ATIS-1000011

ETS Packet Priority for IP NNI Interfaces – Use of Existing DiffServ Per Hop Behaviors

Technical Report

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ATIS-1000011, *ETS Packet Priority for IP NNI Interfaces – Use of Existing DiffServ Per Hop Behaviors*

Is an ATIS Standard developed by the **Signalling, Architecture, and Control (SAC)** Subcommittee under the **ATIS Packet Technologies and Systems Committee (PTSC)**.

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Technical Report on

ETS PACKET PRIORITY FOR IP NNI INTERFACES – USE OF EXISTING DIFFSERV PER HOP BEHAVIORS

Secretariat

Alliance for Telecommunications Industry Solutions

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Abstract

This Technical Report provides guidelines for the application of existing Differentiated Service (DiffServ) Per Hop Behaviors (PHB) and their associated DiffServ Code Points (DSCP) when Emergency Telecommunications Service (ETS) Voice over IP (VoIP) packets are transported in the media stream at Network-Network Interfaces (NNI). Given the current situation involving a single Expedited Forwarding DSCP for all real-time services, it is recommended that public carriers utilize a local/experimental DSCP to differentiate ETS VoIP traffic from other real-time traffic at NNI interfaces between carriers. The local/experiment DSCP assignment can be determined based on Service Level Agreements between the carriers.

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.

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

At the time it approved this document, PTSC, which is responsible for the development of this Technical Report, had the following members:

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ETS Packet Priority for IP NNI Interfaces – Use of Existing DiffServ Per Hop Behaviors

1 SCOPE, PURPOSE, & APPLICATION

This Technical Report provides guidelines for the application of existing[1] Differentiated Service (DiffServ) Per Hop Behaviors (PHB) and their associated DiffServ Code Points (DSCP) when Emergency Telecommunications Service (ETS) Voice over IP (VoIP) packets are transported in the media stream at Network-Network Interfaces (NNI). These guidelines are intended to facilitate the formulation of interconnection agreements between public domain service carriers by providing guidance with respect to the per hop queuing treatment to be provided for ETS calls, thereby allowing for satisfactory end-to-end transport of ETS calls over multiple IP-based networks. These guidelines are intended for use until an acceptable future solution is standardized and available for implementation.

2 REFERENCES

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

[2] IETF RFC 2475, *An Architecture for Differentiated Services*.[3]

[3] IETF RFC 3246, *An Expedited PHB (Per Hop Behavior)*.[3]

[4] IETF RFC 2597, *Assured Forwarding PHB Group*.[3]

[5] ITU-T Recommendation Y.1541, *Network Performance Objectives for IP-Based Services*.[4]

[6] IETF RFC 4594, *Configuration Guidelines for DiffServ Service Classes* (work in progress).[3]

[7] ATIS-0100003, *User Plane Priority Levels for IP Networks and Services*.[2]

3 DEFINITIONS

No new definitions are defined by this document.

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[1] A companion document will develop the requirements for the use a separate Expedited Forwarding Per Hop Behavior dedicated for ETS VoIP service.

[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 from the Internet Engineering Task Force (IETF). < http://www.ietf.org >

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

4 ABBREVIATIONS

This document uses the following abbreviations:

AF	Assured Forwarding
BE	Best Effort
IETF	Internet Engineering Task Force
DiffServ	Differentiated Services
DSCP	DiffServ Code Point
EF	Expedited Forwarding
ETS	Emergency Telecommunications Service
NNI	Network To Network Interface
PHB	Per Hop Behavior
RFC	Request For Comments
SIP	Session Initiation Protocol
UNI	User To Network Interface

5 INTERCONNECTION GUIDELINES FOR ETS PACKET MARKINGS

In IP-based public domain networks, it is expected that under emergency conditions bottlenecks will occur at the network boundary interfaces [1], viz. user to network facing interfaces (UNI) and/or network-network interfaces (NNI). The core backbones are typically engineered with large amounts of spare bandwidth/resources[5]. A regional or a national emergency may create significant loss of network resources, and the impact may be felt at the UNI and NNI interfaces of the network; and possibly even at intranetwork 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.

