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Technical Specification

Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service in TIPHON systems; Part 3: Signalling and control of end-to-end Quality of Service (QoS)

Reference

RTS/TIPHON-05003 [2]a

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Foreword

This Technical Specification (TS) has been produced by ETSI Project Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON).

The present document is part 3 of a multi-part deliverable covering End-to-end Quality of Service in TIPHON systems, as identified below:

TR 101 329-1: "General aspects of Quality of Service (QoS)";

TS 101 329-2: "Definition of speech Quality of Service (QoS) classes";

TS 101 329-3: "Signalling and control of end-to-end Quality of Service (QoS)";

TS 101 329-5: "Quality of Service (QoS) measurement methodologies";

TR 101 329-6: "Actual measurements of network and terminal characteristics and performance parameters in TIPHON networks and their influence on voice quality";

TR 101 329-7: "Design guide for elements of a TIPHON connection from an end-to-end speech transmission performance point of view".

Quality of Service aspects of TIPHON Release 4 and 5 Systems will be covered in TS 102 024 and TS 102 025 respectively, and more comprehensive versions of the Release 3 documents listed above will be published as part of Release 4 and 5 as work progresses.

Introduction

The present document forms one of a series of technical specifications and technical reports produced by TIPHON Working Group 5 addressing Quality of Service (QoS) in TIPHON Systems. The structure of this work is illustrated in figure 1.

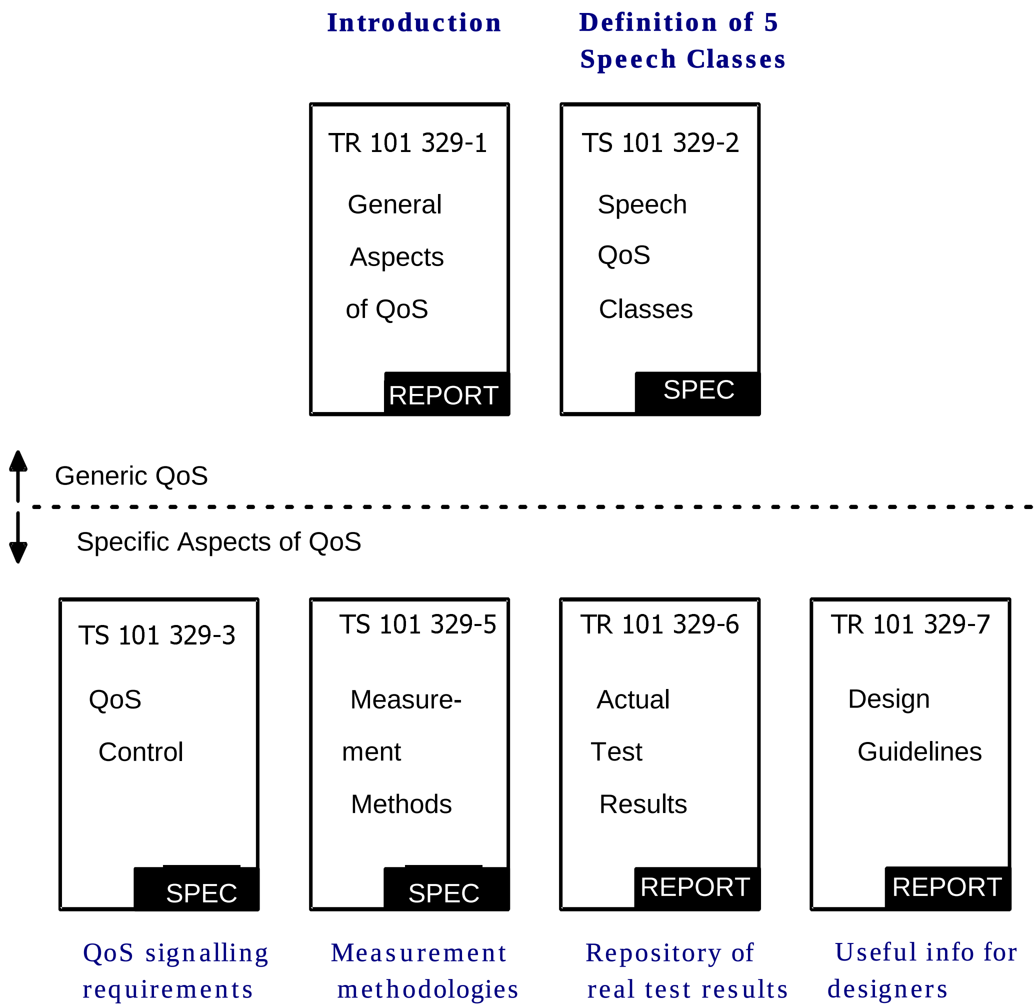


Figure 1: Structure of TIPHON QoS Documentation for Release 3

The present document, describes a framework for the signalling and control of end-to-end Quality of Service in TIPHON Systems.

1 Scope

The present document describes a framework for enabling the end-to-end QoS levels defined in TS 101 329-2 [1] to be signalled and controlled in TIPHON systems. The mechanisms involved operate between TIPHON terminals, IP telephony Service Providers (ITSPs), and network transport systems, and provide a flexible means for the dynamic allocation of QoS parameters across these entities in order to meet the QoS Service Classes defined in TS 101 329-2 [1]. The functional entities involved in the QoS signalling and control are defined, as are the requirements of the reference points between these functional entities. The QoS parameters and information flows used to establish the required Service QoS levels are also specified.

The Application Plane mechanisms described in the present document are intended to be independent of the transport QoS mechanisms used within the underlying IP networks.

The emphasis of the present document is on media QoS (primarily voice, but the mechanisms are also applicable to other media types). Issues related to performance of the signalling channels are outside the scope of the present document.

TS 101 314 [2] describes how this QoS framework fits into the overall TIPHON architecture and details of the signalling involved are described in TS 101 471 [3].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI TS 101 329-2: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service (QoS) in TIPHON systems; Part 2: Definition of speech Quality of Service (QoS) classes".

[2] ETSI TS 101 314: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON); Network architecture and reference configurations; TIPHON Release 2".

[3] ETSI TS 101 471: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON); Signalling for calls between an H.323 terminals and terminals in a Switched-Circuit Network (SCN); Phase III: Scenario 1, 2, 3, and 4".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

IP Telephony Service Provider (ITSP): service provider providing IP telephony services

NOTE: The same business entity may act as both a Transport Network Operator and an IP Telephony Service Provider.

InterConnect Function (ICF): functional entity that interconnects Transport Domains

NOTE: It provides a policy and/or administrative boundary and may police authorized media flows between two Transport Domains to ensure they are consistent with the QoS policy specified by the relevant Transport Resource Manager

Quality of Service Manager (QoSM): functional entity that mediates requests for end-to-end QoS in accordance with policy determined by the QoSPE

NOTE: It communicates with, other QoSMs and with TRMs to determine, establish and control the offered QoS.

Quality of Service Policy Element (QoSPE): functional entity that manages IP Telephony QoS policies and provides authorization of permitted and default QoS levels

NOTE: It receives requests from and issues responses to QoSMs to establish the authorized end-to-end QoS levels.

service domain: collection of physical or functional entities offering IP telephony services under the control of an IP telephony service provider which share a consistent set of policies and common technologies

Transport Domain (TD): collection of transport resources sharing a common set of policies, QoS mechanisms and transport technologies under the control of a transport network operator

transport network: collection of transport resources which provide transport functionality

transport network operator: business entity operating a Transport Network

Transport Policy Entity (TPE): functional entity that maintains the policies of a Transport Domain

Transport Resource Manager (TRM): functional entity that applies a set of policies and mechanisms to a set of transport resources to ensure that those resources are allocated such that they are sufficient to enable QoS guarantees across the domain of control of the TRM

Transport Function (TF): functional entity representing the collection of transport resources within a Transport Domain which are capable of control by a Transport Resource Manager (TRM)

User Equipment (UE): equipment under the control of an End-User

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ATM	Asynchronous Transfer Mode
BC	Bearer Control
CBR	Constant Bit Rate
DiffServ	Differentiated Services
ICF	InterConnect Function
IntServ	Integrated Services
IP	Internet Protocol
ITSP	IP Telephony Service Provider
MPLS	Multi Protocol Label Switching
QoS	Quality of Service
QoSM	Quality of Service Manager
QoSPE	Quality of Service Policy Element
RMS	Root Mean Square
RSVP	Resource Reservation Set-up Protocol
RTP	Real-time Transport Protocol
SCN	Switched Communications Network
SLA	Service Level Agreement
TD	Transport Domain
TF	Transport Function
TPE	Transport Policy Element
TRM	Transport Resource Manager
UDP	User Datagram Protocol
UE	User Equipment
VBR	Variable Bit Rate

VPN Virtual Private Network

4 Void

5 QoS architecture

5.1 TIPHON architectural planes

The Generalized TIPHON Architecture is shown in figure 2 (see TS 101 314 [2]).

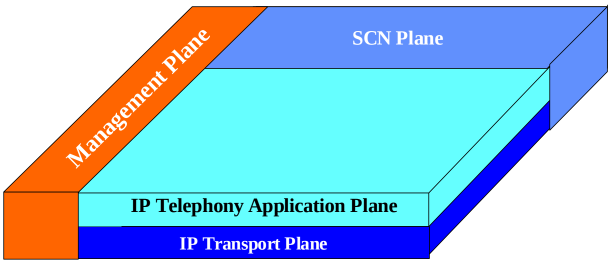


Figure 2: Generalized TIPHON Architecture

End-to-end QoS signalling and control will in general involve QoS information flows in each of the architectural planes.

