ATIS-1000059.2024

Emergency Telecommunications Service Wireline Access Requirements

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ATIS-1000059.2024, *Emergency Telecommunications Service Wireline Access Requirements*

Is an American National Standard developed by the ATIS **Packet Technologies and Systems Committee (PTSC)**.

Published by
Alliance for Telecommunications Industry Solutions
1200 G Street, NW, Suite 500
Washington, DC 20005

ATIS-1000059.2024

American National Standard for Telecommunications

Emergency Telecommunications Service Wireline Access Requirements

Alliance for Telecommunications Industry Solutions

Approved April 2, 2024

American National Standards Institute, Inc.

Abstract

This standard specifies Emergency Telecommunications Service (ETS) network element requirements for wireline access in support of ETS Voice and ETS Video. These requirements are based on the procedures defined in the ETS in IP Networks Phase 1 standard [ATIS-1000010]. In addition, Operations, Administration, Maintenance, and Provisioning (OAM&P) requirements are specified.

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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. The word *may* denotes an optional capability that could augment the standard. The standard is fully functional without the incorporation of this optional capability.

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At the time of consensus on this document, PTSC, which was responsible for its development, had the following leadership:

M. Dolly, PTSC Chair (AT&T)

V. Shaikh, PTSC Vice Chair and Technical Editor (Peraton Labs)

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ETS Wireline Access Requirements

1 Scope & Purpose

1.1 Scope

This standard specifies Emergency Telecommunications Service (ETS) network element requirements for wireline access in support of ETS Voice and ETS Video. These requirements are based on the procedures defined in the ETS in IP Networks Phase 1 standard [ATIS-1000010]. In addition, Operations, Administration, Maintenance, and Provisioning (OAM&P) requirements are specified.

This Standard defines network element requirements for the following wireline access technologies:

- Digital Subscriber Line (DSL)
- Fiber
- Cable
- Ethernet

1.2 Purpose

The purpose of this document is to specify network element requirements for wireline access networks in support of ETS. The wireline access technologies discussed in this document are Digital Subscriber Line (DSL), Fiber (Broadband and Ethernet Passive Optical Networks [PONs]), Cable, and Metro Ethernet Access Networks. This Standard is intended to provide requirements for vendors to use in developing ETS capabilities for their equipment and for Service Providers to use in developing and delivering ETS. In addition, the purpose of this document is to demonstrate that ETS is implementable and interoperable in a multi-vendor environment for various wireline access network deployments.

2 References

2.1 ANSI References[1]

[ATIS-1000010] ATIS-1000010, *Support of Emergency Telecommunications Service (ETS) in IP Networks*.

[ATIS-1000049] ATIS-1000049, *End-to-End NGN GETS Call Flows*.

[ATIS-1000056] ATIS-1000056, *Access Networks Architecture Technical Report*.

[ATIS-1000066] ATIS-1000066, *Emergency Telecommunications Service (ETS) Network Element Requirements for IMS-based Next Generation Network (NGN) Phase 2*.

[1] These documents are available from the Alliance for Telecommunications Industry Solutions (ATIS) at: < https://www.atis.org >.

2.2 ITU[2]

[G.983] ITU-T Recommendation G.983.1, *Broadband optical access systems based on Passive Optical Networks (PON)*, January 2005.

[G.984] ITU-T Recommendation G.984.1, *Gigabit-capable passive optical networks (GPON): General characteristics*, March 2008.

[Q.3303.3] ITU-T Recommendation Q.3303.3, *Resource control protocol No. 3 – Protocols at the Rw interface between a policy decision physical entity (PD-PE) and a policy enforcement physical entity (PE-PE): Diameter*.

[Y.2111] ITU-T Recommendation Y.2111, *Resource and Admission Control Functions in Next Generation Networks*.

2.3 Other

2.3.1 ETSI[3]

[TS 183.017] TS 183.017, *Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control: DIAMETER protocol for session based policy set-up information exchange between the Application Function (AF) and the Service Policy Decision Function (SPDF); Protocol specification*, March 2006.

2.3.2 CableLabs[4]

[CM-SP-MULPIv3.0-I08-080522] CM-SP-MULPIv3.0-I08-080522, *Data-Over-Cable Service Interface Specification, DOCSIS 3.0, MAC and Upper Layer Protocols Interface Specification*, May 2008.

[PKT-SP-MM-I04-080522] PKT-SP-MM-I04-080522, *PacketCableTM Specification, Multimedia Specification*, May 2008.

[PKT-SP-MM-WS-I02-080522] PKT-SP-MM-WS-I02-080522, *PacketCable Multimedia Specification, PacketCable Multimedia Web Service Interface Specification*, May 2008.

[PKT-SP-QOS-I02-080425] PKT-SP-QOS-I02-080425, *PacketCableTM 2.0 Quality of Service Specification*, April 2008.

[PKT-TR-ARCH-FRM-V04-071106] PKT-TR-ARCH-FRM-V04-071106, *PacketCableTM 2.0 Architecture Framework Technical Report*, November 2007.

2.3.3 Broadband Forum[5]

[TR-058] TR-058, *Multi-Service Architecture and Framework Requirements*, September 2003.

[TR-059] TR-059, *DSL Evolution – Architecture Requirements for the Support of QoS Enabled IP Services*, September 2003.

[TR-101] TR-101, *Migration to Ethernet-Based DSL Aggregation*, April 2006.

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[2] These documents are available from the International Telecommunications Union (ITU) at: < http://www.itu.int/ >.

[3] These documents are available from the European Telecommunications Standards Institute (ETSI) at: < www.etsi.org/ >.

[4] These documents are available from CableLabs at: < www.cablelabs.com/ >.

[5] These documents are available from the Broadband Forum at: < https://www.broadband-forum.org/ >.

[TR-156] TR-156, *Using GPON Access in the Context of TR-101*, December 2008.

[TR-134] TR-134, *Broadband Policy Control Framework*, July 2012.

2.3.4 Metro Ethernet Forum[6]

[MEF 4] Technical Specification MEF 4, *Metro Ethernet Network Architecture Framework – Part 1: Generic Framework*, May 2004.

[MEF 7] Technical Specification MEF 7, *EMS-NMS Information Model*, October 2004.

[MEF 15] Technical Specification MEF 15, *Requirements for Management of Metro Ethernet Phase 1 Network Elements*, November 2005.

[MEF 16] Technical Specification MEF 16, *Ethernet Local Management Interface*, January 2006.

[MEF 17] Technical Specification MEF 17, *Service OAM Requirements & Framework – Phase 1*, April 2007.

2.3.5 Federal Communications Commission[7]

[FCC 1] FCC Title 47 Appendix B to Part 64—Wireless Priority Service (WPS) for National Security and Emergency Preparedness, May 2022

3 Definitions, Acronyms, & Abbreviations

3.1 Definitions

3.1.1 Service User: Service User is an individual authorized by the government agency to use ETS and to whom a priority assignment has been granted by the government agency.

3.2 Acronyms & Abbreviations

3GPP	3rd Generation Partnership Project
AAR	AA-Request
AF	Application Function
AN	Access Node
ANMS	Access Node Management System
AS	Application Server
AVP	Attribute Value Pair
BE	Best Effort
BNG	Broadband Network Gateway
CAC	Call Admission Control
CM	Cable Modem
CMTS	Cable Modem Termination System
COPS	Common Open Policy Service
COS	Class Of Service

[6] These documents are available from the Metro Ethernet Forum (MEF) at: < https://mef.net/ >.

[7] This document is available from the Federal Communications Commission at <www.fcc.gov>.

CSCF	Call Session Control Function
CIR	Committed Information Rate
DiffServ	Differentiated Services
DSCP	DiffServ Code Point
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
EF	Expedited Forwarding
EIR	Excess Information Rate
ETS	Emergency Telecommunications Service
FE	Functional Entity
GETS	Government Emergency Telecommunication Service
GETS-AN	GETS Access Number
GETS-FC	GETS Feature Code
GW	Gateway
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
IP	Internet Protocol
MCC	Machine Congestion Control
MDF	Main Distribution Frame
MPS	Multimedia Priority Service
MSO	Multiple System Operator
nrtPS	non-real time Polling Traffic
NCS	National Communication System
NE	Network Element
NGN	Next Generation Network
NID	Network Interface Device
NS/EP	National Security and Emergency Preparedness
OAM&P	Operations, Administration, Maintenance, and Provisioning
ODN	Optical Distribution Network
OLT	Optical Line Termination
OM	Operational Measurement
ONT	Optical Network Termination
PAM	PacketCable Application Manager
PCRF	Policy and Charging Rules Function
P-CSCF	Proxy CSCF
PDF	Policy Distribution Function
PDP	Policy Decision Point

PEP	Policy Enforcement Point
PON	Passive Optical Network
QoS	Quality of Service
RAA	Re-Auth-Answer
RACF	Resource Admission Control Function
RAR	Re-Auth-Request
RFC	Request For Comment
RPH	Resource-Priority Header
RTP	Real-Time Transport Protocol
SBC	Session Border Controller
S-CSCF	Serving CSCF
SDO	Standards Development Organization
SDP	Session Description Protocol
SIP	Session Initiation Protocol
UE	User Equipment

4 Network Architecture Models

This clause provides a high-level description of access network architecture models for:

- DSL.
- Fiber.
- Cable.
- Ethernet.

