ATIS-0100009

OVERVIEW OF STANDARDS IN SUPPORT OF EMERGENCY TELECOMMUNICATIONS SERVICE (ETS)

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Technical Report on

OVERVIEW OF STANDARDS IN SUPPORT OF EMERGENCY TELECOMMUNICATIONS SERVICE (ETS)

Secretariat

Alliance for Telecommunications Industry Solutions

Approved December, 2006

Abstract

This Technical Report (TR) provides a high-level service description of the Emergency Telecommunications Service (ETS), its requirements and objectives, and of current standardization initiatives with a focus on forums and committees of the Alliance for Telecommunications Industry Solutions (ATIS).

FOREWORD

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Network Performance, Reliability, and Quality of Service Committee (PRQC) -- formerly T1A1 -- develops and recommends standards, requirements, and technical reports related to the performance, reliability, and associated security aspects of communications networks, as well as the processing of voice, audio, data, image, and video signals, and their multimedia integration. PRQC also develops and recommends positions on, and foster consistency with, standards and related subjects under consideration in other North American and international standards bodies.

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1 INTRODUCTION

1.1 Scope

This Technical Report (TR) provides a high-level service description of the *Emergency Telecommunications Service (ETS)*, its requirements and objectives, and of current standardization initiatives with a focus on forums and committees of the Alliance for Telecommunications Industry Solutions (ATIS).

It is not expected that all of the requirements discussed in this TR will be accomplished at the same time. However, due to the importance of the ETS, it is hoped that those requirements that can be satisfied quickly will be included in Standards and TRs in the near future.

This TR does not address the feasibility and priority of the requirements stated in the document. Also, it neither endorses nor recommends any given architectural solutions to satisfy these requirements.

1.2 Purpose

This TR describes the ETS and offers some example service scenarios. It provides an overview of the requirements for ETS and discusses current activities regarding ETS standardization.

This TR presents an overview of the basic requirements, features, and concepts for ETS that packet-based telecommunication and Third Generation (3G) mobile networks are capable of providing and that must receive attention during the process of the convergence of these technologies. Specific solutions are not offered, but this TR will be useful in advancing the work on ETS standards.

1.3 Application

As stated above, this TR is meant to be applied by those standards bodies; particularly, ATIS Committees, in their work on current and future enhancements to evolving networks. This TR will provide much-needed guidance concerning where issues are being addressed relating to ETS requirements.

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3 DEFINITIONS

3.1 Emergency Telecommunications Service: A telecommunications service offering available on public communications networks that facilitates the work of authorized emergency personnel in times of disaster, national emergency, or for executive/governmental communications relating to National Security / Emergency Preparedness (NS/EP).

4 ABBREVIATIONS, ACRONYMS, & SYMBOLS

2G	Second Generation
3G	Third Generation
3GPP	3rd Generation Partnership Project
3GPP2	3rd Generation Partnership Project 2
AAP	Alternative Approval Process
ANSI	American National Standards Institute
AT	Access Tandem
ATIS	Alliance for Telecommunications Industry Solutions
ATM	Asynchronous Transfer Mode
BCP	Best Current Practice
BICC	Bearer Independent Call Control
BS	Base Station
CMS	Call Management Server
E911	Enhanced 911
EP	End Point
ETS	Emergency Telecommunications Service
ETSI	European Telecommunications Standards Institute
GETS	Government Emergency Telecommunications Service
GK	Gate Keeper
GSM	Groupe Speciale Mobile (*old definition)* Global System for Mobile Communications
GSM-MAP	GSM Mobile Application Part
H.225	ITU H.323 Call Signaling
H.248	ITU Version of MEGACO
H.323	ITU Recommendation on Packet-based multimedia communications systems
ID	Internet Draft

IEMS	International Emergency Multimedia Service
IEPS	International Emergency Preference Scheme
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
IMT	International Mobile Telecommunications
IP	Internet Protocol
IS-41	TIA Interim Standard 41
ISDN	Integrated Services Digital Network
ISAC	Information Sharing and Analysis Center
ISTP	Internet Signaling Transport Protocol
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
LAN	Local Area Network
M3UA	Message Transfer Part 3 User Adaptation
MAN	Metropolitan Area Network
MEGACO	IETF Media Gateway Control
MG	Media Gateway
MGC	Media Gateway Controller
MGCP	Media Gateway Control Protocol
MPLS	MultiProtocol Label Switching
MSC	Mobile Switching Center
NCS	National Communications System
NCS	Network Call Signaling
NS/EP	National Security / Emergency Preparedness
OSS	Operating Support System
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
RAS	H.323 Registration Authorization Status
RFC	Request for Comments
RTP	Real-time Transport Protocol
SC	Service Customers
SCP	Signaling Control Point
SCTP	Signaling Control Transport Protocol
SDO	Standards Development Organization
SG	Signaling Gateway
SG	Study Group
SIGTRAN	Signaling Transport
SIP	Session Initiation Protocol
SIP-T	SIP for Telephones
SLA	Service Level Agreement
SP	Service Provider
SS7	Same as SSN7
SSG	Special Study Group
SSN7	Signaling System Number 7
SSP	Service Switching Point
STP	Signaling Transfer Part
SWG	Sub-Working Group
TCAP	Transaction Capabilities Application Part
TDM	Time-Division Multiplexing
TGCP	Trunking Gateway Control Protocol
TIA	Telecommunication Industry Association
TIPHON	Telecommunications and Internet Protocol Harmonization Over Networks
TMN	Telecommunications Management Network
TR	Technical Report

TSC	Technical Sub-Committee
TSP	Telecommunications Service Priority
WI	Work Item

5 ETS SERVICE

When a disaster strikes, the public telecommunications infrastructure may sustain damage, experience excessive traffic loads, and be subject to external interference that may severely limit the ability for disaster response and recovery personnel to communicate. Therefore, special provisions to facilitate effective communications for emergency personnel are necessary. This includes priority establishment and processing of communications through the telecommunication resources that remain available. ETS traffic needs to receive preferential use of the surviving capacity of the impacted network.

The emergence of new telecommunications technologies and their application for telecommunication services in evolving telecommunication networks provides great promise for the realization of an enhanced, comprehensive, and effective global ETS. The International Telecommunications Union, Standardization Sector (ITU-T) Draft Recommendation F.706 [2] presents requirements for multimedia services to support emergency operations. Not only will voice telephony services need to continue, the inclusion of broadband services like video broadcast and conferencing will also be beneficial. In addition, narrowband capabilities, such as instant messaging and presence as well as e-mail, would facilitate short, rapid command and control information interchange and would enhance recovery operations. This will be particularly useful during periods of limited bandwidth availability and as a last resort to communicate when conditions become most severe.

Ubiquitous telecommunications resources that provide services to the general population provide the basis for readily available capabilities for an ETS. Since public telecommunication resources are normally at hand, emergency operations activities do not have to wait for deployment of special facilities. However, as emergency operations get underway, supplemental capabilities could also be of significant benefit; particularly when public telecommunication resources become seriously stressed and limited. Therefore, it would be desirable to have a telecommunications infrastructure that can be readily integrated with transportable, re-deployable, and fully mobile facilities, such as personal communications service, cellular, satellite, and high frequency radio. Interoperability and interfaces among selected government or private facilities, systems, and networks would be very beneficial. It is also highly desirable that ETS resources be as robust as possible to support surviving users under a broad range of circumstances, including widespread damage during natural or man-made disasters

5.1 ETS Service Description

The purpose of the ETS is to facilitate emergency recovery operations for restoring the community infrastructure and for returning the population to normal living conditions after serious disasters and events; such as floods, earthquakes, hurricanes, and terrorist attacks. The ETS will be provided through shared resources from the public telecommunications

infrastructure, which is evolving from the basic circuit-switched configuration of today's conventional telephone networks to a packet-switched technology providing a richness of IP-based multimedia communication capabilities.

5.1.1 Applications

The applications for ETS include: Web access, instant messaging, wireless access, unicast/multicast/broadcast of audio, video, and data, interactive video, remote database access, location-based services, push and presence services, streaming video, speech-enabled services, etc. These applications need to be supported across different networks, including: wireline, wireless, satellite, broadband cable, and any hybrid networks. ETS traffic needs to access, traverse, and egress these networks.

5.1.2 Capabilities

A fully comprehensive ETS needs to have a richness of capabilities to support a variety of operational requirements for emergency recovery forces. The following is a list (by no means exhaustive) of specific features that could potentially facilitate communications for disaster recovery activities:

- Selection of multimedia and telephony services;
- Rapid authentication of authorized ETS users;
- Security protection of ETS traffic;
- Preferential access to telecommunications facilities;
- Preferential establishment of ETS communications;
- Preferential routing of ETS traffic;
- Preferential use of remaining operational resources for ETS traffic;
- Preferential completion of ETS traffic to destination;
- Optional preemption of non-emergency traffic (where consistent and compliant with local, national, and regional regulatory provisions, for example not interfering with E911 calls, etc.);
- Allowable degradation of service quality for ETS traffic; and
- Interchange of critical telecommunications service management information.

Not all of these features may be immediately possible, practical, or available universally. These features may only be implemented in those areas where appropriate laws or policy allow. The above list focuses on the basic capabilities that need to be addressed and developed. These capabilities could greatly facilitate effective and timely recovery operations during emergency events.

5.1.3 International Considerations

While some nations have some form of emergency personnel communications service, many nations do not have any emergency capability other than their public telecommunications infrastructure in its present state without any of the special features listed above. In the United States, the *Government Emergency Telecommunications Service (GETS)* supports emergency recovery operations. However, it only provides priority establishment and routing of telephone calls through the *Public Switched Telephone Network (PSTN)* for specifically authorized users who expect to be involved in emergency recovery operations. GETS fulfills the basic functional requirements of ITU-T Recommendation E.106 [1] and is a subset of the ETS of the future.

The ETS needs to have an international scope. Disaster situations are often regional and involve multiple nations. In these cases, disaster recovery assets from multiple nations may be necessary to respond to one specific event. Also, in the increasingly "global" world, many nations often provide support for recovery operations for emergency disasters contained within the borders of another country. ETS traffic, therefore, needs to receive favorable treatment at international gateways and within national networks providing an ETS. Adequate security/protection must be included in the authentication process to allow the service provider handling incoming international ETS traffic to validate its authenticity.

5.1.4 ETS in the Future Telecommunications Infrastructure

Currently, national and international standards bodies are defining a new telecommunication infrastructure that is expected to be deployed over the next several years. It is imperative that the specifications of these networks include support for the functional requirements of a comprehensive ETS before equipment and systems are designed, manufactured, and deployed. The new specifications should not impair the operation of existing emergency response capabilities. With the necessary capabilities built into the new telecommunications infrastructure, the ETS can then become readily available with a diversity of services for emergency response operations through execution of *Service Level Agreements (SLAs)* between *Service Customers (SCs)* supporting recovery operations and the telecommunications *Service Providers* (SPs). It will then be possible to offer the service more expediently and to avoid the expense of deploying special capabilities or retrofitting existing systems. The SC will then pay the appropriate tariffs for actual services received.

The availability of the ETS for authorized users could also be specified in an SLA. The ETS could always be available for use at any time and at any place in a specific network. This would allow fast-response access immediately when the disaster strikes. Some networks, on the other hand, may only activate the ETS upon declaration of an emergency by the appropriate authority. This could cause a serious delay in the ability for response and recovery forces to communicate effectively. Some in-between capability could also be possible, where a basic preferential service would always be available, and then enhanced features could be activated upon declaration of an emergency.

