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SERIES Q: SWITCHING AND SIGNALLING

Signalling protocol mappings in support of the Emergency Telecommunications Service in IP networks

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Supplement 63 to ITU-T Q-series Recommendations

Signalling protocol mappings in support of the Emergency Telecommunications Service in IP networks

Summary

This supplement provides guidance for mapping-required signalling protocol attributes to support the proper set-up and admission of ETS for various protocols. The set of protocols include ISDN user part (ISUP), session initiation protocol (SIP), ITU-T H.248, ITU-T H.225 and Diameter.

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Admission control priority, Diameter, ETS, ITU-T H.225, ITU-T H.248, ISUP, SIP.

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1 Introduction

Service providers are increasingly embracing end-to-end, IP-based networks with various technologies such as wireless access, metro Ethernet backhaul, and multi-protocol label switching (MPLS) core. In such an environment, a likely scenario for setting up a critical emergency telecommunications service (ETS) calls/sessions may involve an ETS call requesting set-up in a wireless access domain with core MPLS transport and final termination over another wireless egress domain. The domain sequence could involve one or more service providers in the end-to-end path. ETS is defined in [ITU-T E.107] and involves authority-to-authority communication.

Setting up the ETS call/session requires careful implementation of the necessary signalling protocols that convey the required information signifying the critical nature of the ETS. [ITU-T Q-Sup.57] identifies the signalling requirements to support preferential capabilities within IP networks for the ETS, which involves authority-to-authority communication. Protocols can be classified as follows:

- Horizontal: A protocol that conveys required information on incoming flows, end-to-end across all domains in the path of the flow for call/session set-up. An example is the session initiation protocol (SIP) [IETF RFC 4412].
- Vertical: A protocol that translates required information from the domain application layer (which may have possibly been received from a horizontal protocol) to the underlying transport layer. An example is the Diameter protocol [IETF RFC 3588].

[ITU-T Q-Sup.61] provides guidance on admission control priority specifications for incoming calls/sessions seeking entry into next generation networks. It provides intra-protocol mappings for admission control priority levels for a variety of services including ETS.

This supplement provides guidance for mapping-required signalling protocol attributes to support the proper set-up and admission of ETS for "horizontal" and "vertical" protocols. The set of protocols includes ISUP, SIP, ITU-T H.248 [ITU-T H.248.1], ITU-T H.225 [ITU-T H.225.0] and Diameter [IETF RFC 3588].

NOTE – National, regional or local emergency and public safety services where an individual from the general public is seeking assistance (i.e., individual-to-authority communication) are outside the scope of this supplement.

2 References

2.1 ITU-T references

[ITU-T E.107] Recommendation ITU-T E.107 (2007), *Emergency Telecommunications Service (ETS) and interconnection framework for national implementations of ETS.*

[ITU-T H.225.0] Recommendation ITU-T H.225.0 v7 (2009), *Call signalling protocols and media stream packetization for packet-based multimedia communication systems*.

[ITU-T H.248.1] Recommendation ITU-T H.248.1 (2013), *Gateway control protocol: Version 3.*

[ITU-T H.248.81] Recommendation ITU-T H.248.81 (2011), *Gateway control protocol: Guidelines on the use of the international emergency preference scheme (IEPS) call indicator and priority indicator in H.248 profiles*.

[ITU-T H.460.4] Recommendation ITU-T H.460.4 (2007), *Call priority designation and country/international network of call origination identification for H.323 Priority calls*.

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2.3 ETSI TISPAN references

[ETSI TS 183.017] ETSI TS 183.017 V2.3.1 (2008), *Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control: DIAMETER protocol for session based policy set-up information exchange between the Application Function (AF) and the Service Policy Decision Function (SPDF); Protocol specification*.
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2.4 3GPP references

[3GPP TS 29.212] 3GPP TS 29.212 (2012), *Universal Mobile Telecommunications System (UMTS);Policy and Charging Control (PCC) over Gx/Sd reference point (Release 11)*.
<http://www.etsi.org/deliver/etsi_ts/129200_129299/129212/11.06.00_60/ts_129212v110600p.pdf>

[3GPP TS 29.214] 3GPP TS 29.214 (2013), *Policy and charging control over Rx reference point (Release 11)*.
<http://www.3gpp.org/ftp/Specs/html-info/29214.htm>