4.1 DSL Access Network

Figure 4.1 illustrates the DSL Access Network architecture based on the Ethernet-based DSL aggregation network architecture described in [TR-101]. The Functional Entities (FEs) are distributed among the Regional Broadband Network, the Access Node (AN), and the Customer Premises Network. The interfaces of interest are between the Customer Premises Network and the AN (the U interface), and the policy control interface into the Broadband Network Gateway (BNG). Policy control in the DSL Access Network is based on the specifications found in [Y.2111], [TR-058], [TR-059], and [TR-134].

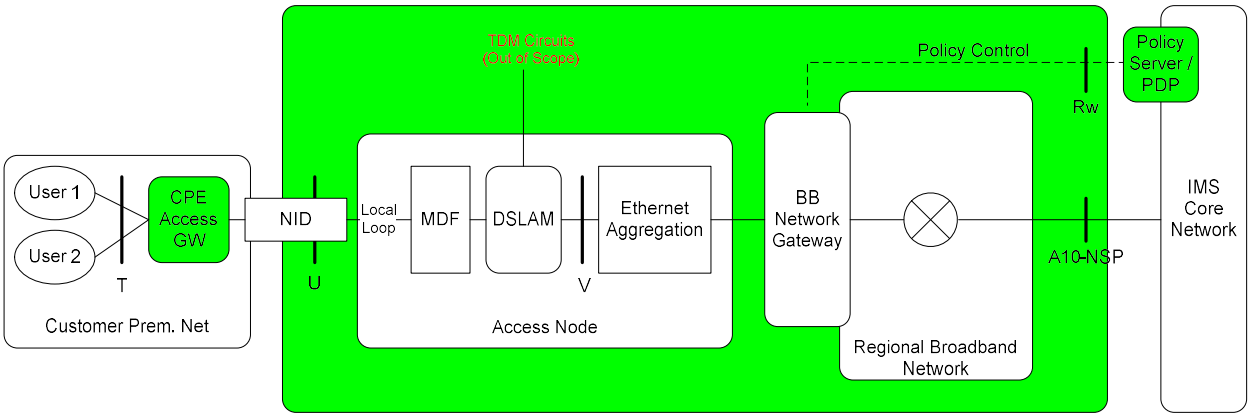

Figure 4.1 – DSL Access Network Architecture

For additional details on the DSL Access Network architecture, description of the DSL Access Network FEs, and description of the DSL Access Network interfaces, refer to [ATIS-1000056]. ETS requirements for the DSL Access Network FEs are provided in Clause 6.1 of this document.

4.2 Fiber Access Network

A reference architecture for PON, based on [ITU-T G.983], is shown in Figure 4.2. The reference architecture refers to an Access Node Management System (ANMS) for control of the Optical Line Termination (OLT) and Optical Network Termination (ONT). The ANMS provides the Policy Decision Point (PDP) functionality that is enforced by the Policy Enforcement Points (PEPs) located in the OLT and ONT. This system is assumed to be located on the border between the Fiber Access Network and the IMS Core Network. For ETS to function properly, the ANMS needs to be upgraded to provide real-time control of the OLT and ONT.

The OLT, Optical Distribution Network (ODN), and ONT from the PON reference architecture can be used in place of the Network Interface Device (NID), Main Distribution Frame (MDF), and Digital Subscriber Line Access Multiplexer (DSLAM) in a Broadband Forum's Access Node within the DSL Access Network architecture (Figure 4.1). Figure 4.3 shows this configuration, which is based on [TR-156].

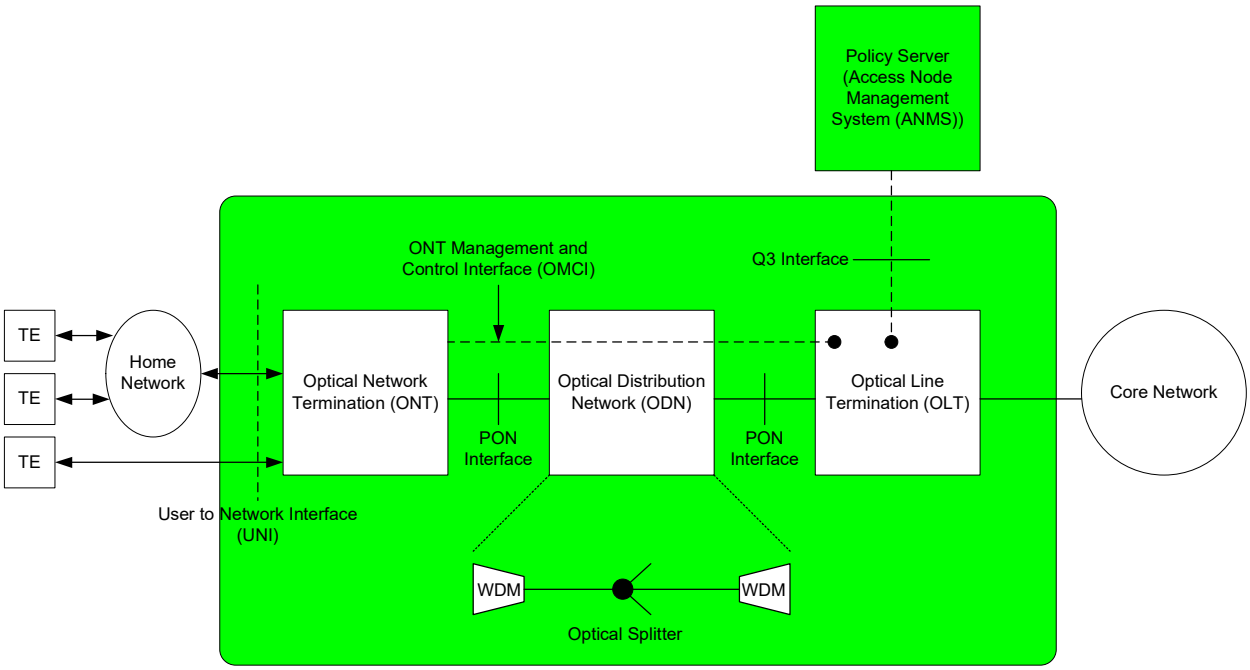

Figure 4.2 – Fiber Access PON Reference Architecture

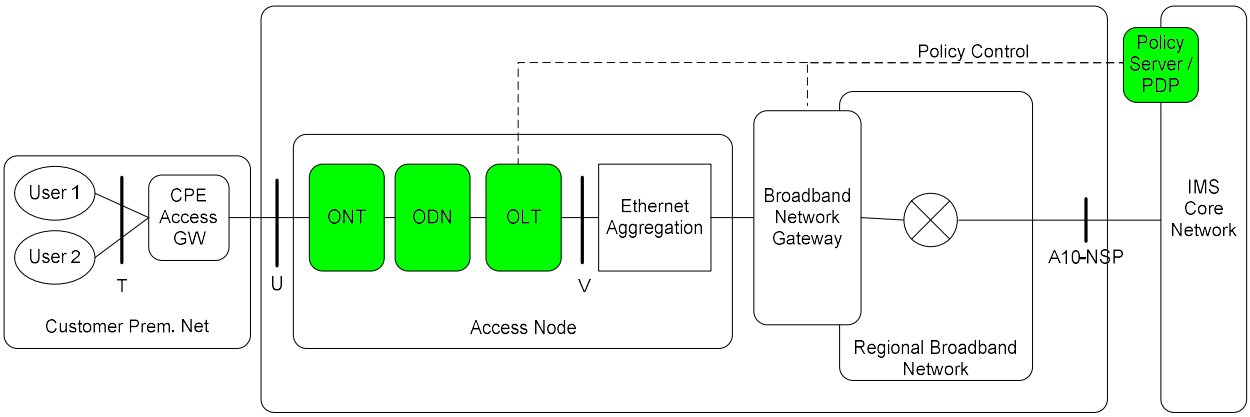

Figure 4.3 – Use of PON in the DSL Access Network

For additional details on the Fiber Access Network architecture, description of the Fiber Access Network FEs, and description of the Fiber Access Network interfaces, refer to [ATIS-1000056]. ETS requirements for the Fiber Access Network FEs are provided in Clause 6.2 of this document.

4.3 Cable Access Network

The Cable Access Network is specified in a set of specifications developed by CableLabs supporting the convergence of voice, video, data, and mobility technologies. These specifications leverage open standards from 3GPP (IMS), IETF, and other Standards Development Organizations (SDOs). The resulting PacketCable reference architecture, which is based on the IMS architecture, is shown in Figure 4.4.