The Required end-to-end QoS levels are established within the IP Telephony Application Plane between End-Users and Service Provider(s). Decisions determining QoS, specific to the application, will take place in the IP Telephony Application Plane (e.g. codec type, packetization, etc).

The IP Transport Plane (IP Network Operators) provides a QoS service to the Application Plane (Service Providers). QoS control within the IP Transport Plane is the responsibility of the IP Network Operators.

5.1.1 IP telephony application plane

Within this plane, QoS parameters specific to the application are requested, authorized, signalled, controlled and accounted.

5.1.2 IP transport plane

Within this plane, general non-application specific parameters effecting QoS must be controlled and accounted to achieve the QoS requirements requested by the application.

5.1.3 Management plane

Within this plane QoS management entities applicable to both application and transport planes will reside and information flows applicable to QoS management will terminate.

5.2 Service and transport domains

A TIPHON-compliant deployment will in the general case be made up of a number of separate Service and End-User Domains, each representing the domain of control of an ITSP or End-User. These domains will generally be restricted to IP Telephony Application plane functionality, e.g. gatekeepers, softswitches, call agents, etc.

Similarly, a TIPHON-compliant system will, in general, also be made up of a number of separate Transport Domains. Transport Domains consist solely of transport related functionality; this includes IP routers and switches, firewalls, etc. Each Transport 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), access, metering, addressing schemes (global, local) and transport protocol (IPv4, IPv6), etc.

Since these policies are local, functional entities are needed to interface to other domains. These entities are called InterConnect Functions.

The general TIPHON deployment is illustrated in figure 3.

5.2.1 Void

5.2.2 Void

5.2.3 End-to-end QoS control

End-to-end QoS control across multiple domains may be achieved in one of two ways:

- by having an IP Telephony Application Service Domain control each Transport Domain. The Service Domain would request the transport resources with QoS from each of the Transport Domains and establish the interconnect in a controlled fashion;
- by means of end-to-end signalling within and between Transport Domains which share common policies.

These two mechanisms are explained hereafter.

5.2.3.1 IP application plane control

In this first case, the routing of the call between Transport Domains is under the control of the ITSPs. In this general case, where the Transport Plane is made up of a number of heterogeneous Transport Domains, each domain may have its own QoS mechanisms and policies.

Figure 3 illustrates the general case where a number of separate ITSPs and Transport Domains are involved in a call.

Call-Control signalling takes place in the IP Telephony Application Plane between ITSPs, and between End-Users and ITSPs.

Transport flows are between End-Users and transport domains, and between transport domains.

QoS signalling and SLAs are between End-Users and ITSPs, and between ITSPs and follow Call Routing. Between each ITSP involved in the call and its associated Transport Domain(s) QoS SLAs then ensure that the required QoS parameters are met by each Transport Domain involved in the call.

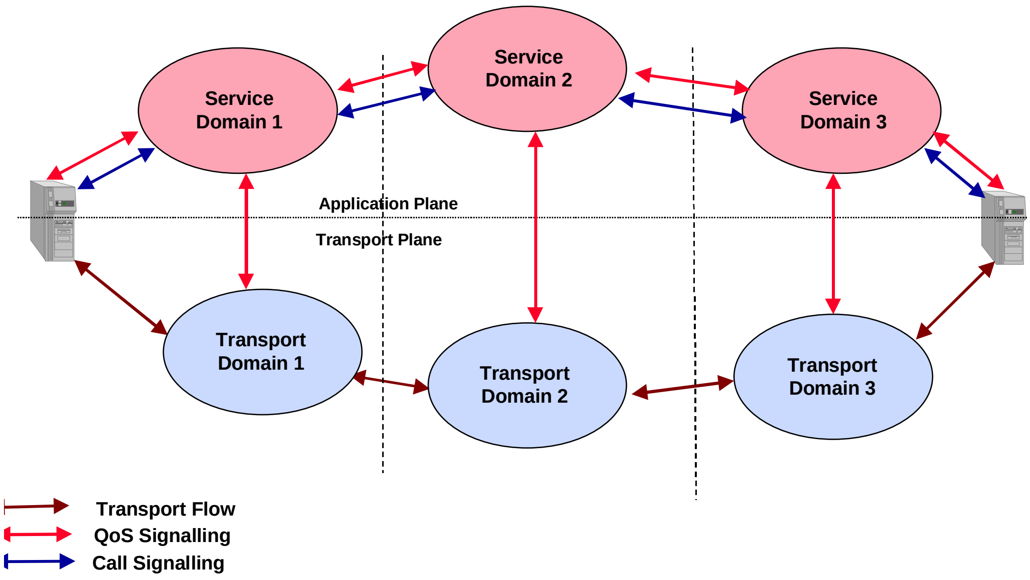


Figure 3: Generalized TIPHON Architecture with Service Domain End-to-end QoS Control

5.2.3.2 Transport plane control

In this case, the QoS control of the call between Transport Domains is performed by the local Transport Domain and by agreement between Transport Network Operators. QoS SLAs are required between End-Users and ITSPs and between Transport Network Operators. The End-Users may first register with their ITSP and receive authorization to make a call before establishing a media connection with the local Transport Network Operator.

This approach is a viable option where the Transport Plane comprises a single homogeneous policy space. Addressing, Access and QoS mechanisms and policies all have to be uniform for this case to work.

Figure 4 illustrates the case where end-to-end control of QoS is performed by signalling in the transport plane with QoS authorization by the access Service Provider.

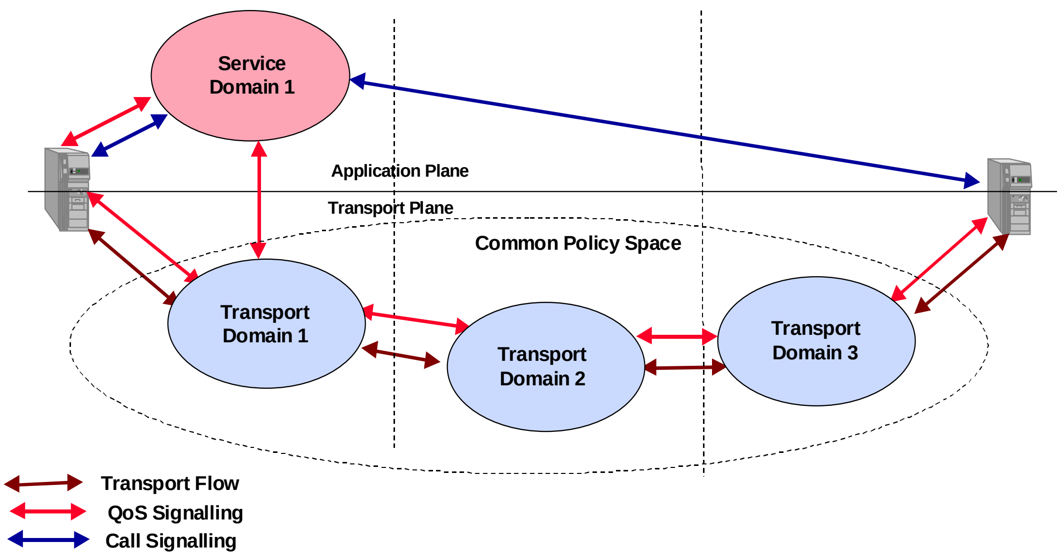


Figure 4: Generalized TIPHON architecture with transport plane End-to-end QoS control

Hybrid situations are possible where a Service Domain may control several Transport Domains or one Transport Domain may control others. Some of these configurations are shown in annex A.

5.3 QoS Functional Elements

The TIPHON QoS mechanisms have elements in both the Transport and in the IP Telephony Application plane.

The following Functional Elements are involved in the QoS Control Framework.

5.3.1 QoS Service Manager (QoSM)

A functional entity that mediates requests for end-to-end QoS in accordance with policy determined by the QoSPE. It communicates with other QoSMs and with TRMs to determine, establish and control the offered QoS.

5.3.2 QoS Policy Element (QoSPE)

A functional entity that manages IP Telephony QoS 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.

5.3.3 Transport Resource Manager (TRM)

A functional entity that applies a set of policies and mechanisms to a set of transport resources to ensure that those resources are allocated such that they are sufficient to enable QoS guarantees across the domain of control of the TRM.

5.3.4 Transport Policy Entity (TPE)

A functional entity that maintains the policies of a Transport Domain.

5.3.5 Interconnect Function (ICF)

A functional entity that interconnects Transport Domains. It provides a policy and/or administrative boundary and may police authorized transport flows between two Transport Domains to ensure they are consistent with the QoS policy specified by the relevant Transport Resource Manager.

5.3.6 Transport Function (TF)

A functional entity representing the collection of transport resources within a Transport Domain which are capable of control by a Transport Resource Manager

5.3.7 Relationship between functional entities

The relationship between these QoS Functional Entities is shown in figure 5.

