org/docstore/default.aspx >

[3] This document is available at the Society for Cable Telecommunications Engineers (SCTE) at < http://www.scte.org/standards/index.cfm?pID=59 >.

[4] This document is available from the International Telecommunications Union. < http://www.itu.int/ITU-T/ >

[5] This document is available from the Internet Engineering Task Force (IETF). < http://www.ietf.org >

IETF RFC 3261, *Session Initiation Protocol.*[5]

IETF RFC 3487, *Requirements for Resource Priority Mechanisms for the Session Initiation Protocol (SIP).* [5]

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IETF RFC 2885, *Megaco Protocol.* [5]

ITU-T Recommendation H.248, *Gateway Control Protocol.*[4]

T1.TR.71-2001, *Signaling Requirements for the Support of Narrowband Services via Broadband Transport Technologies, CS1+.*[2]

T1.673-2002, *Bearer Independent Call Control (BICC) Capability Set 1+.*[2]

T1.TR.79-2003, *Technical Report on Overview of Standards in Support of Emergency Telecommunications Service (ETS).* [2]

TIA TR 45.2 draft PN-3-0054, *WPS Enhancements for CDMA Systems, October 2003.*[6]

3 Abbreviations and Definitions

ACM	Address Complete Message
AN	Access Node
ANM	Answer Message
ANSI	American National Standards Institute
ATM	Asynchronous Transfer Mode
BCF	Bearer Control Function
BICC	Bearer Independent Call Control
BIWF	Bearer Interworking Function
BSC	Base Station Controller
BTS	Base Transceiver Station
CDMA	Code-Division Multiple Access
CM	Cable Modem
CMS	Call Management Server
CPC	Calling Party's Category
CSF	Call Service Function
EO	End Office
ETS	Emergency Telecommunications Service
GSM	Global System for Mobile Communications
HLR	Home Location Register
HPC	High Probability of Completion
IAM	Initial Address Message
IEPS	International Emergency Preference Scheme
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISDN	Integrated-Services Digital Network

[6] This document is available from the Telecommunications Industry Association (TIA).
< http://www.tiaonline.org/standards/overview.cfm >

ISN	Interface Serving Node
ISTP	Internet Signaling Transport Protocol
ISUP	ISDN User Part
ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
MCU	Multi-point Control Unit
MG	Media Gateway
MGC	Media Gateway Controller
MS	Mobile Station
MSC	Mobile Switching Center
MSID	Mobile Station Identifier
MTA	Media Terminal Adapter
MTP	Message Transfer Part
NNI	Network to Network Interface
NS/EP	National Security/Emergency Preparedness
OAM&P	Operations, Administration, Maintenance and Provisioning
PIN	Personal Identification Number
PSTN	Public Switched Telephone Network
SCP	Service Control Point
SCTE	Society of Cable Telecommunications Engineers
SG	Signaling Gateway
SIP	Session Initiation Protocol
SS7	Signaling System 7
STP	Signaling Transfer Point
TCAP	Transaction Capabilities Application Part
TDM	Time Division Multiplexing
TIA	Telecommunications Industry Association
TR	Technical Report
VLR	Visited Location Register
WPS	Wireless Priority Service
WPSC	Wireless Priority Service Center

4 End User View of the Service

The end user view of the services includes:

1. **Ubiquitous Access.** ETS is readily accessible to authorized users. The set of circuit-switched networks may be considered to be "nearly ubiquitous" to authorized users. Where these networks are not available, other network types are expected to be available.
2. **Selection of Multimedia and Telephony Services.** Selection of multimedia services is outside the scope of this document. In this Technical Report, the end user is assumed to select telephony service.
3. **International Connectivity.** The calling party/initiator may invoke ETS for an international call. The call will receive ETS treatment within the United States of America networks and, where applicable, will receive the International Emergency Preference Scheme service. Subject

to bilateral international agreements, the call may receive treatment corresponding to ETS from similar national services outside of the United States of America.

4. **User Authentication**. The calling party's/initiator's authorization to initiate an ETS call/session must be authenticated in a timely fashion, early in the call/session setup process. Authentication may be on a per-call basis, on a one-time (time-limited) authentication basis applicable to the calling party's/initiator's current access, or on a subscription basis. If authentication is per call, the end user may initiate authentication via a call/session to an authentication function using a unique directory number or an access code that may result in an interactive exchange of authorization details that may include a Personal Identification Number (PIN) or other authorization/identification code. Authorization information may be entered by either the initiator/subscriber directly or by an external device that has the appropriate information.

   When the calling party or the terminal equipment is authorized by one-time authentication or user subscription, the calling party may, as part of the call request, request normal call/session setup and decline the use of ETS capabilities. In this case, the additional ETS functions that would occur after any preferential originating access that has already occurred and after authentication will not apply to the call/session. If the calling party does not decline further ETS functionality, all ETS functions will apply for the duration of the call/session setup.

   If the calling party fails authentication, the call/session setup attempt shall fail with an indication to the user. If the authentication function itself fails (e.g., there is no response to a request for authentication) the call/session shall be assigned a default priority and treated as having been authorized at that priority. The user may receive an indication that default priority has been assigned.

5. **Originating Alerting Signals.** The delay caused by invocation of NS/EP-specific functions during setup of an NS/EP call/session may lead to specialized alerting signals that alert the calling party that the setup attempt is continuing.

6. **Terminating Alerting Signals.** The added urgency of an NS/EP call/session may be conveyed to the called party by the use of specialized alerting signals. This function may extend to include alerting of busy subscribers.

7. **Secure, private, and confidential sessions.** The general objective is that ETS services should be at least as secure, private, and confidential as POTS services in the PSTN. The network functions to provide protection of ETS calls/sessions are described in clause 5.2 and 9. ETS calls/sessions requiring additional security may be established using end user equipment capabilities that are transparent to the network (e.g., end-to-end encryption of the media after the bearer channel is established.) Refer to ATIS-0100001.2004 (User Plane Security Guidelines and Requirements for ETS) for guidelines and requirements related to user plane (bearer traffic) security.

5 NETWORK VIEW OF THE SERVICE

5.1 ETS Network Architecture

5.1.1 Generic Architecture

Figure 1 illustrates the generic architectural model for ETS. The figure illustrates that ETS is supported by a set of functions that provide end-to-end preferential/priority call setup service that spans the control plane (signaling), the user plane (bearer path), and the management plane of the networks involved in an ETS call. Specifically, the scope includes all access and network aspects in the end-to-end call/session path as follows:

1. End user (calling party) access to the originating network
2. Originating network
3. Intermediate network(s) involved in the call/session
4. Terminating network
5. End user (called party) access in the terminating network.

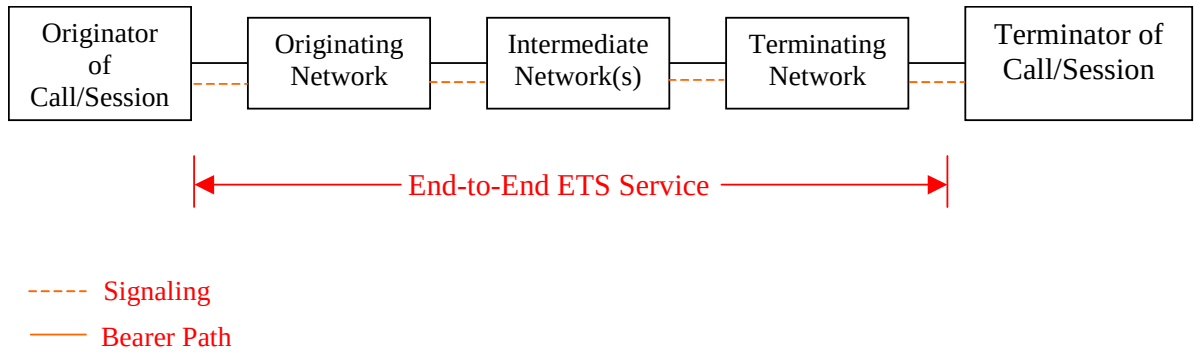


Figure 1: Generic Architecture Model

5.1.2 National Telecommunications Network Environment

The national telecommunications public network consists of multiple non-homogeneous interconnected service provider networks that are based on different technologies (e.g., circuit-switched, wireless, IP, and ATM) and architectures, and supporting a variety of services. The different network types can be generalized as illustrated in Figure 2:

1. Circuit-Switched Networks
2. Satellite Networks
3. Wireless Network/Mobile Radio Access
4. IP Cable Networks
5. Packet-based Multi-media Networks.

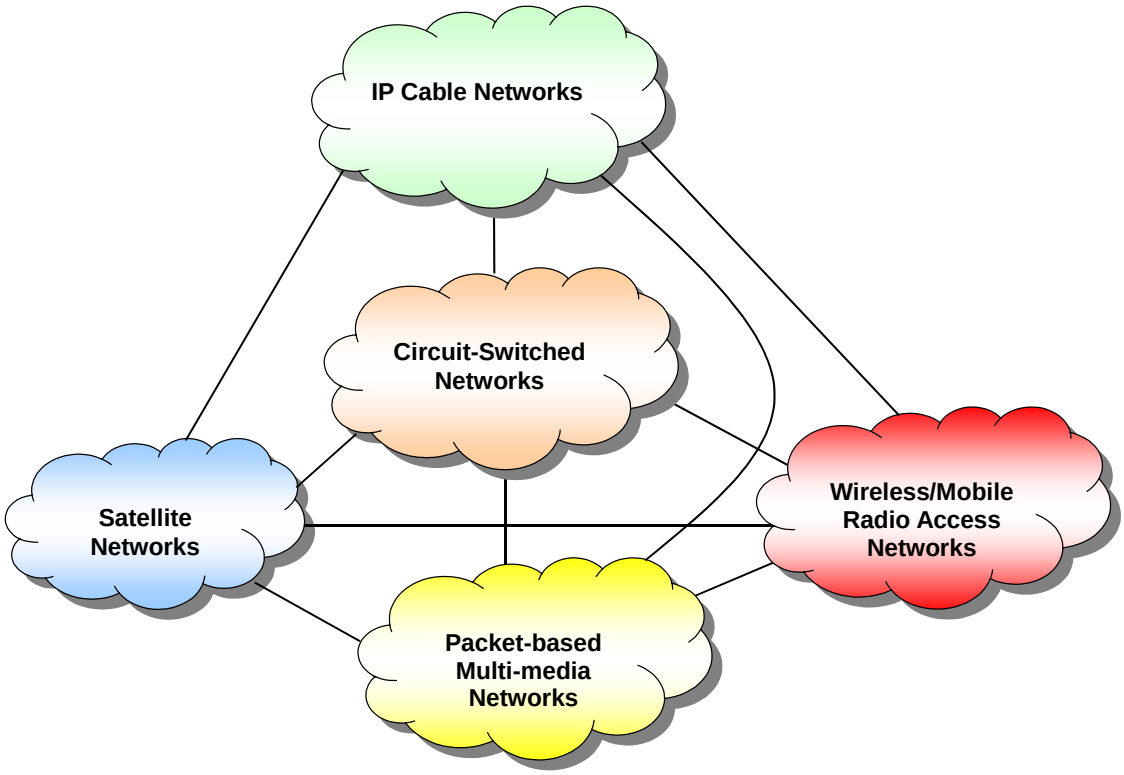


Figure 2: Multiple Interconnected Networks

In this document, the categorization of networks into these five different network types is not necessarily definitive. In fact, it is possible that a particular network type may be using technologies/protocols generally association with another network type. For example, circuit-switched networks, wireless/mobile radio access networks, satellite networks and cable networks are all evolving to use packet-based technologies. The categorization of the different network types is mainly to illustrate the fact that the national telecommunications network consists of multiple network types based on various different architectures, technologies, and protocols, supporting various end user services (voice, data, multi-media, etc.).

The preference/priority schemes employed in support of ETS depend on factors that define the network type such as network architecture, underlying technologies, and protocols. Therefore, specific mechanisms to obtain preferential/priority treatment for ETS calls may vary in the different types of networks or different network segments. Specifications of the necessary preference/priority schemes to support ETS in the various different network types are being developed in various industry fora.

Each of the various network types in the national telecommunications network is required to support ETS. There are two high-level generalizations to consider in specifying ETS:

1. Supporting ETS within a network or network segment.
2. Supporting ETS across network boundaries.

For individual network types, the following relevant factors impacting support of ETS have been identified:

1. Network architectural aspects (e.g., centralized or distributed network elements)
2. Specific access and network signaling protocols (e.g., ISDN, ISUP, SIP, H.323, etc.)
3. Bearer type (e.g., TDM, ATM, IP)

4. Signaling, bearer, and management interactions.

5.1.3 Network-to-Network Interface (NNI) Reference Model

Figure 3 illustrates a generic Network-to-Network (NNI) Interface reference model consisting of a signaling interface and a user (bearer) traffic interface. The signaling interface consists of the call control protocols and the call control signaling transport protocols. The bearer interface consists of the bearer and bearer transport protocols. In cases where the bearer control is separate from the call control signaling, there would also be a bearer control interface to the call control function.

It is expected that network interconnections between the various different network types will be based on standardized interconnection interfaces. For example, it is expected that the different network types will interconnect to each other using PSTN interconnection standards, specifically traditional SS7 protocols for call control signaling and TDM trunks for bearer interconnection. In the longer term, the different types of networks may interconnect directly using interconnection standards other than PSTN interconnection. Therefore, interworking of the preference/priority mechanisms used in the different network types in support of ETS will have to be specified.