The PacketCable architecture is composed of several releases. This Standard is based on the PacketCable 2.0 release, which supports SIP-based endpoints, and the PacketCable Multimedia release, which supports a service agnostic Quality of Service (QoS) and accounting framework.

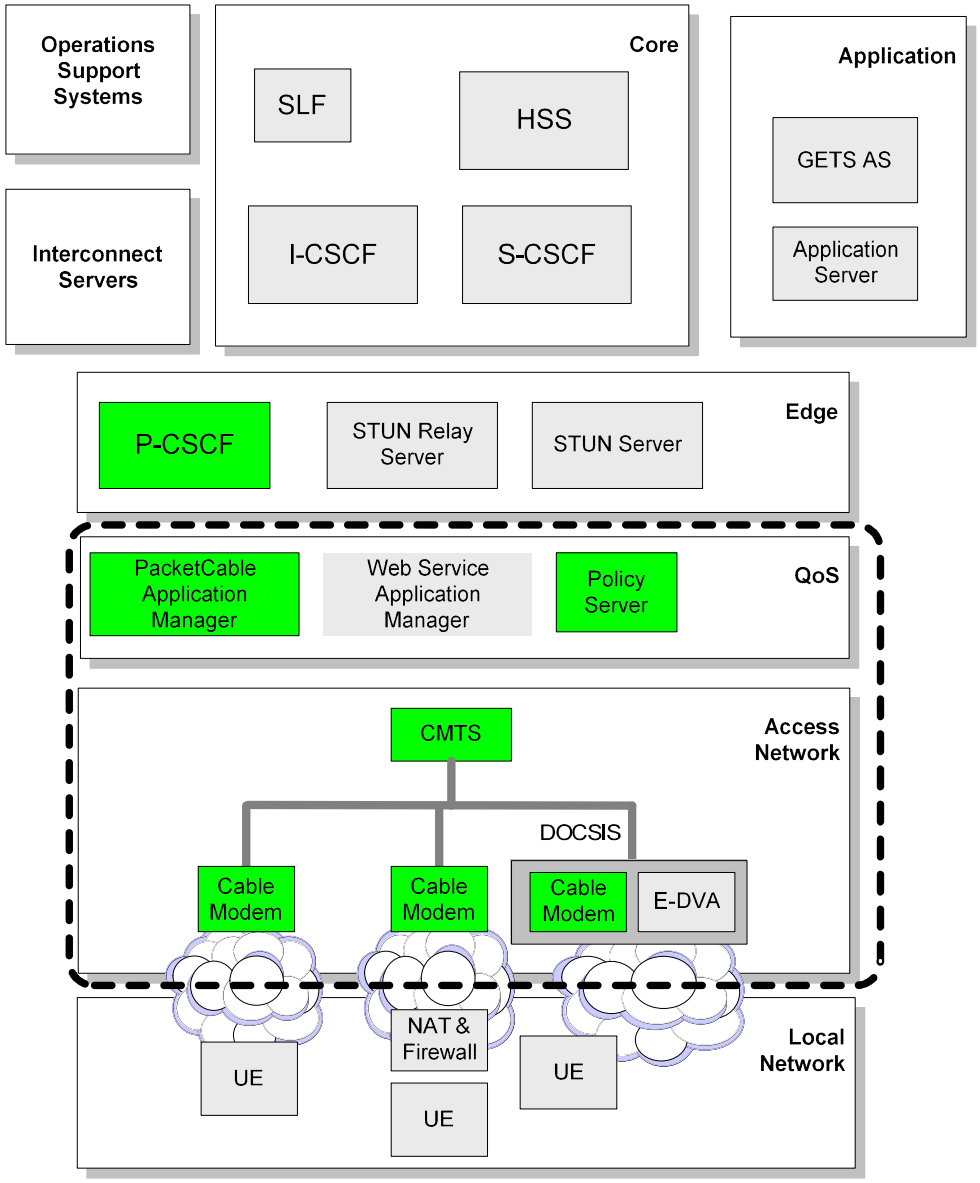

Figure 4.4 – PacketCable Reference Architecture

For additional details on the PacketCable architecture, description of the PacketCable FEs, and description of the PacketCable interfaces, refer to [ATIS-1000056]. ETS requirements for the Cable Access Network FEs are provided in Clause 6.3 of this document.

4.4 Ethernet Access Network

An Ethernet Access Node can be used in place of the NID, MDF, and DSLAM in a Broadband Forum's Access Reference Architecture (i.e., the DSL Access Network Architecture [Figure 4.1]). Figure 4.5 shows the Ethernet Access Network architecture.

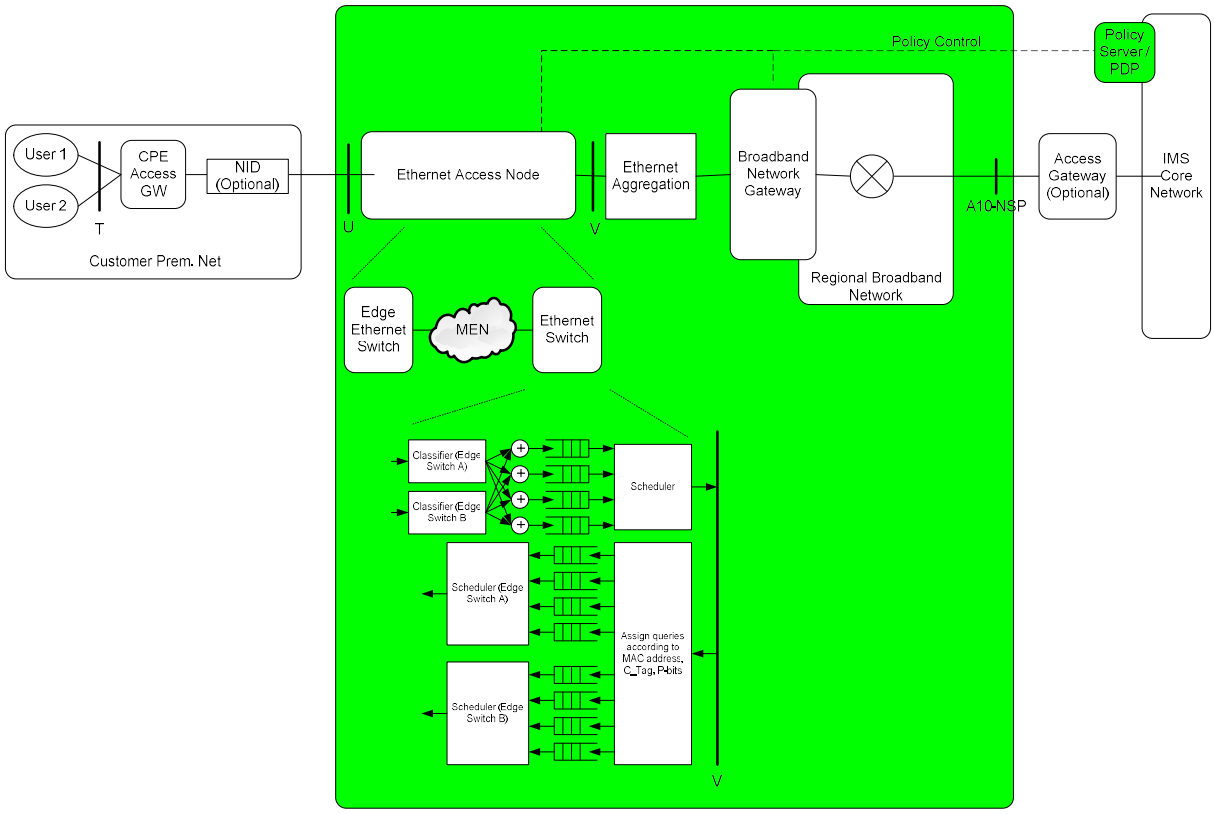

Figure 4.5 – Ethernet Access Network Architecture

For additional details on the Ethernet Access Network architecture, description of the Ethernet Access Network FEs, and description of the Ethernet Access Network interfaces, refer to [ATIS-1000056]. ETS requirements for the Ethernet Access Network FEs are provided in Clause 6.4 of this document.

5 Assumptions & General Principles

5.1 Assumptions

General assumptions for ETS are provided in [ATIS-1000049]. Assumptions specific to the access network and to this Standard are given in this clause.

1. The access network and IMS Core Network to which the access network is connected are operated by the same Service Provider or by Service Providers with a business (and trust) relationship that enables seamless access network and core network interoperation.

   In order to provide ETS services, policy which impacts the operation of the access network is passed from the core network to the access network. Without the appropriate trust and business relationship, this policy request will be rejected by the access network.
2. For wireline access, the user dials a special number (e.g., 710-NXX-XXXX) to invoke the ETS service.
3. It is permitted to provide some initial access network priority treatment (e.g., engineered capacity) for a UE that is identified with ETS Subscription Credentials, even when ETS has not been invoked by the Service User. The priority may apply to all service originations from the UE, and all service terminations to the UE. The full set of priority treatment capabilities for the service will be as a result of ETS invocation and authorization.
4. A UE needs to have a valid, active subscription to make ETS calls.