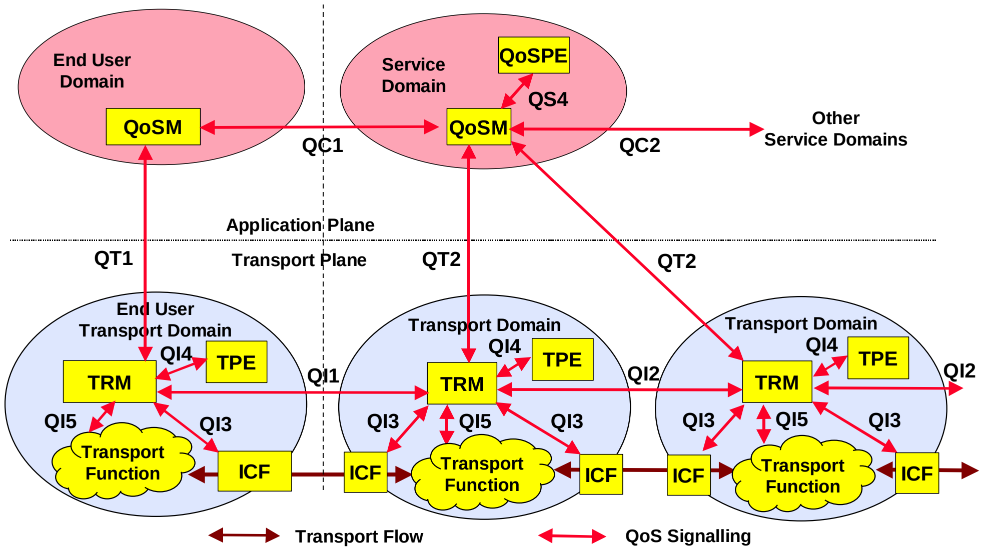


Figure 5: TIPHON QoS Functional Entities

5.4 QoS reference points

The QoS reference points indicated in figure 5 are derived from the general reference points defined in TS 101 314 [2]. They are used for QoS only and are distinguished from their equivalent general reference points by the addition of the letter Q. They are extensively explained in clause 8. In this clause a short description of each is given.

5.4.1 Reference point QC1

The QoS information flow between a QoSM and a User Equipment QoSM is captured in the QC1 reference point. The information flow across this reference point communicates QoS related bearer information between an End User and the End User's ITSP in the IP Telephony Application Plane.

5.4.2 Reference point QC2

Information flowing between two QoSMs in different service domains is captured in QC2. The information flow across this reference point communicates QoS related bearer information between domains (ITSPs) in the IP Telephony Application Plane.

5.4.3 Reference point QS4

Between a QoSM and a QoSPE. The information flow across this reference point communicates QoS policy information relating to the establishment of a bearer with specified QoS levels.

5.4.4 Reference point QT2

Between a QoSM and its associated TRM(s). The information flow across this reference point communicates QoS related transport flow information between a Service Domain and an associated Transport Domain. The information on QT2 communicates the QoS related characteristics required of the transport flows that will carry the media flow, the properties of the media flow, and addressing information related to the transport flows.

5.4.5 Reference point QT1

Between a User Equipment QoSM and an associated Transport Domain. The QoS information flow across this reference point communicates the QoS related characteristics required of the local loop transport flows that will carry the media flow, the properties of the media flow, and possibly addressing information related to the transport flows.

5.4.6 Reference point QI1

Between a TRM and a TRM in another Transport Domain. The QoS information flow across this reference point communicates the QoS related characteristics required of the local loop transport flows that will carry the media flow, the properties of the media flow, and possibly addressing information related to the transport flows.

5.4.7 Reference point QI2

Between two TRMs in different Transport Domains. The information flow across this reference point communicates the QoS related characteristics required of the interconnect transport flows that will carry the media flow, the properties of the media flow, and possibly addressing information related to the transport flows.

5.4.8 Reference point QI3

Between a TRM and an ICF. The information flow across this reference point controls the InterConnect Function and enables it to perform its interworking and policing functions.

5.4.9 Reference point QI4

Between a TRM and its associated TPE. The information flow across this reference point is for further study.

5.4.10 Reference point QI5

Between a TRM and its associated TF. The information flow across this reference point is for further study.

6 Characterizing QoS

6.1 Service, application and transport level QoS parameters

Five end-to-end QOS classes applicable to TIPHON systems are defined in TS 101 329 2 [1]. These TIPHON QoS classes are expressed in terms of the users perception of QoS and they form a suitable basis for QoS agreements between the ITSPs and End-Users.

Within the IP Telephony application the subjective service level QoS Class is determined by a number of engineering parameters which form part of the User Equipment, the network based equipment and the performance of the network itself. Examples are the choice of codec, any forward error correction deployed, the packetization algorithm used, the codec frame size, the algorithms used for handling packet delay variation at the receiver, the dejittering delay introduced at the jitter buffers, error concealment techniques within the decoder and equipment processing delays. At the application level, QoS agreements relating to the registration of User Equipment with ITSPs, must be specified in terms of these application based parameters.

In practice most of these parameters will be determined by the User Equipment design, and control of end-to-end QoS within the application will be reduced to the control of a number of basic network and equipment related parameters. Specifically:

- maximum end-to-end delay;
- maximum end-to-end delay variation;
- maximum Packet loss.

End-to-end control of these parameters is necessary and sufficient to ensure guaranteed speech quality across a particular speech path. Where multiple Transport Domains are involved in a call, the set of parameters must be specified and controlled in each domain if quality is to be specified and controlled.

The QoS achievable at the application and service levels will depend ultimately on the performance of the underlying transport networks supporting the IP telephony service. In the Transport Plane therefore the mean end to end delay, delay variation and packet loss must be controlled.

Figure 6 describes the parameters that are relevant for each level.

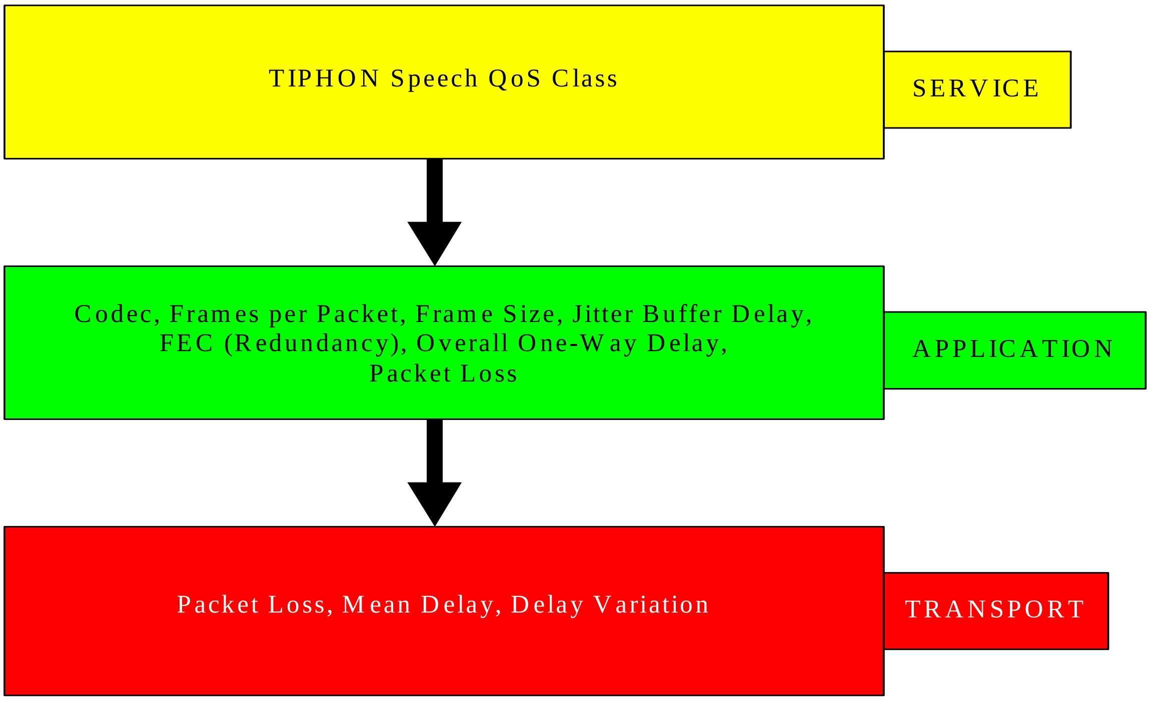


Figure 6: Service, application and transport QoS parameters

6.2 Interfacing to the Transport Plane

Although the QoS requirements arise from the IP telephony application, the parameters must be controlled in the transport plane. The QoS requirements are speech quality related and are therefore independent of the mechanisms used to control quality in the transport plane. Thus ATM, RSVP, DiffServ or MPLS or static network engineering could all be used to control the required QoS parameters, or even a mixture of these mechanisms where multiple Transport Domains are involved. The QoS requirements for a particular media flow must, however, be known to the transport plane in order that the parameters can be controlled to the required levels.

For the purposes of interfacing to the transport plane a distinction is made between Transport QoS Parameters, which specify the QoS levels to be delivered, and a traffic descriptor, which enables the transport network to optimally manage the resources required.

6.2.1 Transport QoS parameters

The transport QoS parameters (maximum end-to-end delay, maximum end-to-end delay variation, maximum mean packet loss) specify the QoS requirements of the transport flow carrying the bearer.

The format in which these parameters are specified may vary depending on individual circumstances. Different levels of instantaneous control are possible and the way in which the parameters are specified will determine this. In general, there are three possibilities:

1) specification of whether QoS is to be controlled on the bearer. Best effort speech communication implies that QoS levels are not specified;

2) specification that any or all of the three parameters are to be controlled but that the values for the parameters are specified elsewhere, e.g. by service level agreements;

3) specification of the absolute values for the three parameters.