[3GPP TS 29.229] 3GPP TS 29.229 (2013), *Cx and Dx interfaces based on the Diameter protocol; Protocol details.* <http://www.3gpp.org/DynaReport/29229.htm>

[3GPP TS 29.238] 3GPP TS 29.238 (2013), *Interconnection Border Control Functions (IBCF) – Transition Gateway (TrGW) interface, Ix interface; Stage 3 (Release 11).* <http://www.3gpp.org/ftp/Specs/html-info/29238.htm>

[3GPP TS 29.329] 3GPP TS 29.329 (2013), *Sh interface based on the Diameter protocol; Protocol details.* <http://www.3gpp.org/DynaReport/29329.htm>

[3GPP TS 29.334] 3GPP TS 29.334 (2013), *IMS Application Level Gateway (IMS-ALG) – IMS Access Gateway (IMS-AGW); Iq Interface; Stage 3 (Release 11).* <http://www.3gpp.org/ftp/Specs/html-info/29334.htm>

3 Definitions

3.1 Terms defined elsewhere

This supplement uses the following term defined elsewhere:

3.1.1 Emergency Telecommunications Service (ETS) [ITU-T E.107]: A national service providing priority telecommunications to ETS authorized users in times of disaster and emergencies.

3.2 Terms defined in this supplement

None.

4 Abbreviations and acronyms

This supplement uses the following abbreviations and acronyms:

AAA Authentication, Authorization and Accounting

ARP Allocation Retention Priority

AVP Attribute Value Pairs

ETS Emergency Telecommunications Service

IEPS International Emergency Preference Scheme

IMS IP Multimedia Subsystem

IP Internet Protocol

ISUP ISDN User Part

MPLS Multi-Protocol Label Switching

MPS Multimedia Priority Service

NGN Next Generation Network

NNI Network-to-Network Interface

PCC Policy and Charging Control

PSTN Public Switched Telephone Network

RPH Resource Priority Header

SIP Session Initiation Protocol

UE User Equipment

WPS Wireless Priority Service

5 Conventions

This supplement uses the term "ETS" according to [ITU-T E.107]. When the term "ETS" is used in this supplement, it also means other authority-to-authority priority services that may be using terminology other than ETS (e.g., IEPS, MPS, etc.).

6 Protocols in support of ETS

This clause provides descriptions of protocols to support ETS call/session set-up.

6.1 SIP

SIP is a control protocol for creating, modifying and terminating IP-based sessions with two or more participants. [IETF RFC 4412] adds two header fields to SIP, namely the resource-priority and the accept-resource-priority fields, and specifies the procedures for their usage. [IETF RFC 4412] specifies two namespaces, ETS and WPS, in support of ETS. According to [IETF RFC 4412], both the ETS and WPS namespaces can support five priority levels (0 to 4 with 0 being the highest) that convey levels of importance in the signalling and control layer. For an ETS call/session, priority processing in the signalling and control plane is triggered by the presence of the RPH with the ETS namespace, and possibly the WPS namespace, in the SIP signalling messages. The SIP resource priority header (RPH) namespaces and associated generic procedures are used to support different priority services in the IP and IP multimedia subsystem (IMS) domains.

For an ETS call/session routed from a PSTN, the coding of the RPH namespaces in SIP is based on the coding of the received ISUP request.

6.2 ITU-T H.248

The gateway control protocol [ITU-T H.248.1] decomposes the gateway function into functional subcomponents and specifies the protocols these components use to communicate. The gateway control protocol is used to provide signalling control between the controller and gateway functions.

To enable priority handling, the following ITU-T H.248 parameters [ITU-T H.248.1] are used with ETS for priority treatment:

- International emergency preference scheme (IEPS) call indicator
- Priority indicator.

For ETS, the IEPS call indicator, identifying an ETS call/session, indicates to the gateway that the context is an ETS context and enables prioritization of the ITU-T H.248 control signalling once received. In addition, this indicator enables prioritized resource allocation in the gateway for an ETS context. The priority indicator, carrying the priority level, provides the gateway with a means to distinguish different priority handling of resources on the gateway for ETS. The priority indicator supports 16 priority levels. The IEPS call indicator and priority indicator satisfy the ETS requirements of indicating an ETS context and carrying the priority level, respectively.

[ITU-T H.248.81] provides guidelines on the use of the IEPS call indicator and priority indicator in ITU-T H.248 profiles for ITU-T H.323 and NGN systems in support of priority services (e.g., ETS).