The considerations in supporting ETS across network boundaries (i.e., involving different network types) are:

1. Signaling ETS call/session setup control
2. Supporting ETS priority user access to the bearer connection
3. Interworking of priority mechanisms between the different signaling network protocols (e.g., ISUP and SIP)
4. Interworking of priority mechanisms between the different signaling transport types (e.g., MTP and IP-based transport)
5. Interworking of priority mechanisms between different bearer types (TDM and IP)
6. Supporting authentication of the ETS call/session request.
7. Exemption of ETS calls from restrictive network management functions that apply to other calls.

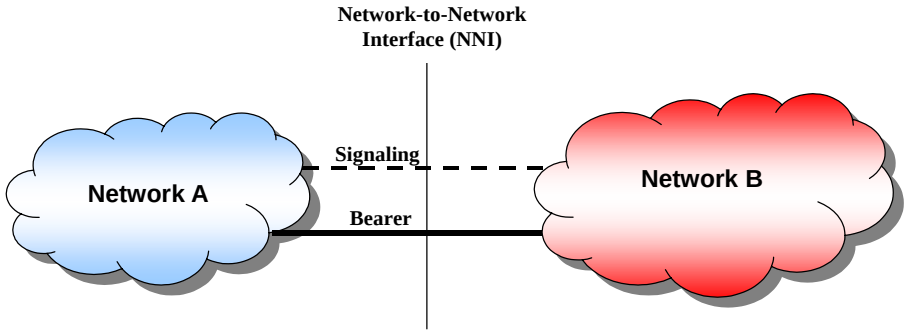


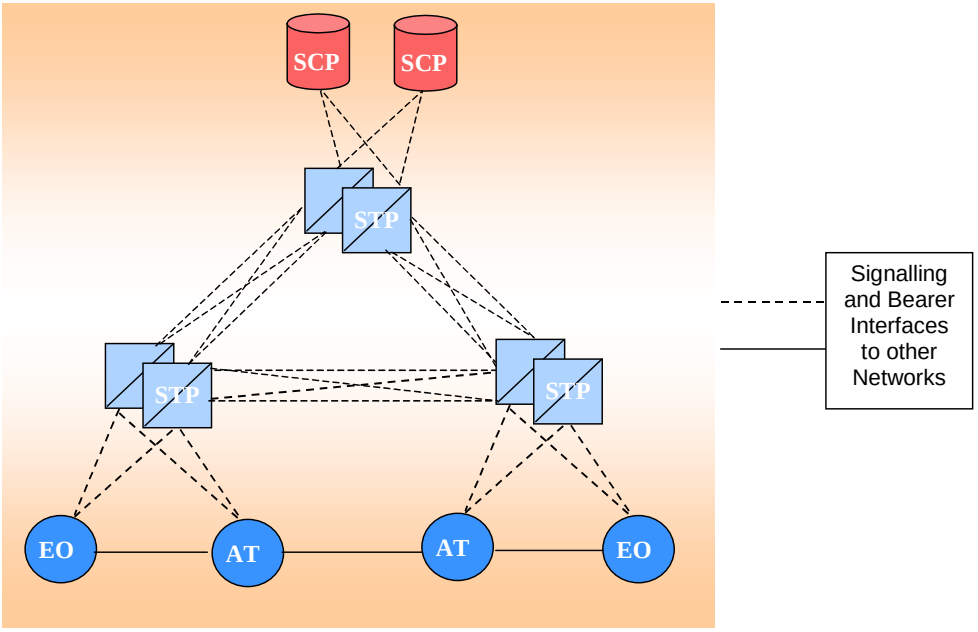
Figure 3: Network Interface

5.1.4 Network Architectures

5.1.4.1 Circuit-Switched Network

Figure 4 illustrates the generic circuit-switched network architecture, which consists of two distinct networks: the SS7 signaling network and the circuit switched trunk (bearer) network. For detailed descriptions of the components and protocols of the SS7 network, refer to T1.110 (General SS7

Information). SS7 support of ETS includes 1) ISUP/BICC signaling to explicitly identify an ETS call, 2) mechanisms (including the use of higher MTP message priority and exemption from certain network management controls) to increase the probability of successful message transfer during signaling network congestion and 3) mechanisms at the originating, intermediate, and terminating nodes to increase the probability of successful call setup. Refer to ATIS-1000006.2005 for more details.



---------- SS7 Links
———— Circuits Switched Trunks
AT – Access Tandem
EO – End Office
SCP - Service Control Point
STP - Signaling Transfer Point

Figure 4: Circuit-Switched Network

Support for ETS in a circuit-switched network involves (but is not limited to) the following functions:

1. Capability to authenticate and authorize an ETS call request.
2. Capability to identify and signal an ETS call as it is set up through the network
3. Use of higher MTP message priority value for SS7 messages to increase the probability of successful transfer during signaling network congestion.
4. Exemption of ETS calls from restrictive network management control to increase probability of successful call completion.
5. Optional ETS-specific signals to the end user.
6. Capability to signal a priority level for an ETS call as it is set up through the network.
7. Trunk queuing capability to increase the probability of successful call completion.

5.1.4.2 Satellite Network

Figure 5 illustrates the public satellite network.

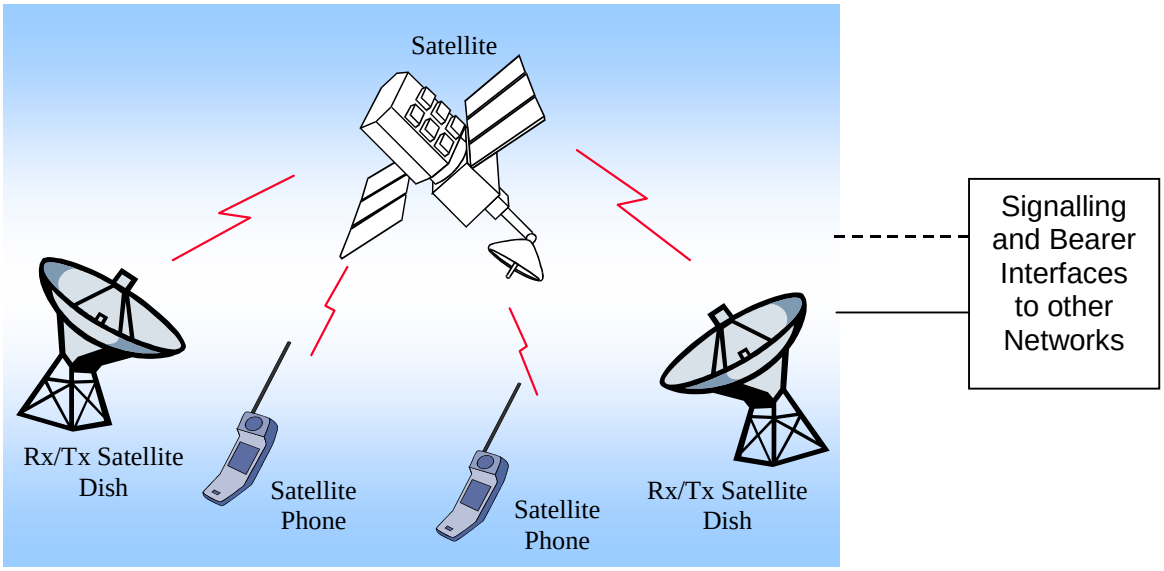


Figure 5: Satellite Network

The satellite network provides network access via satellite phone or satellite dish. To date there are no specifications of ETS functionality for satellite networks. Full support for ETS in satellite networks would involve (but is not limited to) the following:

1. Capability to authenticate and authorize ETS calls.
2. Capability to identify and signal an ETS call as it is set- up through the network.
3. Support of preference/priority schemes in packet-based transport network.
4. Support of preference/priority schemes for signaling and bearer interactions.
5. Exemption of ETS calls from restrictive network management control to increase probability of successful call completion.
6. Optional ETS-specific signals to the end user.

An ETS call entering a non-ETS-capable satellite network should be completed as a normal call. Therefore, if the satellite network does not support ETS, then to successfully interface with ETS-capable networks a satellite network would need, at a minimum, to be able to:

1. Ignore the received indication that a call is an ETS call.
2. Ignore the received indication of the preference/priority of the call.
3. Complete the call as a normal call.

5.1.4.3 Wireless/Mobile Radio Access Network

Figure 6 illustrates a generic wireless/mobile radio access network architecture (including wireless local area network radio access). A wireless/mobile network has a specific radio access technology (e.g., CDMA or GSM) for mobile station access. The core or backbone network segments of wireless/mobile networks are either based on the circuit-switched network architecture described in clause 5.1.4.1 or the packet-based multi-media packet network architecture described in clause 5.1.4.5.

For a detailed description of CDMA network architectures refer to the following:

1. TIA/EIA/TSB-100-A, Wireless Network Reference Model, March 2001.
2. TIA/EIA/-41 Revision D, Cellular Radio Telecommunications Intersystem Operations, 1997.

For detail description of GSM network architectures refer to the following:

1. 3GPP TS 23.002, Technical Specification Group Services and System Aspects; GSM Network Architecture.
2. 3GPP TS 23.228, Technical Specification Group Services and System Aspects; IP Multimedia Subsystem (IMS) Stage 2.

Work on Wireless Priority Service (WPS) is underway in the Third Generation Partnership Project (3GPP) and TIA TR 45.2. Refer to 3GPP TR 22.952, *Priority Service Guide (Release 6)* and TIA TR 45.2 draft PN-3-0054, *WPS Enhancements for CDMA Systems* for more details.

In addition, studies on the feasibility of interworking between 3GPP systems and Wireless Local Area Networks (WLANs) are underway in 3GPP. Refer to 3GPP TR 22.934 V6.2.0 for more details. Similarly, 3GPP2 is in the process of specifying interworking between 3GPP2 systems and WLANs. Refer to draft 3GPP2: X.0028 for more details.

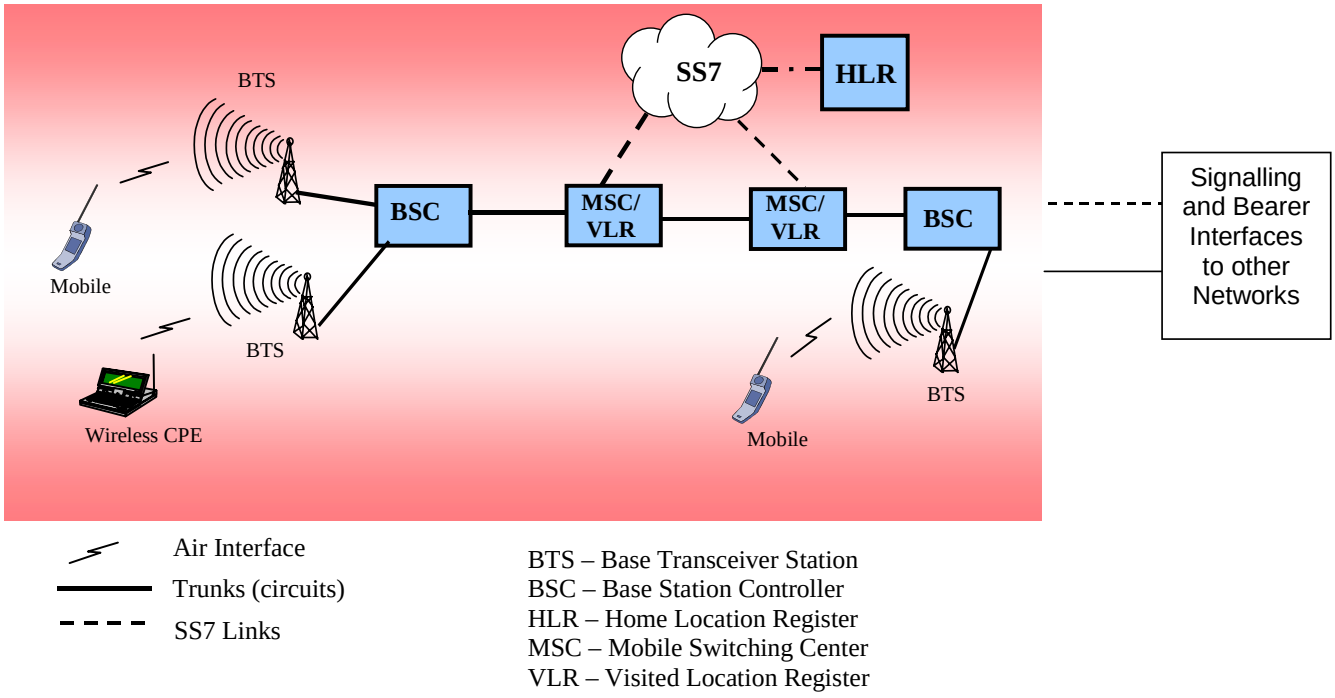


Figure 6: Wireless/Mobile Radio Access Network

Supporting ETS in wireless/mobile networks includes capabilities identified for the PSTN and preferential/priority capabilities in the originating and terminating radio access segments. Specifically, supporting ETS in wireless/mobile networks involves (but is not limited to) the following:

1. Capability to authenticate and authorize ETS call requests.
2. Capability to identify and signal an ETS call as it is set-up through the network.
3. Use of higher MTP message priority value for SS7 messages to increase the probability of successful message transfer during SS7 signaling network congestion.

4. Support for preference/priority schemes in trunking and in the packet-based transport core network.
5. Support for preference/priority schemes for signaling and bearer interactions.
6. Exemption of ETS calls from restrictive network management control to increase probability of successful call completion.
7. Support for preference/priority schemes for originating and terminating radio access.
8. Support for ETS call request queuing for a radio traffic channel, when needed.
9. Optional ETS-specific signals to the end user.