These possibilities are provided by the general format of the transport QoS parameter group (see clause 9.2) which shall be as follows:

Sub-Field 1: Maximum end-to-end delay

MaxDelayClass	**(enumeration)**	**Possibility 2**
MaxDelayValue	**(numeric)**	**Possibility 3**

Sub-Field 2: Maximum end-to-end delay variation

MaxDelayVariationClass	**(enumeration)**	**Possibility 2**
MaxDelayVariationValue	**(numeric)**	**Possibility 3**

Sub-Field 3: Maximum Mean Packet Loss

MaxMeanPacketLossClass	**(enumeration)**	**Possibility 2**
MaxMeanPacketLossValue	**(numeric)**	**Possibility 3**

where the above parameters are defined as follows:

MaxDelayClass:

This parameter shall specify a number representing an entry in a list of possible maximum delay values and based on a priori agreement between business entities. The values of maximum delay to be included in this list are for further study.

MaxDelayValue:

This parameter shall be used to specify the numerical value of the maximum delay.

MaxDelayVariationClass:

This parameter shall specify a number representing an entry in a list of possible maximum delay variation values and based on a priori agreement between business entities. The values of maximum delay variation to be included in this list are for further study.

MaxDelayVariationValue:

This parameter shall be used to specify the numerical value of the maximum delay variation.

MaxMeanPacketLossClass:

This parameter shall specify a number representing an entry in a list of possible maximum mean packet loss values and based on a priori agreement between business entities. The values of maximum mean packet loss to be included in this list are for further study.

MaxMeanPacketLossValue:

This parameter shall be used to specify the numerical value of the maximum mean packet loss.

For possibility 1, where no QoS control is required, the transport QoS Parameter Group shall be omitted from information exchanges.

NOTE 1: The way in which the above variables are characterized is for further study.

NOTE 2: The use of a parameter to indicate the maximum permitted levels of packet loss in a burst of specified duration is for further study.

6.2.2 Traffic descriptor

The traffic statistics of each bearer may be specified and signalled to the transport plane for resource management and admission control purposes. The QoS levels for a media flow will be guaranteed only in the case that the flow remains conformant to its Traffic Descriptor. The format of the traffic descriptor shall be as follows:

PeakBitRate	**(numeric)**
PacketSize	**(numeric)**

where these are defined as follows:

PeakBitRate

This is defined as the maximum rate of the media flow at which the transport domain is required to sustain QoS guarantees. (The overhead from RTP or equivalent framing shall be included in this figure).

For constant bit rate (CBR) media flows, the Peak Bit Rate is sufficient to enable optimum resource utilization in the transport plane.

PacketSize

This is defined as the maximum size of the media packets including the RTP overhead.

The characterization of variable bit rate (VBR) media flows may require further parameters such as the average bit rate of the flow, or a parameter indicating the burstiness of the media flow. For transport resource optimization this information is likely to be derived from measurement within the transport plane rather than from the End-User or the IP telephony application plane. The extension of the traffic descriptor to characterize VBR media flows is for further study.

7 Allocating the QoS budget across service and transport domains

In the generalized model shown in figure 3 it is assumed that the TIPHON system is divided into a number of separate Transport Domains and Service Domains and that a call through the TIPHON system will in general pass through a number of such domains.

End-to-end QoS requirements can be regarded as end-to-end quality budgets related to the media flows. To achieve the required end-to-end QoS these quality budgets must be allocated between the domains, including the user equipment, as illustrated in figure 7. The Transport QoS Parameters specify the QoS budgets for each Transport Domain. It is assumed that the performance of each domain is statistically independent from any other, in which case the overall accumulation of QoS parameter values may be calculated as follows:

- delay is additive, i.e. $D_{tot} = D_1 + D_2 + \ldots\ldots D_n$;
- packet loss accumulates on a probabilistic basis, i.e. $P_{tot} = 1 - [(1 - P_1) \times (1 - P_2) \times \ldots\ldots (1 - P_n)]$;
- delay variation accumulates on an RMS basis, i.e. $DV_{tot} = \sqrt{DV_1^{\,2} + DV_2^{\,2} + \ldots\ldots DV_n^{\,2}}$,

where:

D_n is the mean one-way delay of domain n;

P_n is the packet loss probability of domain n;

DV_n is the standard deviation of the delay variation of domain n.

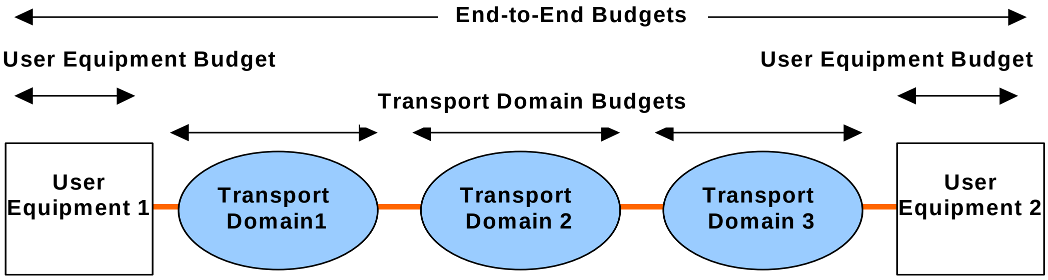


Figure 7: Allocation of TIPHON QoS Budgets

The present document describes three ways in which to apportion the QoS budget between domains:

- dynamic signalling of Transport QoS Parameters end-to-end between ITSPs on a per call [or event] basis;
- static Service Level Agreements (SLAs) between ITSPs which define the Transport QoS parameters for calls passing through their domain of control. This approach will also require policies in the SLAs specifying the maximum number of domains end-to-end that will be involved in a call;
- aggregation of transport domain resource and caching of information on its availability in which dynamic but infrequent signalling of Transport QoS parameters enables a knowledge of the Transport QoS Parameters that may be supported at any point of time to be ascertained.

NOTE: The allocation of budgets between User Equipment and Network must be established before the call either by SLA at time of registration, or by dynamic signalling at call set-up, or by a combination of both.

7.1 Dynamic signalling of Transport QoS Parameters

Dynamic signalling of transport QoS parameters allows an ITSP to signal the QoS requirements on a per call basis.

Call-Control signalling takes place in the application plane between ITSPs, and between End-Users & ITSPs. Similarly, QoS signalling takes place on the basis of SLAs between End-Users & ITSPs and between ITSPs, and follows call routing.
Between each ITSP involved in the call and its associated transport domain(s), transport QoS parameter signalling takes place again on the basis of SLAs to ensure that the required transport QoS parameters are met by each transport domain involved in the call. Some of these parameters may be in the SLA and some signalled dynamically. Clause 9 describes the procedures used for dynamic QoS controlled call establishment.

7.2 Specification of transport QoS parameters in Service Level Agreements (SLA)

SLAs are part of the peering agreement between ITSPs. These may specify the transport QoS parameters for calls passing through their transport domain(s) of control, thereby obviating the need to signal these parameters on a per call basis. Where transport QoS parameters are specified in this way, end-to-end signalling may be restricted to resource availability to support service class (TIPHON QoS class or possibly a transport QoS parametric class).

7.3 Aggregation

With aggregated transport resource reservation or bulk reservation the IP Telephony Application Plane reserves an amount of resources for media transport that is sufficient to support a number of media flows. This allows the application plane to more efficiently use allocated resources by using statistical multiplexing of variable bit-rate media streams. Using aggregated transport reservation also saves on signalling as the transport plane may not need to be contacted for each call.

Resource aggregation may be performed in the transport plane under the control of either transport network operators or ITSPs. Aggregation involves a quantity of transport resource with guaranteed QoS characteristics being allocated prior to the set up of an individual media flow. Individual media flows will then consume a portion of this. In both cases requests to set up a QoS controlled connection may therefore be made without exchanging QoS parameters on a per-flow basis.

7.3.1 Aggregation under control of the TRM

In the case where aggregation is controlled by the transport network operators the role of the TRM will then be to monitor the allocation of this resource. Mechanisms such as MPLS and IntServ may be used for this purpose. The IP telephony application is unaware of the aggregation taking place in the transport plane, therefore this case is outside the scope of the present document.

7.3.2 Aggregation under control of the QoSM

When control of the aggregated resource is by a Service Provider a QoSM may reserve a quantity of transport resource with guaranteed QoS characteristics prior to the set up of an individual media flow. This would be by agreement with the transport network operator. The QoSM then maintains the availability of QoS reserved resource calculating the actual utilization of the aggregate resource.

Resource aggregation requires aggregate bearer bandwidth management and connection admission control functionality.

An aggregate resource has one source and one destination IP address in each transport domain. multiple bearers are multiplexed, for example, by means of their port number using the same IP header belonging to an aggregate. When reserving aggregate resource the IP telephony application plane shall send to the transport plane the aggregate IP address with for example, a range of port numbers, (to be multiplexed over the aggregate resource). It is desirable that all these ports shall be opened by the ICF, thus avoiding per-bearer communication between the IP telephony application and transport planes.

The following methods are identified for aggregate resource creation:

- Provisioning on a semi-permanent basis (pre-assigned).
- Dynamic aggregate resource establishment/clear down.

NOTE: A dynamic aggregate may also be implemented with optional bandwidth negotiation.

Connection admission control to the aggregate resource shall be performed on a per bearer basis. The resource usage information may be used for connection admission control.

Aggregate resource usage can be calculated by different methods, e.g.