In 3GPP, the IEPS call indicator is not used. Instead, the priority indicator ([3GPP TS 29.238], [3GPP TS 29.334]) satisfies the ETS requirements of indicating an ETS context and carrying the priority level. Priority values 11-15 of the priority indicator are reserved for ETS, e.g., Note 3 in clause 5.5 of [3GPP TS 29.334].

6.3 Diameter

The Diameter protocol [IETF RFC 3588] supports authentication, authorization and accounting (AAA) for network functions and applications such as network access and IP mobility.

The following Diameter attribute value pairs (AVPs) are intended to be used in support of ETS:

- MPS-Identifier
- Reservation-Priority
- Priority-Level (as part of the allocation retention priority (ARP) AVP)
- Session-Priority.

The MPS-Identifier AVP is defined by 3GPP in [3GPP TS 29.214]. The MPS-Identifier is used to mark an ETS call/session over the Rx interface. The MPS-Identifier AVP contains the national variant for the priority service name.

The Reservation-Priority AVP is defined in [ETSI TS 183.017]. [ITU-T Q.3301.1 v3] specifies the use of the Reservation-Priority AVP over the resource and admission control function (RACF) Rs interface [ITU-T Y.2111] in support of priority services. Similarly, [3GPP TS 29.214] specifies the Reservation-Priority AVP over the policy and charging control (PCC) Rx interface in support of priority services. The Reservation-Priority AVP supports 16 priority levels that can carry the user priority level and can be used to request priority treatment. Values between 0 and 15 are in increasing order of priority with "15" being the highest and "0" the lowest. The Reservation-Priority AVP includes the priority value of the user.

The Priority-Level AVP (as part of the allocation retention priority (ARP) AVP) is defined by 3GPP in [3GPP TS 29.212]. [ITU-T Q.3303.3 v3] specifies the use of the Priority-Level AVP over the resource and admission control function (RACF) Rw interface [ITU-T Y.2111] in support of priority services. Similarly, [3GPP TS 29.212] specifies the Priority-Level AVP (as part of the ARP AVP) over the PCC Gx interface in support of priority services (e.g., ETS). The Priority-Level AVP supports 15 priority levels that can carry the user priority level and can be used to request priority treatment. Values between 1 and 14 are in decreasing order of priority with "1" being the highest and "15" the lowest. Priority values 1 to 8 are assigned for services that are authorized to receive prioritized treatment, e.g., ETS. Priority value "0" is spare and treated as a logical error if received. The Priority-Level AVP reflects the priority value of the user.

The Session-Priority AVP is defined in [3GPP TS 29.229] (Cx and Dx interfaces based on the Diameter protocol; protocol details) [ITU-T Q.1741.6]. [3GPP TS 29.229] specifies the use of the Session-Priority AVP over the Cx and Dx interfaces in support of priority services. Similarly, [3GPP TS 29.329] (Sh interface based on the Diameter protocol; protocol details) [ITU-T Q.1741.6] specifies the use of the Session-Priority AVP over the Sh interface in support of priority services. The Session-Priority AVP supports five priority levels that can be used to request priority treatment over the Cx, Dx and Sh interfaces. Values between 0 and 4 are defined to be in decreasing order of priority with "0" being the highest and "4" the lowest.

6.4 ISUP

For an ETS call/session routed to a PSTN, the following ISUP [ITU-T Q.763] parameters are used with ETS for priority treatment:

- calling party's category parameter
- IEPS call information parameter.

For ETS, the calling party's category parameter carries the priority indication. The priority level subfield in the IEPS call-information parameter supports five priority levels that can carry the user priority level. Values between 0 and 4 are defined to be in decreasing order of priority with "0" being the highest and "4" the lowest.

For an ETS call/session routed to a PSTN, the coding of the calling party's category parameter and IEPS call information parameter are based on the coding of the received SIP or ITU-T H.225 request.

6.5 ITU-T H.225

[ITU-T H.460.4] specifies the call priority designation and country/international network of call origination identification for ITU-T H.323 priority calls. The ITU-T H.225 call priority designation parameter [ITU-T H.460.4] supports both the priority call indicator and five priority levels.

For an ETS call/session routed from a PSTN, the coding of the call priority designation parameter is based on the coding of the received ISUP request.

7 End-to-end ETS call/Session flow

This clause provides an example of high level end-to-end ETS call/session flow that is applicable to NGNs.

