



**ATIS-1000020**

**ETS Packet Priority for IP NNI Interfaces –  
Requirements for a Separate Expedited Forwarding  
Mechanism**

**TECHNICAL REPORT**



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### ATIS-1000020, *ETS Packet Priority for IP NNI Interfaces – Requirements for a Separate Expedited Forwarding Mechanism*

*Published by*

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

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**ATIS-1000020**

ATIS Standard on

# **ETS Packet Priority for IP NNI Interfaces – Requirements for a Separate Expedited Forwarding Mechanism**

**Alliance for Telecommunications Industry Solutions**

Approved October 2007 (Revised April 2, 2024)

## **Abstract**

This Technical Report (TR) provides the requirements for a separate Expedited Forwarding (EF) mechanism that can recognize a class of traffic for preferential treatment via a unique DiffServ Code Point (DSCP). This class of traffic includes Emergency Telecommunications Service (ETS) Voice over IP (VoIP) calls/sessions with the requirement of a pre-determined quantity of reserved bandwidth for ETS service.

## Foreword

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

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

M. Dolly, PTSC Chair

V. Shaikh, PTSC Vice-Chair

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ATIS Standard on –

# ETS Packet Priority for IP NNI Interfaces – Requirements for a Separate Expedited Forwarding Mechanism

## 1 Scope

### 1.1 Scope

This Technical Report (TR) provides the requirements for a separate Expedited Forwarding (EF) mechanism that can recognize a class of traffic for preferential treatment via a unique DiffServ Code Point (DSCP). This class of traffic includes Emergency Telecommunications Service (ETS) Voice over IP (VoIP) calls/sessions with the requirement of a pre-determined quantity of reserved bandwidth for ETS service.

### 1.2 Background

ATIS-1000011, *ETS Packet Priority for NNI Interfaces – Use of Existing DiffServ Per Hop Behaviors* [Ref 1], recommends the use of a predetermined Local/Experimental DiffServ Code Point (DSCP) for ETS VoIP traffic particularly at Network-Network Interfaces (NNI). The justification for this recommendation is based on current limitations of the Expedited Forwarding (EF) Per Hop Behavior (PHB) [RFC 3246, *An Expedited PHB (Per Hop Behavior)*, March 2002 (Ref 4)] in Differentiated Services [RFC 2475, *An Architecture for Differentiated Services*, December 1998 (Ref 5)] and on the high admission control priority requirements for ETS in IP networks [ATIS-0100003, *User Plane Priority Levels for IP Networks and Services* (Ref 2)] [ATIS-1000005, *Service Description of ETS* (Ref 3)].

In the IETF, the Internet Assigned Numbers Authority (IANA) assigned a separate EF code point, 44, for Capacity-Admitted Traffic [Ref 6]. An operator can treat the ETS class of service requiring preferential treatment as a type of Capacity-Admitted traffic that uses that separate EF code point.

## 2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

[Ref 1] ATIS-1000011, *ETS Packet Priority for NNI Interfaces – Use of Existing DiffServ Per Hop Behaviors*.<sup>1</sup>

[Ref 2] ATIS-0100003, *User Plane Priority Levels for IP Networks and Services*.<sup>1</sup>

[Ref 3] ATIS-1000005, *Service Description of ETS*.<sup>1</sup>

[Ref 4] IETF RFC 3246, *An Expedited PHB (Per Hop Behavior)*, March 2002.<sup>2</sup>

[Ref 5] IETF RFC 2475, *An Architecture for Differentiated Services*, December 1998.<sup>2</sup>

[Ref 6] IETF RFC 5865, *A Differentiated Services Code Point (DSCP) for Capacity-Admitted Traffic*, May 2010.<sup>2</sup>

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<sup>1</sup> 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> >

<sup>2</sup> This document is available from the Internet Engineering Task Force (IETF). < <http://www.ietf.org> >

[Ref 7] IETF RFC 4412, *Communications Resource Priority for the Session Initiation Protocol (SIP)*, February 2006.<sup>2</sup>

[Ref 8] ITU-T Recommendation Y.1541, *Network Performance Objectives for IP-Based Services*, June 2006.<sup>3</sup>

[Ref 9] FCC Title 47 Appendix B to Part 64—Wireless Priority Service (WPS) for National Security and Emergency Preparedness, May 2022.

### 3 Definitions, Acronyms, & Abbreviations

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None identified in this document.

#### 3.1 Acronyms & Abbreviations

AF	Assured Forwarding
ATIS	Alliance for Telecommunications Industry Solutions
BE	Best Effort
CAC	Call Admission Control
IETF	Internet Engineering Task Force
DiffServ	Differentiated Services
DSCP	DiffServ Code Point
EF	Expedited Forwarding
ETS	Emergency Telecommunications Service
GETS	Government Emergency Telecommunications Service
IANA	Internet Assigned Numbers Authority
NNI	Network To Network Interface
PHB	Per Hop Behavior
RFC	Request For Comments
SIP	Session Initiation Protocol
UNI	User To Network Interface
WPS	Wireless Priority Service

### 4 Assumptions for ETS Service

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The specific assumptions related to ETS service over IP networks used within this document are as follows:

- VoIP ETS service over IP networks is expected to be ubiquitous over public domain service providers as specified for ETS service over IP networks [Ref 3]. This is analogous to the Government Emergency Telecommunications Service (GETS) service model in the PSTN network.