5.1.4.4 IP Cable Network

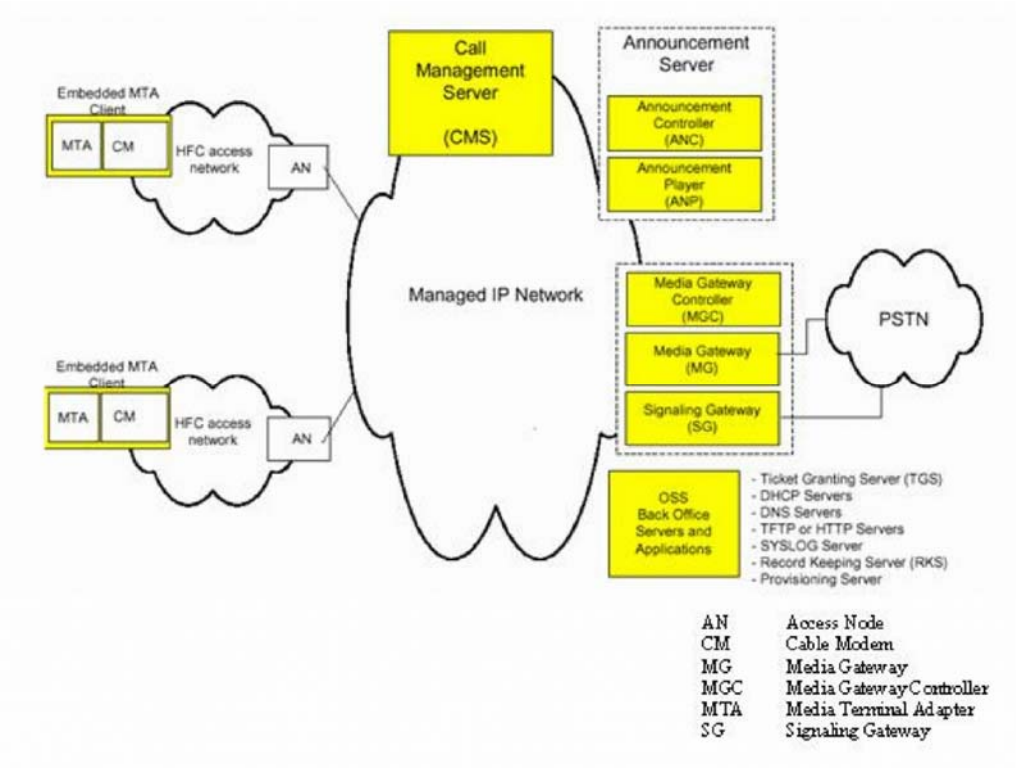


Figure 7: IP Cable Network

Figure 7 illustrates a generic IP cable network architecture. For details of the components and protocols, refer to SCTE 24-1 2001 (IPCablecom Part 1: Architecture Framework for the Delivery of Time-Critical Services Over Cable Television Networks Using Cable Modems), SCTE 24-3 2001 (IPCablecom Part 3: Network Call Signaling Protocol for the Delivery of Time-Critical Services Over Cable Television Networks Using Cable Modems), SCTE 24-9 2001 (IPCablecom Part 9: Event Message Requirements), SCTE 24-11 2001 (IPCablecom Part 11: Internet Signaling Transport Protocol (ISTP)), and SCTE 24-12 2001 (IPCablecom Part 12: Trunking Gateway Control Protocol (TGCP)). The Society of Cable Telecommunications Engineers (SCTE) is expected to work on support of ETS in IP cable network. In addition, ITU-T SG 9 is working on support of ETS both within IPCablecom Networks and between IPCablecom networks and other networks such as the PSTN and the evolving packet-switched networks.

The call signaling interfaces associated with Figure 7 are shown in Figure 8 and are briefly described in Table 1.

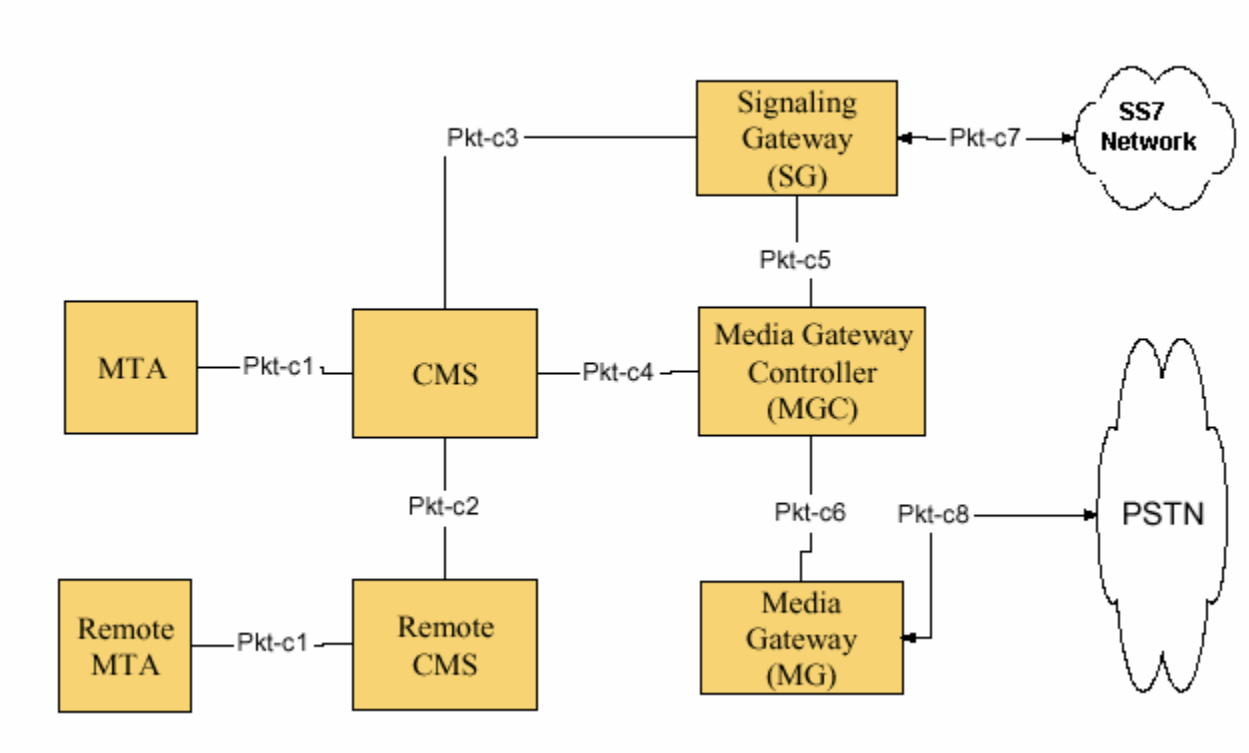


Figure 8: IP Cable Call Signaling Interfaces

Table 1: IP Cable Call Signaling Interfaces

Interface	Functional Components	Description
Pkt-c1	MTA – CMS	Call signaling messages exchanged between the MTA and CMS using the NCS protocol, which is a profile of MGCP.
Pkt-c2	CMS – CMS	Call signaling messages exchanged between CMS's. The protocol for this interface is undefined.
Pkt-c3	CMS – SG	Call signaling messages exchanged between CMS and SG using the ISTP/TCAP protocol.
Pkt-c4	CMS – MGC	Call signaling messages exchanged between the CMS and MGC. The protocol for this interface is undefined.
Pkt-c5	SG – MGC	Call signaling messages exchanged between the MGC and SG using the ISTP/ISUP and ISTP/TCAP protocol.
Pkt-c6	MGC – MG	Interface for media control of the media gateway and possibly in-band signaling using the TGCP protocol, which is a profile of MGCP, similar to NCS.
Pkt-c7	SG – SS7	The SG terminates physical SS7 signaling links from the PSTN (A, F links). The following protocols are supported: • ISUP User Interface. Provides an SS7 ISUP signaling interface to external PSTN carriers. • TCAP User Interface. Provides mechanism for certain trusted entities ("TCAP Users") within the IP Cable network, such as Call Agents, to query external PSTN databases via TCAP messages sent over the SS7 network.
Pkt-c8	MG – PSTN	This interface defines bearer channel connectivity from the Media Gateway to the PSTN. It also supports in-band MF signaling. This function may be viewed as belonging in the Signaling Gateway function.

The IP Cable network architecture is based on the distributed network architectural model of packet-based multimedia networks (see clause 5.1.4.5). It consists of distributed network elements (AN, CM, CMS, MG, MGC, MTA, and SG) and a common packet network for media streams and transport of control messages. The logical components of a CMS are the Call Agent and the Gate Controller. The CMS may also contain the Media Gateway Controller, and the Announcement Controller. Supporting ETS in IP cable networks involves (but is not limiting to) the following:

1 Capability to authenticate and authorize ETS calls.
2 Capability to identify and signal an ETS call as it is set-up through the network.
3 Support of preference/priority schemes in packet-based transport network.
4 Support of preference/priority schemes for signaling and bearer interactions.
5 Exemption of ETS calls from restrictive network management control to increase probability of successful call completion.
6 Optional ETS-specific signals to the end user.

5.1.4.5 Packet-based Multi-media Network

Figures 8 to 11 show variants of packet-based multi-media network architectures. The different architecture types are as follow:

1. H.323 Architecture
2. SIP Architecture
3. MGCP or H.248/Megaco Architecture
4. BICC Architecture.

Figure 9 illustrates the H.323 architecture. For details of the components and protocols, refer to ITU-T Recommendation H.323 (Packet-Based Multimedia Communications Systems). Protocol work related to support of ETS in H.323 network is being done in ITU-T SG 16. Specifically, ITU-T Recommendation H.460.4, (Call Priority Designation for H.323 Calls) provides the mechanism for identifying and processing ETS communications by defining the necessary messages and procedures. The mapping of the call/session priority designation between a packet network and a circuit-switched network via a gateway is described in ITU-T Recommendation H.246 (Interworking of H-Series Multimedia Terminals with H-Series Multimedia Terminals and Voice/Voiceband Terminals on GSTN and ISDN). In addition, on-going work is needed to specify techniques and procedures for controlling service priority to allow a call/session to be identified for preferential treatment during session setup and routing.

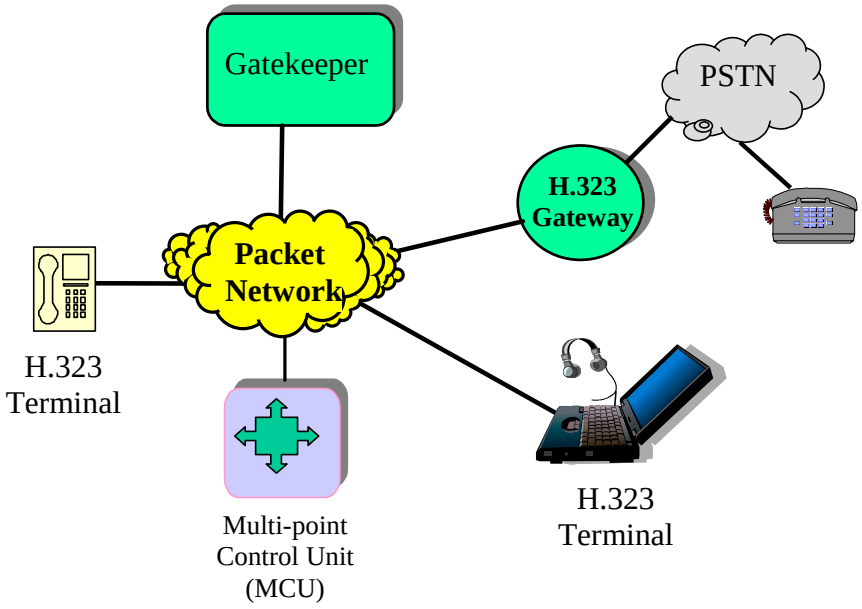


Figure 9: Packet-based Network Diagram – H.323 Architecture

Figure 10 illustrates the SIP architecture. For details of the components and protocols, refer to IETF RFC 3372 (Session Initiation Protocol for Telephones (SIP-T): Context and Architectures) and RFC 3261 (Session Initiation Protocol), respectively. Work related to support of ETS in SIP-based networks is being done in the IETF IEPREP working group. Specifically, IEPREP is in process of defining requirements in support of ETS. The SIP protocol is being enhanced to support priority labels (indicators) to identify calls/sessions for priority setup treatment. The requirements for resource priority mechanisms for the SIP are contained in RFC 3487.

