SERIES Q: SWITCHING AND SIGNALLING

Evaluation of signalling protocols to support ITU-T Y.2171 admission control priority levels

ITU-T Q-series Recommendations – Supplement 61

ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

Supplement 61 to ITU-T Q-series Recommendations

Evaluation of signalling protocols to support ITU-T Y.2171 admission control priority levels

Summary

Supplement 61 to ITU-T Q-series Recommendations provides guidance on how existing signalling protocol extensions can be used to designate the admission control priority classifications for incoming calls/sessions into next generation networks. Specifically, this supplement defines the relationship between the designated values of these protocol extensions and the admission control priority levels/categories defined in Recommendation ITU-T Y.2171.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Q Suppl. 61	2010-04-30	11

Keywords

Admission control priority, diameter, signalling extensions, SIP, ITU-T H.248, ITU-T Y.2171.

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Introduction

The development of admission control priority levels was driven by potential emergency conditions under which critical emergency supporting telecommunication services need priority treatment for admission into networks that may have depleted resources as a result of the emergency. This led to the development of [ITU-T Y.2171] which proposed three broad admission control priority levels/categories as follows:

Priority Level 1: Traffic with this priority level/category receives the highest assurance for admission to the network. This level/category is reserved for emergency telecommunications over NGN.

Priority Level 2: Traffic with this priority level/category will not receive the same assurance for admission as that given to priority level 1 traffic, but it will receive higher assurance for admission than that given to priority level 3 traffic. Examples include real-time services, such as Voice over IP (VoIP) and video, as well as virtual private networks (VPN) and data services. The selection of this priority level/category is expected to be determined by appropriate service level agreements (SLA) between network operators and customers for the desired service.

Priority Level 3: Traffic with this priority level/category receives the least assurance for admission to the network. Examples include "traditional" Internet service provider (ISP) services (e-mail, web surfing). The selection of this priority level/category is expected to be determined by appropriate SLA agreements between network operators and customers for the desired service.

These priority levels/categories are needed at the transport layer in each individual domain over which a call/session traverses such that appropriate resources can be reserved for enabling call/session setup and completion. For example, in an MPLS traffic engineering (MPLS-TE) core backbone network, the call/session admission control priority level could be mapped into an appropriate signalling protocol extension or attribute value, which in turn can be utilized to assign the desired DiffServ Code Point (DSCP) in the MPLS-TE core. DSCP values drive proper packet markings and can be used to direct calls/sessions into appropriate TE-tunnels.

[ITU-T Y.2171] formalized the high-level requirement for such levels/categories. The intent was to drive development of necessary protocol extensions that can assign specific admission control priority levels/categories to individual services, depending on the criticality of these services. Thus, for example, the emergency telecommunications service (ETS) requires the highest available admission control priority and signalling protocol extensions supporting all priority levels assigned for ETS would therefore be classified as ITU-T Y.2171 priority level 1. So as protocol extensions supporting admission control priority get developed in various standards bodies, their adequacy to support the three ITU-T Y.2171 priority levels/categories is critical.

Supplement 61 to ITU-T Q-series Recommendations

Evaluation of signalling protocols to support ITU-T Y.2171 admission control priority levels

1   Scope

The scope of this supplement is stated as follows:

•   Examine existing horizontal and vertical protocol extensions that can support the signalling of admission control priority in next generation networks (NGN). Specifically, if such extensions exist, then the number of allowed priority levels needs to be defined such that all three ITU-T Y.2171 admission control priority levels/categories can be supported.

•   Emphasize critical priority requirements for ETS – note that ITU-T Y.2171 priority level 1 is exclusively reserved for emergency telecommunications applications.

•   Provide guidance in terms of suggested mappings between existing priority supporting protocol extensions and ITU-T Y.2171 priority levels/categories.

•   If existing extensions are found to be insufficient in supporting all ITU-T Y.2171 priority levels/categories, then further actions can be recommended appropriately.

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.248.1]   Recommendation ITU-T H.248.1 (2005), *Gateway control protocol: Version 3*.

[ITU-T H.323]   Recommendation ITU-T H.323 (2009), *Packet-based multimedia communications systems*.

[ITU-T Q.1741.6]   Recommendation ITU-T Q.1741.6 (2009), *IMT-2000 references to Release 8 of GSM-evolved UMTS core network*.

[ITU-T Q.3301.1]   Recommendation ITU-T Q.3301.1 (2007), *Resource control protocol No. 1 – Protocol at the Rs interface between service control entities and the policy decision physical entity*.

[ITU-T Q.3303.3]   Recommendation ITU-T Q.3303.3 (2008), *Resource control protocol No. 3 – Protocols at the Rw interface between a policy decision physical entity (PD-PE) and a policy enforcement physical entity (PE-PE): Diameter*.

[ITU-T Y.2111]   Recommendation ITU-T Y.2111 (2008), *Resource and admission control functions in next generation networks*.

[ITU-T Y.2171]   Recommendation ITU-T Y.2171 (2006), *Admission control priority levels in Next Generation Networks*.