5. FCC Title 47 Appendix B to Part 64—Wireless Priority Service (WPS) for National Security and Emergency Preparedness (NS/EP) [FCC 1] permits voice, data, text, and video communications from NS/EP users assigned to any priority level to preempt or degrade other in-progress communications, except for public safety emergency (911) communications.

5.2 General Principles

General principles for ETS are provided in [ATIS-1000049].

6 Network Element Requirements

6.1 DSL Access Network Functional Entity Requirements

This clause provides detailed FE requirements for a DSL Access Network in support of the ETS voice and video services.

Clause 6.1 is organized as follows:

- Clause 6.1.1 – Common Requirements.
- Clause 6.1.2 – CPE Access Gateway.
- Clause 6.1.3 – DSL Access Network FE-Specific Requirements.
- Clause 6.1.4 – Core Network.

6.1.1 Common Requirements

This clause specifies requirements that are applicable to multiple FEs within the DSL Access Network. FE-specific requirements are specified in the remaining subclauses of Clause 6.1.

Priority treatment for an ETS call/session applies to (a) call/session processing, including resource allocation, (b) processing and transport of signaling messages for ETS, and (c) processing and transport of media packets related to the call/session.

6.1.1.1 Common Priority Treatment Related to Machine Congestion Controls

Most FEs have some form of Machine Congestion Controls (MCCs) in order to maximize the productive processing under overload; that is, to optimize the number of signaling messages successfully processed when overload prevents processing all signaling messages (e.g., after all permitted non-signaling load has been shed and the FE is still in an overload condition). This typically involves shedding signaling load during extreme overload. Usually, there is some level of differentiation in which incoming messages/packets are shed, not just blindly shedding a certain percentage.

Machine congestion itself occurs at the machine (Network Equipment) level, e.g., when real-time processing utilization reaches 96%, rather than at the FE level. However, one machine may host multiple FEs. As a result, the congestion control (e.g., blocking or shedding packets or messages) is often FE or protocol specific. The same Network Equipment may use different methods for filtering different messages, or it may use different methods on different interfaces or ports, corresponding to different functions. Therefore, the MCC requirements are specified in terms of FEs, even though the requirements will be satisfied by Network Equipment implementations.

<Common-CR-00099>

If an FE that is ETS-aware implements machine-congestion-based overload controls, then the FE shall recognize arriving ETS traffic and shall exempt ETS traffic from machine-congestion-based overload controls (e.g., exemption from load shedding) up to the point where further exemption would cause machine instability.

FE specifics, in terms of the method of recognition (either directly or indirectly), and the point at which it must be recognized, are not addressed as common requirements. The priority treatment given by an FE to ETS traffic in respect to machine-congestion-based overload controls ensures that normal traffic is shed before ETS traffic, and ETS traffic is only shed when the FE is in danger of total failure. Recognition and shedding should be provided before significant resources are consumed for packets or signaling messages.

6.1.2 CPE Access Gateway

The CPE Access Gateway is outside the scope of this clause. However, enterprise locations may wish to provision their CPE Access Gateways to support ETS.

6.1.3 DSL Access Network FE-Specific Requirements

6.1.3.1 NID, MDF, & DSLAM

There is no impact to the NID, MDF, and DSLAM when ETS services are invoked in the network.

6.1.3.2 Ethernet Aggregation

<DSL-00100>

The Ethernet Aggregation FE shall be engineered to be non-blocking for all traffic transmitted between the attached DSLAMs and BNGs.

6.1.3.3 Broadband Network Gateway (BNG)

This sub-clause specifies requirements associated with the BNG processing. Only ETS-specific requirements are included, reflecting incremental requirements that extend beyond basic BNG functionality as defined in Broadband Forum specifications.

The BNG is key to providing ETS priority in the DSL Access Network. There are two areas that need to be addressed. The BNG needs to give priority to ETS requests for assignment of DSL access resources and it needs to give priority to transmission of ETS traffic.

When the BNG receives a request from the Policy Server/PDP to create or activate service flows, it needs to recognize the ETS-related requests and process them with priority.

6.1.3.3.1 General Requirements

The Priority-Level AVP (as part of the Allocation-Retention-Priority [ARP] AVP) provides the priority level for an ETS call/session. Values 1 to 8 are assigned for services that are authorized to receive prioritized treatment within an operator domain. If the Priority-Level AVP is included in a Diameter message and populated with a value that is associated with an ETS call/session, then the message receives priority processing at the FE.

NOTE 1: Values 2 (highest) to 6 (lowest) of the Priority-Level AVP are used for an ETS call/session.

NOTE 2 – The Pre-emption-Capability AVP and Pre-emption-Vulnerability AVP (if received as part of the ARP AVP) are not applicable. The use of these AVPs in non-3GPP specified networks is for further study.

NOTE 3 – The use of the QCI AVP in non-3GPP specified networks is for further study.

<DSL-00200>

The BNG shall support the Priority-Level AVP as specified in [Q.3303.3] for ETS call/session processing.

6.1.3.3.2 Priority Treatment Requirements

Priority treatment for an ETS call/session applies to (a) call/session processing, (b) processing and transport of Diameter and SIP signaling messages related to the call/session, and (c) processing and transport of media packets related to the call/session. Priority treatment for ETS call/session processing includes (1) exemption of ETS calls/sessions and related signaling messages from Machine Congestion Control (MCC) and (2) priority Call Admission Control (CAC) for ETS calls/sessions. In addition, priority treatment for ETS service includes enhanced call/session routing capabilities beyond those provided for normal calls/sessions.

<DSL-00300>

A BNG shall apply the procedures of [Q.3303.3] for the processing of the Priority-Level AVP in a received Diameter Re-Auth-Request (RAR) message. Based on the presence of a Priority-Level AVP value that is associated with ETS in the Diameter RAR message, a BNG shall mark the call/session accordingly, and apply the priority treatment specified in <DSL-00400> through <DSL-02000> for an ETS call/session.

When <**DSL-00300**> applies (i.e., when a Priority-Level AVP value that is associated with ETS is received in the Diameter RAR message), the BNG stores the policy information received from the Policy Server/PDP, and applies the policy to subsequent packets related to the selected call/session. The BNG responds to the Policy Server/PDP with a Diameter Re-Auth-Answer (RAA).

A BNG is configured with an IP header DiffServ Code Point (DSCP) value to be used for the IP packets it generates to carry SIP and Diameter signaling messages related to an ETS call/session. It should be noted that the Policy Server/PDP is the FE authenticating the ETS call/session and notifying the BNG through a Diameter RAR message that a given signaling flow is to be provided with the DSCP value.

<DSL-00400>

A BNG shall set the IP header DSCP value to the provisioned DSCP value for the IP packets it generates to carry Diameter and SIP messages that are related to an authenticated ETS call/session.

A BNG is configured with an IP header DSCP value to be used, based on the Priority-Level AVP, and policy received from the Policy Server/PDP, for the IP packets it generates to carry RTP and data payload related to an ETS call/session. It should be noted that the Policy Server/PDP is the FE authenticating the ETS call/session and notifying the BNG through a Diameter RAR message that a given media or data flow is to be provided with the DSCP value.

<DSL-00500>

A BNG FE shall set the IP header DSCP value to the provisioned DSCP value for the IP packets it generates to carry RTP media packets that are related to an authenticated ETS call/session.

For an Ethernet interface with Class Of Service (COS) capabilities, the following requirement applies for an ETS call/session. In this case, the BNG is configured with an Ethernet Frame Header COS parameter value (the “ETS” COS value) to be used for an ETS call/session.

<DSL-00600>

For the Ethernet COS capabilities on the BNG, the BNG shall set the Ethernet Frame Header COS parameter on the Ethernet interface to the provisioned “ETS” COS value for an authenticated ETS call/session.

<**DSL-00600**> ensures that the Ethernet Frame Header COS parameter is set to the “ETS” COS value for the Ethernet frames containing signaling, RTP payload and data related to an ETS call/session. <**DSL-00600**> allows priority treatment to be provided to these frames through the Ethernet. It is expected that the “ETS” COS value provides the highest priority treatment appropriate for user signaling and bearer on the interface. The BNG provides ingress priority treatment and egress priority treatment (e.g., priority outgoing queuing and scheduling) for Ethernet frames with the “ETS” COS value.

When the BNG receives IP packets destined toward the UE, the BNG passes the packets without changing the DSCP value. If the Virtual Channel to the UE has already been established, no ETS-specific handling is required. If the Virtual Channel has not already been established and the incoming packet is marked with a DSCP value associated with ETS, the BNG should provide priority treatment in establishing the Virtual Channel, since the ETS nature of the call/session has already been authenticated.

