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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

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

Amendment 2: DiffServ signalling approach

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Recommendation ITU-T H.248.81

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

Amendment 2

DiffServ signalling approach

Summary

Recommendation ITU-T H.248.81 provides guidelines on the use of the international emergency preference scheme (IEPS) call indicator and priority indicator in ITU-T H.248 profiles for ITU-T H.323 and NGN systems. These guidelines may be used by other standards development organizations (SDOs) when defining their profiles in support of priority services, e.g., the emergency telecommunications service (ETS) and the multimedia priority service (MPS).

Amendment 1 to Recommendation ITU-T H.248.81 (2011/05) introduces additions and corrections to the Recommendation and adds Appendix II, "Use of ECN in the context of ETS traffic".

Amendment 2 to Recommendation ITU-T H.248.81 (2011/05) includes additions to the Recommendation in support of marking priority calls using the DiffServ signalling package as defined in Recommendation ITU-T H.248.52.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.248.81	2011-05-14	16	11.1002/1000/11292
1.1	ITU-T H.248.81 (2011) Amd. 1	2013-03-16	16	11.1002/1000/11862
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* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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1 Scope

[ITU-T H.248.1] defines the international emergency preference scheme (IEPS) call indicator and priority indicator in support of priority services, e.g., the emergency telecommunications service (ETS) and the multimedia priority service (MPS). Use of the IEPS call indicator and priority indicator, as defined in [ITU-T H.248.1], satisfies the ETS requirements of indicating an ETS context and carrying the priority level.

Any prioritization of ITU-T H.248 procedures in the media gateway controller (MGC) and the transport of ITU-T H.248 control signalling towards the media gateway (MG) is based on the identification of ETS.

The IEPS call indicator, identifying an ETS call/session, indicates to the MG that the context is an ETS context and enables prioritization of ITU-T H.248 control signalling once received. In addition, it enables prioritized resource allocation in the MG for an ETS context.

The priority indicator, carrying the priority level, provides the MG with a means to distinguish different priority handling of resources on the MG when ETS is used.

This Recommendation 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. These guidelines may be used by other standards development organizations (SDOs) when defining their ITU-T H.248.1 profiles in support of priority services (e.g., ETS and the MPS). Further details on how these guidelines are used by other networks are outside the scope of this Recommendation. It is up to other SDOs to decide their use when defining their profiles.

ETS and IEPS are defined in [ITU-T E.107] and [ITU-T E.106], respectively. ETS and IEPS involve authority-to-authority communication. The emergency indicator, as defined in [ITU-T H.248.1], is used for identification of emergency calls (i.e., individual-to-authority communication). The IEPS call indicator is used for the identification of a priority call/session (e.g., ETS call/session, IEPS call/session), allowing differentiation from an emergency call/session. The specification of profile procedures for the emergency indicator is outside the scope of this Recommendation.

National regulators may implement ETS in various ways. This Recommendation describes an implementation where the IEPS call indicator and priority indicator are supported. In addition, it describes the DiffServ signalling [ITU-T H.248.52] approach for marking ETS calls/sessions.

NOTE 1 – 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 Recommendation.

NOTE 2 – [b-ITU-T Q-Sup.53] provides the signalling requirements to support the IEPS. It is also applicable for ITU-T H.248 entities, but does not indicate any requirement in addition to clause 7.

NOTE 3 – [b-ITU-T Q-Sup.57] provides the signalling requirements to support the ETS in IP networks. It is also applicable for ITU-T H.248 entities, but does not indicate any requirement in addition to clause 7.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T E.106] Recommendation ITU-T E.106 (2003), *International Emergency Preference Scheme (IEPS) for disaster relief operations.*

[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 (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, including its Amendment 2* (2009).

[ITU-T H.248.4] Recommendation ITU-T H.248.4 (2009), *Gateway control protocol: Transport over Stream Control Transmission Protocol (SCTP).*

[ITU-T H.248.10] Recommendation ITU-T H.248.10 (2001), *Gateway control protocol: Media gateway resource congestion handling package.*

[ITU-T H.248.11] Recommendation ITU-T H.248.11 (2013), *Gateway control protocol: Media gateway overload control package.*

[ITU-T H.248.32] Recommendation ITU-T H.248.32 (2013), *Gateway control protocol: Detailed congestion reporting package.*

[ITU-T H.248.52] Recommendation ITU-T H.248.52 (2008), *Gateway control protocol: QoS support packages.*

[ITU-T H.248.54] Recommendation ITU-T H.248.54 (2007), *Gateway control protocol: MPLS support package.*

[ITU-T H.248.56] Recommendation ITU-T H.248.56 (2007), *Gateway control protocol: Packages for virtual private network support.*

[ITU-T H.248.63] Recommendation ITU-T H.248.63 (2009), *Gateway control protocol: Resource management packages.*

[ITU-T H.248.82] Recommendation ITU-T H.248.82 (2013), *Gateway control protocol: Explicit congestion notification support.*

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

[ITU-T Q.1950] Recommendation ITU-T Q.1950 (2002), *Bearer independent call bearer control protocol*.