2.2 ETSI references

[ETSI TS 129 212]   ETSI TS 129 212 V9.3.0 (2010), *Universal Mobile Telecommunications System (UMTS); LTE; Policy and charging control over Gx reference point (3GPP TS 29.212 version 9.3.0 Release 9).*

[ETSI TS 129 214]   ETSI TS 129 214 V9.3.0 (2010), *Universal Mobile Telecommunications System (UMTS); LTE; Policy and charging control over Rx reference point (3GPP TS 29.214 version 9.3.0 Release 9).*

[ETSI TS 129 229]   ETSI TS 129 229 V9.2.0 (2010), *Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Cx and Dx interfaces based on the Diameter protocol.*

[ETSI TS 129 329]   ETSI TS 129 329 V9.1.0 (2010), *Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Sh interface based on the Diameter protocol.*

[ETSI TS 183 017]   ETSI TS 183 017 V3.2.1 (2010), *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.*

2.3 IETF references

[IETF RFC 3588]   IETF RFC 3588 (2003), *Diameter Base Protocol.*

[IETF RFC 4412]   IETF RFC 4412 (2006), *Communications Resource Priority for the Session Initiation Protocol (SIP).*

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 the ETS authorized users in times of disaster and emergencies.

3.2 Terms defined in this supplement

This supplement does not define any new terms.

4 Abbreviations and acronyms

This supplement uses the following abbreviations and acronyms:

3GPP   3rd Generation Partnership Project

AAA   Authentication, Authorization and Accounting

ARP   Allocation Retention Priority

AVP   Attribute Value Pair

DSCP   DiffServ Code Point

ETS   Emergency Telecommunications Service

IMS   IP Multimedia Subsystem

IP	Internet Protocol
ISP	Internet Service Provider
MPLS	Multi-Protocol Label Switching
MPLS-TE	MPLS Traffic Engineering
NGN	Next Generation Network
PCC	Policy and Charging Control
QoS	Quality of Service
RACF	Resource and Admission Control Function
RPH	Resource Priority Header
SIP	Session Initiation Protocol
SLA	Service Level Agreement
VoIP	Voice over IP
VPN	Virtual Private Network

5 Conventions

There are no conventions specific to this supplement.

6 Protocols to support ITU-T Y.2171 priority levels/categories

This clause provides descriptions of existing protocols to support admission control priority levels/categories defined in [ITU-T Y.2171].

6.1 Session initiation protocol

The session initiation protocol (SIP) resource priority header (RPH) [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 the emergency telecommunications service (ETS). According to [IETF RFC 4412], both "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. The SIP RPH namespaces and associated generic procedures are used to support different priority services in the Internet protocol (IP) and NGN/IP multimedia subsystem (IMS) domain. For example, the presence of a RPH with an "ETS" namespace in the SIP INVITE message is sufficient to indicate that the bearer plane flow is represented by [ITU-T Y.2171] priority level 1.

In the context of [ITU-T Y.2171], the lack of a RPH in a SIP message can be interpreted as a non-ETS call/session with [ITU-T Y.2171] priority level 2 or priority level 3. Thus by itself, the use of SIP RPH does not completely specify all [ITU-T Y.2171] priority levels/categories. It may be possible to combine a SIP message for a non-ETS call/session (no RPH present) with other mechanisms as a way to differentiate between "Best Effort" [ITU-T Y.2171] priority level 3 services and [ITU-T Y.2171] priority level 2 services – this topic is for further study.

6.2 ITU-T H.248

The gateway control protocol [ITU-T H.248.1] decomposes the [ITU-T H.323] 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 the gateway functions. The priority indicator specifies 16 priority levels that can be used to request priority handling in the gateway for the corresponding media connection.

The priority levels in the priority indicator can be mapped into the [ITU-T Y.2171] priority levels/categories. An illustrative example is as follows:

• Priority indicator levels 15-11 could be reserved for [ITU-T Y.2171] priority level 1.

• Priority indicator levels 10-1 could be reserved for [ITU-T Y.2171] priority level 2.

• Priority indicator level 0 could be reserved for [ITU-T Y.2171] priority level 3.

The precise nature of the mappings is for further study.

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 Reservation-Priority attribute value pair (AVP) is defined by the European Telecommunications Standards Institute (ETSI) in [ETSI TS 183 017]. [ITU-T Q.3301.1] and [ITU-T Q.3303.3] specify the use of the Reservation-Priority AVP over the resource and admission control function (RACF) Rs and Rw interfaces [ITU-T Y.2111], respectively, in support of priority services. Similarly, 3GPP TS 29.214 (policy and charging control over Rx reference point) 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 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 priority levels in the Reservation-Priority AVP can be mapped into [ITU-T Y.2171] priority levels/categories. An illustrative example is as follows:

• Reservation-Priority AVP levels 15-11 could be reserved for [ITU-T Y.2171] priority level 1.

• Reservation-Priority AVP levels 10-1 could be reserved for [ITU-T Y.2171] priority level 2.

• Reservation-Priority AVP level 0 could be reserved for [ITU-T Y.2171] priority level 3.