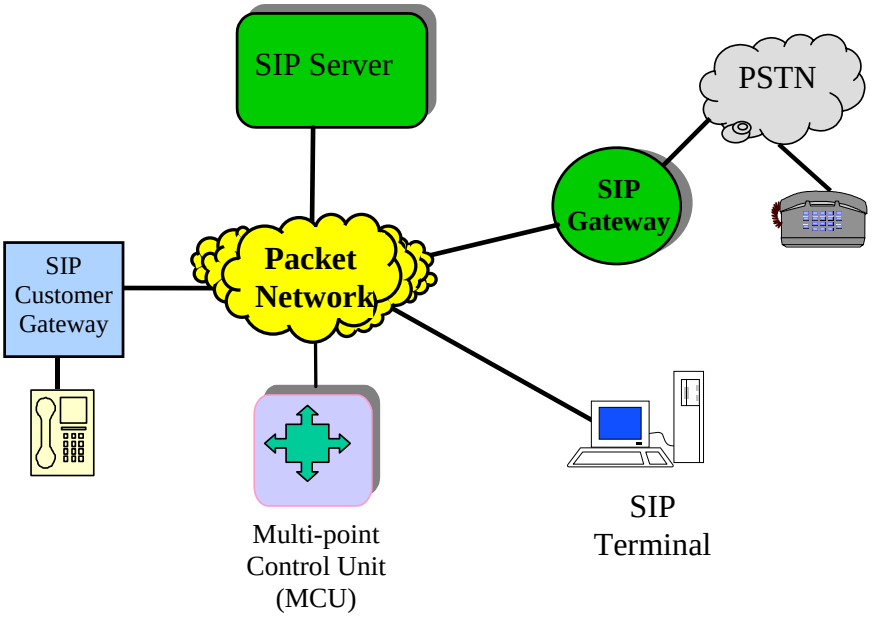


Figure 10: Packet-based Network Diagram – SIP Architecture

Figure 11 illustrates an IP Network-to-Network Interface (NNI) between carriers using SIP[7]. The model in Figure 11 focuses specifically on points of interoperability between technologies and service provider domains. The interconnection concept is based on a specific interface entity, called a session border function. The session border function performs multiple functions designed to help Voice over IP (VoIP) carriers to interface with a customer or another carrier's network. For network-to-network interconnection, a session border function may perform the following functions (not exhaustive):

- Call control signaling, e.g., SIP
- Bearer control signaling for the control of media streams
- Interaction between call control and bearer control functions
- Call/session routing
- Traffic and QoS management
- Screening
- Security
- Network topology hiding from the interconnected networks
- Media stream mapping (e.g., transcoding).

[7] Work initiatives as defined in Issue S0009: Create a standard defining the NNI for IP-IP Network Interconnection Supporting Multimedia Services and Issue S0010: Create an Addendum to T1.679.

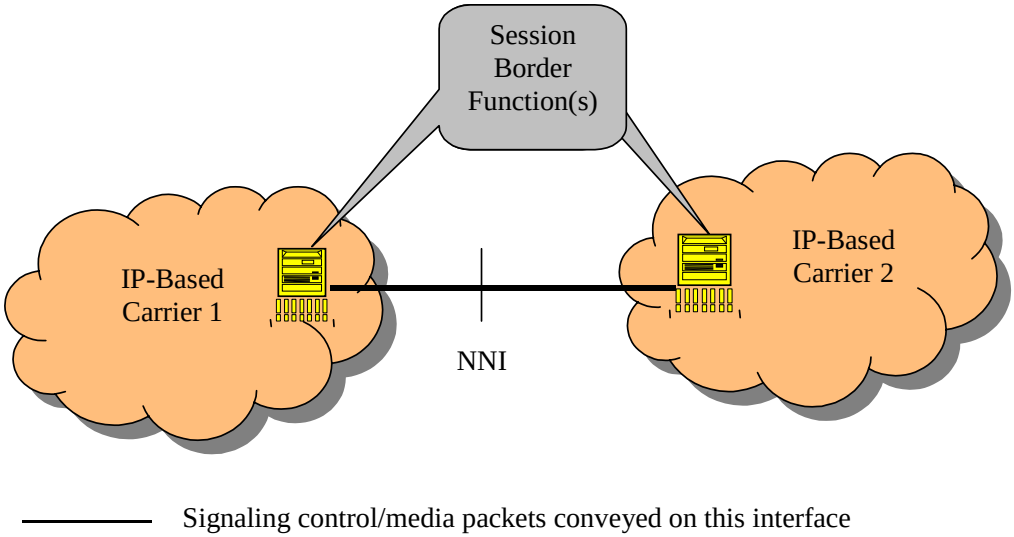


Figure 11: IP-IP Interconnection Model

In support of ETS, the ETS specific information (e.g., identification of an ETS call, calling priority level, bearer priority level, etc.) would need to be passed transparently at the NNI between the interconnecting carriers. Carriers would provide preferential treatment within their own network domain. Details of ETS support at the IP-IP NNI between carriers are for further study. In addition, real-time network management during ETS calling is for further study.

Figure 12 shows the H.248/Megaco architecture. For detail of the components and protocols, refer to IETF RFC 2885 (Megaco Protocol), and ITU-T Recommendation H.248 (Gateway Control Protocol). ITU-T Recommendation H.248 supports 16 levels of priority.

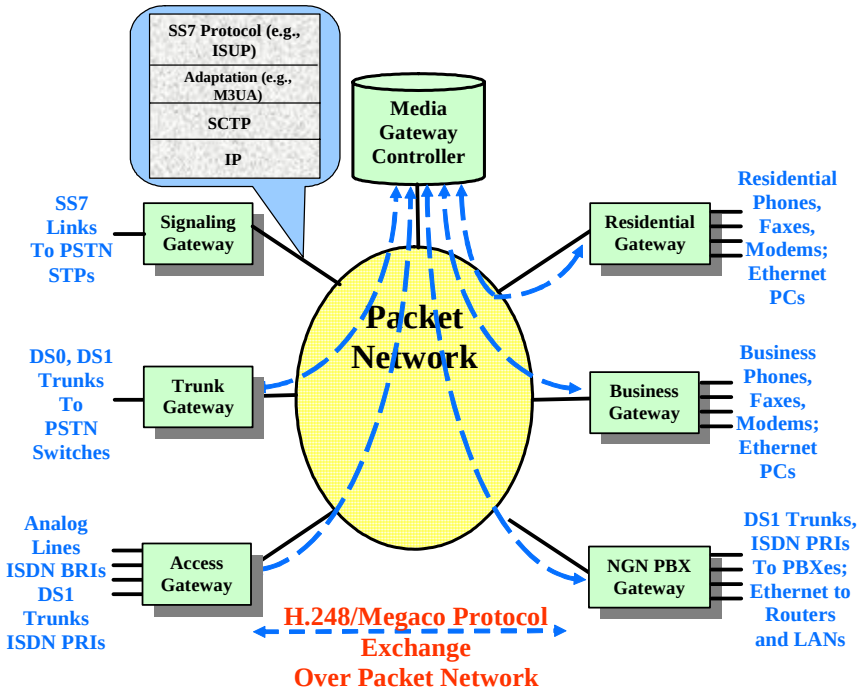


Figure 12: Packet-based Network Diagram –H.248/Megaco Architecture

Figure 13 shows the BICC architecture. For details of the components and protocols, refer to T1.TR.71 (Signaling Requirements for the Support of Narrowband Services via Broadband Transport Technologies, CS1+) and T1.673 (BICC Protocol, CS1+), respectively. T1S1 is developing draft ATIS-1000006.2005 (SS7 Emergency Telecommunications Service), which includes specifying a special indicator to identify an ETS call in the BICC signaling. ATIS-1000006.2005 also specifies the use of higher MTP message priority to increase the probability of successful message transfer during signaling network congestion and exemption from certain network management controls to increase the probability of successful call setup. In the BICC architecture, the priority indicator and priority call levels are signaled via the BICC call control and the priority indicator is passed to the BICC bearer control. To provide priority handling at the bearer level, initially the BICC bearer control shall ensure quality of the bearer path throughout the lifetime of the call during the setup as well as connection phase of the call in case of congested network situations. However, the signaling of the priority indicator and priority levels in the BICC bearer control are for further study in the future phase of this service.

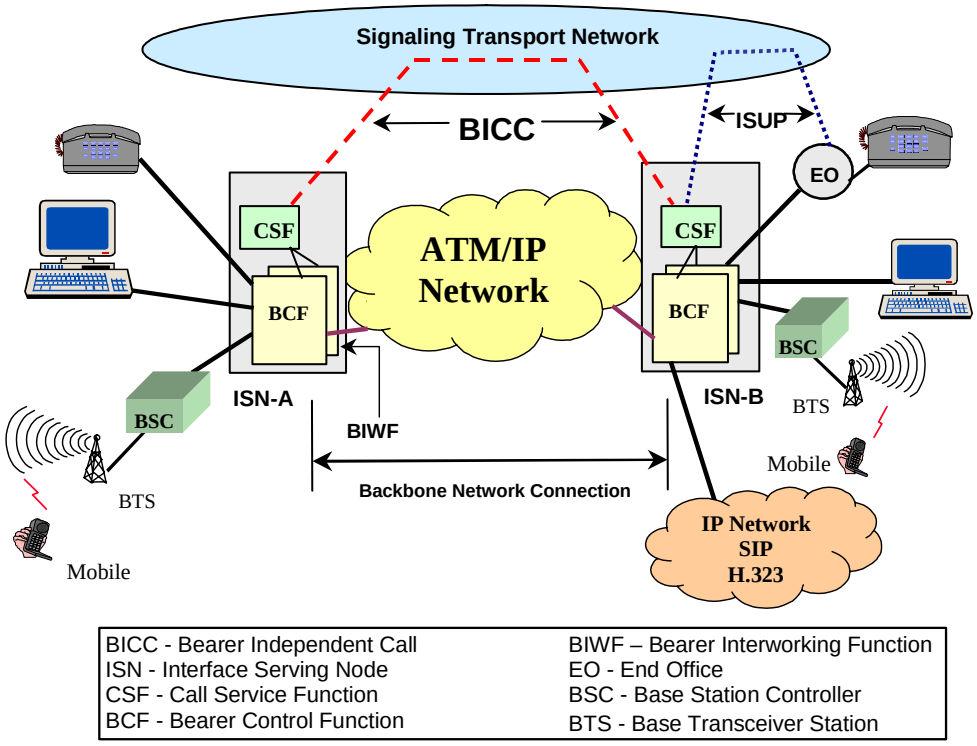


Figure 13: Packet-based Network Diagram –BICC Architecture

In general, supporting ETS in packet-based multi-media networks involves (but is not limiting to) the following:

1. Capability to authenticate and authorize ETS calls.
2. Capability to identify and signal an ETS call as it is set-up through the network.
3. Support of preference/priority schemes in the packet-based transport network.
4. Support of preference/priority schemes for signaling and bearer interactions.

5. Exemption of ETS calls from restrictive network management control to increase probability of successful call completion.
6. Optional ETS-specific signals to the end user.

5.1.5 Industry Activities on ETS

There are activities in various industry groups regarding support of ETS. Technical Report 79 (Overview of Standards in Support of Emergency Telecommunications Service) provides an overview of the development of ETS standards by ATIS Committees and within other standards organizations.

5.2 Service Functionalities

The network view of the services includes:

1. **Access Authentication.** One-time authentication or terminal subscription will result in preferential originating priority for signaling associated with initiating a call attempt from the authorized point to the network.

   When the calling party or the terminal equipment is authorized by one-time authentication or user subscription to use ETS, the calling party may, as part of the request, request normal call/session setup and decline the use of ETS capabilities. In this case, the additional ETS functions that would occur after any preferential originating access that has occurred and after authentication will not apply to the call/session. If the calling party does not decline further ETS functionality, all ETS functions will apply for the duration of the call/session setup.

   Once the calling party has been authenticated, further ETS processing shall result in indications in the forward direction to subsequent networks invoking ETS processing and indicating the assigned priority level.
2. **Application of an ETS-User-Specific Service Profile.** As part of the ETS authentication of authorized users, additional ETS-specific information for the calling party may be obtained within the network. This information could include, e.g., the ETS priority level of the calling party, authorization to invoke non-traceability for the call/session, and authorization to request an international call/session with ETS features.
3. **ETS-specific Response to Network Management Controls.** As part of:
   a. Preferential establishment of ETS communications,
   b. Preferential routing of ETS traffic and optional preemption of non-emergency traffic (where consistent and compliant with local, national and regulatory provisions, for example, not interfering with E911 calls),
   c. Allowable degradation of service quality when setting up an ETS call/session, or
   d. Allowable degradation of service quality of an existing ETS call/session to increase the probability that a new ETS call/session will be successfully set up,
   e. Certain network management controls may be applied or may be prohibited for ETS calls. The general philosophy to be followed is as follows:
      A) Exemption from Certain Restrictive Network Management Controls. To increase the probability of successful call/session completion, ETS calls/sessions and signaling required to facilitate call/session setup will be exempt from certain restrictive network management controls.

      B) Application of Expansive Network Management Controls. Expansive network management controls apply to ETS calls/sessions as for non-ETS calls/sessions.

Additional expansive network management controls may be applied to ETS calls/sessions only.

4. **No Adverse Network Treatment.** While ETS provides preferential access to telecommunications facilities, preferential establishment of the call/session, and preferential routing of ETS traffic, the fact that a particular network element does not recognize a request for ETS service or is not able to respond to the request must not adversely affect the call/session setup or routing of the call/session, nor should it remove any preference indicators.
5. **Priority for Call/session Setup Resources.** As part of:
    a. Preferential access to telecommunications facilities,
    b. Preferential establishment of ETS communications,
    c. Preferential routing of ETS traffic (including queuing for available resources, exemption from certain restrictive network management functions, optional reservation of some routes for ETS traffic) and optional preemption of non-emergency traffic (where consistent and compliant with local, national and regulatory provisions, for example, not interfering with E911 calls),
    d. Preferential completion of ETS traffic to a destination,
    e. Allowable degradation of service quality when setting up an ETS call/session, and
    f. Allowable degradation of service quality of an existing ETS call/session to increase the probability that a new ETS call/session will be successfully set up,

    an ETS call/session should receive preferential treatment when competing for scarce network resources required for call/session setup. When an ETS call/session is identified as such at the originating or terminating network element, this preferential treatment should include preferential treatment when competing for scarce resources at the originating or terminating network access.
6. **Privacy and Confidentiality.** Network and administrative security functions and mechanisms should be used to protect against unauthorized access to the contents of the signaling information related to an ETS call/session as is received by a traditional POTS call and its associated signaling. See Clause 9 for additional detail on security considerations.
    Refer to T1.XXX (User Plane Security Guidelines) for guidelines and requirements related to the user plane (bearer traffic) security.
7. **Non-Traceability.** As part of security protection of ETS traffic, selected users must be able to use ETS with minimal risk of usage being monitored or traced (i.e., user identity and/or geographic location of either originating and/or terminating entities being identified). Privacy protection of both ETS calls/sessions (discussed in item 6 above) and static ETS information (e.g., network provisioned information) is needed. Specifically, protection is needed against observation of network activities that could result in unauthorized entities gaining access to:
    a. Static information (e.g., User name, addresses, telephone numbers), and
    b. Network signaling and bearer information (e.g., calling/called telephone numbers, user's geographic location, IP addresses).

