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Infrastructure of audiovisual services – Quality of service
architecture for audiovisual and multimedia services

**End-to-end quality of service (QoS) and service
priority signalling in H.323 systems**

ITU-T Recommendation H.361



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ITU-T Recommendation H.361

End-to-end quality of service (QoS) and service priority signalling in H.323 systems

Summary

This Recommendation defines the H.323 Quality of Service (QoS) and Service Priority signalling for exchanging, negotiating and controlling QoS and service priority parameters among the H.323 entities in a call. These calls may involve multiple network operator domains, multiple service domains, and heterogeneous transport mechanisms (e.g., mixed IP, ATM, and MPLS environments). In a single network operator domain or H.323 service domain, the QoS policies and mechanisms are usually homogenous and therefore the negotiation and establishment of QoS for a call is relatively simple. However, the same is relatively more complex when a call has to traverse multiple service or network domains each of which has its own set of policies and mechanisms. This Recommendation describes the QoS and priority signalling to enable a H.323-based call to acquire QoS irrespective of the number of domains it traverses.

Source

ITU-T Recommendation H.361 was approved on 29 May 2006 by ITU-T Study Group 16 (2005-2008) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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ITU-T Recommendation H.361

End-to-end quality of service (QoS) and service priority signalling in H.323 systems

1 Scope

This Recommendation defines the mechanisms (parameters, message formats and procedures) between H.323 functional entities that may be used for signalling and control of end-to-end QoS and service priority in H.323 systems. ITU-T Rec. H.360 describes the various QoS signalling types in a H.323 system. Since the focus of this Recommendation is QoS signalling between the H.323 entities within a service domain and across multiple service domains, the signalling in this Recommendation maps to QoS types 1 and 2 described in ITU-T Rec. H.360.

The following is outside the scope of this Recommendation:

- Other QoS signalling: Signalling between H.323 service domain and network domain is outside the scope of this Recommendation.
- Transport QoS mechanisms: QoS signalling that occurs in the network domain is not within the scope of this Recommendation. In other words, the QoS and service priority mechanisms described in this Recommendation are independent of transport QoS mechanisms that exist in the network domain (e.g., Differentiated Services (DiffServ), Integrated Services (IntServ)/RSVP or ATM QoS mechanisms).
- Security: Security is not within the scope of this Recommendation. This Recommendation shall be compatible with any security mechanisms defined for ITU-T Rec. H.323.
- QoS MIB: Though considered important, support of any QoS MIBs is not within the scope of this Recommendation.
- QoS measurement and monitoring: This Recommendation addresses how QoS can be secured. It does not address the subsequent measurement and monitoring of QoS.

2 References

2.1 Normative 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 Recommendation H.360 (2004), *An architecture for end-to-end QoS control and signalling*.
- ITU-T Recommendation Y.1221 (2002), *Traffic control and congestion control in IP-based networks*.
- ITU-T Recommendation Y.1541 (2006), *Network performance objectives for IP-based services*.
- IETF RFC 2205 (1997), *Resource Reservation Protocol (RSVP) – Version 1 Functional Specification*.

- IETF RFC 2474 (1998), *Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers*.
- IETF RFC 3312 (2002), *Integration of Resource Management and Session Initiation Protocol (SIP)*.

2.2 Informative references

- IETF RFC 2998 (2000), *A Framework for Integrated Services Operation over Diffserv Networks*.

3 Definitions

This Recommendation defines the following terms:

- 3.1 application plane:** The H.323 application plane is made up of one or more H.323 service domains, each under the control of an H.323 end-user or H.323 Service Provider.
- 3.2 end user/endpoint:** An entity employing application services.
- 3.3 network operator:** An administrative entity operating a network.
- 3.4 network operator domain:** A collection of network resources sharing a common set of policies, QoS mechanisms and technologies under the control of a Network Operator. Network domain and network operator domain are used interchangeably.
- 3.5 network policy entity (NPE):** A functional entity residing in a Network Domain that maintains the policies of the Network Operator.
- 3.6 QoS service manager (QoSM):** A functional entity that mediates requests for end-to-end QoS in accordance with the policy determined by the QoSPE. It communicates with other QoSMs and with RMs to determine, establish and control the offered QoS. The QoSM will normally be the functionality within an H.323 gatekeeper and therefore is a H.323 service domain function.
- 3.7 QoS policy entity (QoSPE):** A functional entity that manages H.323 application policies and provides authorization of permitted and default QoS levels. It receives requests from and issues responses to QoSMs to establish the authorized end-to-end QoS levels. QoSPE may reside within the H.323 service domain or reside in a back-end policy server.
- 3.8 service domain:** A Service Domain is a collection of physical or functional entities offering Application Services under the control of an Application Service Provider which share a consistent set of policies and common technologies.
- 3.9 transport functionality (TF):** A functional entity in the Network Domain representing the collection of transport resources within a Network Domain which is capable of QoS control.
- 3.10 transport plane:** A collection of network operator domains.
- 3.11 transport resource manager (RM):** A functional entity in the Network Domain that applies a set of policies and procedures to a set of transport resources to ensure that these are allocated to enable QoS guarantees across the domain of control of the RM.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