The precise definition of the mappings is for further study.

The Priority-Level AVP (as part of the allocation retention priority (ARP) AVP) is defined by 3GPP in [ETSI TS 129 212] (Policy and charging control over Gx reference point). It specifies the Priority-Level AVP over the policy and charging control (PCC) Gx interface in support of priority services. The Priority-Level AVP supports 15 priority levels that can be used to request priority treatment. Values between 1 and 14 are in decreasing order of priority with "1" being the highest and "14" the lowest. Priority value "0" is spare and treated as a logical error if received. Priority value "15" is treated as no priority.

The priority levels in the Priority-Level AVP can be mapped into the [ITU-T Y.2171] priority levels/categories. An illustrative example is as follows:

• Priority-Level AVP levels 1-7 could be reserved for [ITU-T Y.2171] priority level 1.

• Priority-Level AVP levels 8-13 could be reserved for [ITU-T Y.2171] priority level 2.

• Priority-Level AVP level 14 could be reserved for [ITU-T Y.2171] priority level 3.

The precise definition of the mappings is for further study.

The Session-Priority AVP is defined in [ETSI TS 129 229] (Cx and Dx interfaces based on the Diameter protocol; protocol details). [ETSI TS 129 229] specifies the use of the Session-Priority AVP over the Cx and Dx interfaces in support of priority services. Similarly, [ETSI TS 129 329] (Sh interface based on the Diameter protocol; protocol details) 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. Values between 0 and 4 are defined to be in decreasing order of priority with "0" being the highest and "4" the lowest.

The priority levels in the Session-Priority AVP can be mapped into the [ITU-T Y.2171 priority levels/categories. For example, the Session-Priority AVP levels 0-4 could be reserved for [ITU-T Y.2171] priority level 1, allowing for the lack of the Session-Priority AVP in a Diameter message over the Cx, Dx, Dh, or Sh interface to be interpreted as indicating that a call/session is associated with [ITU-T Y.2171] priority level 2 or level 3. By itself, the use of Session-Priority AVP does not completely indicate all [ITU-T Y.2171] priority levels/categories.

7 Conclusion

Three signalling protocols are presented in clause 6 demonstrating their ability to recognize admission control priority levels/categories for incoming calls/sessions into NGN – SIP, [ITU-T H.248], and Diameter protocols. Additional text describes possible ways to map the specific protocol values into the three admission control priority levels/categories specified in [ITU-T Y.2171].

In order to summarize the discussions in clause 6, it is important to note the following:

- All three protocols define more than three priority values. Thus, multiple protocol values can populate any given [ITU-T Y.2171] priority level/category.

- The SIP RPH header allows for five priority values reserved for ETS. All other protocol values for admission control define at least five priority levels reserved to support a variety of ETS services (e.g., VoIP, video, etc.) and hence, [ITU-T Y.2171] priority level 1 can have at least five protocol values for any given protocol.

- The Diameter protocol supports the following AVPs for admission control priority levels:
  – Reservation-Priority AVP defined for the PCC Rx interface and the RACF Rs and Rw reference points;
  – Priority-Level AVP defined for the PCC Gx interface;
  – Session-Priority AVP defined for the IMS Cx, Dx, Dh, and Sh interfaces.

The illustrative mappings described in clause 6 are shown in Table 1.

Table 1 – Illustrative mappings of signalling protocol extension values into [ITU-T Y.2171] levels/categories

[ITU-T Y.2171] priority level/category	SIP header values	[ITU-T H.248.1] values	Diameter AVP values
Level 1	RPH = 0, 1, 2, 3, 4	Indicator levels 15-11	Reservation-Priority AVP levels 15-11 Priority-Level AVP levels 1-7 Session-Priority AVP levels 0-4
Level 2	No RPH present	Indicator levels 10-1	Reservation-Priority AVP levels 10-1 Priority-Level AVP levels 8-13 No Session-Priority AVP present
Level 3	No RPH present	Indicator level 0	Reservation-Priority AVP level 0 Priority-Level AVP level 14 No Session-Priority AVP present

Two "gaps" are identified as follows:

1) SIP RPH – In the context of [ITU-T Y.2171], the absence of a SIP RPH indicates that the incoming service is either a [ITU-T Y.2171] priority level/category 2 service or a [ITU-T Y.2171] priority level/category 3 (best effort) service.

2) Session-Priority AVP – This AVP only conveys ETS priorities over the IMS Cx, Dx, Dh, and Sh interfaces.

It may be possible to combine the SIP message for non-ETS services with other indicators to further differentiate between [ITU-T Y.2171] priority level/category 2 services and [ITU-T Y.2171] priority level/category 3 services. Detailed examination of possible mechanisms to do that is for further study. Regarding the Session-Priority AVP, it should be noted that this AVP has been defined only for ETS. For non-ETS services, possible use of other Diameter AVPs over the Cx, Dx, Dh and Sh interfaces could be examined for [ITU-T Y.2171] priority level/category 2 services and [ITU-T Y.2171] priority level/category 3 services.

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