[ITU-T Q.1950 Amd.1] Recommendation ITU-T Q.1950 (2002) Amendment 1 (2006), *New Annex G – Call bearer control – International Emergency Preference Scheme.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation 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 Recommendation

This Recommendation defines the following term:

3.2.1 subject to profile specification: When used, this term indicates that the ITU-T H.248 profile template section requires further specification by a profile specification.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

AQM	Active Queue Management
DSCP	DiffServ Code Point
ECN	Explicit Congestion Notification
ETS	Emergency Telecommunications Service
GoS	Grade of Service
IEPS	International Emergency Preference Scheme
IP	Internet Protocol
IPDV	IP Packet Delay Variation
IPLR	IP Packet Loss Rate
ISUP	ISDN User Part
LSP	Label Switched Path
LTE	Long Term Evolution
Lx	Layer number
MG	Media Gateway
MGC	Media Gateway Controller
MLPP	Multi-Level Precedence and Pre-emption
MPLS	Multi-Protocol Label Switching
MPS	Multimedia Priority Service
N/A	Not Applicable
NGN	Next Generation Network
PHB	Per-Hop Behaviour
QoE	Quality of Experience
QoS	Quality of Service
RPH	Resource Priority Header

SCTP	Stream Control Transport Protocol
SDO	Standard Development Organization
SDP	Session Description Protocol
SIP	Session Initiation Protocol
VPN	Virtual Private Network

5 Conventions

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

6 Relation to other ITU-T Recommendations

The purpose of this clause is to identify possible relations (or not) to other ITU-T Recommendations and past work on ITU-T H.248 profiles.

6.1 Recommendation ITU-T E.106: International emergency preference scheme for disaster relief operations

There is a link between [ITU-T E.106] and [ITU-T E.107] by a reference from [ITU-T E.107], clause 7, item e) to [ITU-T E.106], indicating that "*IEPS could be used in such a scenario for interconnection of ETS national implementations*".

6.2 Recommendation ITU-T Q.1950 Annex F: Call bearer control – Emergency call indication

[ITU-T Q.1950], Annex F defines call-dependent procedures for emergency call indication, based on the ITU-T H.248 Context Attribute *Emergency Indicator*. This property is not required for applications in the scope of this Recommendation.

6.3 Recommendation ITU-T Q.1950 Annex G: Call bearer control – International emergency preference scheme

[ITU-T Q.1950 Amd.1], Annex G defines call-dependent procedures for IEPS call indication, based on the ITU-T H.248 Context Attribute *IEPS Call Indicator*. These procedures may provide guidance for profile definitions based on this Recommendation (i.e., not [ITU-T Q.1950] related). See also clause 8.17.

6.4 ITU-T H-series Recommendations – Supplement 12: Gateway control protocol: Priority traffic treatment by ITU-T H.248 gateways

[b-ITU-T H-Sup.12] defines complementary information on the handling of priority traffic (e.g., IEPS/ETS traffic) by the ITU-T H.248 entities: MGC and MG. This Supplement may provide priority traffic treatment guidance for profile definitions based on this Recommendation.

7 Functional requirements

The media gateway controller (MGC) and media gateway (MG) may support ETS as specified in [ITU-T E.107]. If ETS is supported and the call/session is an ETS call/session:

- Upon receipt of the priority information (e.g., priority indication and priority level) in call control signalling, the MGC shall provide the MG with the IEPS call indicator and possibly the priority indicator. The priority indicator shall be sent to the MG if a priority level is received in call control signalling.

- If the MGC provides the priority indicator, the MG shall determine from the priority indicator the level of priority to a context and associated resources/connections.
- The priority level received from call-control signalling by the MGC may be overwritten based on local policy.
- The MGC may include a default priority level in the priority indicator if the priority level is not received in call-control signalling. A default priority level is based on policy and provisioned in the MGC. This is national specific, and the policy may require default priority level information to be stored in the MGC.
- The MGC shall apply priority to ITU-T H.248 signalling. An MGC may apply priority handling to ITU-T H.248 transactions related to the priority context, e.g., preferential treatment in any queues or buffers. Where the control association utilizes a transport with the possibility for prioritization (e.g., SCTP), the MGC would use the appropriate prioritization procedures.
- When the MGC marks the context with the IEPS call indicator and, optionally, the priority indicator, the MG shall apply priority treatment to ETS traffic (control signalling and media packets) associated with the context.

NOTE 1 – Since ETS is a national feature, mapping of the SIP resource priority header (RPH), [ITU-T H.225.0] "priorityExtension", or ISUP IEPS call information to the ITU-T H.248.1 priority level is a regional/national matter. See [b-ITU-T H-Sup.9] for more information.

If an operator uses DiffServ procedures for prioritizing user plane traffic related to an ETS call/session, including signalling of the IEPS call indicator and optionally the priority indicator as outlined above, the following is possible:

- If both the MGC and MG support [ITU-T H.248.52] and ETS call/session requires a specific ETS DSCP marking, the MGC can configure the MG to apply a specific ETS DSCP marking to the user plane traffic (control signalling and media packets) to indicate that the ETS packets marked with DSCP are of a higher priority than those for normal calls.

NOTE 2 – In the presence of both the DiffServ signalling package and IEPS call indicator, the user plane traffic is marked according to the DiffServ signalling package. Since signalling of the IEPS call indicator is mandatory for an ETS call/session, it may be used to derive layer 2 QoS marking and trigger priority identification/treatment.

8 ITU-T H.248 profile specification guidelines

This clause provides guidelines for ITU-T H.248 profile specifications. The structure follows the profile template according to Appendix III of [ITU-T H.248.1].

The template elements which are not applicable in this Recommendation are indicated by "*Subject to profile specification*".

8.1 Profile identification

Subject to profile specification.

8.2 Summary

Subject to profile specification.

8.3 Gateway control protocol version

The applicable version of the gateway control protocol is ITU-T H.248.1, Version 3 [ITU-T H.248.1].

NOTE – ITU-T H.248.1 version 3 is required for the support of the IEPS call indicator in the profile.