When the BNG receives IP packets destined toward the Core Network, the BNG does one of the following, based on whether it has received a Priority-Level AVP value that is associated with ETS from the Policy Server/PDP for the call/session:

- Pass the packets with the DSCP value unchanged, because it has not received a Priority-Level AVP value that is associated with ETS from the Policy Server/PDP for the call/session and the received DSCP value does not indicate this is an ETS call/session.
- Modify the packets to be marked with the provisioned default DSCP value for the traffic type (e.g., BE or Expedited Forwarding [EF]), if the received DSCP value indicates this is an ETS call/session, but no Priority-Level AVP value that is associated with ETS has been received from the Policy Server/PDP for the call/session.
- Modify the packets to be marked with the appropriate DSCP value if it has received a Priority-Level AVP value that is associated with ETS from the Policy Server/PDP for the call/session.

<DSL-00700>

A BNG receiving IP packets directed toward the Core Network shall set the IP header DSCP value based on the classification rules received from the Policy Server/PDP. The BNG shall:

- **Pass the packets with the DSCP value unchanged, if it has not received a Priority-Level AVP value that is associated with ETS from the Policy Server PDP for the call session and the received DSCP value does not indicate this is an ETS call/session.**
- **Modify the packets to be marked with the provisioned default DSCP value for the traffic type (e.g., BE or EF), if the received DSCP value does indicate this is an ETS call/session, but no Priority-Level AVP value that is associated with ETS has been received from the Policy Server/PDP for the call/session.**
- **Modify the packets to be marked with the appropriate DSCP value if it has received a Priority-Level AVP value that is associated with ETS from the Policy Server/PDP for the call/session.**

The BNG provides the following priority processing for ETS packets.

6.1.3.3.3 ETS Transport Function

<DSL-00800>

The BNG's transport function shall use the provisioned ETS DSCP value and the provisioned ETS COS value, as appropriate, to identify ETS packets.

<DSL-00900>

The BNG shall not drop identified ETS packets being transmitted into the DSL Access Network and the Regional Broadband Network up to the point where exemption from restrictive network management controls would cause instability.

<DSL-01000>

The BNG shall not drop identified ETS packets received from the DSL Access Network and the Regional Broadband Network, when the ETS packet receipt rate is less than or equal to the total packet receipt rate capability of the BNG.

<DSL-01100>

The BNG's transport function shall ensure that identified ETS packets are marked for priority processing to the signaling and media functions within the BNG.

<DSL-01200>

The BNG's transport function shall ensure that identified ETS packets are not dropped in delivery to the ETS signaling and media processing functions within the BNG.

<DSL-01300>

The BNG's transport function shall provide priority network/transmission treatment to identified ETS packets.

6.1.3.3.4 ETS Signaling Processing

<DSL-01400>

The BNG shall ensure that identified ETS signaling packets are marked with the appropriate DSCP and COS values for transport and are not dropped in delivery from the ETS signaling function to the transport function.

<DSL-01500>

The BNG shall provide priority processing for identified ETS signaling messages in comparison to non-ETS signaling messages.

<DSL-01600>

The BNG shall exempt ETS signaling messages from restrictive management controls (e.g., from load shedding or other reasons messages are dropped) up to the point where further exemption would cause BNG instability.

<DSL-01700>

It is desirable that the BNG queue an ETS signaling message that cannot be processed due to lack of resources.

6.1.3.3.5 ETS Media & Data Processing

<DSL-01800>

The BNG shall ensure that identified ETS media and data packets are marked with the appropriate DSCP and COS values for transport and are not dropped in delivery from the ETS media and data processing function to the transport function.

<DSL-01900>

The BNG shall provide priority processing for identified ETS media and data packets in comparison to non-ETS media and data packets.

<DSL-02000>

The BNG shall exempt ETS media and data packets from restrictive management controls (e.g., from load shedding or other reasons packets are dropped) up to the point where further exemption would cause BNG instability.

6.1.3.4 Regional Broadband Network

Wireline Access Networks are typically not SIP aware. Because of this, ETS requests may not be recognized until they enter the Core Network. It is important that the Service Provider's Regional Broadband Network ensures that signaling requests reach the Core Network.

<DSL-02100>

It is desirable that the Service Provider's Regional Broadband Network provide a greater than 99.9 percent probability that all SIP signaling be successfully delivered between the BNG and the Core Network under offered loads of up to ten times the Service Provider network's normal engineered load.

An example of ten times offered load is defined as three times the normal number of active subscribers, each attempting 3.33 times as many calls.

The assumption borne out for voice traffic during actual network congestion events, is that ETS traffic is not greater than ten percent of a service provider's normal engineered network load for any given service. It would be desirable for ETS traffic to receive near normal performance under congestion loads of ten times the normal engineered network load. For purposes of this Standard, this overload condition is applied on a per queue basis within the Regional Broadband Network. For example, a Service Provider could see a ten times overload in the voice queue and the signaling queue, but not see any overload in the video queue or best effort queue.

ETS voice and video traffic can also be marked so that it can be distinguished from normal voice and video traffic.

At a minimum, the Regional Broadband Network shall provide ETS priority by discarding these packets last during congestion. For rate-based queues, (1) ETS packets should be marked with a low drop probability (e.g., AF41) and normal packets should be marked with a medium or high drop probability, and (2) Random Early Detection (RED) should be applied on the rate-based queues.

<DSL-02200>

At a minimum, the Regional Broadband Network shall provide a greater than 99.9 percent probability that all ETS voice, video, and data packets be successfully delivered between the BNG and the Core Network under offered loads of up to ten times the Service Provider network's normal engineered load.

<DSL-02300>

At a minimum, ETS voice, video, and data packets shall be the last packets discarded within a given Regional Broadband Network queue.

6.1.4 Core Network

To support ETS in the DSL Access Network, the following Core Network FEs must support ETS functionality:

- Policy Server/Policy Decision Point (e.g., PCRF).
- P-CSCF.

6.1.4.1 Policy Server

To support ETS in the DSL Access Network, the Policy Server requirements are as specified in [ATIS-1000066].

6.1.4.2 P-CSCF

To support ETS in the DSL Access Network, the P-CSCF requirements are as specified in [ATIS-1000066].

6.1.5 OAM&P

This clause only includes OAM&P requirements related to the Service Provider's DSL Access Network that are specific to ETS. Corresponding ETS-specific OAM&P requirements related to an ETS Core Network are specified in [ATIS-1000066].

6.1.5.1 Common Requirements Applicable to Multiple FEs

This clause specifies requirements that are applicable to multiple FEs within the Service Provider's access network. FE-specific modifications or exceptions to the common requirements are identified where applicable. FE-specific requirements are specified in the remaining subclauses of Clause 6.1.5.

6.1.5.2 BNG

6.1.5.2.1 Operational Measurements

Requirements as specified in clause 6.4.7.4.1 apply.

6.1.5.2.2 Provisioning

Requirements as specified in clause 6.4.7.4.2 apply.

6.2 Fiber Access Network

This clause provides detailed FE requirements for a Fiber Access Network in support of the ETS voice and video services.

Clause 6.2 is organized as follows:

- Clause 6.2.1 – Common Requirements.
- Clause 6.2.2 – Fiber Access Network FE-Specific Requirements.
- Clause 6.2.3 – Core Network.

6.2.1 Common Requirements

This clause specifies requirements that are applicable to multiple FEs within the Fiber Access Network. FE-specific requirements are specified in the remaining subclauses of Clause 6.2.

Priority treatment for an ETS call/session applies to (a) call/session processing, including resource allocation, (b) processing and transport of signaling messages for ETS, and (c) processing and transport of media packets related to the call/session.

6.2.1.1 Common Priority Treatment Related to Machine Congestion Controls

See Clause 6.1.1.1.

6.2.2 Fiber Access Network FE-Specific Requirements

6.2.2.1 UE & ONT

There is no access layer impact to the UE or ONT when ETS services are invoked in the network.

The ONT is not "ETS aware." The ONT will use existing QoS mechanisms to provide priority to ETS services. The ONT will accept policy from the ANMS that identifies (1) how to identify ETS packets (i.e., flow classification policy), and (2) the QoS to be given to these packets (i.e., traffic profile policy for the flow).

6.2.2.2 OLT

There is no access layer impact to the OLT when ETS services are invoked in the network.

The OLT is not “ETS aware.” The OLT will use existing QoS mechanisms to provide priority to ETS services. The OLT will accept policy from the ANMS that identifies (1) how to identify ETS packets (i.e., flow classification policy), (2) the QoS to be given to these packets (i.e., traffic profile policy for the flow), and (3) the DSCP to be used to mark packets headed toward the Core Network (part of the traffic profile policy).

6.2.3 Core Network

To support ETS in the Fiber Access Network, the following Core Network FEs must support ETS functionality:

- Access Node Management System/Policy Server.
- P-CSCF.

6.2.3.1 Access Node Management System/Policy Server

To support ETS in the Fiber Access Network, the ANMS/Policy Server requirements are as specified in [ATIS-1000066].

6.2.3.2 P-CSCF

To support ETS in the Fiber Access Network, the P-CSCF requirements are as specified in [ATIS-1000066].

6.2.4 OAM&P

This clause only includes OAM&P requirements related to the Service Provider’s Fiber Access Network that are specific to ETS. Corresponding ETS-specific OAM&P requirements related to an ETS Core Network are specified in [ATIS-1000066].