The transition to packet-based and 3G mobile telecommunication services will involve a number of issues; one of which is to ensure orderly and transparent continuance of the basic E.106 emergency preference capabilities. During the convergence period, the different schemes for interworking between the two technologies must be considered. For example, voice calls

from the telephone or mobile network may transit voice-over-IP links and then terminate in either the telephone network or directly in a packet-based network. The European Telecommunications Standards Institute (ETSI) describes four (4) different scenarios of interoperation [3]. Because of the variety in configurations, it is necessary to establish the interfaces for interworking between the signaling systems of today's telephone networks and the new call control and signaling protocols of evolving telecommunication networks. This needs to be accomplished without negatively impacting the fundamental operation or infrastructure of existing and future packet-based networks. As new networks with the basic emergency service priority capabilities come into being, it will be important to provide enhanced services by leveraging the new capabilities of the emerging packet-based networks.

5.2 ETS Service Scenarios

Many challenges and considerations need to be addressed in defining and establishing the functional capabilities for the ETS in the emerging packet-based telecommunications services. Disaster situations can occur any time, any place unexpectedly. These events may significantly damage the community infrastructure and severely disrupt daily living. Recovery requires rapid response by local authorities, immediate reaction from utility SPs, and support from medical, construction, fire, and police resources. Effective communications are essential to facilitate the myriad activities for coordinating lifesaving activities concurrent with reestablishing control in the disaster area. Following a disaster, immediate response operations focus on saving lives, protecting property, and meeting basic human needs.

5.2.1 Example Scenario 1

Consider a flood or a hurricane occurs in an area. The emergency response and recovery management personnel are deployed to the site to survey the area with a video camera and assess the situations there. They need to send live video of the site back to the headquarters for coordination and analysis. Given the situation, some communication switches and/or routers might have been damaged; thereby not being able to carry traffic. Consequentially, congestion in communication networks may occur, emergency personnel may be unable to gain access to communications networks, and emergency communication traffic might be discarded if priority treatment is not provided. If ETS service is available, emergency traffic would receive preferential treatment during congestion and the probability that emergency personnel would be able to fulfill their missions would be substantially increased.

5.2.2 Example Scenario 2

In an emergency, NS/EP personnel need to be able to communicate with their counterparts in other organizations to notify them of the emergency situations. For example, Federal workers need to talk to the state and local authorities. In an ETS that includes sufficient interoperability, these personnel will be able to coordinate the necessary emergency response. If needed, this communication can be encrypted for security.

5.2.3 Example Scenario 3

Given an emergency situation in a metropolitan area, NS/EP personnel enter an office building and need to locate the plans to that building. If a fully developed ETS is available, an NS/EP worker with a laptop could plug in to a port on the building's LAN and contact a secure database to access the plans of the building. If the network is congested, the NS/EP worker's traffic will receive preferential treatment. If there is sufficient bandwidth, videoconferencing could also take place from the laptop. If bandwidth is limited, a voice call might be made over the same laptop or an email sent.

5.3 Related Services

ETS is a super set of all emergency services for an authorized select group of users. It includes Government Emergency Telecommunication Service (GETS), Wireless Priority Service (WPS), Telecommunications Service Priority (TSP), etc. It is used to support emergency response and recovery users. ETS users must be authenticated prior to getting the service from service suppliers.

ETS does *not* include local emergency service -- e.g., 911, E911.

6 REQUIREMENTS & OBJECTIVES FOR ETS

A U.S. Government Agency, *National Communications System (NCS)*, identified fourteen (14) basic functional requirements for the future ETS. These requirements are listed in Table 1 and represent the objectives that need to be fulfilled for NS/EP in the ETS.

Eighteen (18) functional requirements are discussed in this TR. Participants of ATIS Committees identified four (4) additional requirements during the preparation of this TR.

Public telecommunication services are universally available, deployed by a massive infrastructure throughout most nations, except in the most remote and unpopulated regions. These critical telecommunications resources, therefore, must be depended upon by the emergency responders for supporting the organization and coordination of initial, as well as ongoing, recovery activities. It is possible to realize these capabilities readily by leveraging the resources that are ubiquitous and most likely to be immediately available any place, any time. This includes the use of wireless services as mobile networks expand their coverage. Dedicated or special government telecommunications resources, on the other hand, do not generally have the immediate global reach to be responsive initially to disaster events.

Two (2) approved Recommendations by the ITU-T present the basic requirements for international emergency telecommunications.

1. ITU-T Recommendation E.106, *Description of an International Emergency Preference Scheme* [1], applies to telephony services provided by the PSTN, Integrated Services Digital Network (ISDN), and Public Land Mobile Network (PLMN).

2. ITU-T Recommendation Y.1271 (10/2004), Framework(s) on Network Requirements and Capabilities to Support Emergency Telecommunications Over Evolving Circuit-Switched and Packet-Switched Networks. [2], applies to all modes of telecommunications service, including telephony, over the newly emerging telecommunication networks, including the packet-based Internet Protocol (IP) technology and 3G mobile networks.

The ETS can be used both in national and international contexts and includes the provisions of the IEPS and the IEMS.

Communication networks are undergoing an evolutionary transition from legacy circuit-switched based technologies to packet-based technologies. Wireless technology is also evolving toward the new 3G (IP-based multimedia services) capabilities for seamless provisioning of services over and across the heterogeneous fixed and mobile networks. A substantial transition period is underway as these technologies converge. As a result, there will be many critical issues of transition and interoperability to address. The newly emerging technologies will provide enhanced capabilities that can be leveraged and can benefit emergency recovery operations during disaster situations. Packet-based technologies provide a new environment that needs to be leveraged to provide effective and economical public telecommunications services for supporting ETS capabilities.

Table 1 - Original Table of NCS-identified ETS Functional Requirements

NS/EP Telecommunication Services Functional Requirements	Description
a. Enhanced Priority Treatment	Services supporting NS/EP missions must be provided priority treatment over other traffic.
b. Secure Networks	Networks must have protection against corruption of, or unauthorized access to, traffic and control, including expanded encryption techniques and user authentication, as appropriate.
c. Non-Traceability	Selected users must be able to use NS/EP services without risk of usage being traced (*i.e.,* without risk of user or location being identified).
d. Restorability	Should a disruption occur, services must be capable of being reprovisioned, repaired, or restored to required service levels on a priority basis.
e. International Connectivity	Services must provide access to and egress from international carriers.
f. Interoperability	Services must interconnect and interoperate with other selected government or private facilities, systems, and networks.
g. Mobility	The communications infrastructure must support transportable, re-deployable, or fully mobile communications (*e.g.,* personal communications service, cellular, satellite, high frequency radio).
h. Ubiquitous Coverage	Services must be readily accessible to support the national security leadership and inter- and intra-agency emergency operations, wherever they are located.
i. Survivability/Endurability	Services must be robust to support surviving users under a broad range of circumstances, from the widespread damage of a natural or man-made disaster up to and including nuclear war.
j. Voice-Band Service	The service must provide voice-band service in support of presidential and other communications.
k. Broadband Service	The service must provide broadband service in support of NS/EP missions (*e.g.,* video, imaging, Web access, multimedia).
l. Scaleable Bandwidth	NS/EP users must be able to manage the capacity of the communications services to support variable bandwidth requirements.
m. Affordability	Services must leverage network capabilities to minimize cost (*e.g.,* use of existing infrastructure, commercial off-the-shelf technologies, services).
n. Reliability/Availability	Services must perform consistently and precisely according to their design requirements and specifications, and must be usable with high confidence.

The additional requirements and more detailed descriptions of the requirements in Table 1 are given in the sections below. These should lead to more specific technical requirements that in turn can be specified in standards.

6.1 Enhanced Priority Treatment

ETS communications should be provided preferential end-to-end treatment -- e.g., access, transport, and egress -- so that higher communication session completion rates, as compared with public communication session completion rates, would be successfully achieved. Priority treatment can be done in both the transport and/or signaling networks. Communication sessions in this context include voice, multimedia, and data.

For example, the *Resource Reservation Protocol (RSVP)* can be used to route communication sessions around congestion points in the network. *Differentiated Services (Diff-Serv)* methods can

be implemented to provide emergency traffic with some priority levels so that access and egress routers would put emergency communication sessions ahead of the queue, and they would not randomly drop -- e.g., Random Early Detection, etc. -- emergency related communication session packets when the queue is full. With *Multi-Protocol Label Switching (MPLS)*, packet priorities can be assigned via the labels so that priority traffic can be forwarded appropriately in the transport network in any given scenario. *Session Initiation Protocol (SIP)* is enhanced to provide priority in the voice-signaling network. WPS provides authorized emergency users the same type of priority and preferential treatment when they access the wireless networks as GETS users have on the wireline PSTN.

6.2 Secure Networks

Networks must have protection against corruption and intrusion such as unauthorized access, control and traffic. Appropriate encryption techniques and authentications can be deployed to provide such protection for ETS. Networks supporting ETS permit system interaction only by authorized users.

Authorized access means only authorized users can access ETS service. All users must be authenticated -- e.g., via a secure distributed database -- prior to accessing the service. Authorized control means only authorized users (emergency personnel or network operators) can securely create and manage emergency services in their networks. Authorized traffic means emergency traffic that has been authorized. Authorized traffic must be routed to the intended destination. Hackers, for example, could otherwise intercept or alter packets in transit and reroute them to their destinations. Strong encryptions, integrity algorithms, authenticating entity identification and validation, and proper authentications are needed.

6.3 Non-Traceability

Selected NS/EP users must be able to use ETS service without risk of users or locations being identified or traced by non-authorized entities. For example, network providers must block caller identifications and suppress origination and destination information.

6.4 Restorability

Restoration to required service levels would be achieved on a priority basis. Networks should be designed to allow very rapid automatic alternative routing to redundant backup paths.

In a circuit-switched network, the TSP System, mandated by the Federal Communications Commission (FCC), allows telecommunications SPs to provide priority treatment to NS/EP telecommunications services. TSP traditionally applies to physically identified circuits and equipment.

For example, in a packet-switched environment, access links and physical ports of edge routers can be provisioned and closely monitored so that a priority treatment can be provided to them

when failures occur. Backbone priority mechanisms could restore ETS functionality before normal traffic.

6.5 International Connectivity

Access to and egress from ETS services should be available from international carriers. Their networks are designed to interconnect with one another. This interconnectivity is achieved through SPs' adherence to international standards. Since ETS is a national and international service, access to and egress from a national ETS service should be available to international carriers. Authorization would be subject to international agreements.

6.6 Interoperability

In order for emergency users to have end-to-end connectivity and service, ETS services must be provided by numerous operators that interconnect and interoperate with one another. Interoperability is achieved by SPs' adherence to a set of standards, in part, from the American National Standard Institute (ANSI)-accredited ATIS standards, ITU Recommendations for international connectivity, and other Standards Development Organizations (SDO) outputs.

The service must include the ability to provide the ETS authorized user with preference regardless whether the called party is another ETS authorized user or is just a normal user. Interoperability includes consideration of the seamless provision of services across circuit-switched and packet-based, wireless and wireline networks.

6.7 Mobility

The communications infrastructures must support transportable, re-deployable, or fully mobile communications. These infrastructures include Cellular, PCS, Paging, Short Message Service, Local Multipoint Distribution System (LMDS), Multipoint Multichannel Distribution System (MMDS), Wireless Local Area Network (WLAN), Personal Area Network (PAN), Satellite, Land Mobile Radio (LMR), Two-way Mobile Radio, etc.