    This protection is intended to minimize and/or delay the ability to locate or identify the originating/terminating entities through reception or interception (internal and external to the network(s) of the telecommunications traffic by unauthorized entities. Both network and administrative security mechanisms may be used to provide the necessary protection for all or some ETS calls. Some mechanisms in the network may be activated by the ETS caller as needed. Administrative mechanisms include security policies such as modified billing and streamlined

management to protect ETS users and services information from identification by non-trusted/cleared individuals within the provider's network (s).

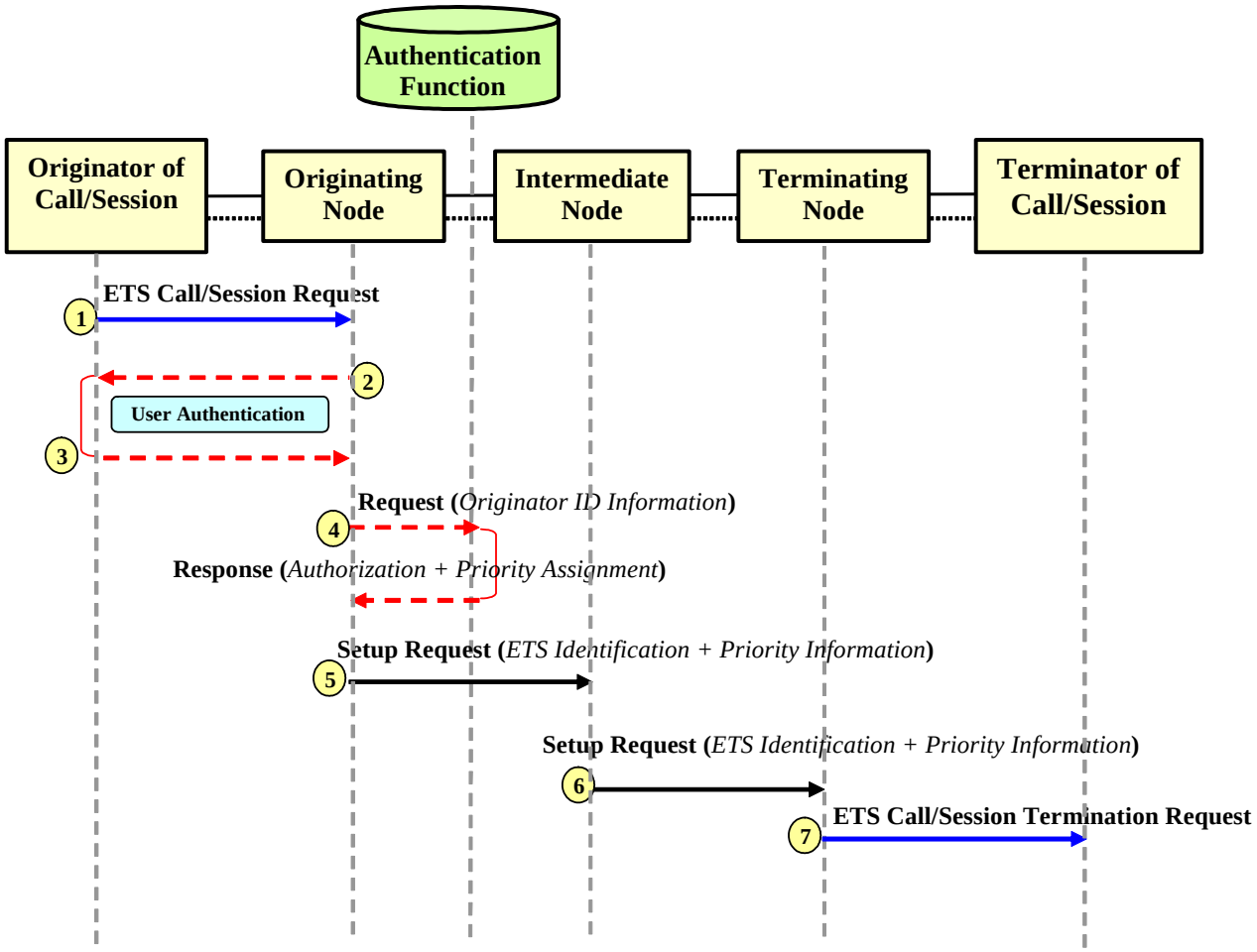
8. **Restorability.** OM&AP functionality and performance functionality must allow the interchange of critical telecommunications service management information in support of network reprovisioning, repair, and restoration on a priority basis for ETS.
9. **Survivability/Endurability.** Performance functionality must allow high confidence that ETS service will perform consistently and precisely according to its design requirements and specifications, including in the event of bearer or signaling network disruption.
10. **Accounting and Billing.** ETS service providers must have a means of accumulating accounting and billing data to bill customers who use the service. ETS is assumed to be a premium service with billing arrangements to be negotiated between the government and ETS service providers. It is assumed that these arrangements will have some charges billed directly to an entity authorized by the national government and other charges (e.g., per-call/session charges) billed directly to the end users.

6 INFORMATION FLOWS

Figure 14 provides the generic call/information flow, independent of the network type, for the ETS call/session. The following is illustrated:

1. The originator/user (calling party) sends an ETS call/session request to the originating node. The originating node determines whether additional user information (e.g., a PIN for authentication of the calling party) is needed.
2. If additional user information is needed, the originating node requests this information via in-band signaling.
   NOTE -This step is optional.
3. The originator/user provides the requested information via in-band signaling.
   NOTE -This step is optional, but is required if step 2 is present.
4. The authentication function may be provided remotely or locally. If an authentication function resides remotely, the originating node sends a request to the authentication function containing information identifying the user. The authentication function responds with the indication of success or failure of the operation. If the authentication function does not respond, or the response contains a protocol error, the originating node assigns a locally-defined default priority to the call and proceeds as if a valid response had been received authenticating the calling party and assigning this priority.
   NOTE -Other information may also be present in this validation response.
5. The originating node provides any available priority treatment and sends a call/session setup request to the succeeding node in the network.
6. The intermediate node provides any available priority treatment and continues with the call/session setup request.
7. The terminating node provides any available priority treatment and completes the ETS call/session.

Specific call/information flows for different network types (e.g., wireless, IP cable) are based on the generic call/information flow and are described in this clause. The network-type-specific information flows include a brief description of the protocol and procedures associated with the ETS aspects of the flow.



Note: Information flows 2-4 are optional.

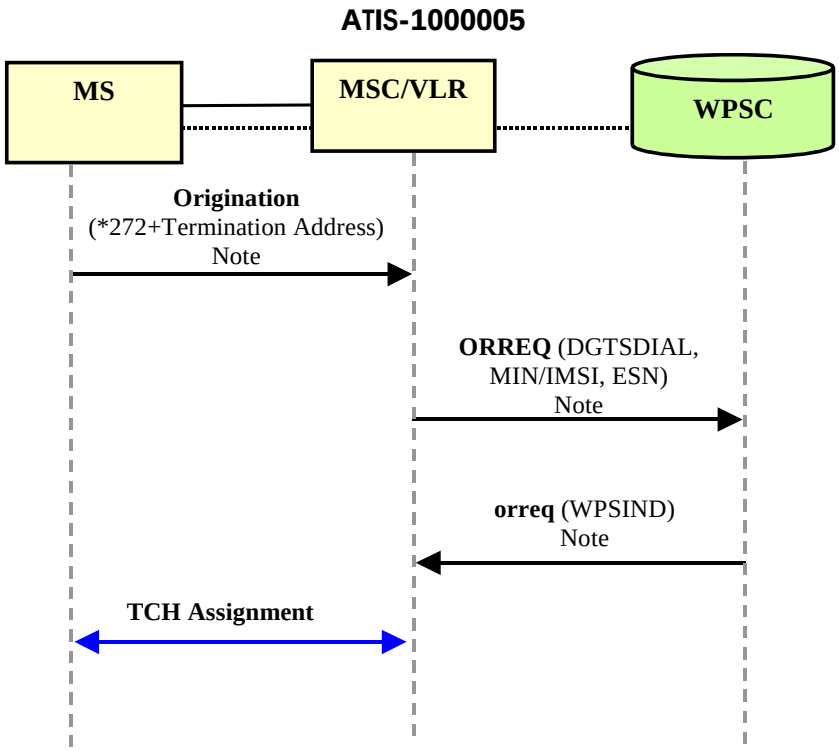
Figure 14: Generic Call/Information Flow for ETS Call/Session

6.1 Wireless/Mobile Radio Access Network

6.1.1 CDMA/WPSC

6.1.1.1 Origination

Steps 1 through 5 in Figure 14 are supported via a series of CDMA air interface and intersystem messages as shown in Figure 15. Messages and parameters related to MS authentication and queuing for radio traffic channel procedures are not shown in this figure. Only ETS-specific steps are shown in Figure 15. The Wireless Priority Service Center (WPSC) function provides authentication as shown in Figure 14.



Note: Other parameters are also included, which are not explicitly mentioned.

MS – Mobile Station
MSC – Mobile Switching Center
WPSC – Wireless Priority Service Center
VLR - Visitor Location Register

Figure 15: ETS Call Origination – CDMA

The air interface Origination message carries the MS dialed digit string (e.g., *272 + Termination Address). The OriginationRequest INVOKE (ORREQ) message uses the Digits (Dialed) (DGTSDIAL) parameter (contains digits as received in the Origination message), the Mobile Station Identifier (MSID) in either the MIN or IMSI parameter (provides the Mobile Station identity for the caller's MS), and ESN parameter (provides the Electronic Serial Number of the caller's MS) to request an ETS service request authorization. Based on the leading *272 feature code in the DGTSDIAL parameter, the WPSC determines that the request is for a WPS call origination and validates the MSID and ESN as belonging to an authorized user. The OriginationRequest RETURN RESULT (orreq) message uses the WPSIndicator parameter to indicate that the ETS authorization was successful and includes the MS's priority level information to be used for the call. The MSC/VLR completes the call by assigning a radio traffic channel to the MS. If no radio traffic channels are available, the MSC/VLR performs radio traffic channel queuing based on the priority level for the MS and the time of arrival of the call.

For more details, refer to TIA TR 45.2 draft PN-3-0054, WPS Enhancements for CDMA Systems, October 2003.

6.1.1.2 Termination

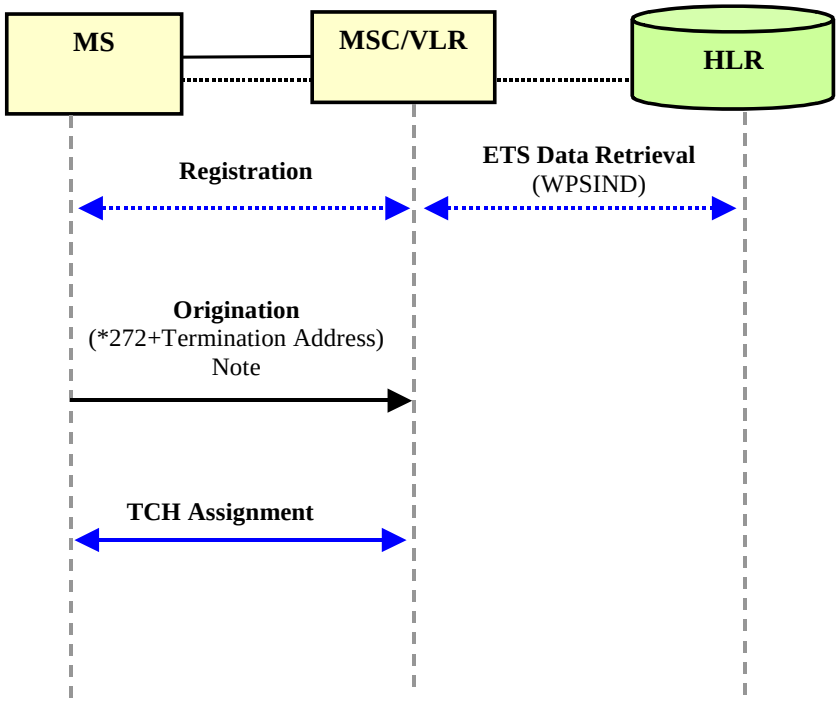
The ETS Call/Session Termination Request (Step 8) for a mobile-terminated ETS call when radio resources are available involves the traffic channel assignment at the terminating side to complete an ETS call to the called MS. Call termination proceeds based on the calling party's priority level.

For more details, refer to TIA TR 45.2 draft PN-3-0054, WPS Enhancements for CDMA Systems, October 2003.