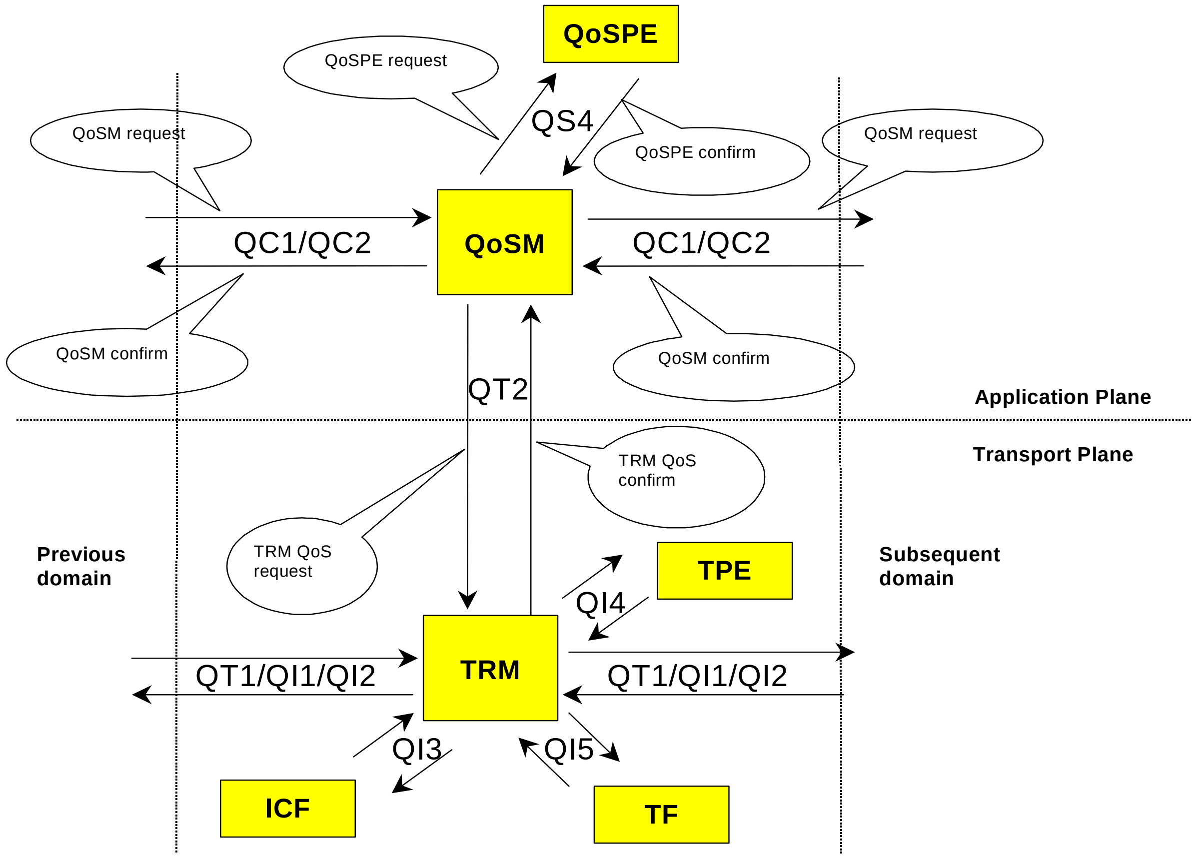
- Traffic engineering methods taking into account Traffic Descriptors;
- Resource usage measurements.

Resource reservation renegotiation may take place at any time. For example when the resource usage of the aggregate flow exceeds a predetermined percentage of the reserved resource the allocation may be renegotiated or a new aggregate flow created. Similarly in low traffic conditions it may be desirable to renegotiate a lower aggregate reservation.

8 QoS Primitives

Figure 8 shows the general model for the QoS information flows introduced in clause 5. These include QoS information flows between IP telephony application plane domains, between transport plane domains and information flows between an IP telephony application plane domain and a corresponding transport plane domain.

For end-to-end QoS control the information flows shall be exchanged between previous and subsequent IP Telephony Application Plane domains and/or transport domains. At each reference point information shall be exchanged via QoS primitives. The figure shows the QoS primitives defined at each of the reference points.



NOTE: The model shows uni-directional end-to-end QoS establishment. The same model shall also apply in the bi-directional end-to-end QoS establishment case.

Figure 8: Model of QoS information flows

8.1 QoS Primitives

NOTE: Primitives required for renegotiation of properties are for further study.

8.1.1 QC1and2

The information flow across this reference point shall communicate QoS related bearer information between domains (ITSPs) in the IP telephony application plane (QC2) or between user equipment and a service domain (QC1).

The following primitives are defined:

QoSM request (QC1/2.QoSMreq) requests the establishment of a bearer conforming to a particular TIPHON class of service or with defined QoS characteristics.

QoSM confirm (QC1/2.QoSMconf) acknowledges the creation of a bearer conforming to a requested TIPHON QoS class or with specified QoS characteristics.

QoSM reject (QC1/2.QoSMrej) rejects the creation of a bearer conforming to a requested TIPHON QoS Class or with specified QoS characteristics.

QoSM release request (QC1/2.QoSMrelreq) requests the release of a bearer.

QoSM release confirm (QC1/2.QoSMrelconf) confirms the release of a bearer.

8.1.2 QS4

The information flow across this reference point shall communicate QoS policy information relating to the establishment of a bearer with specified QoS levels.

The following primitives are defined:

QoSPE request (QS4.QoSPEreq) requests authorization for the establishment of a bearer with defined QoS characteristics.

QoSPE confirm (QS4.QoSPEconf) confirms authorization for the establishment of a bearer with defined QoS characteristics.

QoSPE reject (QS4.QoSPErej) rejects authorization for the establishment of a bearer with defined QoS characteristics.

8.1.3 QT2

The information flow across this reference point shall communicate QoS related transport flow information between a service domain and an associated transport domain. The information on QT2 shall communicate the QoS related characteristics required of the transport flows that will carry the media flow, the properties of the media flow, and addressing information related to the transport flows.

The following primitives are defined:

TRM QoS request (QT2.TRMQreq) requests the establishment of a transport flow with defined QoS characteristics across a transport domain or the reservation of transport domain resource.

TRM QoS confirm (QT2.TRMQconf) acknowledges the creation of a requested transport flow or the reservation of transport domain resource.

TRM QoS reject (QT2.TRMQrej) rejects the creation of a requested transport flow or the reservation of transport domain resource.

TRM QoS release request (QT2. TRM QoS relreq) requests the release of a transport flow.

TRM QoS release confirm (QT2. TRM QoS relconf) confirms the release of a transport flow.

TRM QoS performance notification (QT2. TRM QoS perfnotif) notifies the service domain of the performance of the transport domain in meeting the requested QoS levels. This may be a periodic event or an urgent alarm.

NOTE: This primitive is a management primitive and its use is for further study.

8.1.4 QT1

The information flow across this reference point shall communicate QoS related transport flow information between user equipment QoSM and an associated transport domain. The information on QT1 shall communicate the QoS related characteristics required of the transport flows that will carry the media flow, the properties of the media flow, and addressing information related to the transport flows.

The following primitives are defined:

QoS request (QT1.TRMQreq) requests the establishment of a transport flow with defined QoS characteristics across a transport domain or the reservation of transport domain resource.

QoS confirm (QT1.TRMQconf) acknowledges the creation of a requested transport flow or the reservation of transport domain resource.

QoS reject (QT1.TRMQrej) rejects the creation of a requested transport flow or the reservation of transport domain resource.

QoS release request (QT1.TRMQrelreq) requests the release of a transport flow.

QoS release confirm (QT1.TRMQrelconf) confirms the release of a transport flow.

8.1.5 QI1

The information flow across this reference point shall communicate QoS related transport flow information between a User Equipment TRM and a TRM in another transport domain. The information on QI1 shall communicate the QoS related characteristics required of the transport flows that will carry the media flow, the properties of the media flow, and addressing information related to the transport flows.

The following primitives are defined:

QoS request (QI1.TRMQreq) requests the establishment of a transport flow with defined QoS characteristics across a transport domain or the reservation of transport domain resource.

QoS confirm (QI1.TRMQconf) acknowledges the creation of a requested transport flow or the reservation of transport domain resource.

QoS reject (QI1.TRMQrej) rejects the creation of a requested transport flow or the reservation of transport domain resource.

QoS release request (QI1.TRMQrelreq) requests the release of a transport flow.

QoS release confirm (QI1.TRMQrelconf) confirms the release of a transport flow.

8.1.6 QI2

The information flow across this reference point shall communicate QoS related transport flow information between two associated Transport Domains. The information on QI2 shall communicate the QoS related characteristics required of the transport flows that will carry the media flow, the properties of the media flow, and addressing information related to the transport flows.

The following primitives are defined:

QoS request (QI2.TRMQreq) requests the establishment of a transport flow with defined QoS characteristics across a Transport Domain or the reservation of Transport Domain resource.

QoS confirm (QI2.TRMQconf) acknowledges the creation of a requested transport flow or the reservation of Transport Domain resource.

QoS reject (QI2.TRMQrej) rejects the creation of a requested transport flow or the reservation of transport domain resource.

QoS release request (QI2.TRMQrelreq) requests the release of a transport flow.

QoS release confirm (QI2. TRMQrelconf) confirms the release of a transport flow.