6.8 Ubiquitous Coverage

Services must be readily accessible to support the national security leadership and inter- and intra-agency emergency operations, wherever they are located.

The PSTN may be considered to be "nearly ubiquitous". For some locations, where the PSTN is not available, alternative forms of communications such as satellite, 3G wireless services, etc. should be available. Wireless coverage is typically defined by what percentage of the population can access the wireless network, but has the inherent lack of coverage in non-populous -- i.e., remote -- areas.

6.9 Survivability/Endurability

Networks supporting ETS services must be meshed to provide redundant and diverse routing, and automatic rerouting mechanisms such as Automatic Switch Protection (ASP), Automatic Switched Optical Network (ASON), etc. must be deployed. Hence, the loss of a particular section of the infrastructure does not necessarily inhibit packet transmission.

6.10 Voice-Band Service

Packet-based networks have increasingly been used to support voice grade communications. Numerous switch manufacturers develop products employing ATM and soft switches. As SPs offer voice grade service in packet-based networks, priority must be afforded to ETS communications entering, transiting, and exiting these networks. NS/EP workers, including the U.S. President and the President's s staff, should, given multiple options, be able to make voice calls whenever necessary.

6.11 Broadband Service

The service must be able to provide broadband services such as video, imaging, multimedia, etc. Networks inherently have the capability to provide a wide range of broadband services such as Fractional T1, T1, T3, and Optical Carrier (OC), etc.

> NOTE -- The delivery of ETS capabilities may be constrained by the access method available. For example, it would not be possible to deliver broadband service if the NS/EP user is accessing the network using an access medium that does not support that capability.

6.12 Scaleable Bandwidth

Since packet-based networks can provide services in various bandwidth increments, they inherently have the capability to provide scalable bandwidth. This can be considered like Bandwidth-on-Demand (BOD) in ATM networks. For example, more bandwidth will be allocated for emergency users when they dynamically submit a request. As with data transfer, an increased number of packets are allowed to traverse the networks.

6.13 Affordability

Besides price, other parameters for determining "Affordability" are the service's reliability, availability, maintainability, and ease of implementation and operation. All these parameters affect the service's value to the subscriber and should be determined on a case-by-case basis dependent upon the subscribers and its requirements.

ETS requirements should be identified and satisfied via national and international standards, which the SPs will implement. Costly retrofitting of unique or proprietary solutions should be avoided.

6.14 Reliability/Availability

Services must perform consistently and precisely according to their requirements and specifications. The subscriber may need to invoke enforceable SLAs in its contracts with its SPs, Through SLAs, the subscriber can encourage its SPs to meet reliability, availability, and Quality of Service (QoS) levels necessary to meet the subscriber's NS/EP requirements.

6.15 Quality of Service

End-to-end QoS should be provided based on internationally standardized QoS classes and parameters sufficient to meet user's expectations in inter-domain and inter-network (including wireline and wireless interoperation) contexts.

An acceptable level of QoS is highly desirable end-to-end on any medium (landline, wireless, cable, satellite, etc.) used to establish and maintain an ETS communication session. Each service and/or network provider must have a robust network that has sufficient resources to deliver the expected level of service during a disaster/emergency. For evolving networks, standards are in place for QoS performance parameters for different types of services. For example, the performance parameters -- e.g., delay, packet loss, etc. -- of a wide range of telecommunications services in IP-based networks, such as voice, data, multimedia, are defined by classes in ITU-T Recommendation Y.1541 [4]. The QoS for ETS services over evolving networks could be governed by these standardized recommendations. At the same time, it should be recognized that adverse conditions, depending on the severity of the emergency, may result in degraded performance for ETS services. Under such extreme conditions, degraded performance may be the only possible means of communications.

6.16 Management

Service/Network providers must have Operation Support Systems (OSSs) in place in order to provision and maintain critical network elements that are used for ETS. The OSSs need to have redundancy in the event a disaster/emergency eliminates the utilization of one or more central computer complexes.

6.17 Accounting & Billing

Service/Network providers must have a means of accumulating accounting and billing data to bill customers who utilize the capabilities of ETS. Accounting records will be accumulated automatically and any request for detailed billing statements must be authorized by the appropriate government agency.

6.18 Network Evolution

As more details are known about *Next Generation Network (NGN)* equipment, standards have to be developed to insure interoperability and reliability of any NE inserted into the mix of

technologies that will be used for ETS. The NGN equipment must be designed to provide ETS requirements such as connectivity, priority service, security, QoS, etc.

7 PROGRESS ON ETS STANDARDIZATION

Some of the requirements described above are more critical than others. At the same time, some are more easily addressed or are prerequisites to other, more complex requirements. This section will describe some of the steps that have been taken since the first version of this TR was published.

7.1 Enhanced Priority Treatment

Significant progress has been made in standards bodies in advancing the concept of priority services in IP networks. Initial – and generic - efforts on this concept include ATIS Technical Report T1.TR.84 [PRQC-2005-103--1] that promotes the need for ETS priority services, ITU-T Recommendation Y.1291 [PRQC-2005-103--2] that provides high-level text for priority classification, and ITU-T TRQ-QoS-SIG [PRQC-2005-103--3] that includes high-level signaling requirements for IP-based priority services. Specific efforts on IP-based priority services have also progressed on the following:

- *Priority Classification* – Development of priority classes for IP-based network functions such as admission control and resource reservation and restoration, with emergency services such as NS/EP exclusively reserved for or included in the highest priority class.
- *Priority Signaling* – Recognition and signaling of IP service priority classes.
- *Priority Mechanisms* – Examination of mechanisms that can enable priority-based functions for IP traffic admission and resource reservation as well as for restoration and rerouting.

7.1.1 Priority Classification

Priority classifications for specific IP-based network functions have been developed in the ATIS PRQC committee as follows:

- *Layer 3 (Bearer/User Plane) Admission/Resource Reservation Priority*: This TR, "User Plane Priority Levels for IP Networks and Services" [PRQC-2005-103--4], proposes three admission control/resource reservation priority service classes in Layer 3 (Bearer/User plane) for all IP services with the highest class reserved for emergency services such as NS/EP. Non-emergency services that require better than "Best Effort" guarantees are assigned "Normal" priority whereas services that do not require assurances for admission control/resource reservation are classified as "Best Effort" services. The specific assignment of the "Normal" and "Best Effort" classes to various traffic types and customers is done via SLAs between customers and SPs.
- *Restoration Priority*: TR "Service Restoration Priority Levels in IP Networks" [PRQC-2005-103--5] proposes three classes for this function. In accordance with existing FCC

procedures for service restoration, this report proposes that all NS/EP services and control message traffic should be included in the highest restoration class. It also recommends flexibility for SPs, so long as the above requirement is met. The choice of traffic for the three classes, "High", Normal", and "Best Effort", is done via SLA agreements between SPs and their customers.

7.1.2 Priority Signaling

The ability to signal priority classification is a critical step in enabling IP priority services. Significant advances have been made on this front.

Work in the ATIS PTSC Signaling Architecture and Control sub-committee is as follows:

- *ETS Support in IP Environments*: This comprehensive TR currently under development [PRQC-2005-103--6] provides discussions on mapping between Priority Classes and Signaling Messages. The proposal states that SIP messages associated with High User Plane priority [4] services, such as ETS, should be treated with High Layer 3 priority, whereas SIP messages associated with Normal User Plane priority services [PRQC-2005-103--4] should be treated with Normal Layer 3 priority.
- *ETS Namespace*: This work effort [PRQC-2005-103--7] provided definitions of emergency domain name spaces and mapping their association to the SIP Resource Priority Header (RPH). See below for the follow-up effort in the IETF.
- *Vertical Interface between Application Layer and Layer 3/User Plane:* This work proposal [PRQC-2005-103--8] calls for PTSC and PRQC to jointly develop necessary requirements for communicating priority and QoS parameter information between applications entering an IP network and the Layer 3 processes that setup a Label Switched Path (LSP) in an IP backbone. The goal is to use these requirements for the development of appropriate protocols that will carry out this critical function.
- [*ATIS-1000631.2005] ANSI Standard, Signaling Systems No. 7 (SS7) – High Probability of Completion (HPC) Network Capability (Revision of T1.631-1993 (R1999)*. This is a revision of the ANSI Standard that supports increased call completion capabilities for critical users. The HPC network capability is applied during the call setup of NS/EP calls by providing for an identifier for those calls on the SS7 network protocol. This identifier allows NS/EP to be recognized as they are transported across and between networks so that call completion improvement techniques can be applied by SPs to increase the probability of completion during periods of network congestion or damage. This is currently utilized in GETS.
- *[ATIS-1000011.2006] TR: ETS Packet Priority for IP NNI Interfaces – Use of Existing DiffServ Per Hop Behaviors*. This TR provides guidelines for the application of existing DiffServ Per-Hop Behaviors (PHB) and their associated DiffServ Code Points (DSCP) when 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.

In the IETF, progress has been made in the SIP and Next Steps in Signaling (NSIS) Working Groups as follows:

- SIP-based NS/EP "Namespace" RPH: The RPH header RFC "Communications Resource Priority for the Session Initiation Protocol" [RFC-4412] is a standards track RFC that was approved February, 2006. This document defines two new SIP header fields for communicating Resource Priority – "Resource-Priority" and "Accept-Resource-Priority". The goal is to preferentially enable emergency services in SIP-based elements during congestion conditions created by diminished network capacity during emergency/disaster situations. The "Resource-Priority" header field can influence the behavior of SIP user agents (such as telephone gateways and IP telephones) and SIP proxies. It does not directly influence the forwarding behavior of IP routers.
- QoS *Network Signaling Layer Protocol (NSLP)* "QSPEC" Template: This IETF *Internet Draft* (I-D) [PRQC-2005-103--10] defines a signaling protocol to signal QoS reservations and is independent of specific *QoS Models (QOSM)* such as DiffServe. All relevant information specific to a QOSM is encapsulated in a "QSPEC" object. This draft defines a template for this object with related formats and it includes QoS description and control information. A "Reservation Priority" parameter is defined in this object and RPH namespace attribute values are included. This effort is on a *Request for Comment (RFC)* standard track in the IETF.
- Y.1541 QOSM for Networks Using Y.1541 QoS Classes: This IETF I-D [PRQC-2005-103--11] defines a QoS NSLP QOSM based on the ITU-T Y.1541 [PRQC-2005-103--12] QoS signaling requirements. Y.1541 specifies six IP QoS classes and the Y.1541 QOSM extensions include additional QSPEC parameters and control processing guidance. Restoration priority is included in this draft. This effort will be advanced as an Informational RFC in the IETF.

7.1.3 Priority Enabling Mechanisms

MPLS-based mechanisms under consideration for resource reservation and admission policies and restoration for IP network traffic are listed below. Additional work is required in order to ensure that a specific mechanism can recognize the priority signaled and provide appropriate action per priority requirements.

- *DiffServe-Aware MPLS Traffic Engineering (DS-TE)* Requirement: This IETF RFC [PRQC-2005-103--13] provides requirements for combining DiffServe queue behaviors at the packet level with MPLS-based bandwidth traffic engineering capabilities for LSP's. The objective is to provide guidance for the definition, selection, and specification of solutions that address these requirements. IP network traffic can be aggregated into eight "Class Types"; thus, simplifying scaling issues yet providing needed traffic engineering for greater network efficiencies.
- DS-TE/*Maximum Allocation with Reservation (MAR)*: This RFC track document [PRQC-2005-103--14] provides a functional specification for a MAR bandwidth constraint model in support of DS-TE. MAR performance is analyzed relative to the criteria for selecting a Bandwidth Constraint Model in support of DS-TE. MAR supports allocation of

bandwidth to individual Class Types, protects allocated bandwidth as needed, differentiates between traffic priority types (e.g., High, Normal, and Best Effort), and provides admission control based on priority types.