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<sup>3</sup> This document is available from the International Telecommunications Union. < <http://www.itu.int/ITU-T/> >

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- The total volume of VoIP ETS traffic is expected to be small (based on historical data) when compared to the total IP traffic transported by a public domain service provider. However, based on past experience, during emergency conditions, this small volume of ETS traffic has to compete with a significant spike in non-ETS voice traffic for a depleted set of network resources depending on the type of local/regional/national emergency.
- ETS service is considered to be High Priority from a perspective of admission into IP-based networks [Ref 2]. All ETS calls are expected to be admitted into the network – with stringent QoS requirements as specified by Y.1541 Class 1 performance – up to a specified upper limit based on service level agreements.
- FCC Title 47 Appendix B to Part 64—Wireless Priority Service (WPS) for National Security and Emergency Preparedness (NSEP) [Ref 9] permits voice, data, text, and video communications from NSEP users assigned to any priority level to preempt or degrade other in-progress communications, except for public safety emergency (911) communications.
- VoIP ETS traffic makes use of two Session Initiation Protocol (SIP) Resource Priority Header (RPH) [IETF RFC 4412, *Communications Resource Priority for the Session Initiation Protocol (SIP)*, February 2006 (Ref 7)] “namespaces”, *ets* and *wps*:
  - *ETS Namespace*: ETS calls over an IP network are grouped into this namespace. All ETS calls with this SIP RPH header are given High Priority in the transport layer.
  - *WPS (Wireless Priority Service) Namespace*: An emergency call may originate over a wireless technology (e.g., 3GPP) access network with a *wps* namespace assignment, in addition to an *ets* namespace, and be handed off to a wireline IP network for further transport. The *wps* value is relayed by the IP network to facilitate priority treatment at the wireless egress network. However, the call is treated as an *ets* namespace call by the IP network.
  - All traffic types characterized by other “namespaces” defined in the SIP RPH header are beyond the scope of this document.

## 5 Requirements for ETS VoIP Service

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The following requirements must be met for the purpose of preferentially admitting High Priority ETS VoIP service:

- ETS calls in IP networks must be assigned “High” priority from the perspective of admission/resource allocation as described in ATIS documents [Ref 4].
- The “High” priority for admission/resource allocation must be maintained across NNI interfaces.
- Non-ETS VoIP calls must be assigned an admission/resource allocation priority that is less than ETS.
- QoS for ETS VoIP calls are expected to conform to performance requirements as specified by ITU-T Recommendation Y.1541 Class 1 [ITU-T Recommendation Y.1541, *Network Performance Objectives for IP-Based Services*, June 2006 (Ref 8)]. This class of service preserves the strict jitter and packet loss requirements while permitting longer delays for international emergency calls. The bottom line during emergency conditions is that ETS VoIP packets should not be dropped, in order to preserve the integrity of these critical calls.

## 6 Constraint of a Single EF Mechanism for VoIP ETS Service

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VoIP ETS traffic is expected to represent a very small proportion (<< 5%) of overall traffic in a public service provider’s domain. The majority of IP traffic in such networks is Best Effort traffic (~ > 60%). The issue at hand is how to ensure that critical High Priority ETS calls can successfully complete under emergency conditions involving potentially significant depletion of network resources.

In a public domain IP network, it is expected that (under emergency conditions) bottlenecks will occur at the network boundary interfaces – user to network facing interfaces (UNI) or network-network interfaces (NNI). The core backbones are typically engineered with large amounts of spare bandwidth/resources. However, depending on the severity of the emergency, even core interfaces may experience diminished resources and bottlenecks. Thus, a regional or a national emergency may create significant loss of network resources, and the impact is typically felt at the UNI and NNI interfaces of the network – and possibly even at core interfaces. At the same time, traffic volumes during emergency conditions have been known to increase significantly with the bulk of the increase coming from residential voice calls as the affected population seeks help or tries to establish the safety of family and friends

during these conditions. To summarize, emergency conditions result in diametrically opposite outcomes for a network – depleted network resources particularly at UNI and NNI interfaces along with a significant surge of incoming real-time voice traffic.

The inability of the single EF code point to distinguish ETS calls from other calls comes into play during emergency conditions. In the absence of strict Capacity Admission Control for non-ETS VoIP calls, the likely state of the network during such conditions may overwhelm the potentially depleted resources for the existing EF code point, such that the arrival rates at the EF queues may increase significantly beyond the service rates at these queues. The resulting dropped packets – in addition to added delay and jitter – may impact ETS calls just when they are in urgent need of successful treatment. These circumstances justify the specification of an alternative way to satisfy the high priority requirements of ETS service.

## 7 ETS VoIP Services – Requirements for a SEPARATE EF Code Point

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The critical communications requirements of ETS VoIP calls can be met by assigning them to a separate class of traffic with a unique EF DiffServ Code Point (DSCP). This separate class of real time traffic, subject to strict CAC, can be appropriately treated by a separate EF mechanism meeting the following requirements:

- ETS VoIP traffic needs to be classified as Capacity-Admitted Traffic according to [Ref 6] and processed using the EF DSCP assignment and associated mechanisms defined therein.
- A significant amount of link bandwidth is assumed to be set aside to meet the requirements for Capacity-Admitted Traffic such that:
  - A subset of this bandwidth is reserved for ETS VoIP traffic.
  - The amount of bandwidth for this ETS subset is configured such that a significant overbooking (e.g., 10X) of ETS traffic under emergency conditions is permitted per service level agreements. Given that ETS VoIP traffic volumes are expected to be small (<< 5% of total link traffic), this requirement is not deemed to be cumbersome.
- The separate EF mechanism can involve separate policers or separate queues [Ref 6], such that incoming Capacity-Admitted Traffic marked with this DSCP are recognized, and bandwidth from the reserved bandwidth pool is allocated appropriately to them. This mechanism should be able to admit Capacity-Admitted Traffic based on pre-determined bandwidth capacity allocation rules up to a specified limit.
- Authentication/security requirements for the EF DSCP class are beyond the scope of this document.