8.1.7 QI3

The information flow across this reference point shall communicate QoS related transport flow information between a TRM and an ICF within a Transport Domain. The information on QI3 may communicate the QoS related characteristics required of the transport flows that will carry the media flow, the properties of the media flow or QoS mechanism related information and addressing information related to the transport flows.

The following primitives are defined:

QoS request (QI3.ICFQreq) requests the establishment of a transport flow with defined QoS characteristics and mechanisms into or out of a Transport Domain.

QoS confirm (QI3.ICFQconf) acknowledges the creation of a requested transport flow.

QoS reject (QI3.ICFQrej) rejects the creation of a requested transport flow.

QoS release request (QI3. ICFQ relreq) requests the release of a transport flow.

QoS release confirm (QI3. ICFQrelconf) confirms the release of a transport flow.

8.1.8 QI4

The information flow across this reference point shall contain requests and authorizations for the establishment of QoS controlled transport flows through a Transport Domain and policy related information specific to the QoS mechanisms involved.

NOTE: The information flows on this interface are for further study.

The following primitives are defined:

QoS Policy request (QI4.PQreq) requests authorization for the establishment of a transport flow with defined QoS characteristics and may request a QoS mechanism and ICF address.

QoS Policy confirm (QI4.PQconf) provides authorization for the establishment of the transport flow and defines QoS mechanism and ICF address.

QoS Policy reject (QI4.PQrej) rejects the creation of a requested transport flow.

8.1.9 QI5

The information flow across this reference point shall communicate QoS related transport flow information between a TRM and Transport Functionality within a Transport Domain. The information on QI5 may communicate the QoS related characteristics required of the transport flows and the QoS mechanism related information that will be used to achieve this. The information flows on this interface are for further study.

The following primitives are defined:

QoS request (QI5.TFQreq) requests the establishment of a transport flow with defined QoS characteristics and mechanisms within a Transport Domain.

QoS confirm (QI5.TFQconf) acknowledges the creation of a requested transport flow.

QoS reject (QI5.TFQrej) rejects the creation of a requested transport flow.

QoS release request (QI5.TFQ relreq) requests the release of a transport flow.

QoS release confirm (QI5.TFQrelconf) confirms the release of a transport flow.

8.2 QoS Parameters Groups

8.2.1 QoS parameter groups

The QoS primitives defined in clause 8.1 shall contain a number of parameters from the following defined parameter groups.

Parameter Group	Description	Parameters	Description
QoS Service Class	Describes the end-to-end TIPHON class of a bearer.	Best, High, Medium or Best Effort.	Parameters specifying the TIPHON QoS Class as defined in ETSI TS 101 329-2 [1].
Codec Type and Packetization	Describes the Codec type used on a bearer and the way the media is packetized.	Codec Type (Optionally a list of possible codecs).	Codec Identifier including any relevant codec parameters, e.g. version number, sampling rate, etc.
		Frames per packet (Optionally a list when codec lists are specified).	Number of frames per packet.
Transport QoS Parameters	Specifies the QoS characteristics required of the transport flow carrying the media flow.	Maximum Delay	The maximum delay permitted over either a segment of the transport flow or the remaining part of the transport flow.
		Maximum Packet Delay Variation	The maximum packet delay variation permitted over either a segment of the transport flow or the remaining part of the transport flow.
		Maximum Mean Packet Loss	The maximum mean packet loss permitted over either a segment of the transport flow or the remaining part of the transport flow. [Note: This measure assumes randomly distributed packet loss].
Traffic Descriptor	Characterizes the resource requirements of an application data flow (excludes transport flow resource requirements).	Peak Bit	Maximum bit rate (bit/s) of the media flow.
		Maximum Packet Size	Maximum size of the media packets.
Caller and Callee IDs	Specifies the identity of the calling and called parties. As defined in TS 101 314 [2].	Calling ID	The identity of the calling party.
		Callee ID	The identity of the called party.
Transport Addresses	Specifies addressing information defining the transport flow carrying the bearer.	Originator Transport Address	The originator transport address (typically IP address and port/set of ports) within a transport domain.
		Destination Transport Address	The destination transport address (typically IP address and port/set of ports) within a transport domain.
Application Data Transport Protocol	Specifies the application data transport protocol of the bearer.	Protocol ID	Identifier of the application data transport protocol used by the bearer. Typically RTP.
Packet Transport Protocol	Specifies the packet transport protocol.	Protocol ID	Identifier of the packet transport protocol used in the transport flow. Typically UDP.
QoS Policy	Describes the policy determining the users entitlement to QoS Service Class.	TBD	TBD
QoS Mechanism	Describes the mechanism used in the Transport Plane.	Type	None, RSVP/INTSERV, DIFFSERV or MPLS.
		Mechanism specific parameters	TBD
		Authorization Token	TBD

8.2.2 QC1

The following list defines the parameters used in the QC1 primitives.

Primitive	Parameter	Status
QC1.QoSMreq	QoS Service Class Codec Type and Packetization Transport QoS Parameters Traffic Descriptor Transport Addresses Caller and Called IDs Application Data Transport Protocol Packet Transport Protocol	Mandatory Mandatory Optional Optional Mandatory Mandatory Optional [Default RTP] Optional [Default UDP]
QC1.QoSMconf	QoS Service Class Codec Type and Packetization Transport QoS Parameters Transport Addresses Application Data Transport Protocol Packet Transport Protocol QoS Mechanism	Mandatory Mandatory Optional Mandatory Optional [Default RTP] Optional [Default UDP] Optional
QC1.QoSMrej	Reason [TBD]	Mandatory

8.2.3 QC2

The following list defines the parameters used in the QC2 primitives.

Primitive	Parameter	Status
QC2.QoSMreq	QoS Service Class Codec Type and Packetization Transport QoS Parameters Traffic Descriptor Transport Addresses Application Data Transport Protocol Packet Transport Protocol QoS Mechanism	Optional Mandatory Mandatory Optional Mandatory Optional [Default RTP] Optional [Default UDP] Optional
QC2.QoSMconf	QoS Service Class Codec Type and Packetization Transport QoS Parameters Transport Addresses Application Data Transport Protocol Packet Transport Protocol	Optional Mandatory Mandatory Mandatory Optional [Default RTP] Optional [Default UDP]
QC2.QoSMrej	Reason [TBD]	Mandatory

8.2.4 QS4

The following list defines the parameters used in the QS4 primitives.

Primitive	Parameter	Status
QS4.QoSPEreq	QoS Service Class Caller Identity Called Identity	Mandatory Mandatory Mandatory
QS4.QoSPEconf	QoS Service Class Caller Identity Called Identity	Mandatory Mandatory Mandatory
QS4. QoSPErej	Reason [TBD]	Mandatory

8.2.5 QT2

The following list defines the parameters used in the QT2 primitives.

Primitive	Parameter	Status
QT2.TRMQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol	Mandatory Mandatory Mandatory Optional [Default UDP]
QT2.TRMQconf	Transport QoS Parameters Transport Addresses Packet Transport Protocol QoS Mechanism	Mandatory Mandatory Optional [Default UDP] Optional
QT2.TRMQrej	Reason [TBD]	Mandatory

8.2.6 QT1

The following list defines the parameters used in the QT1 primitives.

Primitive	Parameter	Explanation
QT1.TRMQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism	Mandatory Optional Mandatory Optional [Default UDP] Optional
QT1.TRMQconf	Transport QoS Parameters Transport Addresses Packet Transport Protocol	Mandatory Mandatory Optional [Default UDP]
QT1.TRMQrej	Reason [TBD]	Mandatory

8.2.7 QI1

The following list defines the parameters used in the QI1 primitives.

Primitive	Parameter	Explanation
QT1.TRMQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism	Mandatory Optional Mandatory Optional [Default UDP] Optional
QT1.TRMQconf	Transport QoS Parameters Transport Addresses Packet Transport Protocol	Mandatory Mandatory Optional [Default UDP]
QT1.TRMQrej	Reason [TBD]	Mandatory

8.2.8 QI2

The following list defines the parameters used in the QI2 primitives.

Primitive	Parameter	Explanation
QI2.TRMQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol	Mandatory Optional Mandatory Optional [default UDP]
QI2.TRMQconf	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol	Mandatory Optional Mandatory Optional [default UDP]
QI2.TRMQrej	Reason [TBD]	Mandatory

8.2.9 QI3

The following list defines the parameters used in the QI3 primitives.

Primitive	Parameter	Explanation
QI3.ICFQreq	Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism	Optional Mandatory Optional [default UDP] Mandatory
QI3.ICFQconf	Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism	Optional Optional Optional [default UDP] Optional
QI3.ICFQrej	Reason [TBD]	Mandatory

8.2.10 QI4

The following list defines the parameters used in the QI4 primitives.

Primitive	Parameter	Explanation
QI4.PQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism	Optional Optional Mandatory Optional [default UDP] Optional
QI4.PQconf	Transport QoS Parameters Traffic Descriptor Transport Addresses QoS Mechanism	Optional Optional Optional Optional
QI4.PQrej	Reason [TBD]	Mandatory

8.2.11 QI5

Details of the parameters and primitives on this reference point are for further study.

9 QoS Procedures (Informational)

The QoS Primitives defined in clause 8 can be used in a number of QoS related procedures.

9.1 Third Party Establishment of QoS Controlled Bearer

In this situation a third party, typically a service provider, establishes a QoS controlled bearer on behalf of a calling party by signalling the required QoS characteristics to the transport plane. See clause 5.2.3.1 and figure 3.