- Standardization of protection/restoration mechanisms: These documents [PRQC-2005-103--15], [PRQC-2005-103--16] have been finalized in the IETF Common Control and Measurement Plane (CCAMP) Working Group for RFC status. These mechanisms support fast restoration capabilities with priority and provide additional reliability in IP/MPLS/Generalized MPLS (GMPLS) networks.

Additional work on priority enabling mechanisms in other standards bodies is as follows:

- Illustration of DS-TE/MAR usage to support priority: This ATIS/PRQC contribution [PRQC-2005-103--17] illustrates the use of DS-TE/MAR as one way to allocate bandwidth for IP service class types with priority as a distinguishing parameter.
- IP Service Priority Overview: An ATIS approved overview [PRQC-2005-103--18] advocating the need for priority classification, signaling, and issues related to enabling mechanisms was presented to the ITU-T NGN Focus Group. This proposal was accepted for detailed study in specific ITU-T SGs in 2005.

7.2 Restorability

Section 7.1 lists recent advances on standards for priority-based IP services for various network functions. More specifically, significant progress has been made in advancing the concept of priority-based restorability in IP networks. Initial and generic efforts on this concept include: ATIS TR T1.TR.84 [PRQC-2005-138--1], which promotes the need for ETS priority services; ITU-T Recommendation Y.1291 [PRQC-2005-138--2], which provides high-level text for restoration priority classification; and ITU-T TRQ-QoS-SIG [PRQC-2005-138--3], which includes high-level signaling requirements for restoration priority in IP networks. Specific efforts on priority-based restoration for IP-based services with direct impact on critical services such as ETS include:

- *Restoration Priority Classification* – Development of priority classes for IP-based network restoration, with emergency services such as NS/EP included in the highest priority class.
- *Priority Signaling* – Recognition and signaling of IP service restoration priority classes.
- *Priority Mechanisms* – Examination of mechanisms that can enable priority-based restoration and rerouting of IP traffic.

7.2.1 Restoration Priority Classification

Priority classifications for the restoration and rerouting of IP-based services have been developed in the ATIS PRQC TR, *Service Restoration Priority Levels in IP Networks* [PRQC-2005-138--4] This report proposes up to three classes for service restoration with the requirement that

all NS/EP services and control message traffic should be included in the highest restoration class[7]. This requirement satisfies existing FCC procedures for automated service restoration. This report also recommends flexibility for SPs as long as the above requirement is met. The choice of traffic for the three classes, "High", Normal", and "Best Effort", is done via SLA agreements between SPs and their customers. Depending on the choice of available restoration mechanisms, a service provider may choose to offer a single restoration class that quickly (~200 ms) and efficiently re-routes all impacted IP traffic -- e.g., SONET ring restoration. Alternately, up to three restoration classes can be offered if the re-route mechanisms can recognize the signaled priority class and the mechanisms have the means to provide grades of restoration service -- e.g., 1+1 protection versus 1:N protection.

7.2.2 Restoration Priority Signaling

Work in the ATIS PTSC Signaling Architecture and Control sub-committee is as follows:

- *ETS Support in IP Environments*: This comprehensive TR. currently under development [PRQC-2005-138--5], provides discussions on mapping between priority classes (resource reservation/admission control and restoration) and signaling messages.
- *Vertical Interface between Application Layer and Layer 3/User Plane*: This work proposal [PRQC-2005-138--6] calls for ATIS Committees PTSC and PRQC to jointly develop necessary requirements for communicating priority and QoS parameter information -- e.g., restoration priority -- between applications entering an IP network and the Layer 3 processes that setup an LSP in an IP backbone. The goal is to use these requirements for the development of appropriate protocols that will carry out this critical function

In the IETF, progress has been made in the NSIS Working Groups as follows:

- *QoS NSLP "QSPEC" Template*: This IETF I-D [PRQC-2005-138--7] defines a signaling protocol to signal QoS reservations and is independent of specific QOSMs, such as DiffServe. All relevant information specific to a QOSM is encapsulated in a "QSPEC" object. This draft defines a template for this object with related formats and it includes QoS description and control information. A "Reservation Priority" parameter is defined in this object and RPH namespace attribute values are included. This effort is on an RFC standard track in the IETF.
- *Y.1541 QOSM for Networks Using Y.1541 QoS Classes*: This IETF I-D [PRQC-2005-138--8] defines a QoS NSLP QOSM based on the ITU-T Y.1541 [PRQC-2005-138--9] QoS signaling requirements. The Y.1541 QOSM extensions include additional QSPEC parameters and control processing guidance. Restoration priority is included in this draft. This effort will be advanced as an Informational RFC in the IETF.

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[7] Given that ETS traffic is not expected to be large in volume, it is suggested that other service types can be included in the highest restoration class along with ETS. This permits fast and efficient restoration that is best exemplified by today's SONET rings – 48 DS3's worth of traffic is restored in ~200 ms regardless of the type of transported traffic.

7.2.3 Restoration Priority Enabling Mechanisms

MPLS-based mechanisms under consideration in the IETF for restoration for IP network traffic are listed below.

- *MPLS-Based Fast Reroute*: This mechanism [PRQC-2005-138--10], [PRQC-2005-138--11] creates backup LSP tunnels that can protect primary LSP tunnels against link failures (Next Hop re-route) and node failures (Next Next Hop re-route).
- *Standardization of Generalized MPLS-Based protection/restoration mechanisms*: These documents, [PRQC-2005-138--12] and [PRQC-2005-138--13], have been finalized in the IETF CCAMP Working Group for RFC status. These mechanisms support fast restoration capabilities with priority and provide additional reliability in IP/MPLS/ GMPLS networks. They describe specialized protection mechanisms such as 1+1, 1x1, 1:N, etc, that can be invoked for fast re-routing of LSP tunnels.

Additional work needs to be done in order to enable restoration mechanisms to recognize the signaled priority of LSP tunnels and provide appropriate action. In addition, process coordination is required between the re-route mechanism and the mechanisms that move the traffic from the backup LSP tunnels to a new set of primary tunnels that are created once the network – with reduced capacity – has reached a steady state. It is important that the high traffic priority of ETS is recognized for this move.

In 2006, ATIS published PRQC's TR ATIS-0100006, *Service Restoration Priority Levels for IP Networks*. This Report recommends three restoration priority class levels for IP services. It also recommends that NS/EP services such as ETS be included in the highest restoration priority class.

Work is expected to be completed in 2006 or early 2007 for the following documents:

- ATIS PRQC-2006-149 TR "Priority for NSEP Services in NGN/IP Environment – Role of TSP"
- ITU-T SG13: Recommendation Y.RestPriority – Service Restoration Priority Levels in NGNs

7.3 Quality of Service

7.3.1 Y.1541 IP QoS Class Definitions and ETS

ITU-T Recommendation Y.1541 provides eight unique classes of IP-based network performance. Different service types can request a specific class of network performance, depending on specific service requirements. These network performance classes serve as a basis for agreements between end-users and SPs and between SPs. They support a wide range of traffic applications including point-to-point telephony, data transfer, and multimedia conferencing – applications whose performance needs are more demanding than others (future applications may require new or revised classification). The limited number of classes supports the requirement for feasible implementation, particularly with respect to scale in global networks.

According to this recommendation, "a packet flow is the traffic associated with a given connection or connectionless stream having the same source host, destination host, class of service, and session identification". The QoS class applies to this packet flow. Detailed parameter specifics and explanations for each class are described in Tables 1 and 2 in Recommendation Y.1541. Brief descriptions on each class are provided here:

- *Class 0*: Real-time, highly interactive applications, sensitive to jitter. Mean delay upper bound is 100 ms, delay variation is less than 50 ms, and loss ratio is less than 10-3. Application examples include VoIP and *Video Teleconference* (VTC).
- *Class 1*: Real-time, interactive applications, sensitive to jitter. Mean delay upper bound is 400 ms, delay variation is less than 50 ms, and loss ratio is less than 10-3. Application examples include VoIP and VTC.
- *Class 2*: Highly interactive transaction data. Mean delay upper bound is 100 ms, delay variation is unspecified, and loss ratio is less than 10-3. Application examples include signaling.
- *Class 3*: Interactive transaction data. Mean delay upper bound is 400 ms, delay variation is unspecified, and loss ratio is less than 10-3. Application examples include signaling.
- *Class 4*: Low Loss Only applications. Mean delay upper bound is 1s, delay variation is unspecified, and loss ratio is less than 10-3. Application examples include Short Transactions, Bulk Data, and Video Streaming
- *Class 5*: Unspecified applications with unspecified mean delay, delay variation, and loss ratio. Application examples include traditional applications of Default IP Networks

Revisions to Y.1541 are currently under way to support the performance requirements of high bit rate user applications -- e.g., IPTV -- that have more stringent loss/error requirements than those supported by Classes 0 through 4 in Table 1/Y.1541. Two new provisional classes are under consideration for this purpose.

Specific ETS services (including future video and data ETS transactions) can be mapped into the Y.1541 network performance classes as follows:

ETS Service	Y.1541 QoS Class
VoIP Call	Class 0, Class 1 if Class 0 is not possible
(Future) Video/IPTV Services	Class 0 or new provisional classes 6 or 7 as appropriate
(Future) Data Transactions (File Transfers, E-Mail) Services	Class 2, 3, or 4 as appropriate

NOTE 1 -- It is recognized that under severe emergency conditions with the likelihood of significant loss of network resources and bandwidth, it may not be possible to achieve the desired Y.1541 Class network performance for ETS services. Under such conditions, service completion is considered to be vital even under degraded network performance levels.

NOTE 2 -- It is important to recognize that the network performance requirements of user applications are independent from their emergency priority status (whether ETS or non-ETS). Thus, there are no Y.1541 classes dedicated to ETS, and emergency priorities must be communicated using other means.

7.4 Management

ITU-T Recommendation M.3350, approved May 2004, provides the basic functional requirements, framework, and use-cases for interchange of service management information across the TMN X-interface between a service customer and service provider, both officially authorized, associated with provision of ETS. This capability is called the *ETS Management Service* (ETSMS).

In the Telecom Management and Operations Committee (TMOC), ATIS-0300236-2005 "Signaling System 7 (SS7) - ISDN User Part Compatibility Testing (Revision of T1.236-2000)" was approved in November, 2005. This standard addresses the testing required for internetwork connections employing Common Channel Signaling (CCS) based on Signaling System No. 7 (SS7) protocol used in North America. The internetwork connection may be either within or between North American countries. This standard provides a list of test scripts for testing compatibility between the interconnecting networks of the ISDN User Part (ISUP) of the SS7 protocol used for call control and circuit supervision.

7.5 Reliability/Availability

In 2006, ATIS PRQC developed and approved the TR ATIS-0100004, "Availability and Restorability Aspects of Emergency Telecommunications Service (ETS)." This TR addresses aspects of the functional requirements of Availability and Restorability for ETS.

7.6 Secure Networks

In 2004, ATIS PRQC developed and approved the Standard ATIS-0100001.2004, "USER PLANE SECURITY GUIDELINES AND REQUIREMENTS FOR ETS." This Standard provides guidelines and requirements for security aspects of ETS communications relevant to the user plane.