Figure 1 illustrates a high level end-to-end ETS call/session flow. The following key steps are illustrated:

1. **Network attachment**: This is the normal procedure for the device attachment to the access network.
2. **Device registration**: This is the normal procedure for a device to register for services with the service provider.
3. **ETS call/session set-up request**: This is a request from user equipment (UE) to invoke an ETS call/session set-up:
   a. Policy control procedures may be invoked.
   b. The ETS call/session request is initially routed with ETS indication (and possibly with default priority) for ETS authentication/authorization.
4. **ETS user/subscription authentication and authorization**: This step involves authentication of the ETS user or user subscription, and verifies authorization for ETS.
5. **ETS call/session set-up**: Upon ETS authorization (either based on subscription or PIN) and if the calling party is authorized, the ETS call/session request is progressed with the user priority level towards the destination UE.
   a. Policy control procedures are invoked.
   b. Based on policy, the priority information may be passed, removed or modified.
   c. Processing of the ETS call/session, including the associated signalling and media, is provided priority treatment over a non-ETS call/session based on the presence of the priority information with ETS.
   d. An ETS call/session may transverse from an IP network to a circuit-switched network.
6. **ETS set-up completion across the NNI**: This step involves ETS call/session set-up completion across an NNI. Priority is honoured across the NNI based on security policy. A secure mechanism that validates the identity of the far-end-sending network is required in order to support priority handling of packets on an NNI. Based on policy, the priority information may be passed, removed or modified across the NNI.

7. **ETS call/session set-up**: The ETS call/session request is progressed towards the destination UE.

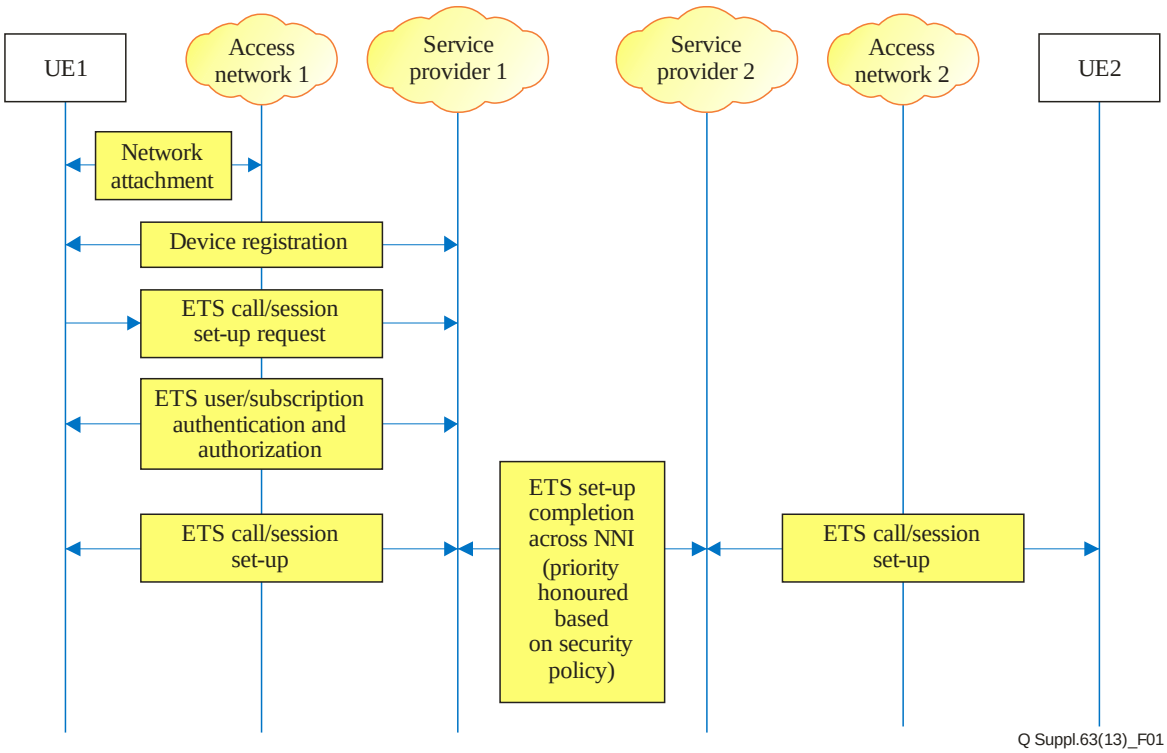

Figure 1 – High level end-to-end ETS call/session flow

The above flows involve various "horizontal" and "vertical" signalling protocols (e.g., SIP, Diameter, ITU-T H.248, etc.) attributes (priority information) and their interworking to support the proper set-up and admission of an ETS call/session. Guidance on the mapping of the priority information between various signalling protocols in support of ETS is provided in clause 8.