ACF	Admission Confirm
ARJ	Admission Reject
ARQ	Admission Request
BCF	Bandwidth Confirm
BRJ	Bandwidth Reject
BRQ	Bandwidth Request
DiffServ	Differentiated Services
DSCP	Differentiated Service Code Point
IntServ	Integrated Services
NPE	Network Policy Entity
QoS	Quality of Service
QoSM	Quality of Service Manager
QoSPE	Quality of Service Policy Entity
QST	QoS Signalling Type
RCF	Registration Confirm
RM	Resource Manager
RRJ	Registration Reject
RRQ	Registration Request
RSVP	Resource ReSerVation Protocol (RFC 2205)
TF	Transport Functionality
ToS	Type of Service

5 Architecture

The architecture for end-to-end QoS control and signalling is described in ITU-T Rec. H.360. The signalling components described in this Recommendation are based on the architecture therein.

5.1 The H.323 system

In this Recommendation, the H.323 system is defined as the H.323 application plane and the associated transport plane. The H.323 application plane is made up of one or more H.323 service domains, each under the control of an H.323 end-user or H.323 Service Provider. Examples of H.323 entities within the service domain are gatekeepers, gateways, H.323 endpoints, etc. The transport plane includes a number of separate network operator domains. The network operator domain consists of transport-related functionality that includes IP routers, switches, firewalls, etc. Each network domain may have its own QoS policies and/or differ from other domains in terms of administrative control (e.g., network operator), QoS mechanisms (RSVP/IntServ, DiffServ, MPLS, etc.), access, metering, addressing schemes (global or local), transport protocol (IPv4 or IPv6), etc.

5.2 Functional entities

The different functional entities in a H.323 system have been described in ITU-T Rec. H.360 and shown in Figure 1:

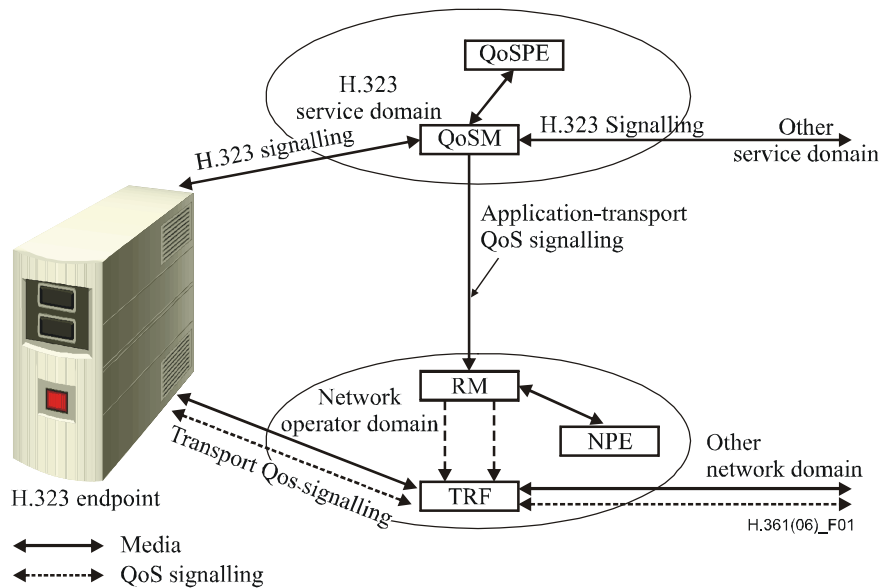


Figure 1/H.361 – Relationship between QoS functional entities

The two functional entities that are important to this discussion are the QoSM and the QoSPE. QoSM is the entity that mediates end-to-end QoS request in accordance with the policy determined by the QoSPE. The QoSPE is the entity that manages the application policies and provides authorization for QoS. The QoSPE and QoSM usually reside in the gatekeeper. The components are not usually called out individually in this Recommendation.

6 QoS parameters

The QoS parameters necessary for H.323 QoS signalling include four main elements. These elements are:

- Service priority: Indicates the priority of the stream.
- QoS descriptor: Provides the QoS requirements for the stream.
- Traffic descriptor: Provides the traffic characteristics of the stream.
- Authorization parameters: Policy elements that authorize the request.

These are described in greater detail below.

6.1 Service priority

The service priority parameter is used to signal the priority of service to be provided to a bearer stream within an H.323 system. This priority parameter may be signalled between service providers, or between service providers and end users. Media flows categorized as high priority shall take precedence over those categorized lower in priority with respect to the allocation of transport resource. The initiating endpoint/service provider shall determine the priority to be assigned to the media stream in both directions and signal this to other service providers or endpoints involved in the call.

Service Priority is an optional parameter and need not be included if routine priority is sufficient. If service priority is required, then it is signalled via the service priority parameter. The service priority uses the following format:

- **servicePrioritySignalled** (boolean)

This parameter shall specify whether service priority is to be signalled using the servicePriorityValue parameter. A false value indicates that the service priority is based on a value determined by *a priori* agreement between business entities.