6.2.4.1 Common Requirements Applicable to Multiple FEs

This clause specifies requirements that are applicable to multiple FEs within the Service Provider’s access network. FE-specific modifications or exceptions to the common requirements are identified where applicable. FE-specific requirements are specified in the remaining subclauses of clause 6.2.4.

6.2.4.2 Service Reliability

It is desirable that the Server Provider recognize established ETS sessions within the Fiber Access Network and use this information to protect these sessions during network changes, due to maintenance or other reasons. It should be noted that the AN Management System may be the only device in the Fiber Access Network with knowledge of what sessions are ETS sessions.

<Fiber-00100>

It is desirable that the Service Provider maintain network priority for an ETS session during a network protection switch.

<Fiber-00200>

It is desirable that the Service Provider protect OLTs and ONTs supporting ETS sessions from being dropped.

6.2.4.3 Operational Measurements

There are no ETS Operational Measurement (OM) requirements associated with the ONT and OLT.

6.2.4.4 Provisioning

<Fiber-00300>

For ITU-T G.984 Series GPON QoS Mechanisms, a Service Provider shall use a T-CONT Type I for ETS Voice sessions, and a T-CONT Type II for all other ETS sessions.

<Fiber-00400>

For IEEE 802.3 EPON QoS Mechanisms, a Service Provider shall use an 802.1Q priority of B'110' for ETS sessions.

6.3 Cable Access Network

This clause provides detailed FE requirements for a Cable Access Network in support of the ETS voice and video services.

Clause 6.3 is organized as follows:

- Clause 6.3.1 – Common Requirements.
- Clause 6.3.2 – General Requirements.
- Clause 6.3.3 – FE-Specific Requirements.
- Clause 6.3.4 – Core Network.
- Clause 6.3.5 – OAM&P.

6.3.1 Common Requirements

This clause specifies requirements that are applicable to multiple FEs within the Cable Access Network. FE-specific requirements are specified in the remaining subclauses of Clause 6.3.

Priority treatment for an ETS call/session, applies to (a) call/session processing, including resource allocation, (b) processing and transport of signaling messages for ETS, and (c) processing and transport of media packets related to the call/session.

6.3.1.1 Common Priority Treatment Related to Machine Congestion Controls

See Clause 6.1.1.1.

6.3.2 General Requirements

The functional entities (FEs) in the Cable Access Network need to ensure that ETS signaling messages (e.g., Gate-Set messages, DSA-x messages) sent between them are not lost in the event of a local network overload. Each FE has its own ways of detecting that an incoming message is for ETS (e.g., the Multimedia [PAM] from the P-CSCF). Note that the ETS markings occur at multiple protocol layers (e.g., DSCP at the

packet layer and RPH at the SIP session layer). Once the FE recognizes an ETS service request, the following requirements apply for the FE.

6.3.2.1 ETS Transport Layer Function

It is desirable that an FE's transport layer function be able to recognize and provide priority to ETS signaling packets based on the ETS markings in the packet layer.

<Cable-00100>

It is desirable that an FE's transport layer function use the provisioned ETS DSCP value and the provisioned ETS Class Of Service (COS) value, as applicable, to identify ETS packets.

<Cable-00200>

The FE's transport layer function shall not drop identified ETS packets being transmitted into the Cable Access Network and the Core Network up to the point where exemption from restrictive network management controls would cause instability.

<Cable-00300>

The FE's transport layer function shall not drop identified ETS packets received from the Cable Access Network and Core Network, when the ETS packet receipt rate is less than or equal to the total packet receipt rate capability of the FE.

<Cable-00400>

The FE's transport layer function shall ensure that identified ETS packets are marked for priority processing to the signaling function within the FE.

<Cable-00500>

The FE's transport layer function shall ensure that identified ETS packets are not dropped in delivery to the ETS signaling function within the FE.

<Cable-00600>

The FE's transport layer function shall provide priority network/transmission treatment to identified ETS packets.

6.3.2.2 ETS Signaling Layer Function

The signaling layer function includes processing of Diameter, Gate messages, and DSx messages to set up ETS flows through the FE. An FE's signaling layer function will meet the following ETS requirements.

<Cable-00700>

The FE's signaling layer function shall ensure that identified ETS signaling packets are marked with the appropriate DSCP or COS values for transport and are not dropped in delivery from the ETS signaling function to the transport function.

<Cable-00800>

The FE's signaling layer function shall provide priority processing for identified ETS signaling messages in comparison to non-ETS signaling messages.

<Cable-00900>

The FE's signaling layer function shall exempt ETS signaling messages from restrictive management controls (e.g., from load shedding or other reasons messages are dropped) up to the point where further exemption would cause FE instability.

6.3.3 FE-Specific Requirements

6.3.3.1 UE and CM

There is no access layer impact to the UE or Cable Modem (CM) when ETS services are invoked in the network. The UE and CM do not support the ETS requirements specified in Clause 6.3.2.

The CM is not "ETS aware." The CM will use existing QoS mechanisms to provide priority to ETS services. The CM will accept policy from the PCRF that identifies (1) how to identify ETS packets (i.e., flow classification policy), and (2) the QoS to be given to these packets (i.e., traffic profile policy for the flow).

6.3.3.2 CMTS

In addition to the requirements specified in Clause 6.3.2, the CMTS needs to support the following ETS requirements.

The CMTS is the key to providing ETS priority in the Cable Access Network. There are two areas that need to be addressed. The CMTS needs to give priority to ETS requests for assignment of cable resources and it needs to give priority to transmission of ETS contention-based traffic.

The CMTS needs to recognize the ETS-related requests from the PCRF to create or activate service flows, and it needs to process these requests with priority relative to non-ETS-related requests.

<Cable-001000>

The CMTS shall use the SessionClassID as the basis for determining which requests for resources to process and honor, and the CMTS shall process the highest priority requests first.

To maintain network health, a Multiple System Operator (MSO) may define maintenance flows between the CM and CMTS to have a higher priority than ETS, since if the network is not functioning, then ETS will not work.

<Cable-001100>

A unique SessionClassID priority value shall be allocated for ETS. The ETS SessionClassID value shall have a higher priority than any other SessionClassID value with the possible exception of network maintenance values.

<Cable-001200>

The CMTS shall be able to allocate a predetermined percentage of assignable resources to ETS priority service flows. When not allocated to ETS priority service flows, these resources should be available for normal BE service flows.

<Cable-001300>

When the CMTS receives a request to assign resources for a request with an ETS SessionClassID, it shall honor that request if the CMTS has not reached the resource limit for ETS priority service flows.

<Cable-001400>

When the CMTS receives a request to assign resources for a request with an ETS SessionClassID, and if it has reached the resource limit for ETS priority service flows, it shall do one of the following:

1. **If the CMTS has not reached other limits for assigning resources, the CMTS may allocate resources as if this was a normal priority request.**
2. **If the CMTS chooses not to assign resources, the CMTS shall fail the request and send the normal failure response when resources are not available.**

When the CMTS is processing upstream traffic requests, the CMTS needs to recognize the Traffic Priority in the Best Effort (BE) and non-real time Polling Traffic (nrtPS) flows and may use the ETS Traffic Priority value for best effort flows to provide additional contention request opportunities as needed. The CMTS needs to honor ETS priority requests and to send messages marked for priority handling preferentially ahead of messages not marked for priority handling.

<Cable-001500>

For BE and nrtPS upstream service flows, the CMTS shall give priority to traffic requests based on the Traffic Priority value assigned to the service flow.

<Cable-001600>

A unique Traffic Priority value shall be allocated for ETS. The ETS Traffic Priority value shall have a higher priority than any other Traffic Priority value with the possible exception of network maintenance values.

<Cable-001700>

The CMTS shall support the granting of periodic special contention request opportunities to BE service flows that are assigned an ETS Traffic Priority value.

When the CMTS receives IP packets destined for a CM, the CMTS needs to recognize the assigned Traffic Priority and give priority to ETS priority IP packets.

<Cable-001800>

The CMTS shall give priority to received IP packets destined for a CM based on the Traffic Priority value assigned to the service flow.

ETS has defined a DSCP value for IP packets transmitted in the access network. Similarly, for an Ethernet interface with COS capabilities, an “ETS” COS value has been defined. Based on parameters in the Gate-set messages used to create a service flow, the CMTS will set the proper DSCP or COS value in the Service User’s data and signaling IP packets.

6.3.3.3 PCRF

Within the PacketCable Multimedia architecture, the PCRF is functionally equivalent to two separate functional entities: an application manager and the policy server. Application managers provide a standard way for applications to interface with the PacketCable Multimedia Policy Server. The PacketCable Application Manager is specifically designed to interface with the PacketCable 2.0 elements using the IMS Diameter Rx reference point. The Web Service Application Manager provides a SOAP/XML interface to other web service applications. This clause provides detailed requirements for each functional element. Note that in this clause, signaling messages refer to the Diameter, Gate messages, and DSx messages used to establish ETS flows in the access network.