8 Protocol mappings to support ETS

This clause provides guidance for mapping-required signalling protocol attributes (priority information) to support the proper set-up and admission of ETS for "horizontal" and "vertical" protocols. The set of protocols includes ISUP, SIP, ITU-T H.248, ITU-T H.225 and Diameter. Priority information for an ETS call/session consists of a priority indicator and a priority level, which are special markings in the call/session establishment request to provide priority treatment.

8.1 ISUP and SIP

8.1.1 Priority indicator

The SIP RPH ETS namespace [IETF RFC 4412] maps to the "IEPS call marking for preferential call set-up" code in the ISUP calling party's category parameter [ITU-T Q.763] to carry the priority indication for an ETS call/session.

8.1.2 Priority level

The mapping between the priority-level value in the WPS namespace carried in the SIP RPH [IETF RFC 4412] and the priority-level value carried in the "priority level subfield" in the ISUP IEPS call information parameter [ITU-T Q.763] in support of ETS is shown in Table 1.

Table 1 – Mapping of priority level

SIP RPH (priority value in WPS namespace) Value	ISUP IEPS call information (priority level subfield) Value
0 (highest)	0 (highest)
1	1
2	2
3	3
4 (lowest)	4 (lowest)

8.2 SIP and Diameter

8.2.1 Priority indicator

The SIP RPH ETS namespace [IETF RFC 4412] maps to the 3GPP Diameter MPS-identifier AVP [3GPP TS 29.214] to carry the priority indication for an ETS call/session.

8.2.2 Priority level

The suggested mapping between the priority-level value in the WPS namespace carried in the SIP RPH [IETF RFC 4412] and the priority-level value carried in the Diameter Reservation-Priority AVP [ETSI TS 183.017] in support of ETS is shown in Table 2.

Table 2 – Mapping of priority level

SIP RPH (priority value in WPS namespace) Value	Diameter Reservation-Priority AVP Value
0 (highest)	15 (highest)
1	14
2	13
3	12
4 (lowest)	11
NOTE 1 – Values 0-10 of the Diameter Reservation-Priority AVP may not be used for ETS. NOTE 2 – If the priority-level value in the WPS namespace carried in the SIP RPH is not available, a default value between 11 and 15 may be included in the Diameter Reservation-Priority AVP.	

8.3 SIP and ITU-T H.225

8.3.1 Priority indicator

The SIP RPH ETS namespace [IETF RFC 4412] maps to the "emergencyAuthorized" priorityValue in the ITU-T H.225.0 call priority designation parameter [ITU-T H.460.4] to carry the priority indication for an ETS call/session.

8.3.2 Priority level

The mapping between the priority-level value in the WPS namespace carried in the SIP RPH [IETF RFC 4412] and the priority-level value carried in the "priorityExtension" in the ITU-T H.225.0 call priority designation parameter [ITU-T H.460.4] in support of ETS is shown in Table 3.

Table 3 – Mapping of priority level

SIP RPH (priority value in WPS namespace) Value	**ITU-T H.225.0 call priority designation (priorityExtension) Value**
0 (highest)	0 (highest)
1	1
2	2
3	3
4 (lowest)	4 (lowest)

8.4 SIP and ITU-T H.248

8.4.1 Priority indicator

The SIP RPH ETS namespace [IETF RFC 4412] maps to the ITU-T H.248.1 IEPS call indicator [ITU-T H.248.1] to carry the priority indication for an ETS call/session.

In 3GPP, this mapping does not exist. However, the SIP RPH ETS namespace implicitly maps to the priority indicator to carry the priority indication for an ETS call/session.

8.4.2 Priority level

The suggested mapping between the priority-level value in the WPS namespace carried in the SIP RPH [IETF RFC 4412] and the priority-level value carried in the ITU-T H.248.1 priority indicator [ITU-T H.248.1] in support of ETS is shown in Table 4.

In 3GPP, priority values 11-15 of the priority indicator are reserved for ETS, and the priority-level value in the WPS namespace carried in the SIP RPH maps to one of the dedicated priority-level values carried in the priority indicator ([3GPP TS 29.238], [3GPP TS 29.334]).