- **servicePriorityValue** (enumeration)

This parameter contains the requested service priority information that is used to signal the service priority between the H.323 entities. The description of this parameter will be further defined in a future annex of this Recommendation.

The service priority (**servicePriority**) parameter is added to the existing **qosCapability** parameter.

6.2 QoS descriptor

The QoS descriptor contains the QoS requirements for the bearer stream. It is an optional parameter. If best effort service is sufficient, then the QoS descriptor parameter need not be included. The presence of a QoS descriptor indicates that better-than-best-effort service is required. The QoS descriptor includes a **qosType** followed by a **qosValue**. The elements of QoS descriptor are described in detail below.

6.2.1 Parameter QoSType

The parameter QoSType indicates the strength of the QoS request which guides the action to be taken in case of a QoS failure. In other words, it is used by the H.323 system to decide whether a call is to be continued or failed based on QoS failures. There are two possibilities with respect to the QoS type. They are:

- **Desired**: This indicates that QoS is desirable but not mandatory for the call. This means that the QoS request should be attempted but the call can continue even if the desired QoS is not granted.
- **Required**: This indicates that QoS is required and the call cannot continue if the required QoS for the stream is unavailable.

6.2.2 Parameter QoSValue

The parameter QoSValue is used to specify the QoS requirements for the stream. The **qosValue** values may be left unspecified if they are to be derived from other sources such as static configurations and service level agreements. They are to be signalled via the **qosValue** parameter if they are to be specified. It is necessary to signal this information end-to-end as it allows the H.323 entities to agree upon the required QoS for the stream as well as it allows intermediary H.323 entities to negotiate these QoS requirements with their respective network domains. The **qosValue** is described in terms of a QoS class as defined by ITU-T Rec. Y.1541, which provides a list of defined classes from which one that is appropriate for the bearer stream may be selected. Each QoS class defined in ITU-T Rec. Y.1541 contains a specific combination of bounds for end-to-end delay, end-to-end delay variation, and mean packet loss.

The **qosDescriptor** parameter is added to the existing **qosCapability** parameter.

6.3 Traffic descriptor

The traffic descriptor describes the bearer stream. The traffic descriptor is required for negotiating QoS with the network domain. The network domain utilizes such information for admission control and resource management. The agreed-upon QoS for a stream is guaranteed only if the flow remains conformant to the traffic descriptor provided.

ITU-T Rec. H.245 has already provided parameters for certain mechanisms such as RSVP and ATM. Hence, these parameters (rsvpParameters and atmParameters) will be reused for providing the traffic descriptor for RSVP and ATM respectively. For other QoS and transport mechanisms, a generic transport parameter is added to the qosCapability parameter. This genericTransport parameter consists of maximum allowed packet size, rate of flow, peak rate and bucketSize as described in ITU-T Rec. Y.1221 for transport parameter.

6.4 Authorization parameters

These authorization elements are required for authorization with the H.323 service domain and/or with the network domains. These parameters may be used by the gatekeeper for admission control. They may also be shared with the network domain to authorize the request for network resources.

This parameter will be discussed in detail in a future annex of this Recommendation. A placeholder for authorization elements have been provided in the **qosCapability** parameter.

7 QoS negotiation with the network

The H.323 QoS signalling is influenced by QoS signalling in the network, QoS authorization mechanisms supported, and network awareness among the H.323 entities. Therefore, a brief discussion of the various options in which the H.323 system can interact with the network entities is provided below. The objective of this Recommendation is not to make a suggestion but to ensure that QoS elements described in this Recommendation are sufficient irrespective of the option selected.

7.1 Direct QoS negotiation

This type of QoS negotiation is described as option 1 in ITU-T Rec. H.360. This model expects that the H.323 entities have the necessary network awareness to identify the network device/interface that is going to service the bearer stream. Therefore, it can engage with the identified network device/interface to ensure that the bearer stream receives the necessary QoS. The H.323 entity can request the necessary resources from the identified network device/interface and provide the appropriate authorization parameters to ensure that the bearer stream receives the desired QoS. If the network device is unable to meet the QoS request, it may fail the request or return an error. In such a case, the H.323 domain takes necessary actions such as failing the call, re-routing or any other configured failure actions. If the QoS request is granted, then the H.323 system allows the endpoint to initiate the call and exchange media.

7.2 Path-coupled QoS negotiation

In another model, the network devices that service the media are identified via network-based QoS signalling. This signalling is out-of-band and traverses the same path as that of the bearer stream. Hence, it is referred to as a path-coupled QoS signalling. An example of this type of signalling is RSVP. This is described as option 2 in ITU-T Rec. H.360.

The path-coupled QoS signalling traverses the network entities along the path requesting resources for the bearer stream. The credentials for authorizing the QoS request may be presented via the same signalling or the network devices may approach the H.323 domain for authorization. This model is usable in large and complex topologies. However, the additional signalling and maintenance of state may be undesirable in some networks.