6.3.3.3.1 PacketCable Application Manager (PAM)

In addition to the requirements specified in Clause 6.3.2, the PAM needs to support the following ETS requirements.

The PAM needs to recognize the MPS-Identifier AVP and Reservation-Priority AVP in Diameter requests on the Rx reference point and use this information in communicating with the Policy Server.

NOTE: It is recommended that values 11-15 of the Reservation-Priority AVP be used for ETS.

<Cable-001900>

The PAM shall support the MPS-Identifier AVP as specified in [TS 29.214]. The MPS-Identifier indicates that the request is associated with an ETS call/session and that the request shall receive priority processing.

<Cable-002000>

The PAM shall support the Reservation-Priority AVP as specified in [TS 29.214] and [TS 183.017] for ETS call/session processing. It carries the Service User's priority level.

<Cable-002100>

When a PAM receives a Diameter AA-Request (AAR) message over the Rx interface with the MPS-Identifier AVP and Reservation-Priority AVP, the PAM shall initiate procedures with priority processing.

<Cable-002200>

The PAM shall set the IP header DSCP value to the ETS-provisioned DSCP value for the IP packets it generates to carry signaling messages (e.g., GATE control messages) that are related to an ETS call/session. This value is specified in <Measurement-00700>.

<Cable-002300>

If the PAM supports Ethernet COS capabilities, then the PAM shall set the Ethernet Frame Header COS parameter on the Ethernet interface to the provisioned "ETS" COS value for an ETS call/session. The range and default values are specified in <Measurement-00900>.

<Cable-002400>

The PAM shall use the MPS-Identifier AVP and Reservation-Priority AVP in creating the ETS SessionClassID value. Provisioning of the SessionClassID value is given in Clause 6.3.5.2.1.

<Cable-002500>

For upstream and downstream traffic flows that use the Traffic Priority attribute, the PAM shall use the MPS-Identifier and Reservation-Priority AVP in creating the ETS Traffic Priority value.

<Cable-002600>

When the PAM recognizes a request to create or modify an ETS service flow (i.e., the MPS-Identifier AVP and the Reservation-Priority AVP in the Diameter AA-request message), the PAM shall set the DSCP field in the GateSpec to the appropriate ETS DSCP value or shall set the appropriate TOS field.

Per the DOCSIS specification, only some service flow types allow for a traffic profile. Per [PKT-SP-MM-I04-080522], a FlowSpec can be used to describe the QoS needs for the session. If a FlowSpec is used, [PKT-SP-MM-I04-080522] defines the default traffic priority. Thus the traffic priority is only used when applicable, and if the CMTS receives a request described with a FlowSpec, it needs to determine the traffic priority based on the associated SessionClassID and application type. Since a controlled load FlowSpec Gate-Set message does not allow setting the Traffic Priority, an Application Manager needs to use other options for specifying the Traffic Profile.

<Cable-002700>

When the PAM receives an ETS request, it shall not create service flows using the controlled load FlowSpec option for the Traffic Profile.

6.3.3.3.2 Policy Server

In addition to the requirements specified in Clause 6.3.2, the Policy Server needs to support the following ETS requirements.

In general terms, the Policy Server receives Gate-Set and Gate-Delete messages from the Application Manager in Common Open Policy Service (COPS) decision messages, forwards them to the CMTS in COPS decision messages, and passes responses back to the Application Manager.

<Cable-002800>

The Policy Server shall recognize the SessionClassID in Gate-Set messages and the Policy Server shall use the values to give priority in processing requests.

6.3.4 Core Network

To support ETS in the Cable Access Network, the following Core Network FEs must support ETS functionality:

- P-CSCF.

6.3.4.1 P-CSCF

To support ETS in the Cable Access Network, the P-CSCF requirements are as specified in [ATIS-1000066].

6.3.5 OAM&P

This clause only includes OAM&P requirements related to the Service Provider's Cable Access Network that are specific to ETS. Corresponding ETS-specific OAM&P requirements related to an ETS Core Network are specified in [ATIS-1000066].

6.3.5.1 Common Requirements Applicable to Multiple FEs

This clause specifies requirements that are applicable to multiple FEs within the Service Provider's access network. FE-specific modifications or exceptions to the common requirements are identified where applicable. FE-specific requirements are specified in the remaining subclauses of Clause 6.3.5.

6.3.5.2 General Provisioning

An MSO acting as a Service Provider will need to allocate and provision special ETS SessionClassID and Traffic Priority values for use in the Cable Access Network.

6.3.5.2.1 SessionClassID

The SessionClassID is a 1-byte unsigned integer value that identifies the proper admission control policy and parameters to be applied to a Gate. The field is defined as follows:

- Bits 0-2: Priority, a number from 0 to 7, where 0 is low priority and 7 is high priority.
- Bit 3: Preemption, set to enable preemption of bandwidth allocated to lower priority sessions.
- Bits 4-7: Configurable, defaulted to 0.

The ETS SessionClassID value will meet the following requirements:

<Cable-002900>

A unique SessionClassID priority value shall be allocated for ETS.

<Cable-003000>

The ETS SessionClassID priority value (Bits 0-2) shall be higher (i.e., have a higher priority) than any other SessionClassID value with the possible exception of network maintenance values. It is recommended that the value 6 be used for this purpose.

If needed, a Service Provider may use Bits 4-7 to provide further classification of ETS sessions. It is recommended that values 10-15 be reserved for ETS use.

<Cable-003100>

The marking of and recognition of the SessionClassID value as ETS shall be provisionable, with a value of enabled or disabled, and a default of disabled.

6.3.5.2.2 Traffic Priority

The Traffic Priority specifies the priority assigned to a Service Flow. The traffic priority is 3 bits long and has values from 0 to 7, where higher numbers indicate a higher priority.

The ETS Traffic Priority value will meet the following requirements:

<Cable-003200>

A unique Traffic Priority value shall be allocated for ETS.

<Cable-003300>

The ETS Traffic Priority value shall be higher (i.e., have a higher priority) than any other Traffic Priority value with the possible exception of network maintenance values. It is recommended that the value 6 be used for this purpose.

<Cable-003400>

The marking of and recognition of the Traffic Priority value as ETS shall be provisionable, with a value of enabled or disabled, and a default of disabled.

6.3.5.2.3 ETS DSCP & COS Markings

An FE will need to recognize and set ETS DSCP or COS values for signaling of Diameter, GATE messages, and DSx messages.

<Cable-003500>

An FE shall allow configuration of the DSCP value to be used for IP packets it generates to carry Diameter and other signaling messages, and media (e.g., RTP packets) related to an ETS call/session. This value shall also be used by the FE to recognize an ETS packet for priority processing. The range of allowable values shall be 000000 to 111111 (0 to 63). The factory (default) value shall be 101100 (44) (VOICE-ADMIT).

<Cable-003600>

The recognition of the DSCP value as ETS shall be provisionable, with a value of enabled or disabled, and a default of disabled.

<Cable-003700>

If an FE supports the Ethernet COS capabilities, then the FE shall allow configuration of the "ETS" COS value. The range of allowable values shall be 0 through 7. The factory (default) value shall be 6.

<Cable-003800>

If an FE supports the Ethernet COS capabilities, then the recognition of the COS value as ETS shall be provisionable, with a value of enabled or disabled, and a default of disabled.

6.3.5.3 CMTS

6.3.5.3.1 Operational Measurements

The CMTS identifies a request for an ETS service via an ETS SessionClassID value.

<Cable-003900>

A CMTS shall count the number of ETS service requests received with an ETS SessionClassID value.

An MSO may provision up to six ETS SessionClassID values to distinguish between signaling, voice, video, and data services.

<Cable-004000>

The CMTS shall maintain a count of each unique ETS SessionClassID value for which a policy request has been received.

If the CMTS satisfies the request, it will send a Gate-Set ACK message indicating success.

<Cable-004100>

The CMTS shall count the number of ETS service requests honored.

<Cable-004200>

The CMTS shall maintain a count of each unique ETS SessionClassID value for which resources have been allocated.

6.3.5.4 Policy Server

6.3.5.4.1 Operational Measurements

The Policy Server identifies a request for an ETS via an ETS SessionClassID value and via the ETS DSCP value on signaling packets.

<Cable-004300>

A Policy Server shall count the number of ETS service requests received via a Diameter AAR message with the MPS-Identifier AVP and Reservation-Priority AVP.

<Cable-004400>

The Policy Server shall maintain a count of each unique ETS SessionClassID value for which a policy request has been received.

<Cable-004500>

A Policy Server shall maintain a count of the number of ETS service requests sent to the CMTS.

<Cable-004600>

A Policy Server shall maintain a count of each unique ETS SessionClassID value for which a service request has been sent to the CMTS.

<Cable-004700>

The Policy Server shall count the number of ETS service requests honored.

<Cable-004800>

The Policy Server shall maintain a count of each unique ETS SessionClassID value for which resources have been allocated.