8.4 Connection Model

Maximum number of contexts:	N/A
Maximum number of terminations per context:	N/A
Allowed termination type combinations in a context:	Context (one or more IP terminations)

NOTE – The scope of this Recommendation is only applicable to ITU-T H.248 gateways in IP networks.

8.5 Context Attributes

Context Attribute	Supported	Values Supported
Topology	Unspecified	See clause 8.7.8
Priority Indicator	Optional (Notes 1, 2)	1-15
Emergency Indicator	*Subject to profile specification* (Note 3)	N/A
IEPS Call Indicator	Yes	N/A
ContextAttribute Descriptor	*Subject to profile specification*	N/A
ContextIDList Parameter	*Subject to profile specification*	N/A

Is the AND/OR Select operation Context Attribute supported?

AND/OR Context Attribute	*Subject to profile specification*	N/A

NOTE 1 – If the priority indicator is not signalled, a default value may be assumed at the MG.

NOTE 2 – If the priority value is not received in call control signalling, a default value may be included in the priority indicator.

NOTE 3 – The use of the emergency indicator is outside the scope of this Recommendation. However, it may be used by profiles using the guidelines in this Recommendation. The emergency indicator is not used to indicate ETS.

8.6 Terminations

Subject to profile specification.

NOTE – The use of ETS does not have implications on terminations other than those terminations that must relate to IP networks. This is covered in clause 8.4 above.

8.7 Descriptors

8.7.1 Stream descriptor

Subject to profile specification.

NOTE – The use of ETS does not have implications on this descriptor.

8.7.2 Events descriptor

Subject to profile specification.

NOTE – The use of ETS does not have implications on this descriptor.

8.7.3 EventBuffer descriptor

Subject to profile specification.

NOTE – The use of ETS does not have implications on this descriptor.

8.7.4 Signals descriptor

Subject to profile specification.

NOTE – The use of ETS does not have implications on this descriptor.

8.7.5 DigitMap descriptor

Subject to profile specification.

NOTE – The use of ETS does not have implications on this descriptor.

8.7.6 Statistics descriptor

Subject to profile specification.

NOTE – The use of ETS does not have implications on this descriptor.

8.7.7 ObservedEvents descriptor

Subject to profile specification.

NOTE – The use of ETS does not have implications on this descriptor.

8.7.8 Topology descriptor

Subject to profile specification.

NOTE – The use of ETS does not have implications on this descriptor.

8.7.9 Error descriptor

Which ITU-T H.248.8 and package defined error codes are supported?

Error codes sent by the MGC:

Supported ITU-T H.248.8 Error Codes:	*Subject to profile specification*
Supported Error Codes defined in packages:	*Subject to profile specification*

Error codes sent by the MG:

Supported ITU-T H.248.8 Error Codes:	All ITU-T H.248.8 error codes or a list of the individual error code numbers
Supported Error Codes defined in packages:	*Subject to profile specification*

8.8 Command API

NOTE – It is assumed that an error descriptor may be returned in any command reply.

8.8.1 Add

The ContextAttribute descriptor containing the priority and IEPS call indicators will be used in conjunction with an Add command. The use of other descriptors is "*Subject to profile specification*".

NOTE – In order to signal the IEPS call indicator and priority indicator, the ContextAttribute descriptor must accompany a command.

8.8.2 Modify

The ContextAttribute descriptor containing the IEPS call indicator and priority indicator will be used in conjunction with a Modify command. For example, the initial default priority value for ETS call/session is updated to reflect the user's actual priority. The use of other descriptors is "*Subject to profile specification*".

NOTE – In order to signal the IEPS call indicator and priority indicator, the ContextAttribute descriptor must accompany a command.

8.8.3 Subtract

Subject to profile specification.

NOTE – No statistics are associated with the ETS, thus no impact is envisaged on this command.

8.8.4 Move

The ContextAttribute descriptor containing the IEPS call indicator and priority indicator will be used in conjunction with a Move command. The use of other descriptors is "*subject to profile specification*".

NOTE – In order to signal the IEPS call indicator and priority indicator, the ContextAttribute descriptor must accompany a command.

8.8.5 AuditValue

Subject to profile specification.

NOTE – No statistics are associated with the ETS, thus no impact is envisaged on this command. Clause 8.8.9 deals with auditing context attributes.

8.8.6 AuditCapabilities

Subject to profile specification.

NOTE – No statistics are associated with the ETS, thus no impact is envisaged on this command. Clause 8.8.9 deals with auditing context attributes.

8.8.7 Notify

Subject to profile specification.

NOTE – No events are associated with the ETS, thus no impact is envisaged on this command.

8.8.8 ServiceChange

This clause is "*subject to profile specification*" with the exception of parameter ServiceChange Version.

Which version of ITU-T H.248.1 is used by ServiceChangeVersion? The lowest value here should be the minimum version defined in clause 8.3.

Version used in ServiceChangeVersion:	3

NOTE – As the IEPS call indicator was added to ITU-T H.248.1v3, this version must be offered in a ServiceChange. While the IEPS call indicator and priority indicator have no direct impact on ServiceChange procedures, the values of these indicators may be taken into account. If the MG needs to change the ServiceState of a termination(s), it should consider whether the termination is related to a context that is ETS marked.

8.8.9 Manipulating and auditing context attributes

Which context attributes may be manipulated and/or audited?

Context attributes manipulated:	Priority indicator, IEPS call indicator Other context attributes are "*subject to profile specification*".
Context attributes audited:	Priority indicator, IEPS call indicator Other context attributes are "*subject to profile specification*".

8.9 Generic command syntax and encoding

Subject to profile specification.

NOTE – ETS has no impact on encoding.

8.10 Transactions

Subject to profile specification.