7.3 Other QoS negotiation

There are other types of QoS establishment that are a variation or a combination of the above two options. Media relay is one such example. A media relay participates in both call signalling and media transmission. Hence, QoS request and response occurs between the different components in a

single device. Another example is a variation of the direct QoS mechanism where the H.323 entity communicates with a QoS server in the network which in turn translates the request to the appropriate devices/interfaces.

Any of these options may be combined with the Differentiated Services QoS mechanism. The Differentiated Services is an implicit in-band signalling mechanism that carries a value in the ToS byte (DSCP value) in an IP header of the bearer packet. The network entities classify, meter and schedule the packets based on the DSCP value thus providing the packets with the necessary QoS. RFC 2998 describes the use of RSVP along with DiffServ.

8 H.323 QoS and service priority procedures

In this clause, the QoS and service priority procedures are described for the various stages of call establishment. These requirements may vary depending on QoS capabilities and mechanisms supported among the H.323 entities.

8.1 Pre-call setup procedures

This is the discovery phase of the QoS and service priority setup. The following steps are involved:

- **System QoS Discovery:** First of all, the endpoints need to discover the QoS and service priority classes supported by the H.323 system and any defaults provided as well.
- **Default Class Selection:** The next step is the endpoint selection of a default H.323 QoS and service priority class applicable to all calls or media streams established from that endpoint.
- **Transport-QoS capabilities negotiation:** In this step, the endpoint indicates its QoS capabilities to the gatekeeper. This is discussed in greater detail in the following subclause.
- **Gatekeeper user profile discovery:** Discovery by a gatekeeper of the profile of a visiting user to the service domain controlled by the gatekeeper.
- **Gatekeeper to Gatekeeper Service Class Discovery:** Gatekeeper discovery of the H.323 QoS and priority classes supported by another gatekeeper or the default QoS and priority levels provided by the system.

8.1.1 Endpoint QoS capabilities registration

The endpoint indicates its QoS capabilities to the gatekeeper during the RAS phase. This capability is signalled during the endpoint registration using the **transportQoS** field of the RRQ or the ARQ message. The gatekeeper either accepts or rejects the endpoint's selection and indicates its choice. The gatekeeper's choice is binding on the endpoint. If sent in the RRQ, the capabilities expressed in the **transportQoS** field apply to all calls made by the endpoint, unless the endpoint overrides the capability by specifying a **transportQoS** field in an ARQ message. If the endpoint includes **transportQoS** in an ARQ message, the capabilities specified apply only to that particular call.

The **transportQoS** field is an optional parameter in an RRQ and ARQ message. It indicates whether the endpoint is capable of participating in transport-QoS exchange. The elements of the **transportQoS** parameter are as follows:

- **Endpoint Controlled:** This option implies that the endpoint will control the transport QoS exchange.
- **Gatekeeper Controlled:** In this option, the endpoint expresses that the gatekeeper will control the transport QoS exchange on behalf of the endpoint.
- **No Control:** This option implies that no QoS exchange is necessary. This option indicates to the gatekeeper that QoS exchange is not necessary for the call.

- **QoSCapability**: This is a new parameter added by this Recommendation. This parameter provides the details of the endpoint's QoS capability, credentials and service priority as required. If the endpoints are capable of RSVP, then the **qosMode** in the **rsvpParameters** is used. If the endpoint prefers to locally secure QoS within its domain, then it indicates by setting the **localQoS** to TRUE. If a non-routine service priority is required, then this is indicated to the gatekeeper for approval. **transportQoS** as defined earlier is not stream specific. It has been modified by this Recommendation to contain a sequence of QoSCapability each of which will apply to a single stream.

Since at the time of RAS the H.323 entity does not know which streams will be finally selected in the call, it shall request admission for the different media streams that are being offered in a given call (SimultaneousCapabilitySet). Among the various options given for a single media (alternativeCapabilitySet), the H.323 endpoint shall pick the one that requires the most QoS resources. The bandwidth parameter shall contain the total of the bandwidth requests of all the simultaneous streams.

Subsequently, if there is change from what was originally admitted, the H.323 can update the QoS admission by sending a new QoSCapability in a BRQ request.

8.1.2 Gatekeeper selection of QoS capabilities

The gatekeeper decides whether to accept or reject the QoS capabilities received in the ARQ message based on the received information, its knowledge on the state of the network, any defaults configured, etc. The gatekeeper accepts the request by responding with an ACF or a RCF message. It may optionally insert a **transportQoS** if any information needs to be communicated to the H.323 endpoint such as Differentiated Service Code Point (DSCP) value to be used with the stream. If the gatekeeper rejects the selection provided by the H.323 endpoint, then it rejects the request by sending an ARJ or a RRJ.

The gatekeeper uses the parameters provided by the endpoint to admit or deny a request. The service priority parameter is used to ensure that the endpoint/user is allowed to request priority resources. The authorization credentials, if provided, are used to authorize the request. The gatekeeper also verifies the endpoint's use of the right QoS mechanism such as RSVP, local QoS or a particular QoS strength for the call. The gatekeeper's response may indicate one of the following options:

- **Endpoint Controlled**: In an ACF message, the presence of this option confirms the endpoint's control of QoS.
- **Gatekeeper Controlled**: In an ACF message, this confirms the gatekeeper's control of QoS.
- **No Control**: If included in an ACF message, then it confirms that no control of QoS is required.