Differentiated Services [2], [3], & [4] enable the implementation of scalable service differentiation in IP networks. This differentiation is achieved by aggregating traffic types (e.g., real-time telephony, high throughput data, etc.) into one of three *Per Hop Behavior (PHB)* categories whereby packet streams of similar traffic types are classified and treated appropriately in router queues. These PHBs are:

- ♦ *Best Effort (BE)*: This is the default forwarding behavior available in existing routers. Packets in this behavior aggregate are not subject to any specified assurances and the network will deliver as many of these packets as possible as quickly as feasible, subject to network policy conditions and constraints.

- ♦ *Assured Forwarding (AF)*: This PHB provides a means to offer different levels of forwarding assurances for IP packet streams that do not have very stringent delay, jitter, or loss requirements (e.g., high throughput data). Four AF PHB classes have been defined where each

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[5] Depending on the severity of the emergency, even core interfaces may experience diminished resources and bottlenecks.

AF class has a certain amount of forwarding resources (queue buffer space and bandwidth) allocated. Within each AF class, packets are marked with one of three possible drop precedence levels, indicating the priority with which the packets will be dropped in case of congestion.

♦ *Expedited Forwarding (EF)*: This PHB is intended to provide a forwarding behaviour that provides assurances of low delay, low packet loss, and low jitter services such as that required to support real-time telephony. Packet streams intended for this PHB are suitably "marked" and they encounter queues which are typically empty or which are very sparsely populated. The intent is to keep queue occupation low relative to buffer space, thus minimizing delay and delay variation. This is achieved by ensuring that service rates at the EF queues exceed the arrival rates. Due to the stringent requirement of low delay, jitter, and loss, and the lack of reasons to do otherwise, the EF PHB currently has a single class defined. Thus, all real-time telephony calls are currently handled by this PHB regardless of the type of the call – ETS or non-ETS.

Attempts to classify various IP-based service types into the defined PHBs have been made based on the performance and QoS characteristics of the traffic type in question. The ITU-T Recommendation Y.1541 [5] provides a mapping between user applications, network performance QoS classes, and DiffServ PHBs. In the IETF, work is in progress that attempts to group specific traffic types to individual Per Hop Behaviors based on performance and QoS characteristics [6]. However, the priority of a critical emergency service is not discussed in either of these aforementioned guidelines.

ATIS documents [7] have provided some guidance on the criticality of IP-based service in the form of a priority related to admission control and resource reservation. Three broad classes – *High*, *Normal*, and *Best Effort* – have been defined with the recommendation that High Priority be exclusively reserved for emergency services such as ETS. It is straightforward to note that all Best Effort priority services can be mapped to the Best Effort PHB. For services in the Assured Forwarding PHB, the presence of four AF classes -- each with drop precedence values -- can provide the means to meet priority requirements for these services. It is the Expedited Forwarding PHB that is of concern when attention is turned to the requirement to support Emergency Services – in practice, there is only one EF class for all real-time telephony traffic regardless of whether calls are High Priority ETS calls or Normal Priority non-ETS calls.

This inability of the single EF PHB to distinguish ETS voice calls from other voice calls only becomes significant during emergency conditions. Recall the likely state of the network during such conditions discussed earlier -- depleted network resources particularly at UNI and NNI interfaces along with a significant surge of incoming real-time voice traffic. These conditions may overwhelm the potentially depleted resources available for the EF PHB, 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 the ETS calls, just when they are in urgent need of successful treatment.

Given this severe constraint of a single EF PHB Class, the following recommendation is proposed as a way for service providers to recognize ETS voice calls at NNI interfaces:

♦ At NNI interfaces between public domain carriers, assign a local/experimental DiffServ Code Point (DSCP) to ETS VoIP service based on SLA agreements, and continue to utilize the existing EF PHB DSCP for non-ETS VoIP service.

In conclusion:

1. This recommendation should be adopted as part of the interconnection agreements between public domain, service providers to define how DiffServ PHB Code Points will be applied to ETS and non-ETS VoIP calls at NNI interfaces.

2. This recommendation should be adopted on the understanding that it is a temporary solution, due to the existing constraint of the currently specified single EF PHB Class for all VoIP telephony services regardless of their priority requirements. Provision should be made for the adoption of new operating guidelines when available, thereby allowing for the separation of ETS and non-ETS VoIP traffic.

3. This recommendation does not dictate how ETS and non-ETS traffic is to be carried within service provider's networks. It is understood that how service providers carry ETS and non-ETS traffic, with respect to PHB treatment, may depend upon the provider's capabilities and preferences.