NOTE – ETS has no impact on transactions other than those transactions that relate to a context that has the IEPS call indicator and priority indicator set which may receive preferential handling.

8.11 Messages

Subject to profile specification.

NOTE – ETS has no impact on the number of transaction per message.

8.12 Transport

Subject to profile specification.

NOTE – ETS does not mandate any particular ITU-T H.248 transport modes. However, given the nature of these services, profile specifications should consider the use of a transport that provides priority handling.

8.13 Security

Subject to profile specification.

NOTE – ETS has no impact on ITU-T H.248 transport security.

8.14 Packages

Although ITU-T H.248.81 does not mandate any ITU-T H.248 package for profile specifications that are based on this Recommendation, there might be some useful packages for supporting ETS. The following is a non-exhaustive list of available ITU-T H.248 capabilities:

– ITU-T H.248 transport:
  - [ITU-T H.248.4] for SCTP-based transport
– ITU-T H.248 MG overload control:
  - [ITU-T H.248.11], and [ITU-T H.248.10]
– ITU-T H.248 MG resource congestion control in general:
  - [ITU-T H.248.32]
– ITU-T H.248 MG resource management support:
  - [ITU-T H.248.63]
– Bearer network related "QoS concepts" support:
  - [ITU-T H.248.52] in case of IP differentiated services and IP header "QoS tagging" in general
  - [ITU-T H.248.54] in case of MPLS-based QoS support
  - [ITU-T H.248.56] in case of VPN-based QoS support.

The use of the above Recommendations (except [ITU-T H.248.52]) has not been taken into account in the definition of this profile specification guide.

NOTE – The above Recommendations contain many different properties, signals, and events. However, as they are optional, to simplify the definition of this profile specification guideline, these impacts are not listed.

8.15 Mandatory support of SDP and ITU-T H.248.1 Annex C information elements

Subject to profile specification.

NOTE – ETS has no impact on SDP or ITU-T H.248.1 Annex C elements.

8.16 Optional support of SDP and ITU-T H.248.1 Annex C information elements

Subject to profile specification.

NOTE – ETS has no impact on SDP or ITU-T H.248.1 Annex C elements.

8.17 Procedures

8.17.1 ETS Context

When an MGC determines that the call/session is an ETS call/session based on the priority information (e.g., priority indicator and priority level) received in call-control signalling, the MGC shall send the IEPS call indicator and possibly the priority indicator with the appropriate priority value to the MG. The priority indicator shall be sent to the MG if a priority level is received in call control signalling. The IEPS call indicator indicates to the MG that the context is associated with an ETS call/session. The priority indicator provides the MG with information about a certain prioritization level to be used for resources/connections for the indicated context. Both the IEPS call indicator, and possibly the priority indicator, are used to trigger appropriate priority treatment at an MG for an ETS call/session. If the priority level is not available, a default value may be included in the priority indicator. For implementations using DiffServ procedures [ITU-T H.248.52] for prioritizing user plane traffic, the MGC may configure the MG to apply a specific ETS DSCP marking to the user data transport packets.

The "ETS Context" procedure may be used in conjunction with other profile-defined procedures.

NOTE 1 – Since ETS is a national feature, the mapping between the call-control signalling (e.g., SIP, [ITU-T H.225.0], and ISUP) and the ITU-T H.248.1 priority level is a regional/national matter. See [b-ITU-T H-Sup.9] for more information.

Upon receipt of the IEPS call indicator, and possibly the priority indicator, the MG shall mark the contexts accordingly and apply priority treatment to media packets that are related to an ETS call/session. Example traffic management mechanisms that can be used to provide priority treatment for ETS traffic (signalling and media packets) include packet marking (DiffServ) and per-hop behaviour (PHB), bandwidth reservation and allocation using various types of multi-protocol label switching (MPLS) networks (e.g., DiffServ-aware MPLS, reserved LSPs for ETS traffic), queuing of an ETS call/session, etc.

For implementations using DiffServ procedures [ITU-T H.248.52] for prioritizing user plane traffic, and if the MG receives an indication to apply a specific ETS DSCP marking to the user data transport packets, it shall apply this DSCP marking to ETS traffic (i.e., IP headers).

NOTE 2 – Appendix I discusses a traffic model example for decomposed gateways. Physical realization is "*Subject to profile specification*".

Figure 1 illustrates an example signalling flow for creating an ITU-T H.248 context with ETS-specific information. For simplicity, only the ITU-T H.248 signalling message impacted by ETS is shown. If priority is honoured, the Add.Response message provides a confirmation that the MG shall apply the priority treatment. If the priority handling cannot be honoured by the MG, the Add.Response message shall include the appropriate error code based on the reason why priority could not be applied.

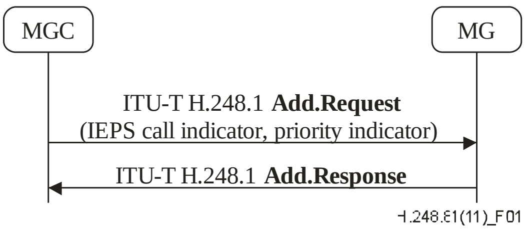

Figure 1 – MGC and MG interaction for an ETS call/session

For implementations supporting DiffServ procedures for prioritizing user plane traffic related to an ETS call/session, Figure 2 illustrates an example signalling flow where the MGC may request the streams associated with an ETS call/session to be marked with a certain priority code point. The MG shall then mark each IP packet header accordingly.