The gatekeeper's decision relayed in the RCF message applies to all calls made by the endpoint, unless the gatekeeper later supplies a **transportQoS** field in an ACF message. If relayed in the ACF message, the decision applies only to that particular call to which the ACF applies. The endpoint shall accept the gatekeeper's decision in order to place a call.

8.2 Call setup procedures

In many cases, synchronizing QoS negotiation with call signalling is necessary to implement the required QoS policies and provide consistent QoS quality. To provide synchronization, the QoS negotiation must occur before the endpoint is alerted. Currently, alerting of the called endpoint occurs before media stream setup. Since QoS establishment requires information that is normally available only during media-setup, QoS establishment occurs after media-setup and therefore after alerting. This gives rise to undesirable scenarios such as failing the call if sufficient network

resources are not available after the called endpoint has been alerted. To avoid such scenarios, it is necessary to perform QoS establishment before alerting the called endpoint. This can be done in the following ways:

- Fast Start procedures.
- Inclusion of the H.245 address in the Setup message.
- H.245 Tunnelling.

If the called H.323 endpoint or any intermediary H.323 entity requires a "required" **qosType** and receives the setup messages without any of the above, then the call establishment is failed because the QoS requirements cannot be met. If the calling endpoint wishes a **qosType** of "desired", then it is allowed to perform QoS signalling without requiring that the alerting be withheld. Therefore, it can use the normal H.323 signalling sequence as the call will be established irrespective of the QoS response.

8.2.1 Fast-start procedures

Fast-start procedures may be used by the H.323 entities to enable QoS establishment before alerting of the called endpoint. In this procedure, a sequence of OpenLogicalStructures is included in the Setup message. To allow for QoS negotiation, these procedures contain the QoS parameters as well. The presence of the QoSCapabilities indicates to the called endpoint that QoS procedures are required. This enables the withholding of the alerting until the QoS procedures are complete. Figure 2 shows an example call flow.