Table 4 – Mapping of priority level

SIP RPH (priority value in WPS namespace) Value	ITU-T H.248.1 priority indicator Value
0 (highest)	15 (highest)
1	14
2	13
3	12
4 (lowest)	11
NOTE 1 – Values 0-10 of the ITU-T H.248.1 priority indicator are not used for ETS. NOTE 2 – If the priority-level value in the WPS namespace carried in the SIP RPH is not available, a default value between 11 and 15 may be included in the ITU-T H.248.1 priority indicator.	

8.5 ISUP and ITU-T H.248

8.5.1 Priority indicator

The "IEPS call marking for preferential call set-up" code in the ISUP calling party's category parameter [ITU-T Q.763] maps to the ITU-T H.248.1 IEPS call indicator [ITU-T H.248.1] to carry the priority indication for an ETS call/session.

In 3GPP, this mapping does not exist. However, the ISUP calling party's category parameter implicitly maps to the priority indicator to carry the priority indication for an ETS call/session.

8.5.2 Priority level

The suggested mapping between the priority-level value carried in the "priority level subfield" in the ISUP IEPS call information parameter [ITU-T Q.763] and the priority-level value carried in the ITU-T H.248.1 priority indicator [ITU-T H.248.1] in support of ETS is shown in Table 5.

In 3GPP, priority values 11-15 of the priority indicator are reserved for ETS, and the priority-level value carried in the "priority level subfield" in the ISUP IEPS call information parameter maps to one of the dedicated priority-level values carried in the priority indicator ([3GPP TS 29.238], [3GPP TS 29.334]).

Table 5 – Mapping of priority level

ISUP IEPS call information (priority level subfield) Value	ITU-T H.248.1 priority indicator Value
0 (highest)	15 (highest)
1	14
2	13
3	12
4 (lowest)	11
NOTE 1 – Values 0-10 of the ITU-T H.248.1 priority indicator are not used for ETS. NOTE 2 – If the priority-level value carried in the "priority level subfield" in the ISUP IEPS call information parameter is not available, a default value between 11 and 15 may be included in the ITU-T H.248.1 priority indicator.	

8.6 ITU-T H.225 and ITU-T H.248

8.6.1 Priority indicator

The "emergencyAuthorized" priorityValue in the ITU-T H.225.0 call priority designation parameter [ITU-T H.460.4] maps to the ITU-T H.248.1 IEPS call indicator [ITU-T H.248.1] to carry the priority indication for an ETS call/session.

8.6.2 Priority level

The suggested mapping between the priority-level value carried in the "priorityExtension" in the ITU-T H.225.0 call priority designation parameter [ITU-T H.460.4] and the priority-level value carried in the ITU-T H.248.1 priority indicator [ITU-T H.248.1] in support of ETS is shown in Table 6.

Table 6 – Mapping of priority level

ITU-T H.225.0 call priority designation (priorityExtension) Value	ITU-T H.248.1 priority indicator Value
0 (highest)	15 (highest)
1	14
2	13
3	12
4 (lowest)	11
NOTE 1 – Values 0-10 of the ITU-T H.248.1 priority indicator are not used for ETS. NOTE 2 – If the priority-level value carried in the "priorityExtension" in the ITU-T H.225.0 call priority designation parameter is not available, a default value between 11 and 15 may be included in the ITU-T H.248.1 priority indicator.	

8.7 ITU-T H.225 and ISUP

8.7.1 Priority indicator

The "emergencyAuthorized" priorityValue in the ITU-T H.225.0 call priority designation parameter [ITU-T H.460.4] maps the "IEPS call marking for preferential call set-up" code in the ISUP calling party's category parameter [ITU-T Q.763] to carry the priority indication for an ETS call/session.

8.7.2 Priority level

The mapping between the priority-level value carried in the "priorityExtension" in the ITU-T H.225.0 call priority designation parameter [ITU-T H.460.4] and the priority-level value carried in the "priority level subfield" in the ISUP IEPS call information parameter [ITU-T Q.763] in support of ETS is shown in Table 7.

Table 7 – Mapping of priority level

ITU-T H.225.0 call priority designation (priorityExtension) Value	**ISUP IEPS call information (priority level subfield) Value**
0 (highest)	0 (highest)
1	1
2	2
3	3
4 (lowest)	4 (lowest)

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