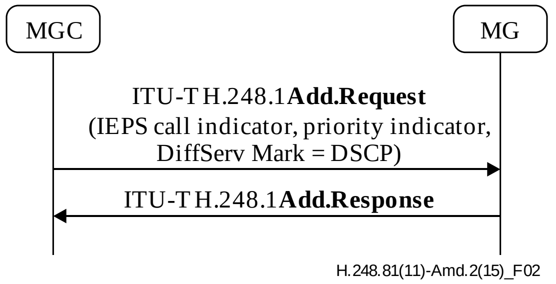

Figure 2 – MGC and MG interaction for an ETS call/session using DiffServ

9 Explicit congestion notification (ECN) and ETS

ECN is defined in [ITU-T H.248.82]. For a call/session that is ETS marked, the MGC may or may not request the MG to enable ECN based on service provider's local policy. If ECN is disabled, the MG, when acting as an ECN endpoint, shall not apply the ECN congestion control procedures outlined in section 7.3.3 of [b-IETF RFC 6679] to the ETS traffic, if congestion is experienced. Whether or not ECN and ETS can be applied to the same Context/Termination is network-dependent. For details on the effect on ETS of using ECN, see Appendix II.

NOTE – This is based on theoretical analysis and a more detailed performance study may be desired for a more quantitative consideration.

Appendix I

Overall example traffic model for decomposed gateways

(This appendix does not form an integral part of this Recommendation.)

It is expected that ETS (priority) services will be supported by functions (which are typically out of the scope of ITU-T H.248 Recommendations), like precedence handling, priority treatment, local policies, traffic-management mechanisms, etc. This appendix provides an example of an overall traffic model as complementary information. The purpose of this model is to indicate "gateway components" that are relevant for "priority traffic handling" and to structure the "ITU-T H.248 gateway" in suitable sub-models.

This appendix highlights potential areas of the entire decomposed gateways that may have relevance to priority call handling in a specific environment. The entire "picture" might be worth of consideration, depending on the particular use case. This appendix does not provide any guidelines; rather, it is assumed that the specific support of ETS priority services is up to application-specific ITU-T H.248 profile definitions, which may then specify functional behaviour at a level beyond the scope of [ITU-T H.248.81].

I.1 Overview

I.1.1 Introduction

Priority call handling as such affects multiple areas in a decomposed gateway due to the distributed architecture and the involvement of many components. "Priority" in general is related to some ITU-T H.248 context attributes (e.g., emergency indicator, priority indicator, and IEPS call indicator) that indicate a specific handling of bearer traffic across the corresponding ITU-T H.248 context. Although in this Recommendation "Priority" relates to the combination of the IEPS call indicator and the priority indicator, this does not restrict the model itself.

There is also a possible relation to the selected policy and QoS architectures of the bearer network, at least in the case of packet-switched networks.

The proposed model may help to identify:

– *which* resource component types would be affected;

– *how* priority call support appears for such resources; and

– indicate possible *interactions* (concerning the above entire set of ITU-T H.248 context attributes).

I.1.2 Overall model

Figure I.1 illustrates a model which is an extension of the traffic model from Appendix II "*Basic traffic models for ITU-T H.248 systems*" in [b-ITU-T H-Sup.6]. Priority handling not only affects bearer traffic (user plane), but also signalling traffic (control plane); therefore, a *combined control/user plane model* is required (e.g., clause II.3 of [b-ITU-T H-Sup.6]).