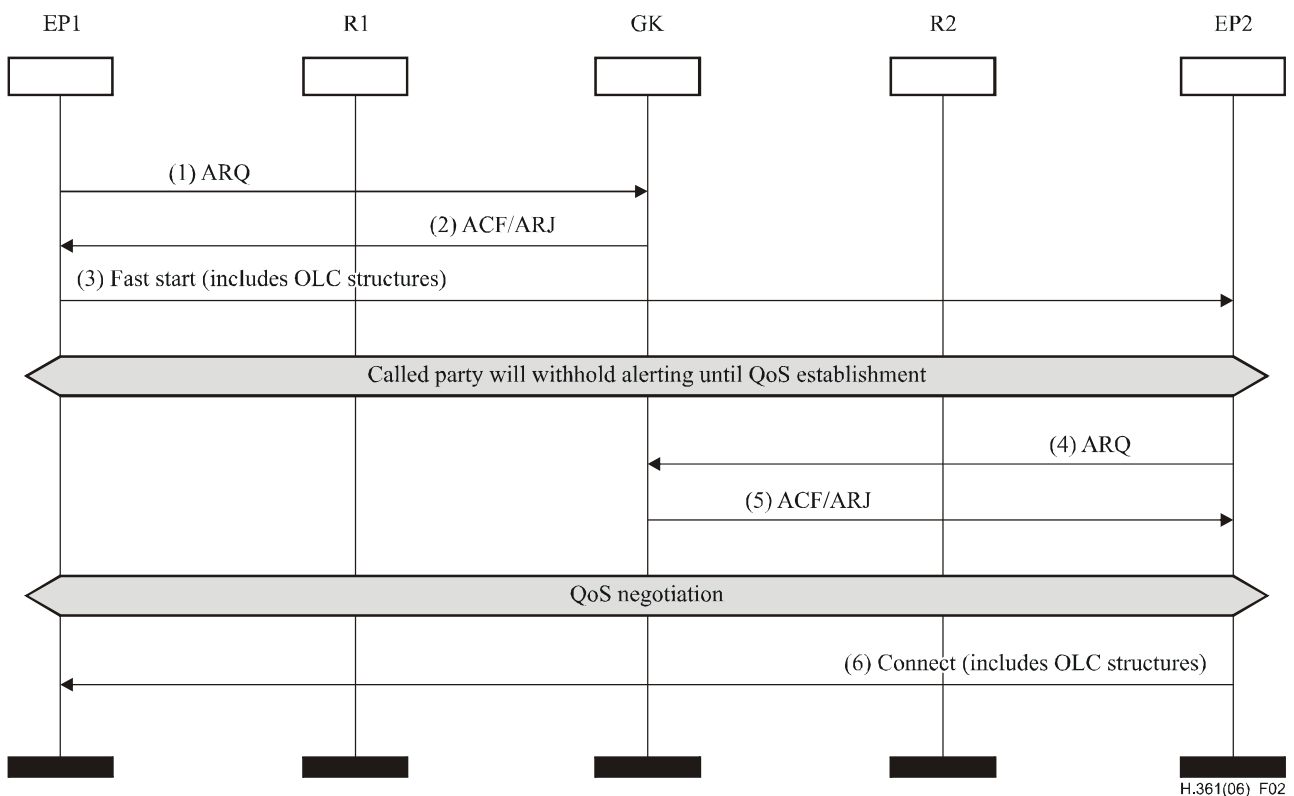


Figure 2/H.361 – Fast-start with QoS negotiation

8.2.2 H.245 address in the setup message

In this mechanism, the H.323 entity adds the H.245 address in the Setup message. Once the called endpoint receives the H.245 address, it can initiate the H.245 exchange which allows for QoS negotiation. Until the QoS negotiation is complete, alerting is withheld. A Call Proceeding message is sent to prevent timeouts.

8.2.3 H.245 tunnelling

H.245 tunnelling is another mechanism by which the H.245 information necessary for the QoS procedures can be exchanged during the call-setup process. This allows an endpoint to initiate the QoS procedures and ensures the requested QoS is available before the alerting process.

8.3 Bearer/media stream setup procedures

The previous clause dealt with how the H.245 exchange can be made possible during the call-setup phase. This clause elaborates the QoS handling within the H.245 exchange.

8.3.1 qosType Negotiation

The **qosType** indicates whether the call can proceed even if the QoS request failed. Even if a single call leg has a "required" **qosType**, the following rules apply:

- A stream is said to have a "required" **qosType** even if one of the call-legs has a "required" **qosType** policy. At each H.323 entity, the **qosType** is combined with the **qosType** from the incoming message to derive the **derivedQoSType**. The **derivedQoSType** is the one that is used and is also used in the **QoSDescriptor** that is forwarded onwards. If a "required" **qosType** is combined with a "desired" **qosType**, then the resulting **derivedQoSType** is "required". A "required" **qosType** in any call leg will cause a stream to be failed if QoS is not secured for any leg of the call.
- Any H.323 entity that fails to receive the required QoS must initiate the call teardown in the case of the "required" QoS.
- The called endpoint must not alert the user until the confirmation to the QoS request is received in the case of a "required" **qosType**. This is done to avoid a situation where the user is alerted and the call is failed subsequently.

All the rules above apply to a single logical channel (stream). The H.323 entities should contain policies that dictate what kind of action is required when there is QoS failure for a subset of streams in a call.

8.3.2 H.245 capability exchange phase

During the H.245 capability exchange, each endpoint indicates its QoS capabilities to the other endpoint via the **qosCapability** parameter which is included in the **transportCapability** Parameter. Since **transportCapability** is common and does not differentiate between send capabilities and receive capabilities, the QoS capability shall apply to both the send and the receive directions. Since H.245 exchange is not stream specific, there is no value in providing stream specific parameters at this time. The omission of the **qosCapability** parameter in the H.245 capability exchange indicates to the called endpoint that the calling endpoint has either no capability or desire to provide QoS negotiation.

The following can be signalled to the other endpoint during this phase using the **qosCapability** parameter:

- Endpoint indicates the strength of the QoS required for the call via the **qosType** in **qosDescriptor** parameter.
- If the endpoint wishes to engage in RSVP, then it is signalled via the **qosMode** in **rsvpParameters**. Since RSVP requires the participation of both the endpoints, if the called endpoint does not support this capability, it may reject the request.
- Endpoint can signal **localQoS** if it wishes to locally secure QoS in its domain. The called endpoint should signal whether it is capable of **localQoS** as well.
- If the calling endpoint requires the use of non-routine service priority, then it signals the service priority in the **qosCapability**. The calling endpoint will use the same priority for its side of the bearer stream.
- If the **qosType** of the different channels is different, then the **qosType** in the H.245 capability exchange should represent the strongest of the values as explained in the above subclause.