The functional elements involved are shown in figure 9. The QoSM in the terminal requests service of the QoSM in Service Domain 1. This QoSM establishes a QoS controlled bearer by communicating with the TRM in transport domain 1 and QoSM in service domain 2.

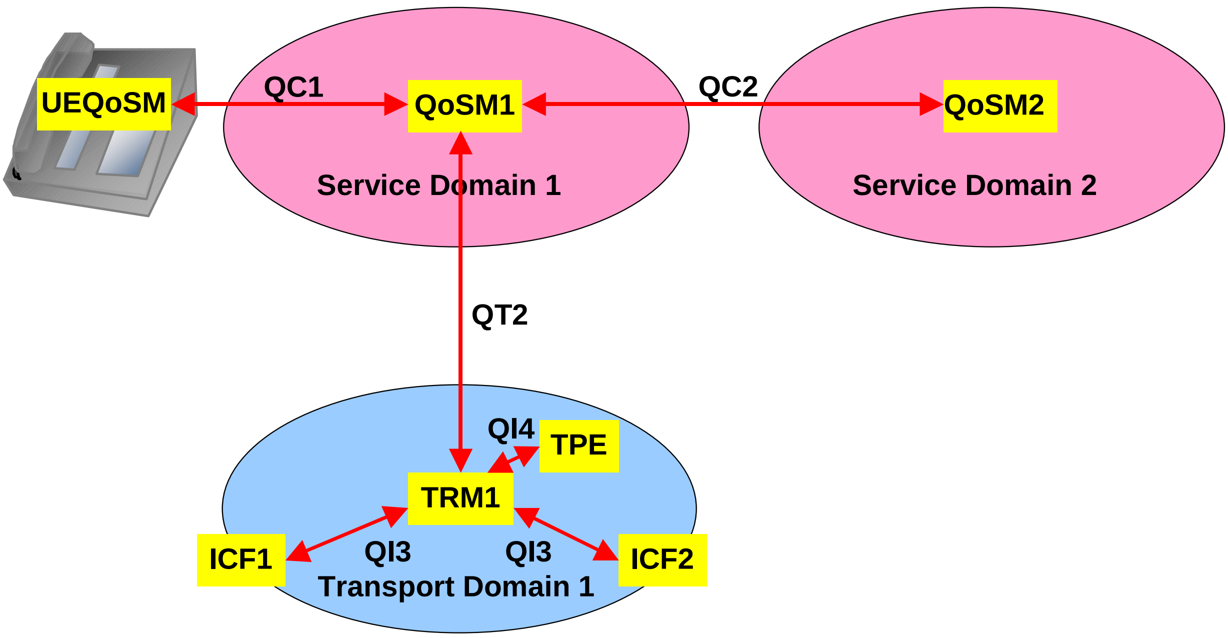


Figure 9: Functional elements involved in Third Party Bearer Establishment

The information flows are shown in figure 10.

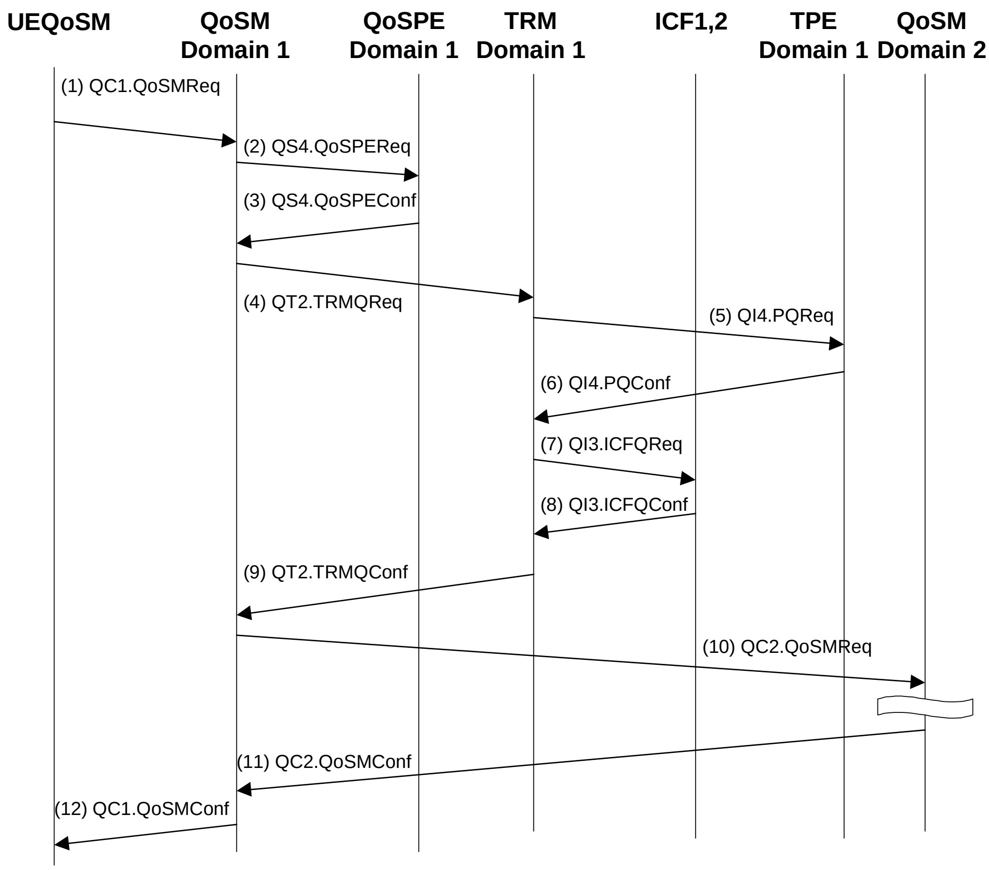


Figure 10: Information Flows for Third Party QoS Bearer Establishment

The primitives carry the following parameters. Other optional parameters listed in clause 8 are not required for this procedure.

Primitive	Parameter
QC1.QoSMreq	QoS Service Class Codec Type and Packetization Application Data Transport protocols Packet Transport Protocol Caller and Called ID Originating Transport Address
QS4.QoSPEreq	QoS Service Class Caller and Callee IDs
QS4.QoSPEconf	QoS Service Class Caller and Callee IDs
QT2.TRMQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol
QI4.PQreq	Transport QoS parameters Traffic Descriptor Transport Addresses Packet Transport Protocol
QI4.PQconf	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism
QI3.ICFQreq	Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism (including mechanism parameters)
QI3.ICFQconf	Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism (including mechanism parameters)
QT2.TRMQconf	Transport QoS Parameters Transport Addresses Packet Transport Protocol
QC2.QoSMreq	QoS Service Class Codec Type and Packetization Transport QoS Parameters Transport Addresses Application Data Transport Protocols Packet Transport Protocol
QC2.QoSMconf	QoS Service Class Codec Type and Packetization Transport QoS Parameters Transport Addresses Application Data Transport Protocols Packet Transport Protocol
QC1.QoSMconf	QoS Service Class Codec Type and Packetization Transport Addresses Application Data Transport Protocols Packet Transport Protocol

9.2 First Party Establishment of QoS Controlled Bearer

In this situation the calling party establishes a QoS controlled bearer directly by signalling the necessary QoS characteristics to the transport plane. See clause 5.2.3.2 and figure 4.

The functional elements involved are shown in figure 11. The QoSM in the initiating terminal first establishes compatible codecs via end-to-end application plane signalling. At the same time the QoS parameters of the responding terminal must be established. QoS transport budgets will then be determined by the QoSM in service domain 1 and communicated to the QoSM in the initiating terminal. The QoS controlled bearer is then established directly by signalling between the initiating terminal and the TRM in transport domain 1. This TRM communicates in the usual way with the TPE and ICFs in transport domain 1 and subsequently with the TRM in transport domain 2.

NOTE: In this scenario the service provider can only offer guarantees about the quality levels achievable from the transport plane via fixed parameters in service level agreements with transport operators. Other factors such as network address translation and firewalls may also present difficulties.

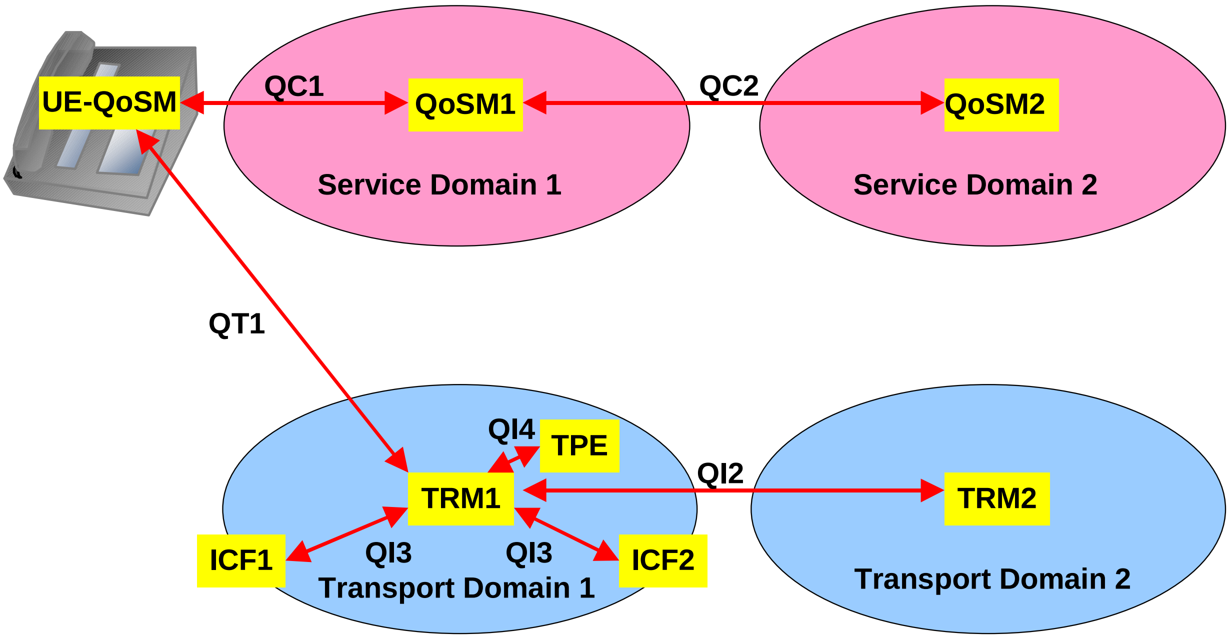


Figure 11: Functional elements involved in First Party Bearer Establishment

The information flows are shown in figure 12.