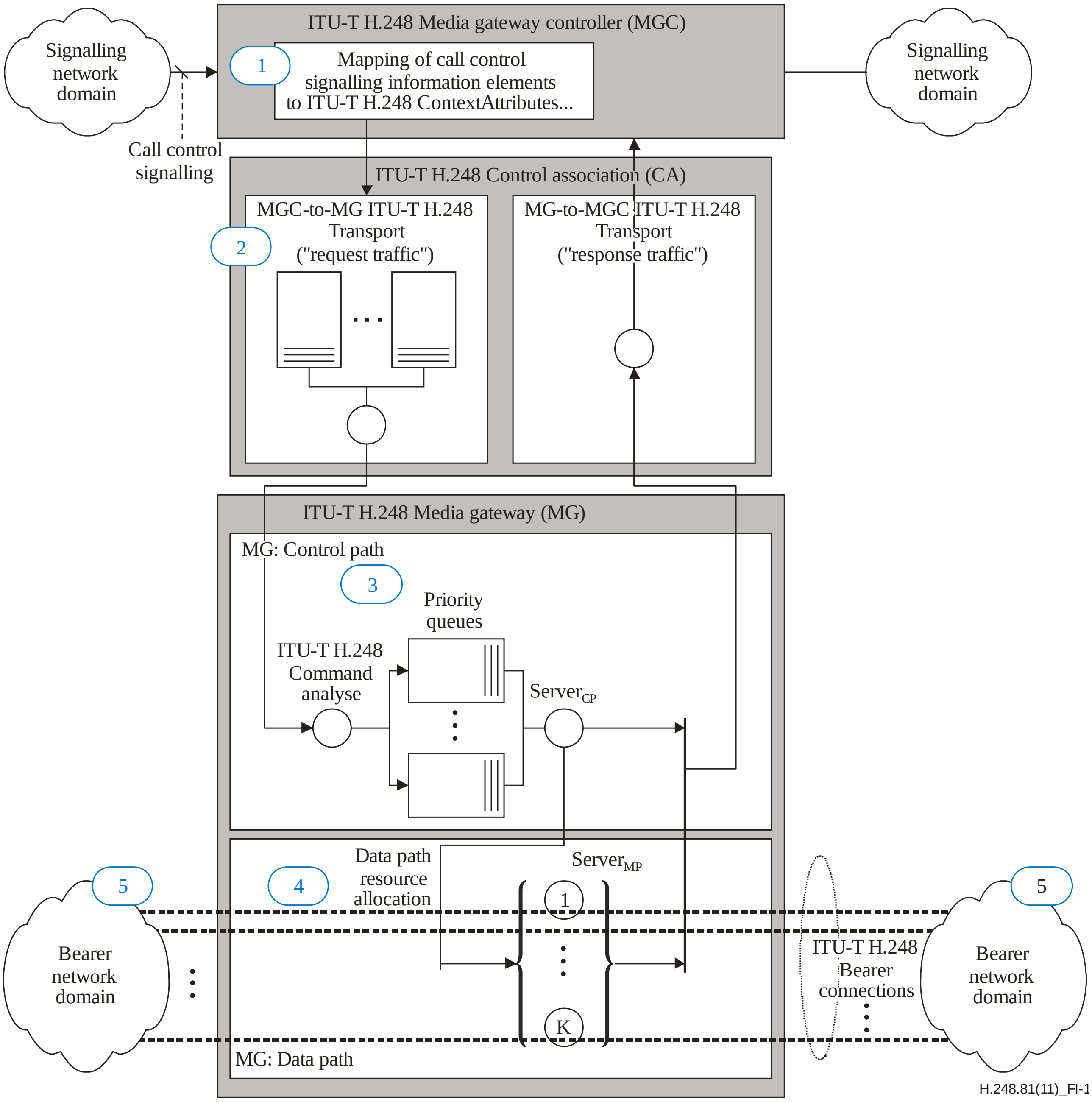

Figure I.1 – Example overall traffic model for priority services

Five relevant areas may be identified (from a MG perspective):

– Part I: MGC – Mapping function for setting ITU-T H.248 context attributes values
– Part II: ITU-T H.248 control association (i.e., ITU-T H.248 signalling transport) – Priority transport
– Part III: MG control path – Priority command processing
– Part IV: MG data path – Reservation, allocation and pre-emption of resources depending on national variation
– Part V: Bearer network – Support of dedicated "QoS and policy architectures"

I.2 Traffic processing stages – Model subcomponents

I.2.1 Part I: MGC – Mapping function for ITU-T H.248 context attributes

Call control signalling information provides input to the mapping function on ITU-T H.248 context attribute property values. There might also be some interaction in the case of MLPP support, i.e., signal settings according to the *Multi-level Precedence and Pre-emption* package [b-ITU-T H.248.44]. Since the mapping function between call control level ETS/MLPP information and ITU-T H.248 signalling is internally located in the MGC, it is out of the scope of this and other Recommendations of the ITU-T H.248.x-series.

I.2.2 Part II: ITU-T H.248 control association – Priority transport

I.2.2.1 Transport layer

Priority call handling may be supported by priority transport at ITU-T H.248 interfaces. There are many ITU-T H.248 transport modes for carrying ITU-T H.248 signalling traffic between MGC and MG (see Table 1 of [b-ITU-T H.248.67]).

In particular, the ITU-T H.248-over-SCTP based transport mode could benefit from SCTP capabilities.

NOTE – Control associations based on [ITU-T H.248.4] allow the support of SCTP streams for ITU-T H.248 signalling traffic. It should be noted that multiple SCTP streams may be used (see clause 11 of [H.248.4]), which allows the mapping of multiple "ITU-T H.248 traffic classes" on dedicated SCTP streams. Such mappings may be based on context attributes, e.g., the use of particular SCTP streams for priority traffic.

I.2.2.2 Network layer or/and Lx-VPNs

For IP layer or others (e.g., in the case of ITU-T H.248-over-IP), different "QoS levels" may be applied for different ITU-T H.248 messages of the same ITU-T H.248 control association.

I.2.3 Part III: MG control path – Priority command processing

Priority call handling relates to priority command and priority context processing at ITU-T H.248 MG level (see also [b-ITU-T H-Sup.6]), particularly in phases of high load or overload of the MG control path. Such a kind of MG internal prioritized processing of ITU-T H.248 commands, etc., is implementation-specific, thus out of the scope of this Recommendation.

It may be noted that a more detailed congestion reporting capability (according to [ITU-T H.248.32]) may be a helpful complementary function for priority-call support.

I.2.4 Part IV: MG data path – Reservation, allocation and pre-emption of resources

The MG internal data path may be modelled by applicable resources, which may be reserved, allocated, modified and released again. However, possible pre-emption also needs to be considered in the scope of priority calls.

The consideration of ITU-T H.248 resource-management packages according to [ITU-T H.248.63] may be useful here.

[ITU-T H.248.32] may also be applied in monitoring the usage level of MG data path resources.

NOTE – For certain national implementations, pre-emption of resources in support of ETS is not required.

I.2.5 Part V: Bearer network – Support of dedicated "QoS architectures"

Any network engineering for ETS support is tightly coupled with the underlying QoS architecture of the network transport stratum. It would be ineffective to separately consider node and network capabilities. For instance:

– There might be an implicit, MG-level configuration for linking ITU-T H.248 context attribute value settings to a specific "QoS class" at the bearer network.

– There might be explicit procedures defined (i.e., "call-dependent procedures in ITU-T H.248 profiles"), which link priority calls to ITU-T H.248 capabilities accordingly, e.g.,:

  a) [ITU-T H.248.52] ("QoS marking of priority traffic")

  b) [ITU-T H.248.54] ("dedicated MPLS LSPs for priority traffic")

  c) [ITU-T H.248.56] ("dedicated Lx-VPNs for priority traffic").

Appendix II

Use of ECN in the context of ETS traffic

(This appendix does not form an integral part of this Recommendation.)