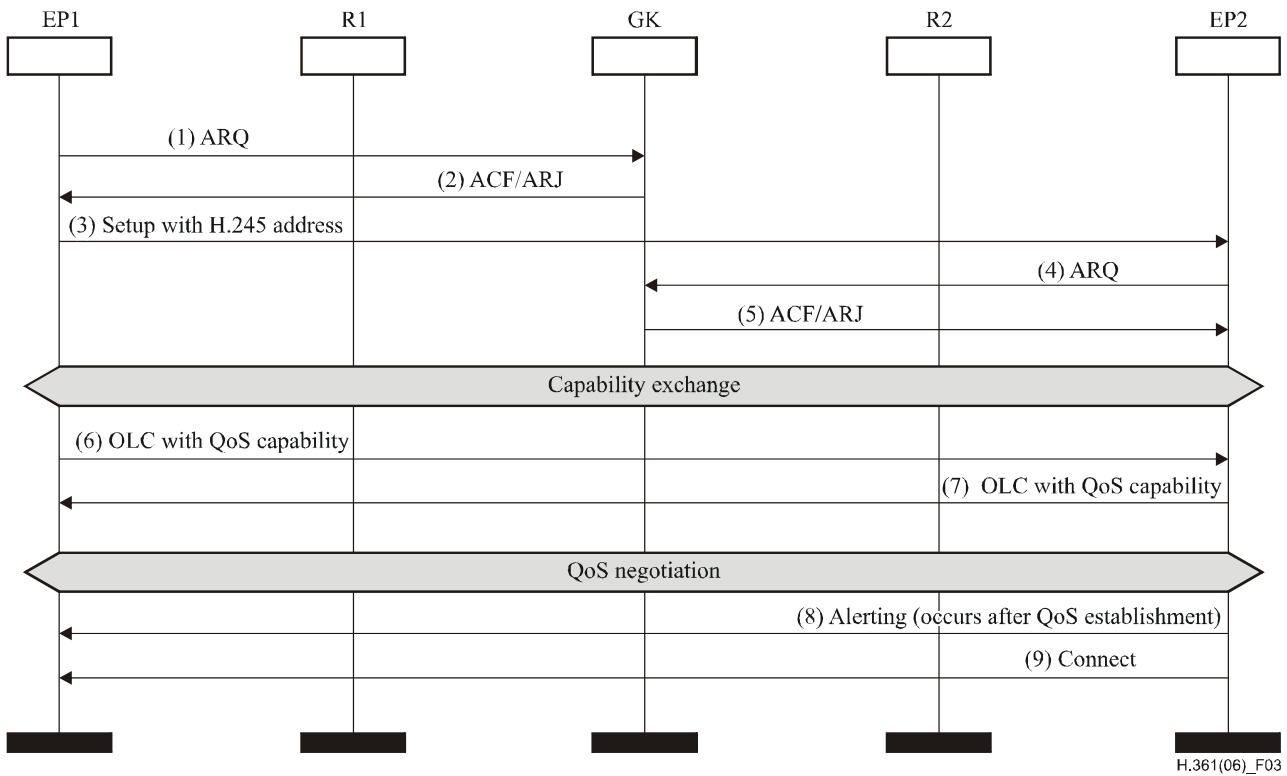
8.3.3 Logical channel signalling

In this phase, the opening of the H.245 logical channel is where the main QoS exchanges happen and reserving of resources are done. Reservations (guaranteed or controlled) are performed only if both H.323 endpoints indicate that they are RSVP capable during capability exchange.

Figure 3 shows the flow for a call that includes H.245 address in the Setup message and uses path-coupled QoS negotiation. The gatekeeper (GK) shown in the figure may be one or more gatekeepers in one or more service and network domains. In this figure, the calling H.323 endpoint (EP1) sends a Setup message with the H.245 address. In the capability exchange, EP1 indicates that QoS is required. The called H.323 endpoint (EP2) accepts the QoS parameters by responding to the Capability exchange. The OLC exchange includes all the QoS parameters for each logical channel for which end-to-end QoS is required. The parameters are used for QoS negotiation between the endpoints. Once the QoS is confirmed, then the called endpoint (EP2) alerts the users and continues with call establishment.

If the called endpoint does not receive a fast-start message or a H.245 component in the setup message, it assumes that the calling endpoint is not capable of path-coupled QoS negotiation. The called endpoint can then decide to decline the call based on the configured policies.

If the **qosType** for the call is "desired", then the called party can alert the user even before the QoS negotiation is complete. The reason for this is that a failure of QoS will not result in a failure of the call.



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Figure 3/H.361 – OLC exchange with QoS negotiation

Figure 4 shows a flow for a call that includes H.245 address in the Setup message and uses local (direct) QoS negotiation. In this model, the gatekeeper identifies and pushes down the QoS parameters and authorization elements onto the network device(s) in its domain to request and secure QoS. During RAS exchange, the endpoints and gatekeeper do not have the necessary QoS parameters such as the traffic descriptor to negotiate QoS with the network. Therefore, to implement direct QoS negotiation, the gatekeeper controlled H.245 exchange is suggested. This allows the gatekeeper to be in the path of the OLC exchanges which contain the negotiated QoS parameters that are used to negotiate QoS with the network. The H.245 capability exchange is not shown in the figure for simplicity sake.