6.1.2 CDMA/HLR

6.1.2.1 Origination

Steps 1 through 5 in Figure 14 are supported via a series of CDMA air interface and intersystem messages as shown in Figure 16. Messages and parameters related to MS authentication and queuing for radio traffic channel procedures are not shown in this figure. Only ETS-specific steps are shown in Figure 16. The Home Location Register (HLR) provides the authentication function information shown in Figure 14; the calling party's authorization to invoke ETS and the resulting priority for the call will be provisioned in the HLR and provided to the MSC/VLR during MS registration or service qualification. This scenario shows delivery of the priority information in calling party's subscription profile during MS registration and an ETS call origination using the dialed digit string (e.g., *272 + Termination Address). The WPSIndicator (WPSIND) parameter will indicate that the ETS authorization was successful and will also include the MS's priority level information to be used for the call. Note that the registration messages carrying the WPSIndicator parameter are not shown in Figure 16.



MS – Mobile Station
MSC – Mobile Switching Center
HLR – Home Location Register
VLR - Visitor Location Register

Figure 16: ETS Call Origination – CDMA

The air interface Origination message will carry the MS dialed digit string (e.g., *272 + Termination Address) to originate an ETS call. The MSC/VLR determines from the dialed digit string that an ETS call is originated and determines from the MS service profile that the MS is authorized for an ETS call.

The MSC/VLR (with the BSS) completes the call by assigning a radio traffic channel to the MS. If no radio traffic channels are available, the MSC/VLR performs radio traffic channel queuing based on the priority level for the MS and the time of arrival of the call.

For more details, refer to TIA TR 45.2 draft PN-3-0054, WPS Enhancements for CDMA Systems.

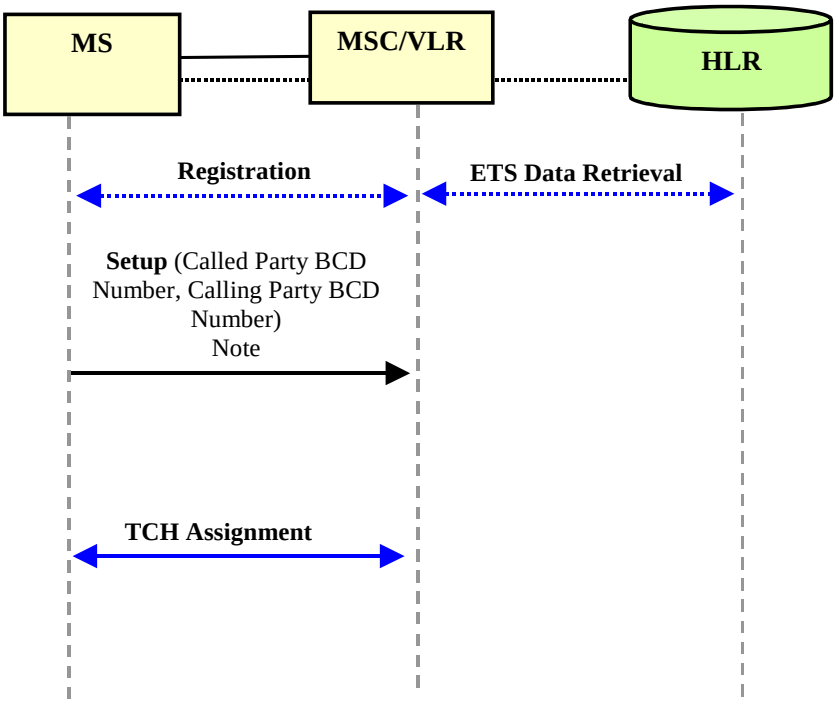
6.1.2.2 Termination

See 6.1.1.2.

6.1.3 GSM

6.1.3.1 Origination

Steps 1 through 5 in Figure 14 are supported via a series of GSM messages as shown in Figure 17. GSM messages and information elements related to MS authentication and queuing for radio traffic channel procedures are not shown in this figure. The Home Location Register (HLR) provides the authentication function information shown in Figure 14; the calling party's authorization to invoke ETS and the resulting priority for the call will be provisioned in the HLR. The GSM description below requires fewer ETS-specific messages than the corresponding CDMA description, since in the GSM network there is no separate ETS-specific authenticating network element.



Note: Other information elements are also included, which are not explicitly mentioned.

MS – Mobile Station
MSC – Mobile Switching Center
HLR – Home Location Register
VLR - Visitor Location Register

Figure 17: ETS Call Origination – GSM

The Setup message uses the Called Party BCD Number information element to carry the dialed digit string (e.g., *272 + Directory Number), Calling Party BCD Number information element (which provides the caller's MS ISDN number) to request an ETS service request authorization. Based on the mobile identity, MS subscription profile information, and the information received from the HLR, the MSC/VLR authorizes the caller to invoke ETS and provides the MS priority level to be used for the call. The MSC/VLR completes the call by assigning a radio traffic channel to the MS.

For more details, refer to 3GPP TR 22.952, Priority Service Guide (Release 6).

6.1.3.2 Termination

The ETS Call/Session Termination Request (Step 8) for a mobile-terminated ETS call when radio resources are available involves traffic channel assignment at the terminating side to complete an ETS call to the called MS. Call termination proceeds based on the calling party's priority level.

For more details, refer to 3GPP TR 22.952, Priority Service Guide (Release 6).

6.2 Circuit Switched Network

6.2.1 ISUP

The Setup Request (Steps 6 and 7) in Figure 14 is the Initial Address Message (IAM). An ETS call is identified by its use of the "National Security and Emergency Preparedness (NS/EP) call" codepoint in the mandatory Calling Party's Category parameter (CPC). The Precedence parameter in the IAM, if present, carries the ETS user's priority level. The MTP message priority of the IAM is set to value 1.

For more details, refer to ATIS-1000006.2005.

6.2.2 BICC

The Setup Request (Steps 6 and 7) in Figure 14 is the Initial Address Message (IAM). An ETS call is identified by its use of the "National Security and Emergency Preparedness (NS/EP) call" codepoint in the mandatory Calling Party's Category parameter (CPC). The Precedence parameter in the IAM, if present, carries the ETS user's priority level. The MTP message priority of the IAM is set to value 1. The associated BICC bearer control signaling flows are not shown in Figure 14.

For more details, refer to ATIS-1000006.2005.

6.2.3 TCAP

Transaction Capabilities Application Part (TCAP) signaling messages supporting ETS calls shall be marked with MTP message priority level value of 2. This will increase the probability of successful transfer of TCAP messages associated with an ETS call during signaling network congestion since messages are discarded in accordance with procedures of T1.111 (MTP).

For more detail refer to ATIS-1000006.2005.

6.3 IP Cable Networks

Steps 1 through 6 of Figure 14 for an ordinary call are described in SCTE 24-11 2001 and are shown in Figure 18.

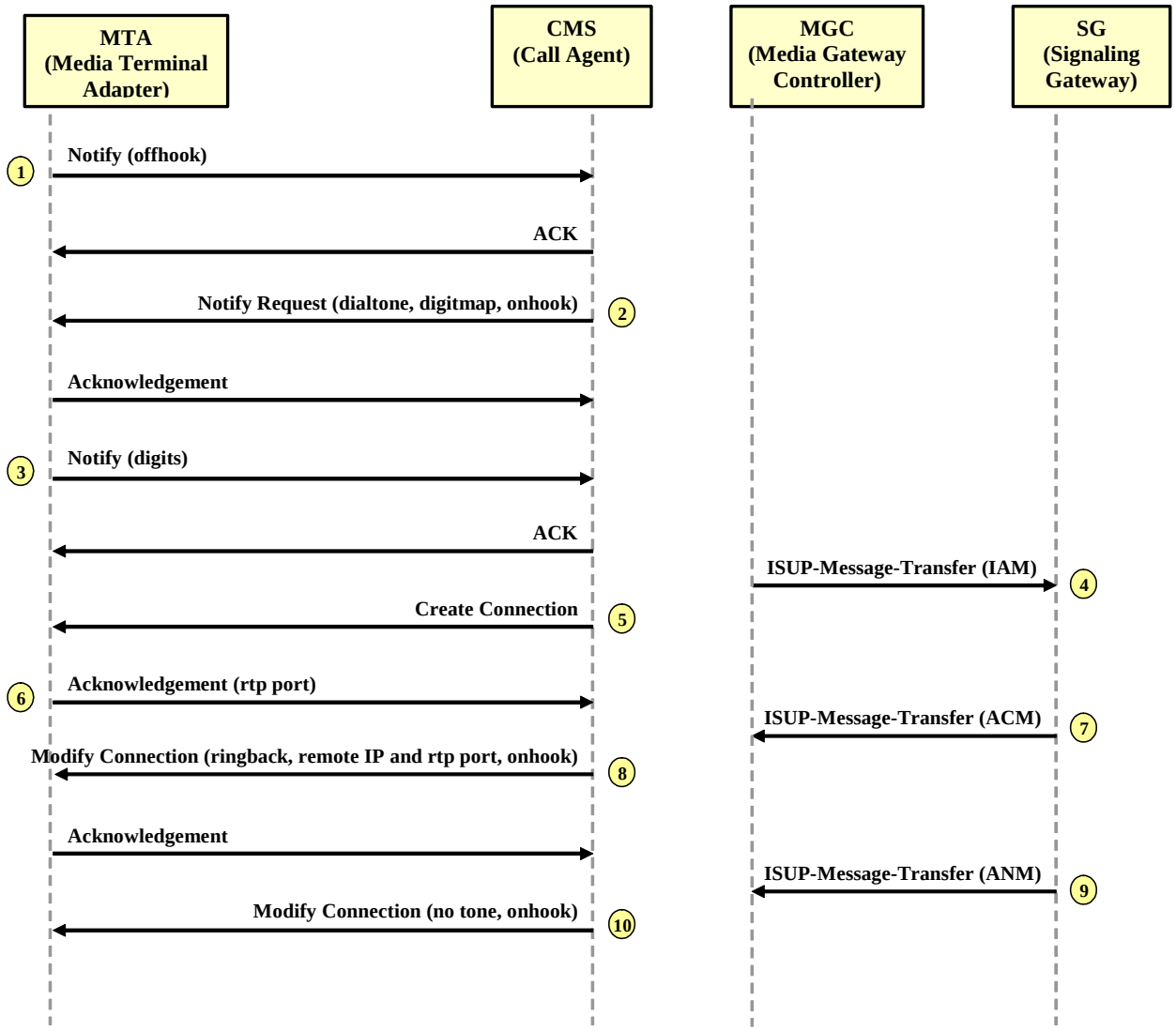


Figure 18: Typical Call Origination – Cable Network

The following steps are illustrated in Figure 18:

1. A subscriber activates the voice device connected to the Media Terminal Adapter (MTA). The MTA detects the offhook and sends a Notify event to the Call Agent with observed event set to offhook.
2. The Call Agent sends a Notify Request to the MTA with digitmap, signal set to dial tone, and observe event set to onhook.
3. The Media Terminal Adapter sends a Notify message after digits are collected.
4. The Call Agent analyzes the digits and determines to route the call to the PSTN network over an ISUP trunk.

If the Call Agent determines that the call origination includes a request to invoke ETS, the Call Agent is responsible to authenticate the call as coming from an authorized user (prior to step 4 in the generic call flow shown in Figure 14.)

The Call Agent establishes a communication with the Media Gateway Controller, which selects an ISUP trunk and sends an ISUP-Message-Transfer (IAM) message to the Signaling Gateway. If the Call Agent has determined that this is an ETS call, the ISUP-Message-Transfer (IAM) message sent by the Media Gateway Controller will need to indicate a properly populated outgoing SS7 IAM. This includes: 1) populating the CPC in the IAM (step 4 in the generic call flow shown in Figure 14) with the "National Security and Emergency Preparedness (NS/EP) call" codepoint to identify the call as an ETS call, and 2) populating the Precedence parameter in the IAM with the ETS user's priority level. In addition, the MTP message priority of the IAM sent by the Signaling Gateway must be set to value 1. This may require further information in the ISUP-Message-Transfer (IAM) message. For more details, refer to ATIS-1000006.2005.

8. In the meantime, the Call Agent sends a Create Connection message to the Media Terminal Adapter. This message may need to include information identifying the call as an ETS call.
9. The Media Terminal Adapter returns an Acknowledgement event with the RTP port number, which serves this communication.
10. When the terminating party is alerted, the remote switch sends an ACM message to the Signaling Gateway, which sends an ISUP-Message-Transfer (ACM) message to the Media Gateway Controller.
11. The Media Gateway Controller forwards the ACM information to the Call Agent, and the Call Agent sends a Modify Connection message to the Media Terminal Adapter instructing the Media Terminal Adapter to apply back notification tone. The IP address and RTP port of the ISUP circuit on the MG are also sent in this message.
12. When the terminating party answers the communication, remote switch sends an ANM. SG sends an ISUP-Message-Transfer (ANM) to the Media Gateway Controller.
13. The Media Gateway Controller sends the ANM information to the Call Agent, the Call Agent then sends a Modify Connection to the Media Terminal Adapter to turn off the back notification tone and set the mode to full duplex.

6.4 Packet-based Multimedia Network

6.4.1 H.248/Megaco

Figure 19 shows a communication between the Media Gateway Controller (MGC) and Media Gateway (MG) for an ETS call. If the MGC has determined, using appropriate mechanisms (e.g., via signaling from another network element), that this is an ETS call, the Emergency Call Indicator will be sent in an Add.req command to indicate to the MG that this particular context/call is being used for an ETS call and to request preference handling in the MG with respect to the bearer connection associated with the specified context. In addition, the Priority Indicator may be included in the Add.req command to indicate the priority value for the ETS context/call. The effect of the Priority Indicator on preference handling with respect to the bearer connection is for further study.