7.7 Other areas

Although documentation is not presented, some progress has been also been made in the area of Network Evolution as the NGN is developed in multiple SDOs .

8 ARCHITECTURE OF EMERGENCY TELECOMMUNICATIONS

The PSTN has been developed, refined, and optimized for voice traffic and services over many years through the combination of circuit-switching, Time-Division Multiplexing (TDM) and

SS7. This voice infrastructure has matured into a ubiquitous architecture with high quality, reliability and security. NS/EP communications, such as GETS and the WPS, rely heavily on this infrastructure.

The data communications infrastructure, with the growth of computing and networking, has been significantly developed in recent years. This packet-switching infrastructure was primarily developed to carry data for corporations and private networks. In recent years, it has been extended to residences. Because of the growth and the popularity of the Internet, many SPs have started using packet-switching technology to carry voice traffic and service as well.

The voice and data infrastructures have evolved to become a common infrastructure to support a wide range of applications, including voice, data, video, and multimedia. This converged infrastructure will maintain the high reliability, QoS, and security offered in the PSTN. Existing NS/EP services -- e.g., TSP, GETS -- will need to function over this converged infrastructure and future emergency services -- e.g., ETS -- should take advantage of this infrastructure.

Because natural or man-made disasters could happen anywhere, emergency users need to have wide communication coverage in order to fulfill their missions. Emergency traffic needs to access, traverse, and egress different networks. Interworking and interoperability of many technologies are needed in order to support ETS traffic.

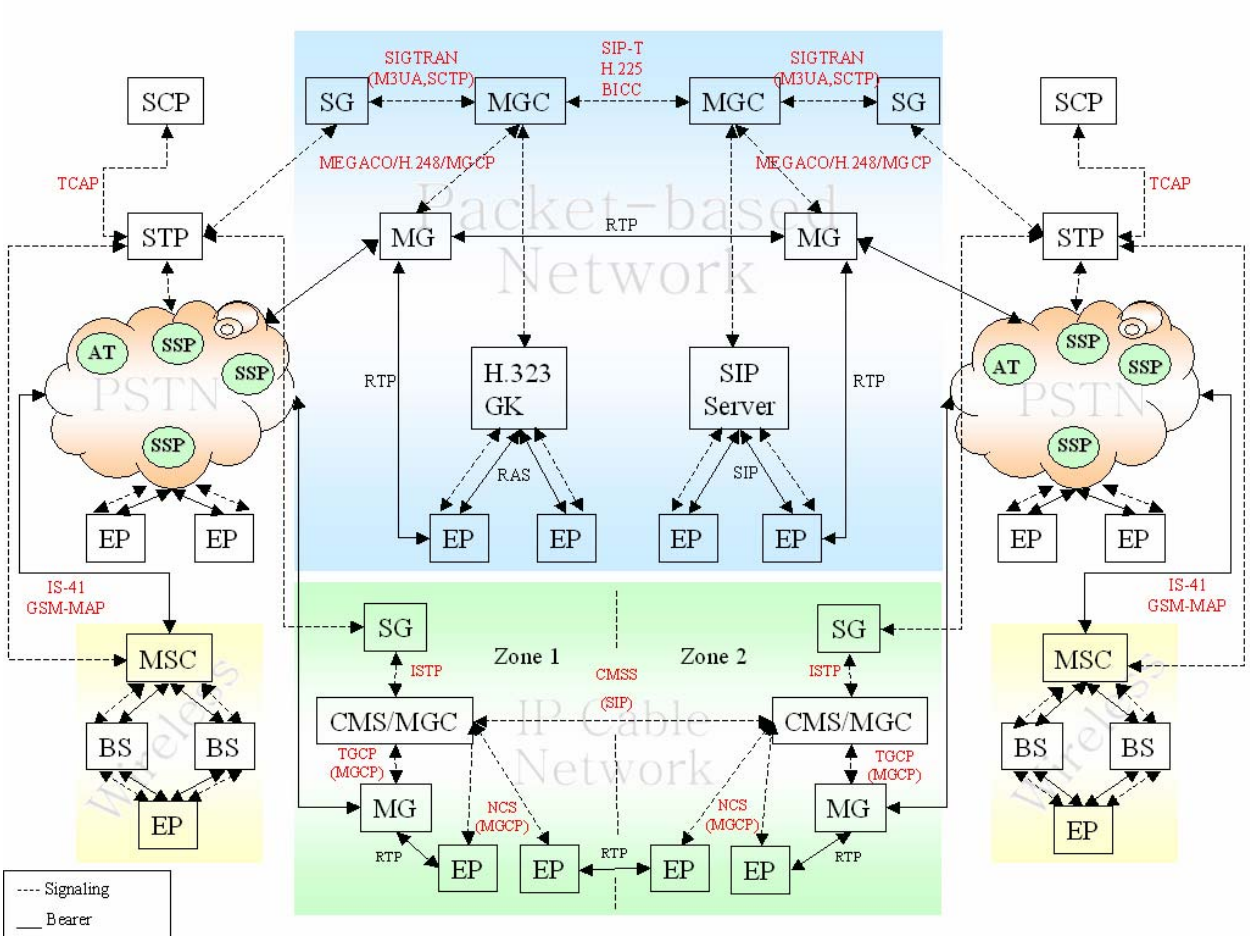

Figure 1 - Example Signaling and Transport Protocols in Evolving Networks that Support ETS

Figure 1 shows some signalling and transport protocols that need to support the interworking of these networks, which provide ETS functionality. ETS users need to communicate with one another via ETS applications and services -- e.g., web access, instant messaging, wireless access, unicast/multicast/broadcast of audio, video, and data, interactive video, remote database access, etc.

From the IMS-based NGN perspective, an ETS user could be on any access network (see Figure 2). Users on any type of access network may need to communicate with on another on any other type of access networks and/or the PSTN. These sessions may or may not need to traverse the IMS core. This new architecture is currently under development and will be standardized in ATIS PTSC.

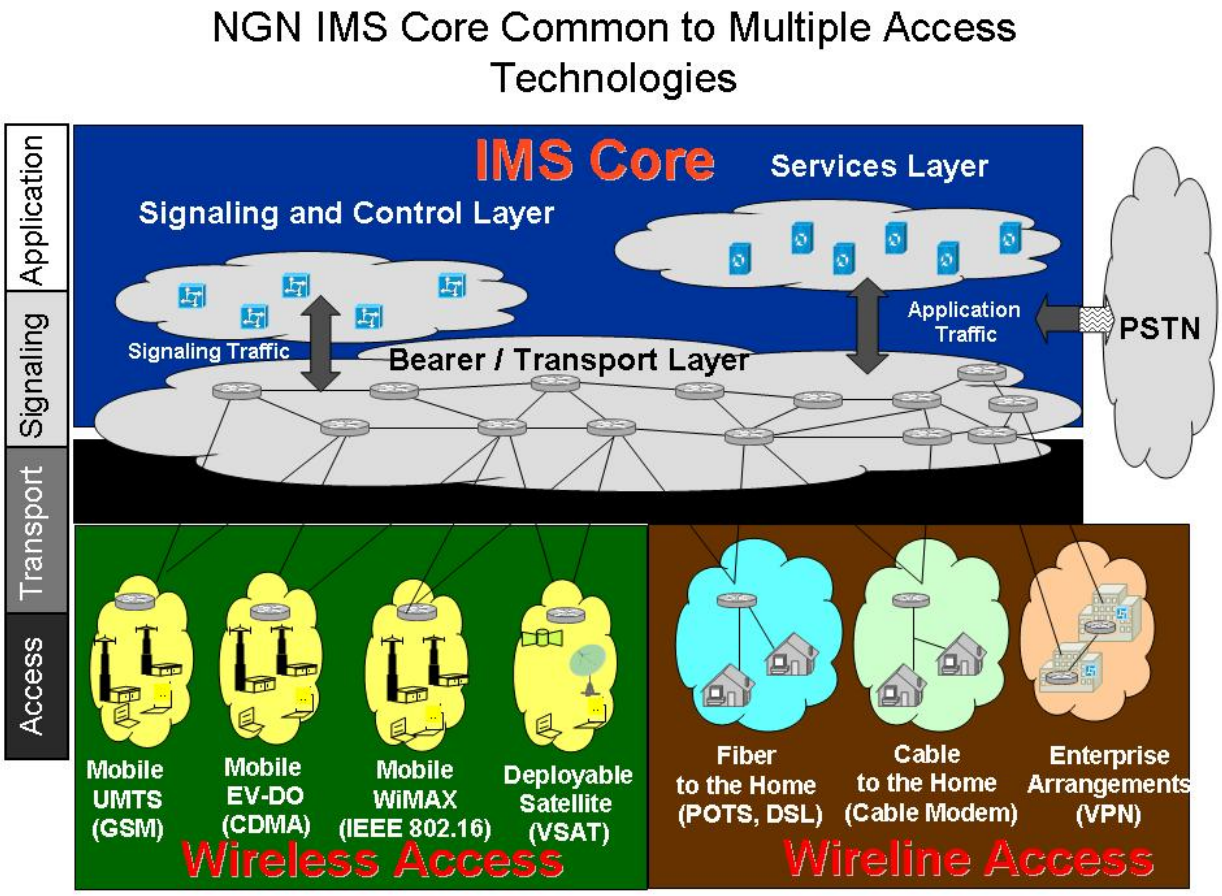

Figure 2 - IMS Architecture

9 STANDARDS BODIES INVOLVED WITH (OR CONSIDERING) ETS

This section discusses the Forums and Standards Bodies involved in the work on ETS.

9.1 ATIS Technical Committees

ATIS Technical Committees are the North American SDOs supporting standardization of ETS in the communications industry. ATIS Technical Committees are accredited as an American National Standards Committees by ANSI. ATIS has a number of Technical Committees that address many issues for the ETS. This section provides an overview of the areas of interest for each Technical Committee.

9.1.1 PRQC – Network Performance, Reliability, and Quality of Service Committee

PRQC develops and recommends standards, requirements, and TRs related to the performance, reliability, and associated security aspects of communications networks, as well as the processing of voice, audio, data, image, and video signals and their multimedia integration. PRQC also develops and recommends positions on, and foster consistency with, standards and related subjects under consideration in other North American and international standards bodies.

PRQC (or its predecessor T1A1) has produced or is working on the following ETS-related documents:

- Revision of T1.TR.79-2003, *Overview of Standards in Support of Emergency Telecommunications Service (ETS)*. (This document)
- ATIS-0100001.2004, *User Plane Security Guidelines And Requirements For ETS*.
- T1.TR.84-2004, *IP Network Traffic Priorities and ETS*.
- ATIS-0100006.2006, *Service Restoration Priority Levels for IP Networks*.
- ATIS Contribution PRQC-2005-108, "Priority & QoS Parameters for Communication from Applications to Layer 3 Setup Processes in IP Networks via Proposed Signaling Interface".
- ATIS-0100004, *Availability and Restorability Aspects of Emergency Telecommunications Service (ETS)*. This TR addresses aspects of the functional requirements of Availability and Restorability for ETS.

9.1.2 NIPP – Network Interface, Power, and Protection Committee

This committee develops and recommends standards and TRs related to power systems, electrical, and physical protection for the exchange and interexchange of carrier networks and interfaces associated with user access to telecommunications networks.

Standards most relevant to ETS include: T1.328-YYYY (Protection of Telecommunications Links from Physical Stress and Radiation Effects and Associated Requirements for DC Power Systems (A Baseline Standard), T1.331-YYYY (Above Baseline Protection), and a number of other standards in the electrical and protection family of ANSI standards.