II.1 Introduction

This appendix addresses the question whether explicit congestion notification (ECN) could positively or negatively influence emergency telecommunication service (ETS) traffic ("*Can ECN improve or degrade ETS traffic?*") and, hence, what is the recommended use of ECN in the context of ETS traffic. Any (individual call) *enabled* congestion control (for IP bearer traffic) definitely has a direct impact on the IP application/service (e.g., ETS). Whether the impact is negative or positive, from the perspective of the perceived/experienced quality (i.e., QoE) by the ETS user, is firstly not straightforward. *Disabled* congestion control also affects the ETS quality since (temporal and/or spatial) congestion situations in a network normally decrease the grade of service (GoS) of the *entire* IP bearer traffic ("of a congested network area"); under the assumption of a best effort infrastructure, ETS traffic shares at least some of the same infrastructure resources as non-ETS traffic.

Some use case examples are evaluated below.

NOTE 1 – The evaluations are mostly qualitative; quantitative statements containing concrete traffic mixes, the likelihood of a use case in reality, absolute QoS/QoE objectives, results of simulation studies, time scale of control loop, etc. are outside the scope of this Recommendation.

ECN provides a mechanism to detect and react to incipient network congestion typically before packets start being dropped by the network routers. It may be noted that the measure of burstiness experienced at the congestion point, along with sustained levels of congestion, may cause an increased amount of packet loss over a period of time (even with ECN support).

Independently on whether ECN is deployed or not, routers applying active queue management (AQM) mechanisms, for example random early detection (RED), avoid tail drop (dropping of all new arriving packets when the queue is full) by establishing a queue occupancy threshold. At this threshold, the router starts randomly dropping a certain percentage of the new arriving packets or, if ECN is used, ECN marking them.

When analysing the benefits of ECN the following aspects can be considered:

– ECN enabled flows can react to ECN marks and reduce bandwidth consumption. It must be noted that ECN is dependent on the capability of the RTP media flow to react to ECN marks [b-IETF RFC 6679], for example by changing the codec mode to a lower bit rate. It can be further noted that in this case they produce a "community" benefit , i.e., the reduced bandwidth consumption contributes to alleviating the congestion situation, something that will benefit any other IP flow in the network, whether it is ECN enabled or not.

  ETS flows may be allowed to employ a less aggressive back-off mechanism in response to ECN marks. This approach may be offered in varying degrees and may also be applied to different types of ETS flows (e.g., a video call where the video component has a less aggressive back-off mechanisms, and there is an exemption from back-off mechanisms for the voice component).

– ECN enabled flows may allow an overall increase in the number of flows through an access controlled network. This possibility can be complementary to other approaches, like access overload control, that can increase the probability in allowing new ETS flows through an access network. Relationship between decreased load through back-off mechanisms and a slight increase in additional flows is a topic for future study.

– There are scenarios in which each IP flow has its own scheduling queue, which is subject to AQM. This can be the case for example in long term evolution (LTE) eNodeB. A flow that is ECN enabled and reacts to ECN marks is likely to experience a better GoS than one that is not or does not react to ECN marks, because it will tend to adjust its bit rate to the available capacity. This aspect is fairly independent on the total amount of ETS traffic.

– In a network where both ECN enabled and non ECN flows co-exist, routers applying incipient congestion detection will initially start dropping packets of non ECN flows whereas they will only start ECN marking packets of ECN enabled flows. For the same level of congestion, a router will drop a packet of a non ECN flow whereas it will just ECN mark a packet of an ECN flow (instead of dropping it) [b-IETF RFC 3168]. This behaviour is necessary in order not to penalize ECN flows, something that would happen if ECN marking of ECN enabled flows would start at a lower level of congestion than dropping of packets belonging to non ECN flows.

  From this point of view, it can be noted that the ECN-enabled flow is itself the beneficiary of using ECN. Obviously, in addition it benefits the community by contributing to reducing the load.

  NOTE 2 – Routers applying AQM can classify the IP traffic according to their DiffServ code point (DSCP) values and apply different thresholds as well as different dropping probabilities to packets with different DSCPs, using for example Weighed RED (WRED). In this case, an ECN enabled ETS flow would have an advantage, at a minimum, versus a non ECN flow that has the same DSCP value, e.g., Expedited Forwarding.

II.2 Use case examples

The following examples provide qualitative considerations. Complementary quantitative evaluations would rather be the subject of network engineering and associated performance investigations (e.g., traffic simulation studies).

II.2.1 Example 1: Networks with "significant ETS traffic"

There is basically a mix of ETS and non-ETS traffic. In this case, it is assumed that there is significant ETS traffic.

Evaluation:

ETS calls could experience a better QoE/QoS if ECN is enabled for ETS traffic due to a positive effect of an enabled congestion control. The positive effect is in the form of the aggregated reduced load by each entity that responds to the congestion notification.

NOTE – The portion of ETS traffic, under normal load conditions, is typically *limited* in real networks. See e.g., [b-3GPP TS 22.153] for MPS traffic in 3GPP networks ("… *MPS traffic volumes should be limited (e.g, not to exceed a regional/national specified percentage of any concentrated network resource, …), so as not to compromise this function."*).

This example assumes that the terminal has a method to react to ECN marks.

II.2.2 Example 2: Terminal with two-mode-multirate codec, AQM applied per flow

A terminal with a generic two-mode-multirate codec provides the following two operational modes:

– codec 1 "high quality mode" with 60 kbit/s transport capacity; and

– codec 2 "good quality mode" with 20 kbit/s transport capacity requirement.

The codec furthermore supports a sender-driven congestion control:

– any notified network congestion would lead to a transition to the 20 kbit/s mode ("fall-back to lower transport capacity").