For more details, refer to and ITU-T Recommendation H.248 and RFC 2885.

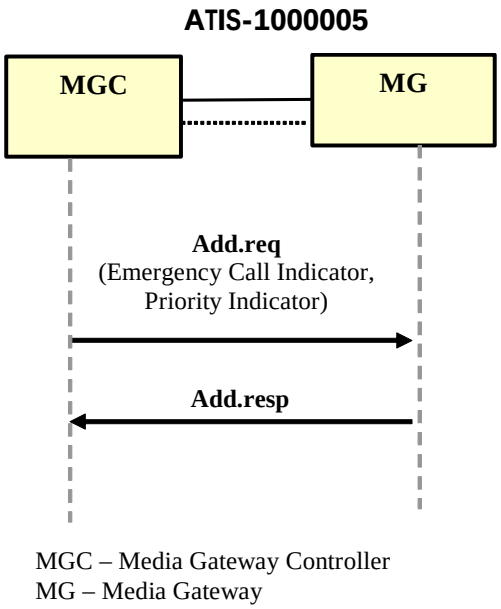


Figure 19: ETS Call/Connection Handling – H.248/Megaco

6.4.2 SIP

Steps 1, 6, 7, and 8 in Figure 14 are supported via SIP message as shown in Figure 20. SIP messages and fields related to ETS User authentication are not shown in this figure. Authentication for an ETS call may be based on subscription, on a per-call basis using the SIP authentication/authorization methods, or other mechanisms. Only ETS-specific call setup steps after ETS authentication has been successfully completed are shown in Figure 20. Upon determination that this is an ETS call, the Resource-Priority header field is included in the SIP INVITE to indicate that this particular call is an ETS call and to request prioritized resource access. In response, the Resource-Priority header field is included in the 180 Ringing to indicate the actual resource priority that is granted to the request. The Resource-Priority header field may also be included in other SIP requests and responses (as shown in Figure 20), but there is no requirement that every request and response within a SIP dialog or call use the Resource-Priority header field.

For the specification of SIP Resource Priority Header, refer to draft-ietf-sip-resource-priority-05, March 2004.

NOTE -Support of priority levels for ETS calls in SIP needs to be specified in draft-ietf-sip-resource-priority-05.

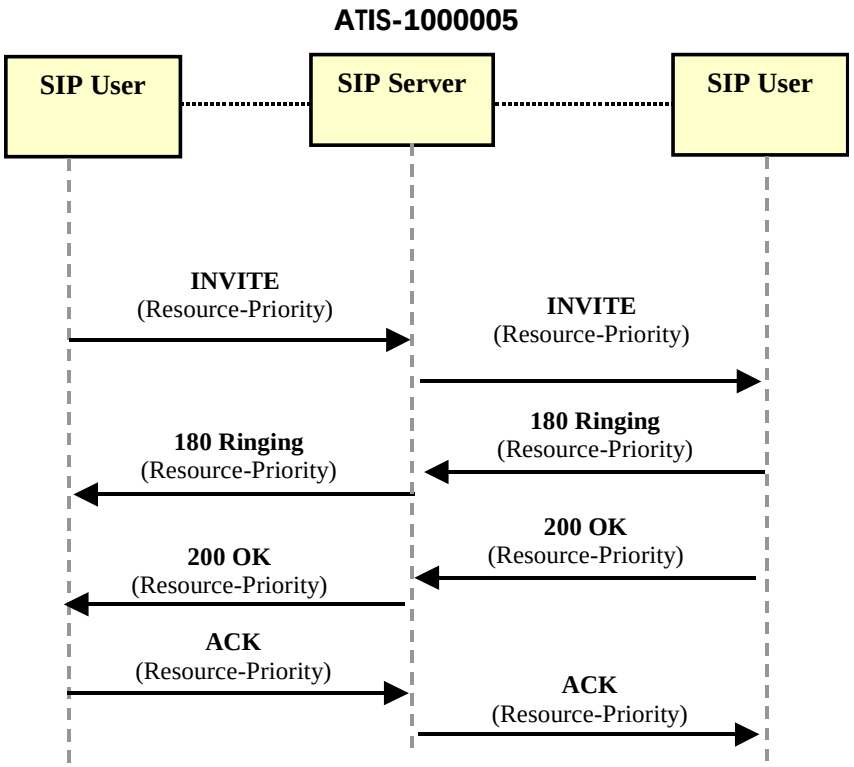


Figure 20: ETS Call/Connection Handling – SIP

6.4.3 H.323

Steps 1 through 8 in Figure 14 are supported via Registration, Admission and Status (RAS) and Call Control messages as shown in Figure 21. One ETS-specific example call setup flow is shown in Figure 21. The ARQ message (ARQ_1), sent by the originating H.323 user, will use the priorityValue field of the CallPriorityRequest parameter to request an ETS call authorization from its Gatekeeper. Upon determination that this is an ETS call, the ACF message (ACF_1), sent by the Gatekeeper, will use the CallPriorityConfirm parameter to grant the request. The SETUP message ($SETUP_1$) will use the CallPriorityRequest parameter, indicating that the Gatekeeper has authorized the request, to establish an ETS call originated by that H.323 user. The Gatekeeper will forward the request in the SETUP message ($SETUP_2$) to the terminating H.323 user. The terminating H.323 will first forward the request to its Gatekeeper in the ARQ message (ARQ_2) to authenticate its ETS call request. After receiving the ACF message (ACF_2) with the CallPriorityConfirm parameter from the Gatekeeper confirming the request, the CONNECT message ($CONNECT_1$), sent by the terminating H.323 user, will use the CallPriorityConfirm parameter to respond to the call setup and to indicate that the terminating H.323 user is able to grant the priority returned by the Gatekeeper. The Gatekeeper will forward the response in the CONNECT message ($CONNECT_2$) to the originating H.323 user.

Optionally, the Call Priority designation parameters (CallPriorityRequest and CallPriorityConfirm) may use the priorityExtension field to carry priority levels for ETS calls.

For protocol specification for ETS support using H.323, refer to ITU-T Recommendation H.460.4.

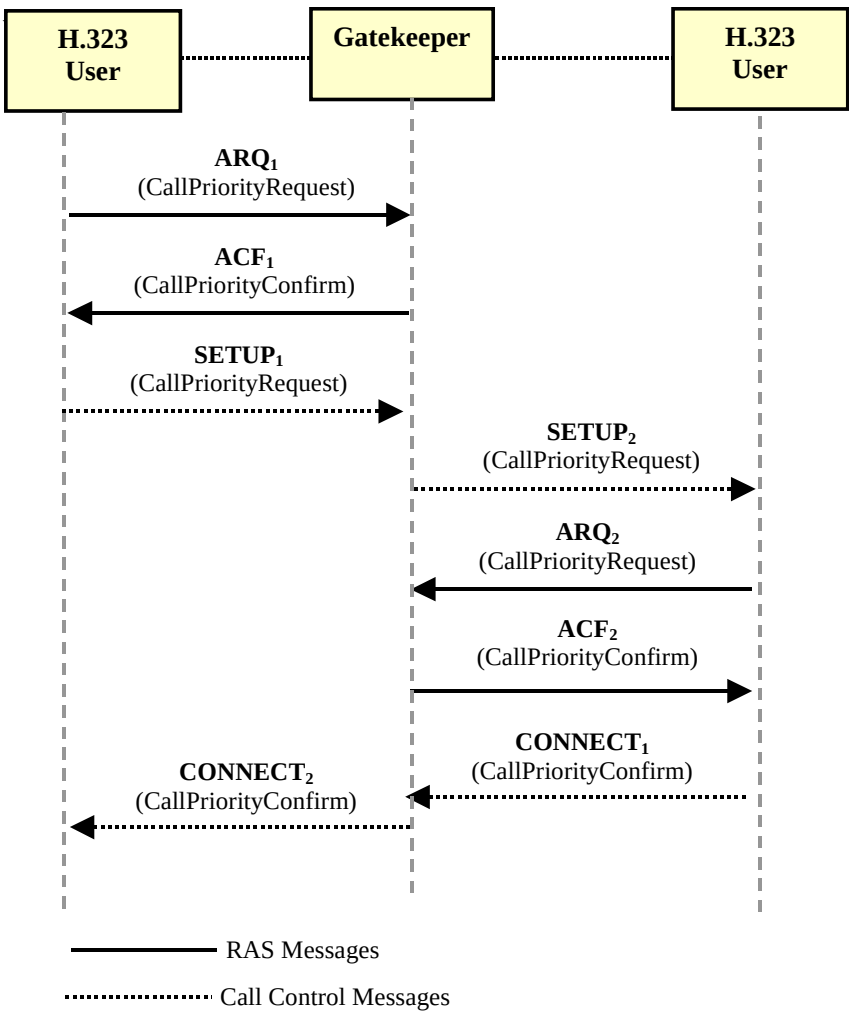


Figure 21: ETS Call/Connection Handling – H.323

6.4.4 BICC

Flows 6 and 7 in Figure 14 are supported via BICC call control and bearer control messages as shown in Figure 22. Only ETS-specific call and connection setup flows are shown in Figure 22. Upon determination that it is an ETS call, the Initial Address Message (IAM), sent by the Call Service Function (CSF), will use the mandatory Calling Party's Category parameter (CPC) coded "National Security and Emergency Preparedness (NS/EP) call" to indicate that this particular call is an ETS call and to request prioritized resource access. In addition, the IAM will use the optional Precedence parameter to carry the ETS user's priority level. To ensure priority handling in the bearer network (DSS2 and AAL2) upon receiving an ETS indication from the CSF, the Bearer Set-up request (sent by the Bearer Control Function (BCF)) will use the IEPS Indicator information element/parameter to select appropriate bearer resources for a call with CPC set to "NS/EP call". The BICC bearer control and CSF to BCF signaling flows are not shown in Figure 22.

For protocol specification for ETS support using BICC, refer to ATIS-1000006.2005. For protocol specification for ETS support using DSS2 and AAL2, refer to TD GEN/11-66 R1 (3/04), Enhancements to DSS2, AAL 2, ISUP, and BICC in Support of IEPS.

NOTE -Identification of an ETS call within the bearer network is under discussion in ITU-T SG11.

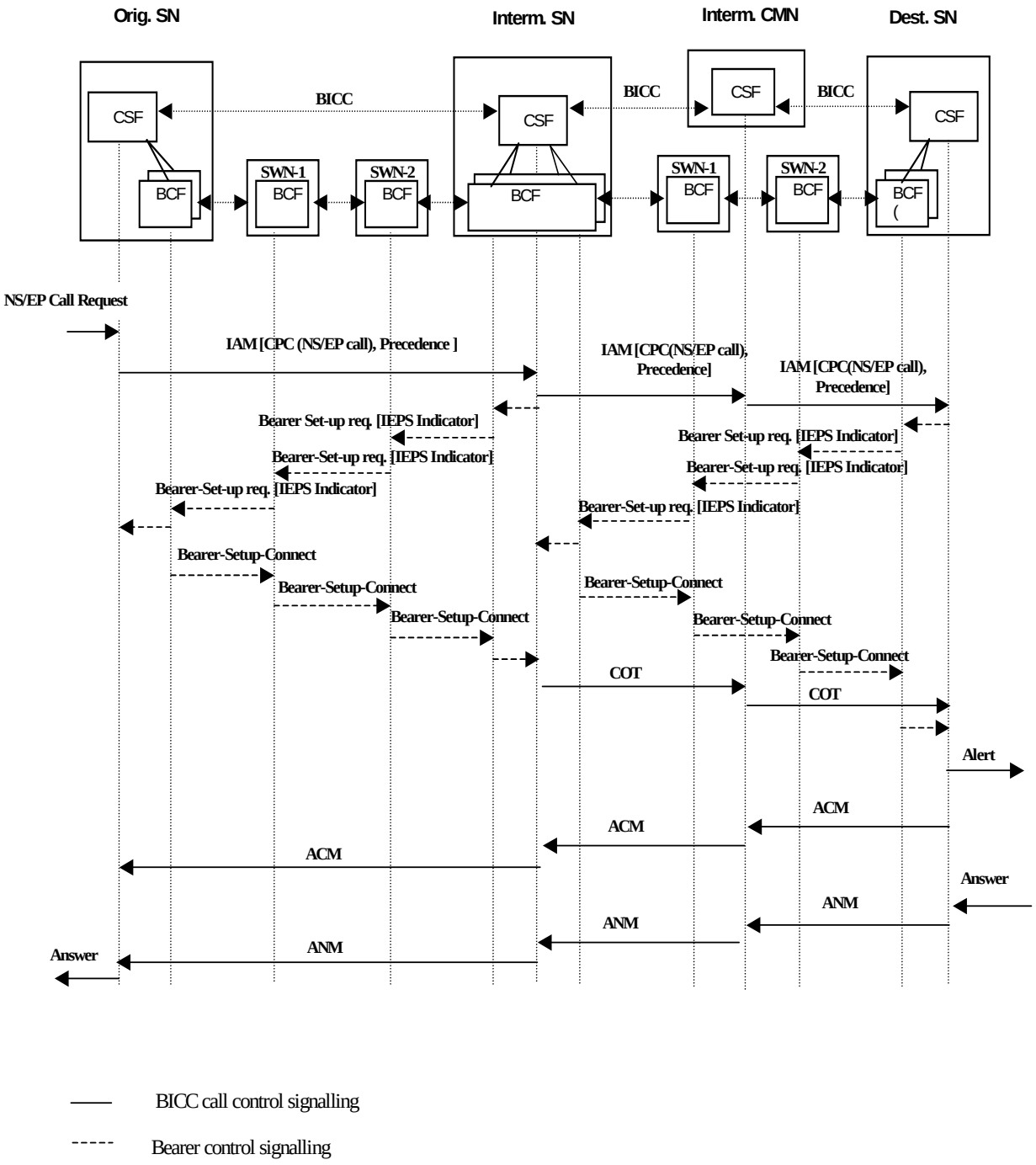


Figure 22: ETS Call/Connection Handling – BICC

6.5 Interworking

6.5.1 Public Switched Telephone Network (PSTN) – Wireless Networks

There are two ETS-specific information elements that must be mapped between network types to support ETS: the identification of the call as an ETS call and the priority level associated with the call setup. To identify the call as an ETS call, the ISUP/BICC IAM includes the Calling Party's Category

(CPC) parameter set to "NS/EP call". The Precedence parameter value indicates the calling party's priority level (as received in the WPSIndicator parameter of the orreq message for an originating CDMA-based system or as provided by the HLR for an originating GSM-based system). When the IAM is received in the wireless/mobile radio access network (terminating CDMA-based system or GSM-based system) and is identified as an ETS call based on the CPC parameter value, it is assigned an appropriate priority treatment in the terminating network.