9.1.3 TMOC – Telecom Management and Operations Committee

TMOC develops operations, administration, maintenance and provisioning standards, and other documentation related to *Operations Support System* (OSS) and *Network Element* (NE) functions and interfaces for communications networks - with an emphasis on standards development related to U.S.A. communication networks in coordination with the development of international standards.

With respect to ETS, TMOC is providing input to the ITU-T SG 4 Recommendations for an ETSMS (see Section 9.3.2). TMOC is also responsible for revisions and extensions to American National Standard T1.202, Guidelines for Network Management of the Public Switched

Networks Under Disaster Conditions. While T1.202 is not specifically an "ETS standard", it does rely on (and describe the use of) ETS, since ETS is one of several important capabilities that can be used to prepare for and manage Public Switched Networks under disaster conditions.

In November, 2005, TMOC approved ATIS-0300236-2005 "Signaling System 7 (SS7) - ISUP Compatibility Testing (Revision of T1.236-2000)." This standard addresses the testing required for internetwork connections employing CCS based on SS7 protocol used in North America. The internetwork connection may be either within or between North American countries. This standard provides a list of test scripts for testing compatibility between the interconnecting networks of the ISUP of the SS7 protocol used for call control and circuit supervision. [ATIS-0300236-2005]

9.1.4 WTSC – Wireless Technologies and Systems Committee

Develops and recommends standards and TRs related to wireless and/or mobile services and systems, including service descriptions and wireless technologies.

9.1.5 PTSC – Packet Technologies and Systems Committee

ATIS PTSC develops and recommends standards and TRs related to services, architectures, and signaling, in addition to related subjects under consideration in other North American and international standards bodies.

PTSC has completed a TR that recommends the use of a predetermined Local/Experimental DiffServ Code Point (DSCP) for ETS VoIP traffic particularly at NNI ("ETS Packet Priority for NNI Interfaces – Use of Existing DiffServ Per Hop Behaviors", ATIS PTSC Technical Report (pre-publication), PTSC-SAC-2006-231 R1, June 2006). The justification for this recommendation is based on current limitations of the *Expedited Forwarding* (EF) PHB in Diff-Serv and on the high admission control priority requirements for ETS in IP networks. PTSC (or its predecessor T1S1) has produced or is working on the following ETS-related documents:

- TRs
    - ATIS-1000005 (2005): Service Description of ETS
    - PTSC-SAC-2006-257R1, Draft Technical Report: Service Requirements for ETS in NGN
    - Draft Technical Report "ETS Packet Priority for IP NNI Interfaces – Use of Existing DiffServ Per Hop Behaviors"

- Standards
    - ATIS-1000006 (2005): Signaling System No.7 (SS7) – Emergency Telecommunications Service (ETS)
    - Letter Ballot S079: Support of Emergency Telecommunications Service (ETS) in IP Networks

- Draft Standard: Support of ETS in IP Networks Phase II

9.1.6 OPTXS – Optical Transport and Synchronization Committee

OPTXS is the lead ANSI Technical Committee (TC) on Optical Networking. As such, it maintains a view of optical network related work in other TCs. It also serves as the focal point for contributions to ITU-T Study Group (SG) 15 that originate in the United States. SG 15 is the lead ITU SG for optical networking and for access networks. The OPTXS work in Optical Heirarchal Interfaces (OHI), on Automatic Switched Optical Networks (ASON) Signaling Protocols, Ethernet transport in public optical networks, and flexible and reliable transport is directly relevant to ETS. ASON signaling protocols are the mechanism that will be used to obtain priority use of ASON services. With respect to Ethernet, work is underway to develop standards for carrying Ethernet frames over access and core networks, which will be a potential resource for supporting ETS objectives. Flexible transport standardization work includes The Link Capacity Adjustment Scheme (LCAS), which permits services to gracefully degrade as opposed to failing completely. For ETS, LCAS permits a degraded type of service--- a preferred option to a completely failed service.

9.2 TIA – Telecommunication Industry Association

TIA is a leading association in the telecommunications and information technology industry. Three (3) TIA technical standards groups, TR-8, TR-41, and TR-45, are addressing issues related to ETS.

9.2.1 TR-8 Mobile and Personal Private Radio Standards

TR-8 develops and maintains standards for private radiocommunications systems and equipment for both voice and data applications. Within the telecommunications industry, TR-8 addresses all technical matters for systems and services, including definitions, interoperability, compatibility and compliance requirements used in systems such as emergency services -- e.g., ambulances, fire fighting, etc.

9.2.2 TR-41 – User Premises Telecommunications Equipment Requirements

TR-41 deals with standardizing network interfaces from a terminal equipment perspective. TR-41's current standards development centers on two (2) types of interfaces: 1) interfaces to enterprise networks; and 2) interfaces to users. A current TR-41 industry standards project, IP Telephony Support for Emergency Calling Service (e.g., E911), is addressing requirements for an Enterprise IP Network to properly support emergency calling services. The identification of specific issues in TR-41 to address ETS using the resources of Enterprise Networks is still under development.

9.2.3 TR-45 – Mobile and Personal Communications Public 800 Standards

TR-45 deals with the issues associated with wireless communications. This activity interfaces with the international work on this subject in the ITU-T SSG on IMT-2000 and beyond, and in 3GPP2.

9.3 International Telecommunications Union, Telecommunication Standardization Sector (ITU-T)

Ten (10) ITU-T SGs have been identified that address various issues related to development of effective and comprehensive standards for the ETS. Each SG has a different, but specific, focus of work. The areas of interest in each SG are given below.

9.3.1 Study Group 2 – Operational Aspects of Service Provision, Networks and Performance

SG2 is the lead SG on service definition, numbering and routing, as well as Lead SG for Telecommunication for Disaster Relief/Early Warning. In October 2003, SG2 approved Recommendation E.106, *International Emergency Preference Scheme for Disaster Relief Operations*; it describes an international preference scheme for the use of public telecommunications by national authorities for emergency and disaster relief operations. Annex A of E.106 describes features and techniques to enhance call completion. SG2 is also developing two draft recommendations to define services that may utilize the E.106 preference scheme. One proposed draft recommendation is intended to describe the TDR service capability and addresses service and operational numbering aspects for providing telecommunications to and within a disaster area. The second draft recommendation is intended to describe the ETS service capability and provides an interworking framework for national implementation of ETS using the International Telephone Service to enable interworking between national implementations of ETS type services.

SG2 also has responsibility for the Telecommunications for Disaster Relief and Mitigation - Partnership Co-ordination Panel (PCP-TDR).[8]

9.3.2 Study Group 4 – Telecommunication Management

SG4 is the lead SG on Telecommunication Management. Specific area of responsibility includes the management of telecommunication services, networks, and equipment, including support for NGNs and the application and evolution of the *Telecommunication Management Network* (TMN) framework. SG4 is also responsible for other telecommunication management studies relating to designations, transport-related operations procedures, and test and measurement techniques and instrumentation. ETS relevant work includes responsibility for ITU-T Recommendation M.3350 on TMN service management requirements for information

[8] Additional information about PCP-TDR may be found at its web page:
< http://www.itu.int/ITU-T/special-projects/pcptdr/index.html >.

interchange across the TMN X-interface to support provisioning of ETS, and related management interface specifications needed to fulfill the requirements identified by M.3350.

9.3.3 Study Group 9 – Integrated Broadband Cable Networks and Television and Sound Transmission

Lead SG on integrated broadband cable and television networks

This SG is responsible for: Use of cable and hybrid networks, primarily designed for television and sound programme delivery to the home, as integrated broadband networks to also carry voice or other time critical services, video on demand, interactive services, etc. and Use of telecommunication systems for contribution, primary distribution and secondary distribution of television, sound programmes and similar data services.

ETS relevant work includes: Recommendation J.260, *Requirements for preferential telecommunications over IPCablecom networks*, and development of draft new Recommendation J.pref – Specifications for preferential telecommunications over IPCablecom networks and draft new Recommendation J.preffr, Framework for implementing preferential telecommunications in IPCablecom networks.

9.3.4 Study Group 11 – Signaling Requirements and Protocols

SG 11 is the lead SG on signaling and protocols. This SG is responsible for studies relating to signaling requirements and protocols for IP related functions, some mobility related functions, multimedia functions for networks including convergence toward NGN, and enhancements to existing Recommendations on access and internetwork signaling protocols of ATM, N-ISDN and PSTN.

- SG 11 has completed the following ETS-related documents: International Emergency Preference Scheme (IEPS) Phase 1 Specifications - Amendments to ISUP 2000 Recommendations (Q.761-764), Q.767, BICC CS2 Recommendations (Q.1902.1-Q.1902.4), and BISUP Recommendations (Q.2761-Q.2764) to satisfy the IEPS requirements specified in the 2000 version of ITU-T Recommendation E.106.
- IEPS Phase 2 Specifications - Amendments to ISUP 2000 Recommendations (Q.761-764), BICC CS2 Recommendations (Q.1902.1-Q.1902.4), ITU-T Recommendation Q.2931, ITU-T Recommendation Q.2630.3, and New Annex G to ITU-T Recommendation Q.1950 to satisfy the IEPS requirements specified in the 2003 version of ITU-T Recommendation E.106.
- ITU-T Series Q Supplement 53, "Signaling Requirements to Support the International Emergency Preference Scheme (IEPS)". This supplement identifies the signaling requirements to support preferential capabilities within networks that are used to support emergency response/recovery activities and disaster responders.

SG 11 has been working on the following ETS-related documents:

- Draft TRQ.ETS, "Supplement on Signaling Requirements in Support of ETS in IP Networks". This TRQ will identify the signaling requirements to support preferential capabilities within IP networks for ETS that is specified in ITU-T Recommendation E.107.
- Draft TRQ.TDR, "Supplement on Signaling Requirements in Support of TDR in IP Networks". This TR will identify the signaling requirements to support preferential capabilities within IP networks for Telecommunication for Disaster Relief (TDR).
- SG 11 is also involved in studying the NGN signaling impacts/protocol enhancements of the Resource and Admission Control architecture in support of ETS, taking into account various authentication/authorization scenarios and requirements. In addition, SG 11 will also be developing signaling/protocol specifications on QoS and Priority based on requirements defined in SG 13.

9.3.5 Study Group 12 – End-to-End Transmission Quality of Networks and Terminals

SG12, as Lead SG for QoS, contributes expertise for end-to-end transmission quality issues relating to ETS. SG12 will be consulted for specification of ranges of transmission quality recommended for Emergency Telecommunication Services. For example, SG12 can address the degradations caused by delay in transmission caused by ETS mechanisms for all user applications -- e.g., audio, video, data. Recommendations in force or in progress that provide guidance on performance issues of ETS are G.107 (E-Model), P.561 and P.562 (Voice Quality Monitoring), G.109 (Transmission Planning), and G.1010 (Multimedia QoS/Performance Requirements). Although SG12 has no direct activity to report in support of ETS, it will be consulted when ETS performance questions arise.

9.3.6 Study Group 13 – Multi-Protocol and IP-Based Networks and Their Internetworking

SG13 deals with a number of issues under the IP Project which are associated with the ETS. It has prepared and approved ITU-T Recommendation Y.1271 (10/2004), Framework(s) on Network Requirements and Capabilities to Support Emergency Communications Over Evolving Circuit Switched and Packet Switched Networks. This Recommendation incorporated the majority of the requirements and objectives identified in clause 6 of this report. The more general term "emergency communications" was used because SG13 does not deal with specific services. It can be considered that the ETS supports emergency communications.