– AQM is applied per flow. As a consequence of the flow exceeding the allowed or available bit rate, AQM results in ECN marks (in the form of setting the Congestion Experience bit) on IP packets.

NOTE – An example of AQM applied per flow is eNodeB in LTE.

Consider the following example scenario:

1. A call starts in 60 kbit/s mode and experiences (in a later point in time) a mean packet loss ratio of e.g., 5 % due to network congestion.
2. Given that ECN is enabled (negotiated during call setup), network congestion leads to ECN marking, i.e., IP packets are marked as supporting ECN.
3. Received ECN indications at sender side activate the sender-driven congestion control method.
4. There is then a transition to the 20 kbit/s mode.
5. This mode then experiences e.g., a mean packet loss of 0.1%, hence a lower information loss.
6. There are consequently two situations with different QoE as perceived by the user, labelled as QoE_{60} and QoE_{20}:
   – the QoE_{60} in the "high quality" codec mode could actually be worse than the QoE_{20} in the "low quality" codec mode under network congestion because the GoS_{20} would be better than the GoS_{60} (primarily due to relations "$IPLR_{20} << IPLR_{60}$ and $IPDV_{20} << IPDV_{60}$").

Evaluation:

ECN-enabled ETS calls could experience a better QoE/QoS than ECN-disabled ETS calls due to the possible positive effect that the lower transport quality may receive a better GoS.

II.2.3 Example 3: Network with "sparse ETS traffic"

A network situation where there is a low portion of ETS traffic, e.g., when "ETS traffic is much less than non-ETS traffic".

Evaluation:

ETS calls (whether they are ECN enabled or disabled) could benefit from the *ECN-enabled non-ETS calls* due to a potential positive effect of more available transport capacity from non-ETS traffic and a reduced overall congestion level. Congestion control could reduce the consumed bit rate by non-ETS calls in the form of reduced load by each entity that responds to the congestion notification.

ECN enabled ETS calls could also benefit in this scenario vs. non ECN calls due to the fact that, at a certain level of congestion, the latter ones may start experiencing packet loss while the ECN enabled ones will experience ECN marks.

NOTE – Routers applying AQM may apply different packet dropping policies based on the DSCP, hence this advantage has a dependency on the DSCP policies applied in the network. It is noted that that DSCP values will most likely be applied by the access network as opposed to being set by user equipment due to a lack of trust by carriers concerning differentiated services between autonomously controlled resources.

It must be noted that scenario II.2 is also applicable for sparse ETS traffic and can, therefore, give an additional benefit for ECN enabled ETS calls.

II.2.4 Example 4: Limited terminal capability

Assume a hypothetical IP terminal equipment *with* ECN sender-driven congestion control, but *without* any signalling capability of ECN information. The implemented IP protocol stack may provide ECN support at all possible protocol layers, but the application level logic ("ECN user instance") may not be available, which does not allow to process ECN information at the IP interface. Such a terminal limitation prevents a *closed* control loop (see Figure 1), since either the congestion notification path would be interrupted, or the feedback path, or both.

Evaluation:

Disabling ECN for ETS would not impact the network congestion in such a situation. Furthermore, if a terminal is not able to react to ECN congestion indications, it should not itself use ECN marking, as it would otherwise behave unfairly to other flows. Therefore, *ECN-disabled ETS calls* is the recommended strategy.

II.2.5 Example 5: Multimedia ETS calls with media type individual ECN configurations

Multimedia ETS calls with media components audio, video and text. An ECN sender-driven congestion control may trigger:

1. complete deactivation of a specific media component;
2. reduction of audio quality; and
3. reduction of video quality.

All three control reactions should lead to a reduced IP transport load caused by ETS calls, but still allow sufficient end-to-end communication. Like in II.2.1, the contribution of these actions to the reduction of the overall network congestion would be dependent on the amount of ETS traffic: the more ETS traffic, the more it can contribute. However, it may be noted that:

– The video component has normally higher bandwidth requirements than the voice component. Hence its deactivation is likely to have a more noticeable per call effect on the overall congestion than lowering the audio codec mode.

– Independently of the amount of ETS traffic, a congestion situation may be highly disturbing on the user experience if this is using a video component. Thus, deactivation of the video component may be the recommended strategy.

Evaluation:

Enabling ECN for ETS might be beneficial for multimedia ETS calls, given that at least one media component allows sufficient communication.

II.3 Observations

It is generally expected that enabling ECN for non-ETS calls, which normally constitute the biggest part of the served traffic, will have a positive service impact on ETS calls, due to the reduction of used bandwidth, potentially yielded by non-ETS calls.

It is also expected that enabling ECN for ETS calls is beneficial for ETS traffic due to the following considerations:

1. If the amount of served ETS traffic is significant – in relation to the total traffic – ETS traffic can contribute to reduce the overall network congestion if it is ECN enabled and is able to react to ECN marks. ETS traffic would benefit from a reduced overall congestion. A prerequisite is that ETS terminals have the capability to react to ECN marks, for example by:
   a) Changing to a lower codec mode
   b) Deactivating the video component in a multimedia call
   c) Reducing the video quality in a video call, etc.

2. Independently of the amount of ETS traffic, ETS calls can benefit from being ECN enabled due to:

a) Routers applying AQM on a per flow basis, for example in LTE eNodeB

b) Routers marking packets of ECN enabled flows (by setting the Congestion Experience bit) while dropping packets of non ECN enabled flows

NOTE – this positive service impact is dependent on the DSCP policies applied in the network in relation to AQM.

ECN should not be enabled for those terminals that do not support a congestion control mechanism, either sender-driven or receiver-driven.

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