The PSTN does not support degradation of service quality for established ETS or non-ETS traffic to increase the probability of new ETS call completion (per point 13 in clause 1.) There are no ISUP procedures to support degradation of service quality once a call is set up. Although optional BICC procedures support codec negotiation during call setup, codec modification during the active phase of the call and mid-call codec negotiation during the active phase of the call, these procedures are not allowed in conjunction with ETS. A detailed discussion of the rationale for this restriction may be found in ATIS-1000006.2005, Annex B.

As a result, the PSTN will not request that the wireless network degrade service quality as part of ETS. Similarly, the PSTN will not degrade service quality on established calls/sessions nor will it provide an increased probability of successful call/session setup if the wireless network degrades service quality on established calls/sessions.

The wireless network should recognize that signaling to degrade service quality for existing calls/sessions would not pass the network boundary. Therefore, if practical, the wireless network should not initiate procedures within that network to degrade service quality if the resources that are limiting successful call/session setup are in the PSTN.

6.5.2 Public Switched Telephone Network (PSTN) – IP Cable Networks

The PSTN does not support degradation of service quality for established ETS or non-ETS traffic to increase the probability of new ETS call completion (per point 13 in clause 1.) There are no ISUP procedures to support degradation of service quality once a call is set up. Although optional BICC procedures support codec negotiation during call setup, codec modification during the active phase of the call and mid-call codec negotiation during the active phase of the call, these procedures are not allowed in conjunction with ETS. A detailed discussion of the rationale for this restriction may be found in ATIS-1000006.2005, Annex B.

As a result, the PSTN will not request that the IP Cable network degrade service quality as part of ETS. Similarly, the PSTN will not degrade service quality on established calls/sessions nor will it provide an increased probability of successful call/session setup if the IP Cable network degrades service quality on established calls/sessions.

The IP Cable network should recognize that signaling to degrade service quality for existing calls/sessions would not pass the network boundary. Therefore, if practical, the IP Cable network should not initiate procedures within that network to degrade service quality if the resources that are limiting successful call/session setup are in the PSTN.

6.5.3 Public Switched Telephone Network (PSTN) – Packet-based Networks

The PSTN does not support degradation of service quality for established ETS or non-ETS traffic to increase the probability of new ETS call completion (per point 13 in clause 1.) There are no ISUP procedures to support degradation of service quality once a call is set up. Although optional BICC procedures support codec negotiation during call setup, codec modification during the active phase of the call and mid-call codec negotiation during the active phase of the call, these procedures are not

allowed in conjunction with ETS. A detailed discussion of the rationale for this restriction may be found in ATIS-1000006.2005, Annex B.

As a result, the PSTN will not request that the packet-based network degrade service quality as part of ETS. Similarly, the PSTN will not degrade service quality on established calls/sessions nor will it provide an increased probability of successful call/session setup if the packet-based network degrades service quality on established calls/sessions.

The packet-based network should recognize that signaling to degrade service quality for existing calls/sessions would not pass the network boundary. Therefore, if practical, the packet-based network should not initiate procedures within that network to degrade service quality if the resources that are limiting successful call/session setup are in the PSTN.

6.5.3.1 SIP

There are two ETS-specific information elements that must be mapped between different network types to support ETS: the identification of the call as an ETS call and the priority level associated with the call. To identify the call as an ETS call, the ISUP/BICC IAM includes the Calling Party's Category (CPC) parameter set to "NS/EP call". The Precedence parameter value indicates the calling party's priority level. These codes are included in the ISUP/BICC IAM based on the Resource-Priority header field received in the SIP INVITE.

When the IAM for an ETS call is received in the Packet-based Multimedia Network using SIP and is identified as an ETS call based on the CPC parameter value of "NS/EP call", then whether or not the IAM includes a Precedence parameter identifying a priority level (e.g., if the Precedence parameter is not received, the call may be assigned a default priority level), the Resource-Priority header field is included in the SIP INVITE and the call is assigned an appropriate priority treatment. The mapping between the SIP Resource-Priority header field and ISUP/BICC Calling Party's Category (CPC) and Precedence parameters is for further study.

6.5.3.2 H.323

There are two ETS-specific information elements that must be mapped between different network types to support ETS: the identification of the call as an ETS call and the priority level associated with the call. To identify the call as an ETS call, the ISUP/BICC IAM includes the Calling Party's Category (CPC) parameter set to "NS/EP call" when the Call Priority designation parameter is included in the SETUP message and it indicates a priority value of emergency Authorized. The Precedence parameter value indicates the calling party's priority level and the mapping of the priorityExtension field of the Call Priority designation parameter to Precedence parameter is for further study. When the IAM for an ETS call is received in the Packet-based Multimedia Network using H.323 and is identified as an ETS call based on the CPC parameter value of "NS/EP call", then whether or not the IAM includes a Precedence parameter identifying a priority level (e.g., if the Precedence parameter is not received, the call may be assigned a default priority level), the Call Priority designation parameter is sent in the ARQ and SETUP messages with a priority value of emergencyAuthorized and the call is assigned an appropriate priority treatment. The mapping of the Precedence parameter to priorityExtension field in the Call Priority designation parameter is for further study.

For protocol interworking between PSTN and H.323, refer to ITU-T Recommendation H.246.

The mapping of the "NS/EP call" codepoint in the ISUP/BICC Calling Party's Category (CPC) parameter to "emergencyAuthorized" field in the H.323 Call Priority designation parameter and vice versa is specified in ATIS-1000006.2005.

7 OPERATIONS, ADMINISTRATION, MAINTENANCE AND PERFORMANCE CONSIDERATIONS

Guidelines for network management and maintenance functionality may be found in T1.202, *Guidelines for Network Management of the Public Switched Networks under Disaster Conditions.*

8 GENERAL SECURITY CONSIDERATIONS

8.1 Overview

Several aspects related to security protection of ETS services are discussed in other parts of this Technical Report. Specifically, requirements regarding secure, private, and confidential ETS calls/sessions, ETS user authentication, and protection against unauthorized surveillance/monitoring are discussed in Clauses 4 and 5.2. This clause discusses general security considerations for ETS services in a homogenous or non-homogeneous network environment. Since the national telecommunications network consists of multiple interconnected networks using different technologies and protocols (e.g., circuit-switched, wireless, IP, and ATM), the network functions that may be applied to protect ETS calls/sessions would depend on factors such as the network type and environment, technology specific security capabilities/features, network specific security policies and practices, and which other network types interconnected with the network.

8.2 Primary Security Needs/Objectives

The general objective is that ETS services should be as secure or more secure that POTS services in the PSTN. The primary security needs for ETS include, but is not limited to:

1. Preventing use of ETS services by unauthorized users.
2. Preventing denial of service and other types of attacks on ETS services and resources impacting ETS availability.
3. Providing privacy/confidentiality and integrity for ETS calls/sessions.

The general concept is to support security capabilities, policies and practices to prevent exploitation of network interconnects and transport network protocol priority mechanisms interworking functions to impact availability of ETS services.

8.3 General Intra-network Security Considerations

Each network should employ security functions and capabilities based on the needs identified in Clauses 4, 5.2, and 8.2. Specifically, security functions and capabilities should be supported to provide privacy/confidentiality and integrity of ETS calls/sessions, to prevent the unauthorized use of ETS services, and to prevent attacks (e.g., denial of service attacks) impacting availability of ETS services. ETS services should be protected using network and technology specific security capabilities, and by establishing and adhering to appropriate network specific security policies and practices. Specifically, mechanisms are needed to validate ETS calls/sessions within one management domain or across different management domains in one network. For example, a circuit-switched network should employ security services, policies, and practices (such as use of dedicated communications channels, and physical security practices, etc) applicable to the circuit-switched network environment. Similarly, other network types such as packet-based multimedia networks should employ security capabilities, policies, and practices (e.g., IP encryption and authentication services) applicable to a packet network environment.

8.4 General Inter-network Security Considerations

ETS services would have to be protected end-to-end across multiple interconnected network types that are using different technologies and protocols (e.g., circuit-switched, wireless, IP, and ATM) based on the needs identified in Clause 8.2 above. Each network should establish and adhere to security policies and practices in support of internetwork ETS services (i.e., ETS services across network boundaries). Specifically, mechanisms are needed to validate ETS calls/sessions across the network boundary. In addition, security mechanisms, policies, and practices should protect network interconnection interfaces, interworking nodes and protocol interworking functions related to internetwork ETS services.

8.5 ETS Signaling and Control Security Example[8]

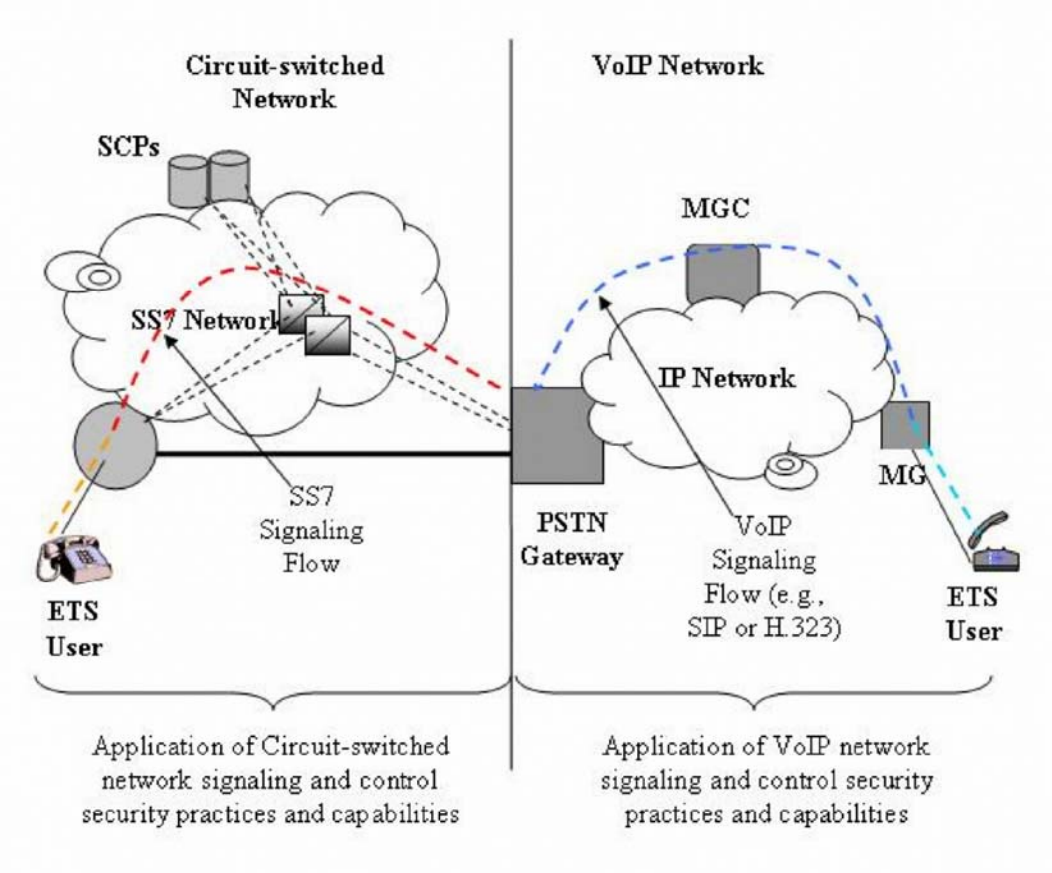


Figure 23: End-to-End ETS Signaling and Control Security Example

Figure 23 shows the end-to-end signaling and control of an example ETS call between a circuit-switched network and a VoIP network. Each network in this example is required to provide security protection for ETS signaling and control as follows:

[8] This is the subject of ongoing work in the Packet Technologies and Services Committee, under Issues S003, S004, S005, S006, and S007.

- Circuit-switched Network – Will establish and implement security practices and capabilities supported in circuit-switched networks to protect ETS signaling and control in the circuit-switched network domain. For example, the access and SS7 signaling message flows should be protected by implementing security best practices and use of physical security capabilities.
- VoIP Network – Will establish and implement security practices and capabilities supported in VoIP networks to protect ETS signaling and control in the VoIP network domain including the bearer control signaling and any routing and translation protocols (e.g., DNS translations). For example, IPsec, Transport Layer Security (TLS) and/or application protocol (e.g., SIP or H.323) specific mechanisms should be used as appropriate to protect ETS signaling and control in the VoIP network.