In addition, SG 13 is the Lead SG for NGNs and satellite matters. Currently, work related to support of ETS and TDR in SG 13 is in the NGN related work.

This SG is responsible for the architecture, evolution and convergence of NGNs including frameworks and functional architectures, signaling requirements for NGN, NGN project management coordination across SGs and release planning, implementation scenarios and deployment models, network and service capabilities, interoperability, impact of IPv6, NGN mobility and network convergence and public data network aspects.

ETS relevant work includes:

- Recommendation Y.1271—Frameworks (s) on Network Requirements and Capabilities to Support Emergency Telecommunications Over Evolving Circuit Switched and Packet Switched Networks
- Development of new draft Recommendation Y.NGN-ET-Tech -- Next Generation Networks - Emergency Telecommunications – Technical Issues. This Recommendation will fulfill the emergency telecommunications requirements standardized in Y.1271 for an NGN environment.
- Draft ITU-T Recommendation Y.2701: Appendix A: Security Objectives and Requirements for Emergency Telecommunications Service (ETS).
- ITU-T Recommendation Y.2171: Admission Control Priority Levels in Next Generation Networks. Approved September, 2006.

9.3.7 Study Group 15 – Optical and Other Transport Networks

Lead SG on Access Network Transport and on Optical Technology

This SG is the ITU-T focal point for the development of standards on optical and other transport network infrastructures, systems, equipment, optical fibres, and the corresponding control plane technologies to enable the evolution toward intelligent transport networks. This encompasses the development of related standards for the customer premises, access, metropolitan and long haul sections of communication networks.

ETS relevant work includes:

ITU-T Draft Recommendation G.709 defines the fundamental structure of the optical transport hierarchy. As such, all standards-based optical networks must satisfy its requirements. Consequently, all proposals for directly marking OTN client signals for priority access, protection, or restoration must identify specific mechanisms defined in ITU-T Draft Recommendation G.709 that can be used to achieve their objectives.

ITU-T Draft Recommendation G.7041 defines a Generic Framing Procedure (GFP) to encapsulate variable length payload of various client signals for subsequent transport over SDH and OTN networks as defined in ITU-T Draft Recommendation G.707 and ITU-T Draft Recommendation G.709. The use of GFP encapsulation increases the flexibility of substituting client signals over a transport bearer channel. As such, GFP provides a mechanism whereby SCs may interchange compatible client signals without service provider involvement. Such a capability can support service customer specified priorities during periods of reduced service provider capacity.

ITU-T Draft Recommendation G.7042 provides a LCAS that is a means for rapid increases in bandwidth for service customer transport links. If such functionality should prove cost effective during emergency conditions, a priority mechanism can be proposed for LCAS.

ITU-T Draft Recommendation G.8080 specifies the ASON high-level architecture and the means by which ASON satisfies the ASTN requirements in ITU-T Draft Recommendation G.807. ITU-T Draft Recommendation G.8080 is the foundational Recommendation for all ASON

capabilities. It is a prerequisite for all work on specifying priority ASON calls and priority call restoration.

The discovery process is the mechanism that will be relied on in ASON to determine the state of the telecommunications network resources after network failures. This mechanism is especially important after the loss of significant network capacity in that it can enable service restoration to take place in these cases within minutes or hours as compared to days or weeks using conventional techniques.

ITU-T Draft Recommendation I.326 describes the functional architecture of ATM transport networks using the generic rules defined in Recommendation G.805. ATM is the leading candidate for layer 2 broadband switching functionality. To the degree that public SPs adopt ATM, it will be necessary to insure priority access to Switched Virtual Channels (SVCs) for NS/EP applications.

The transport of Ethernet frames over public transport networks is an area of high interest to telecommunications SPs. Currently, work is underway to develop standards for carrying Ethernet frames over access and core networks. Additionally, SPs have a strong interest in the potential of public access, OSI Layer 2 networks and services based on IEEE Ethernet standards. Such public Ethernet-based networks are a potential resource for supporting ETS objectives.

The routing requirements and architecture in ITU-T Draft Recommendation G.7715 will be used to identify specific routing protocol suites to be used within ASON. As candidate protocols are proposed that meet the ITU-T Draft Recommendation G.7715 requirements, contributions describing how these protocols may support priority ETS services will be developed.

The protection and restoration protocols now under development by SG 15 may provide a mechanism to support priority restoration services. Many proposed Recommendations are in their development stages. When fully developed, these Recommendations will play a role for ETS to use priority restoration services.

9.3.8 Study Group 16 – Multimedia Services, Systems and Terminals

SG 16 is responsible for studies relating to multimedia service capabilities, and application capabilities (including those supported for NGN). This encompasses multimedia terminals, systems (e.g., network signal processing equipment, multipoint conference units, gateways, gatekeepers, modems, and facsimile), protocols and signal processing (media coding). SG 16 has also been designated the Lead SG for multimedia terminals, systems and applications, and ubiquitous applications ("e-everything," such as e-health and e-business). Of particular interest to ETS work, SG 16 has the following Recommendations:

- ITU-T Rec. H.460.4, "Call Priority Designation for H.323 Calls"
  - Specifies call priority designation for H.323 calls. The use of the call priority designation provides a mechanism to indicate the desire for or approved call establishment priority for an H.323 call. It is necessary to signal the call priority during registration, admission, location, and call setup signaling in order for the

Gatekeepers, Gateways, and other NEss to take appropriate action to attempt to assure the successful establishment of priority calls over normal traffic during times of degraded operation due to damaged resources or heavy loads.

- ITU-T Rec. H.460.14, "Support for Multi-Level Precedence and Preemption (MLPP) within H.323 Systems"
- ITU-T Recommendation H.246 Annex C, "ISDN User Part Function – H.225.0 Interworking
  - Describes the interworking between ISUP (ISUPs of Signalling System No. 7) and H.225.0 Multimedia Call Control protocol. It specifies the necessary mapping an Interworking Function would utilize to achieve connectivity and functionality between an H.323 network and an ISUP network.
- ITU-T Recommendation H.248.1 v3 – Gateway Control Protocol
  - The addition of MGC Overload control and support for E.106.

ITU-T Recommendation H.361, "End-to-End Quality of Service (QoS) and Service Priority Signaling in H.323 Systems", defines the H.323 QoS and Service Priority signaling for exchanging, negotiating and controlling QoS and service priority parameters among the H.323 entities in a call. The scope of H.361 is limited to extending H.225.0 and H.245 signaling messages to support end-to-end QoS. Detailed description of the service priority will be provided in an Annex of H.361. This annex will provide details on signaling of service priority information, procedures to be adopted in allocating and reserving transport resources, call processing procedures to support service priority, and procedures to support special cases. In support of International Emergency Preference Scheme (IEPS) requirements described in the revised E.106 and protocol enhancements specified in ITU-T SG 11 (IEPS Phase 2), SG 16 has initiated new work focusing on enhancements to the H.323-series of specifications. The work plan includes:

- Enhancements to Recommendation H.246 in support of mapping user priority level between H.225 and ISUP;
- Enhancements to Recommendation H.460.4 to signal the country/international network of call origination, equivalent to the ISUP amendments for IEPS Phase 2;
- Enhancements to Recommendation H.246 in support of mapping country/international network of call origination between H.225 and ISUP;
- Enhancements to Recommendation H.245 in support of a priority indication in the bearer network, equivalent to the SG 11 DSS2 and AAL2 amendments for IEPS Phase 2;
- Mapping/interoperation between H.323 call control and bearer control protocols -- i.e., H.225 and H.245 -- via H.248 in support of a priority call/session; and
- Specification of procedures on how to use the IEPS indicator and priority levels specified in the H.248 protocol within the context of the H.225 and H.245.

SG 16 is also working to complete its goal of a broad, general, flexible and extensible multimedia architecture being defined under the H.325 project "NGN Multimedia". The work on the H.325 project is still in its formative stages. This architecture will include all functions

and features in the existing H.300 series including SIP, and to permit interoperability with these multimedia systems. It will be capable of being extended to include all anticipated new functions and to be sufficiently flexible to permit the inclusion of unanticipated new requirements. It is expected that the H.325 project will start by addressing simple point-to-point audio and video calls, a basic streaming mode, and a basic broadcast mode. The H.325 project will need to be enhanced in support of ETS.

9.3.9 Study Group 17 – Data Networks and Telecommunication Software

SG 17 has been designated the Lead SG for Communication Systems Security (CSS). Its core activities are to define and maintain overall security frameworks, conduct project management, assign and prioritize studies to be done by SGs, and develop CSS Recommendations. One of the security issues is to study and evaluate the vulnerabilities of systems and networks in which ETS services are to be provided, and develop solutions Recommendations.

9.3.10 Study Group 19 Mobile Telecommunication Networks

Lead SG on mobile telecommunications networks, including international mobile telecommunications, wireless internet, convergence of mobile and fixed networks, mobility management, mobile multimedia functions, internetworking, interoperability, and enhancements to existing ITU-T Recommendations developing the NGN. SG19 introduced ETS WPS mobility requirements into the emerging NGN.

9.4 Internet Engineering Task Force (IETF)

The IETF is an international organization that develops standards and specifications applicable to the Internet. They primarily deal with very specific issues and do not concern themselves with systems, service, or architectural aspects. Many ETS-related contributions have been submitted in the form of Internet-Drafts (IDs) and some of these have become RFCs. The following IETF Working Groups have addressed ETS in a significant way.

9.4.1 IEPREP

The IEPREP working group provides a focus for ETS work in the IETF. Their main deliverables include Best Common Practices RFCs and Informational RFCs on topics such as IETF Recommendations for the ETS and Requirements for Internet Emergency Preparedness (IEPREP) in the Internet.

Completed RFCs include:

- Requirements for Resource Priority Mechanisms for the SIP (RFC 3487)
- IEPREP Telephony Topology Terminology (RFC 3523)
- IP Telephony Requirements for Emergency Telecommunication Service (RFC 3690)

- General Requirements for Emergency Telecommunication Service (RFC 3689)
- Framework for Supporting ETS in IP Telephony (RFC 4190)
- ETS Requirements for a Single Administrative Domain

In the IETF, considerations for treatment and security of emergency communications stretch across a number of Areas and Working Groups. These include the various telephony signaling working groups, Diff-Serv, Protocol for carrying Authentication for Network Access (PANA), and various operational groups and the IEPREP working group must cooperate closely with these groups and with groups outside of the IETF such as various ITU-T SGs. The group is currently undergoing a re-charter which may extend the scope of the group.

9.4.2 NSIS

The Next Steps in Signaling (NSIS) Working Group is responsible for standardizing an IP signaling protocol with QoS signaling as one of the first signaling layer application protocols to run on the NSIS transport layer protocol. The intention is to re-use where appropriate, the protocol mechanisms of RSVP, while at the same time simplifying it and applying a more general signaling model. Work on the requirements [PRQC-2005-174R1-1], the framework [PRQC-2005-174R1-2], and analysis [PRQC-2005-174R1-2] of existing protocols has been completed and is being used as input for the protocol development.

The goal of NSIS is to develop a transport layer signaling protocol for the transport of upper application layer signaling protocols. In order to support a toolbox or building block approach, the two-layer model will be used to separate the transport of the signaling from the application signaling. This allows for a more general signaling protocol to be developed to support signaling for different services or resources, such as NAT & firewall traversal, and QoS resources. The initial NSIS application will be an optimized QoS signaling protocol to be followed by a middle box traversal protocol. Finally, security concerns will also be addressed via study and analysis of threats and security requirements for signaling.