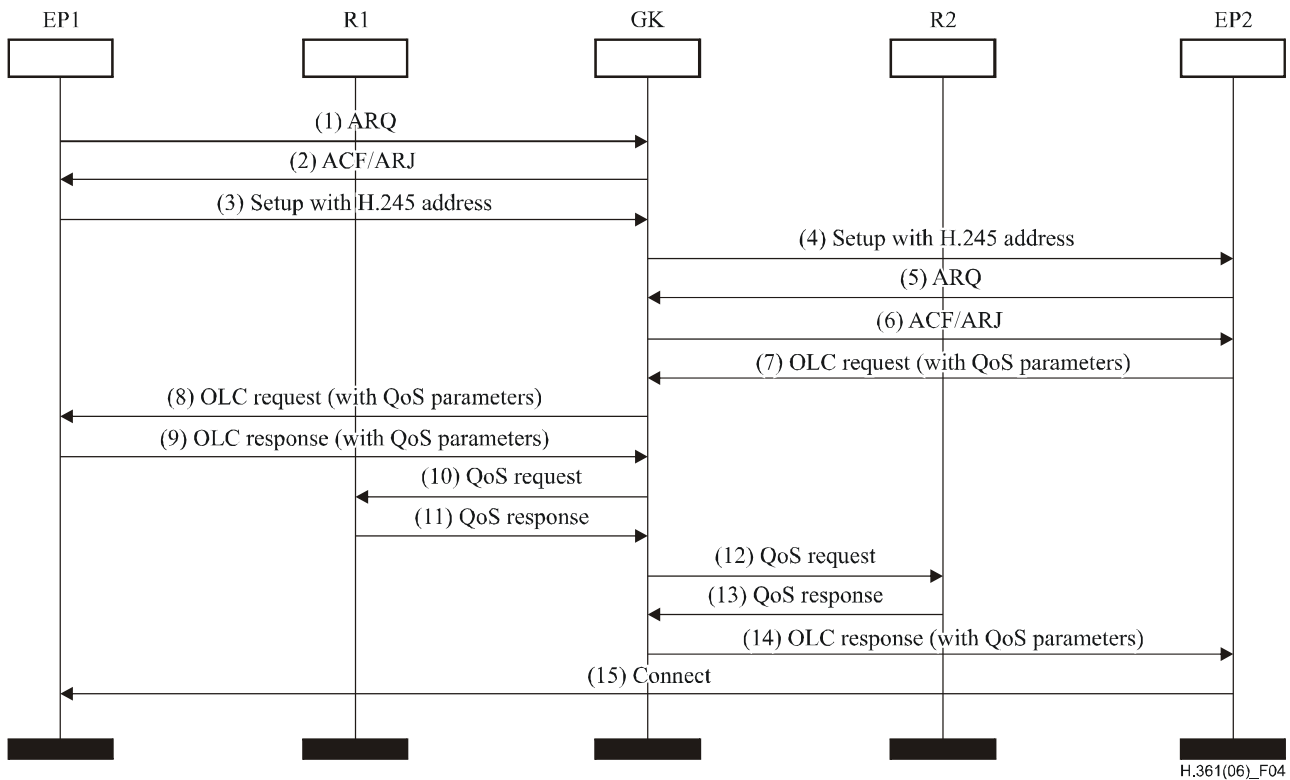


Figure 4/H.361 – H.323 QoS signalling via direct QoS negotiation

The GK shown in Figure 4 may be one or more gatekeepers in one or more service and network domains. Each gatekeeper is responsible for securing QoS in its local domain. If the called endpoint does not receive a fast-start message or a H.245 component in the setup message, it can consider that the calling endpoint is not capable of QoS synchronization. The called endpoint can then decide to decline the call based on the configured policies.

8.4 Gatekeeper update

Once the call is established, the endpoint is responsible to register any changes in **transportQoS** with the gatekeeper. For instance, if the average rate of the channel is more than what was originally negotiated in the ARQ message, then the endpoint must provide the correct information in the BRQ message. A revised **transportQoS** is used in the BRQ message to provide the corrected information regarding the channel. The BRQ is necessary even if the changes that occur in multiple streams result in no overall change to the requirements.

If the gatekeeper receives a BRQ with a new QoSCapability, then the gatekeeper replaces the old QoSCapability with the new one and performs the admission control again for the new parameters. If admitted, then the gatekeeper returns a BCF. The QoSCapability can be optionally included in a BCF for indicating the DSCP value to be used for the stream. The gatekeeper sends a BRJ if it rejects the new BRQ.

8.5 Authorization procedures

The authorization process depends upon each domain. The authorization processes occur in the H.323 system as well as in the transport system. In the application plane, the **QoS**M, along with **QoS**PE, authorize the call and ensure that the end-user/call is allowed to ask for the level of QoS requested, i.e., the **servicePriority**, the **qosType**, the **qosValue** values, etc., are all within the limits allowed for the particular end-user/call.

In the transport system, the network device may require authorization to permit the H.323 system to request and be granted the necessary resources. The authorization for the network resource request can be done in a couple of ways. In the direct-QoS method, where the **QoS**M pushes down the authorization along with the requirements to the relevant network entities, no additional authorization may be necessary except a trusted relationship between the **QoS**M and the network entities. The establishment of such trust is outside the scope of this Recommendation. In the path-coupled model, the network entity may be provided with the relevant credentials to authenticate the request. This can be done by including credentials within the QoS signalling message that the network device can trust. Another option is for the network device to approach the **QoS**M to verify if the request is genuine before proceeding.

These authorization mechanisms will be covered in greater detail in a future annex of this Recommendation.

8.6 Media exchange

Most of the above procedures pertain to admission control and making sure that necessary resources are available in the network for the call. In addition, the endpoint may also provide in-band QoS signalling by marking the packets with the appropriate DSCP value. These markings help the media packets be classified, policed, queued and scheduled appropriately. More details on this aspect of QoS handling will be discussed further in an annex of this Recommendation.

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