6.3.5.4.2 Provisioning

The Policy Server will need to recognize and set ETS policies.

<Cable-004900>

The Policy Server shall create and maintain policies that provide ETS traffic flow priority. At a minimum, an ETS policy shall contain:

- **Classification information to identify the ETS traffic flow,**
- **The ETS SessionClassID value associated with the traffic flow,**
- **Where applicable, the ETS Traffic Priority value associated with the traffic flow,**
- **The ETS DSCP value associated with the traffic flow,**
- **Where applicable, the ETS COS value associated with the traffic flow.**

6.3.5.5 PacketCable Application Manager (PAM)

6.3.5.5.1 Operational Measurements

The PAM identifies a request for an ETS service via a Diameter AAR message with the MPS-Identifier AVP.

<Cable-005000>

A PAM shall count the number of ETS service requests received via a Diameter AAR message with the MPS-Identifier AVP and Reservation-Priority AVP.

<Cable-005100>

The PAM shall count the number of ETS service requests honored.

6.4 Ethernet Access Network

This clause provides detailed FE requirements for an Ethernet Access Network in support of the ETS voice and video services.

Clause 6.4 is organized as follows:

- Clause 6.4.1 – Common Requirements.
- Clause 6.4.2 – NID, Edge Ethernet Switch, & Ethernet Switch.
- Clause 6.4.3 – Ethernet Aggregation.
- Clause 6.4.4 – Broadband Network Gateway.
- Clause 6.4.5 – Regional Broadband Network.
- Clause 6.4.6 – Core Network.
- Clause 6.4.7 – OAM&P.

6.4.1 Common Requirements

This clause specifies requirements that are applicable to multiple FEs within the Ethernet Access Network. FE-specific requirements are specified in the remaining subclauses of Clause 6.4.

Priority treatment for an ETS call/session applies to (a) call/session processing, including resource allocation, (b) processing and transport of signaling messages for ETS, and (c) processing and transport of media packets related to the call/session.

6.4.1.1 Common Priority Treatment Related to Machine Congestion Controls

See Clause 6.1.1.1.

6.4.2 NID, Edge Ethernet Switch, & Ethernet Switch

There is no operational or service level impact to the NID.

The Edge Ethernet Switch and Ethernet Switch will use commercially-implemented QoS mechanisms to accept policy from a Policy Server; thus no ETS-unique requirements are specified.

6.4.3 Ethernet Aggregation

<Ethernet 00100>

The Ethernet Aggregation function shall be engineered to be non-blocking for all ETS traffic transmitted between the attached Ethernet Switches and the Broadband Network Gateway.

6.4.4 Broadband Network Gateway

This clause specifies requirements associated with Broadband Network Gateway processing. Only ETS-specific requirements are included, reflecting incremental requirements that extend beyond basic Gateway functionality.

6.4.4.1 General Requirements

Requirements as specified in Clause 6.1.3.3.1 apply.

6.4.4.2 Priority Treatment Requirements

Requirements as specified in Clause 6.1.3.3.2 apply.

6.4.4.3 Priority Processing Requirements

The Broadband Network Gateway will provide the following priority processing for ETS packets.

6.4.4.3.1 ETS Transport Function

<Ethernet 00200>

The Broadband Network Gateway's transport function shall use the provisioned ETS DSCP value and the provisioned ETS COS value, as appropriate, to identify ETS packets.

<Ethernet 00300>

If the queues for traffic being transmitted into the Broadband Network Connectivity FE and the Regional Broadband Network must shed packets, the Broadband Network Gateway shall ensure identified ETS packets in these queues are the last to be discarded.

<Ethernet 00400>

If the Broadband Network Gateway must shed traffic, the Broadband Network Gateway shall discard identified ETS packets received from the Ethernet Aggregation function and the Regional Broadband Network last, when the ETS packet receipt rate is less than or equal to the total packet receipt rate capability of the Broadband Network Gateway.

<Ethernet 00500>

It is desirable that the Broadband Network Gateway discard identified ETS packets received from the Ethernet Aggregation function and the Regional Broadband Network last, when the packet receipt rate is greater than the total packet receipt rate capability of the Broadband Network Gateway.

<Ethernet 00600>

The Broadband Network Gateway's transport function shall ensure that identified ETS packets are marked for priority processing to the signaling and media functions within the Broadband Network Gateway.

<Ethernet 00700>

The Broadband Network Gateway's transport function shall ensure that identified ETS packets are not dropped in delivery to the ETS signaling and media processing functions within the Broadband Network Gateway.

<Ethernet 00800>

The Broadband Network Gateway's transport function shall provide priority network/transmission treatment to identified ETS packets.

6.4.4.3.2 ETS Signaling Processing

Requirements as specified in Clause 6.1.3.3.4 apply.

6.4.4.3.3 ETS Media and Data Processing

Requirements as specified in Clause 6.1.3.3.5 apply.

6.4.5 Regional Broadband Network

Requirements as specified in Clause 6.1.3.4 apply.

6.4.6 Core Network

Clause 6.1.4 identifies the ETS requirements for the Core Network.

6.4.7 OAM&P

This clause only includes OAM&P requirements related to the Service Provider's Ethernet Access Network that are specific to ETS. Corresponding ETS-specific OAM&P requirements related to an ETS Core Network are specified in [ATIS-1000066].

6.4.7.1 Common Requirements Applicable to Multiple FEs

This clause specifies requirements that are applicable to multiple FEs within the Service Provider's access network. FE-specific modifications or exceptions to the common requirements are identified where applicable. FE-specific requirements are specified in the remaining subclauses of clause 6.4.7.

6.4.7.2 Edge Ethernet Switch & Ethernet Switch

6.4.7.2.1 Operational Measurements

The Edge Ethernet Switch and Ethernet Switch will follow the Service OAM Requirements and Framework specified in [MEF 17].

6.4.7.2.2 Provisioning

<Ethernet 00900>

The Service Provider shall set the Committed Information Rate (CIR) and Excess Information Rate (EIR) values of policies associated with ETS frames so that the ETS frames are the last to be discarded by the Ethernet Switch.

6.4.7.3 Ethernet Aggregation

<Ethernet 001000>

The Service Provider shall size the Ethernet Aggregation function so that identified ETS traffic is the last to be shed under overload conditions that may be experienced by the aggregation network.

<Ethernet 001100>

If a GPON is used for the Ethernet Aggregation function, then the Service Provider shall provision the Ethernet Aggregation function with T-CONT Type I for ETS Voice sessions and shall provision the Ethernet Aggregation function with T-CONT Type II for all other ETS sessions.

6.4.7.4 Broadband Network Gateway

6.4.7.4.1 Operational Measurements

The Broadband Network Gateway receives a request for an ETS service via a Diameter RAR message with the Priority-Level AVP.

<Ethernet 001200>

A Broadband Network Gateway shall count the number of ETS service requests received via a Diameter RAR message with the Priority-Level AVP.

The policy for ETS flows used by the Broadband Network Gateway will identify the ETS DSCP value for packet remarking.

If the Broadband Network Gateway honors the request, it will send an RAA message indicating success.

<Ethernet 001300>

The Broadband Network Gateway shall count the number of ETS service requests honored.

Note that <Measurement-00500> may be satisfied by counting the number of Diameter RAA messages sent by the Broadband Network Gateway.

6.4.7.4.2 Provisioning

The Broadband Network Gateway shall be provisioned to support Priority-Level AVP. The Broadband Network Gateway needs to know the range of values in the Priority-Level AVP associated with ETS in order to give priority to ETS requests.

<Ethernet 001400>

A Broadband Network Gateway shall allow configuration of a range of values associated with ETS to allow identification of ETS requests via the Diameter Priority-Level AVP. The factory minimum value for the range shall be 4 while the factory maximum value for the range shall be 2.

The Broadband Network Gateway may be required to recognize and set an ETS DSCP value for signaling.

<Ethernet 001500>

A Broadband Network Gateway shall allow configuration of the DSCP value to be used for IP packets it generates to carry SIP and Diameter signaling messages, and media (e.g., RTP packets) related to an ETS call/session. This value shall also be used by the Broadband Network Gateway to recognize an ETS packet for priority processing. The range of allowable values shall be 000000 to 111111 (0 to 63). The factory (default) value shall be 101100 (44) (VOICE-ADMIT).

<Ethernet 001600>

The marking of and recognition of the DSCP value as ETS shall be provisionable, with a value of enabled or disable, and a default of disabled.

<**Measurement-00800**> allows a Service Provider that has engineered its FE and network with sufficient capacity to treat all signaling messages equally.

<Ethernet 001700>

If a Broadband Network Gateway supports the Ethernet COS capabilities on the access interface, then the Broadband Network Gateway shall allow configuration of the "ETS" COS value. The range of allowable values shall be 0 through 7. The factory (default) value shall be 6.

<Ethernet 001800>

If a Broadband Network Gateway supports the Ethernet COS capabilities on the access interface then the marking of and recognition of the COS value as ETS shall be provisionable, with a value of enabled or disabled and a default of disabled.