Three IDs dealing with priority and QoS aspects related to ETS services are currently being progressed. Brief descriptions on these drafts are as follows:

- QoS NSLP QSPEC Template [PRQC-2005-174R1-3]: The QoS-NSLP protocol is intended to signal QoS reservations (http://ietf.org/internet-drafts/draft-ietf-nsis-qos-nslp-10.txt) [PRQC-2005-174R1-4] and is independent of specific QOSM such as Integrated Services (IntServ). Rather, all information specific to a QOSM is encapsulated in a separate object, the QSPEC. The QSPEC Template draft (http://ietf.org/internet-drafts/draft-ietf-nsis-qspec-09.txt) defines a template for the QSPEC, which contains both the QoS description and QSPEC control information. The QSPEC format is defined, as are a number of QSPEC parameters. These parameters provide a common language to be re-used in several QOSMs to ensure interoperability. Specific parameters pertinent to ETS services included in this template are:
    - Reservation Priority

- Defending Priority (which has the potential to support systems like the WPS and its ability to "displace" reservations under certain circumstances)
- SIP Resource Priority Header
- DiffServ Code Points
- DS-TE Class Type

- Y.1541 QoS Model for Networks Using Y.1541 QoS Classes [PRQC-2005-174R1-5]: This draft describes a QOSM for the NSIS NSLP signaling layer protocol application based on the ITU-T Recommendation Y.1541 [PRQC-2005-174R1-6] QoS signaling requirements. Y.1541 specifies eight [PRQC-2005-174R1-7] (recently updated from six) standard network performance classes, and the Y.1541-QOSM extensions include additional QSPEC parameters and QOSM control processing guidelines. The extensions are based on standardization work in the ITU-T on QoS signaling requirements [PRQC-2005-174R1-8], [PRQC-2005-174R1-9]. Specific parameters pertinent to ETS services included in this template are:
  - Y.1541 QoS Classes/Signaling Requirements
  - Restoration Priority

- User Application-to-User Plane Vertical Interface [PRQC-2005-174R1-10] (ftp://ftp.rfc-editor.org/in-notes/internet-drafts/draft-ietf-nsis-y1541-qosm-02.txt): This draft describes the need for a mechanism to map QoS requirements from the user application layer down to the user plane to create an NSIS session. This 'vertical signaling interface' between the user application layer and user plane is needed to communicate QoS requirements, such as flow priority values, to user plane NEs. This document proposes that an adaptation of the NSIS QoS NSLP could be an appropriate way to develop a *Vertical Interface Protocol* (VIP). The progression of a high-priority, ETS VoIP call is used as an illustrative example to demonstrate the need for developing a vertical signaling interface between the user application layer and user plane.

9.4.3 SIP and SIPPING

The SIPPING working group works closely with the SIP working group and the former often serves as a filter for the latter.

As noted above in 7.1.2, RFC-4412 specifies an optional header for SIP that can store various priority schemes, including one specifically for ETS. The RFC is titled the "Communications Resource Priority for the Session Initiation Protocol" [PRQC-2005-103 --9] [RFC-4412].

9.4.4 TSVWG

The Transport Services Working Group (TSVWG) takes on work that is involved in the Transport Area, but is not large enough for its own working group. A recent individual contribution RSVP Extensions for Emergency Services specifies an extension to RSVP that is

targeted at conveying prioritization of a reservation. Unlike RFC-3181, which allows pre-emption for prioritized reservations, this new contribution only focuses on priority.

9.5 European Telecommunications Standards Institute (ETSI)

ETSI has opened some of their areas of work as international activities. One area is Project TISPAN (Telecommunications and Internet converged Services and Protocols for Advanced Networking) to deal with interworking issues during the period of convergence when the PSTN transitions to an IP-based packet infrastructure. The other area is Project 3GPP, dealing with development of the future wireless standards.

9.6 3GPP (3rd Generation Partnership Project)

The Project 3GPP work is a very intensive and extensive activity to develop a new family of standards for the next-generation wireless capabilities. Priority Access work (Second Generation {2G} circuit-switched voice) is underway in 3GPP. ETS work addressing 3G packet-based multimedia underway.

In 3GPP, a Feasibility Study for Multimedia Priority Services (MPS) has been completed (3GPP TR 22.953). This Feasibility Study identifies the High-level requirements for MPS and indicates the gaps in existing 3GPP specifications to support MPS.

In addition, Stage 1 specification work for MPS has begun in 3GPP. The scope of the requirements document is to specify the requirements for MPS for IMS-based Networks. The focus of this MPS effort is on session based services using IMS, incorporating packet data and IP transport.

9.7 3GPP2 (3rd Generation Partnership Project 2)

The Third Generation Partnership Project 2 (3GPP2) is a collaborative 3G telecommunications standards-setting project comprising North American and Asian interests developing global specifications for ANSI/TIA/EIA-41 "Cellular Radiotelecommunication Intersystem Operations network evolution to 3G, and global specifications for the Radio Transmission Technologies (RTTs) supported by ANSI/TIA/EIA-41.

3GPP2 was born out of the ITU's IMT-2000 initiative, covering high speed, broadband, and IP-based mobile systems featuring network-to-network interconnection, feature/service transparency, global roaming and seamless services independent of location. IMT-2000 is intended to bring high-quality mobile multimedia telecommunications to a worldwide mass market by achieving the goals of increasing the speed and ease of wireless communications, responding to the problems faced by the increased demand to pass data via telecommunications, and providing "anytime, anywhere" services.

In 3GPP2, an initial Stage 1 Requirements Standard has already been accepted by the organization. The scope of the requirements document is to define the requirements for MPS for Multimedia Domain (MMD)-based Networks (where MMD is the 3GPP2 version of IMS). The

focus of this MPS effort will be on session based services using MMD incorporating packet data and IP transport. The stage 2 work is now beginning.

9.8 TeleManagement Forum (TMForum)

The TMForum addresses implementation and interoperability issues of the OSSs for management operations of the telecommunications infrastructure. One Forum activity of significant interest to the ETS work is the development of an industry handbook for SLAs. This handbook provides a mechanism to clearly address QoS issues and certain responsibilities of both SPs and SCs with respect to "delivered services" and customer requirements in the new emerging telecommunications business environment. Edition 1 of the Handbook was published in early 2001. Edition 2 is under development with provisions for the ETS as an "extension" of normal services to preclude any potential need for expensive service provider retrofitting. The services can then be obtained for supporting emergency recovery operations through the execution of specific SLAs for the ETS.

The final version of the SLA QoS Management Handbook (GB-917) was published by the TM Forum in 2004. Work on Application Notes to supplement the Handbook commenced after this publication.

In 2005, the TM Forum published a VoIP Application note (GB-934) as the first supplement to the Handbook. Work started on development of a Video over IP Application Note in 2005. This Video Note will be published in early 2007. Work on an Application Note specific to GETS is scheduled to commence in 2007.

9.9 IEEE

IEEE's 802.16 is working on ETS related standards. The IEEE 802.16 Working Group on Broadband Wireless Access develops standards and recommended practices to support the development and deployment of broadband Wireless Metropolitan Area Networks. Mobile WiMAX based on the IEEE 802.16e would enable WiMAX systems to address portability and mobility aspects of broadband wireless users.

Annex A

A Partial Mapping of ETS Functional Requirements

The following diagram depicts a partial mapping of the functional requirements to ATIS and TIA. The diagram then indicates the international SDOs that ATIS and TIA address on ETS-related subjects.

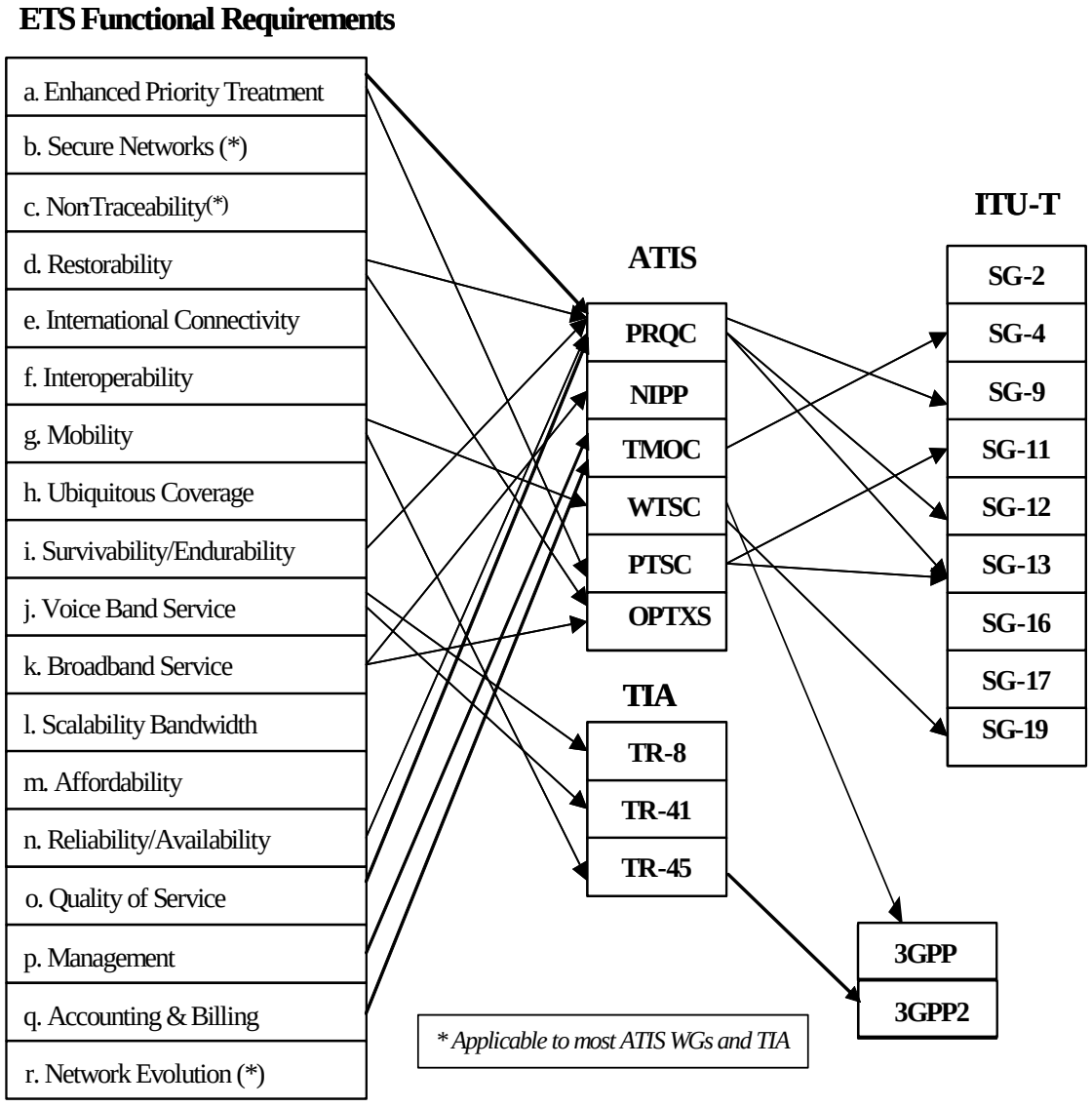

Figure A.1 - Partial Mapping of ETS Functional Requirements to ATIS and TIA and from Them to the International Standards Organizations and Forums They Address