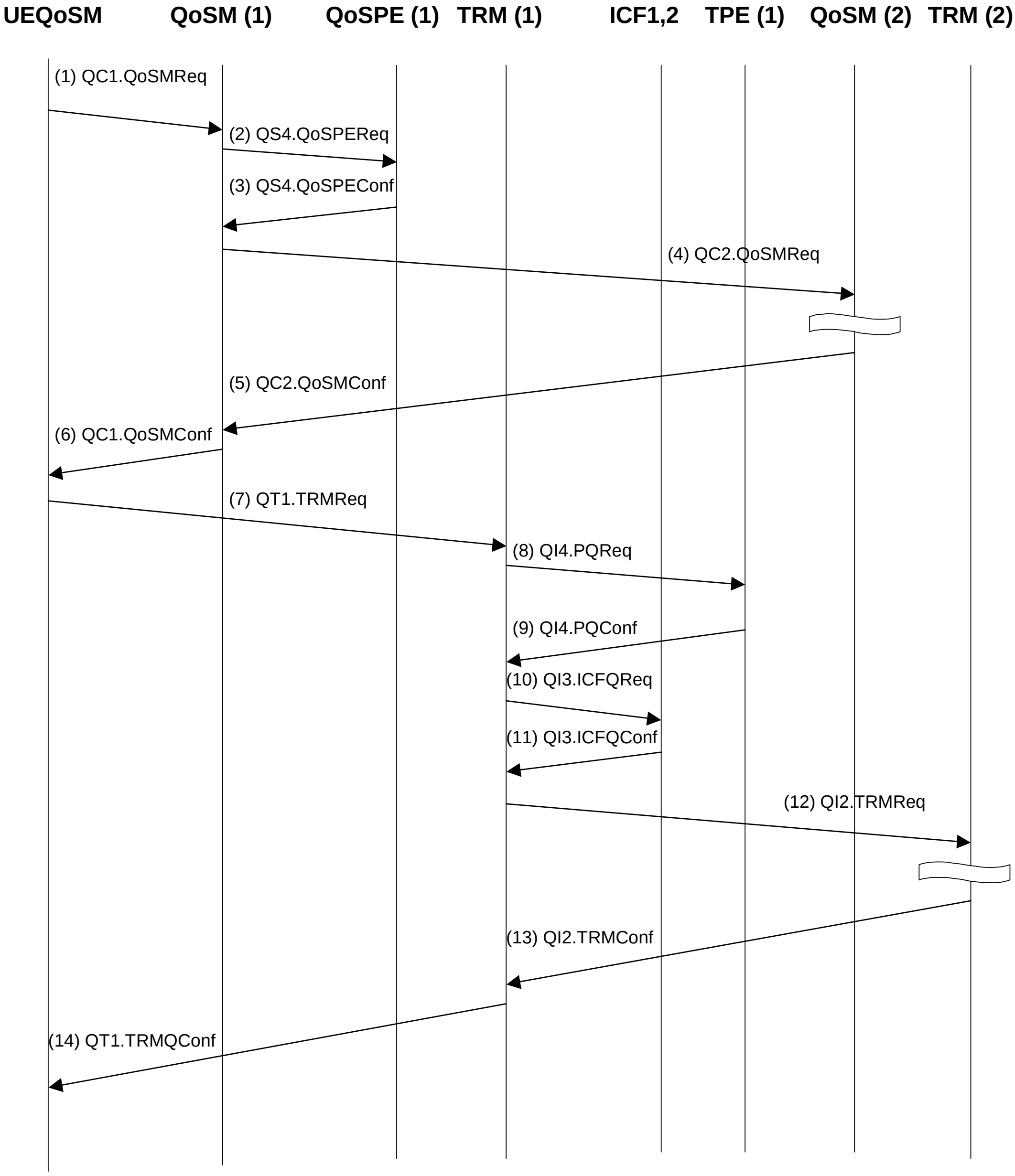


Figure 12: Information Flows for First Party QoS Bearer Establishment

The flows contain the following parameters.

Primitive	Parameter
QC1.QoSMreq	QoS Service Class Codec Type and Packetization Application Data Transport Protocols Packet Transport Protocol Caller and Called ID Originating Transport Address
QS4.QoSPEreq	QoS Service Class Caller and Callee IDs
QS4.QoSPEconf	QoS Service Class Caller and Callee IDs
QC2.QoSMreq	QoS Service Class Codec Type and Packetization Transport QoS Parameters Transport Addresses Application Data Transport Protocols Packet Transport Protocol
QC2.QoSMconf	QoS Service Class Codec Type and Packetization Transport QoS Parameters Transport Addresses Application Data Transport Protocols Packet Transport Protocol
QC1.QoSMconf	QoS Service Class Codec Type and Packetization Transport Addresses Application Data Transport Protocols Packet Transport Protocol
QT1.TRMreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol
QI4.PQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol
QI4.PQconf	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism
QI3.ICFQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism NOTE: Mechanism dependent signalling will take place here.
QI3.ICFQconf	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol
QT1.TRMconf	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol

9.3 Hybrid Third Party/First Party Establishment of QoS controlled bearer via authorization tokens

In this situation the calling party establishes a QoS controlled bearer directly by signalling the necessary QoS characteristics to the transport plane but after receiving authorization from a service provider.

This mechanism overcomes some of the difficulties associated with first party bearer establishment.

The functional elements involved are shown in the figure 13. The QoSM in the terminal communicates directly with the TRM in transport domain 1 but also with the QoSM in service domain 1. The TRM in transport domain 1 communicates in the usual way with the TPE and ICFs in transport domain 1. Remaining legs of the bearer may either be established via the application plane or by signalling within the transport plane between TRMs.

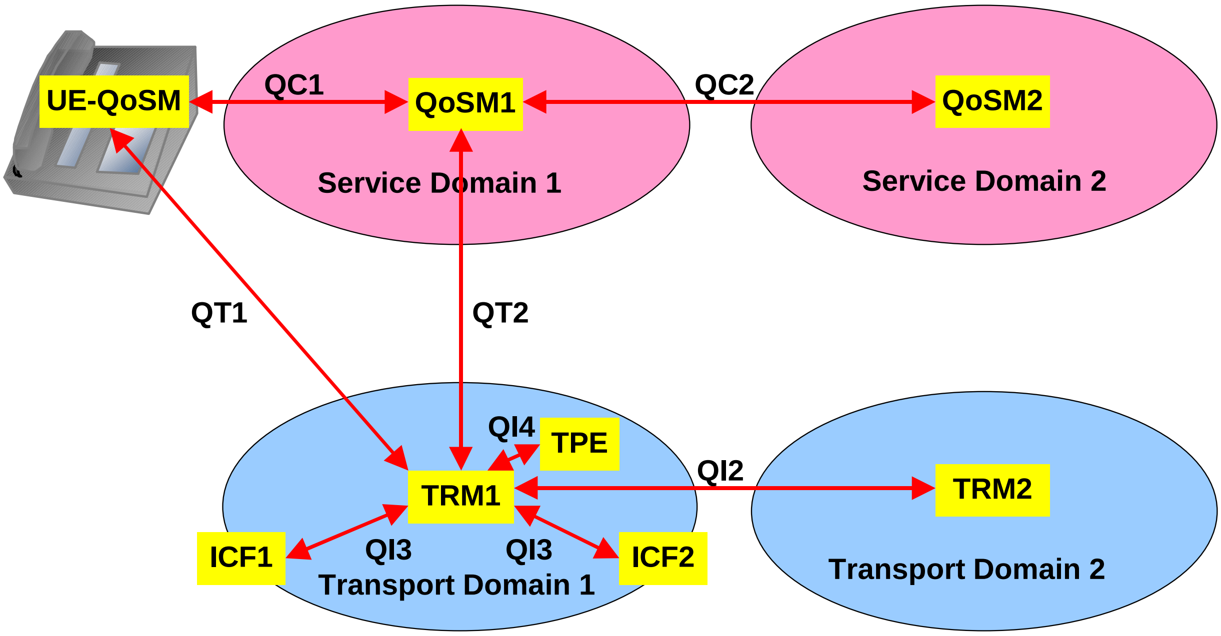


Figure 13: Functional elements involved in Hybrid Third Party/First Party bearer establishment

The information flows are shown in figure 14.

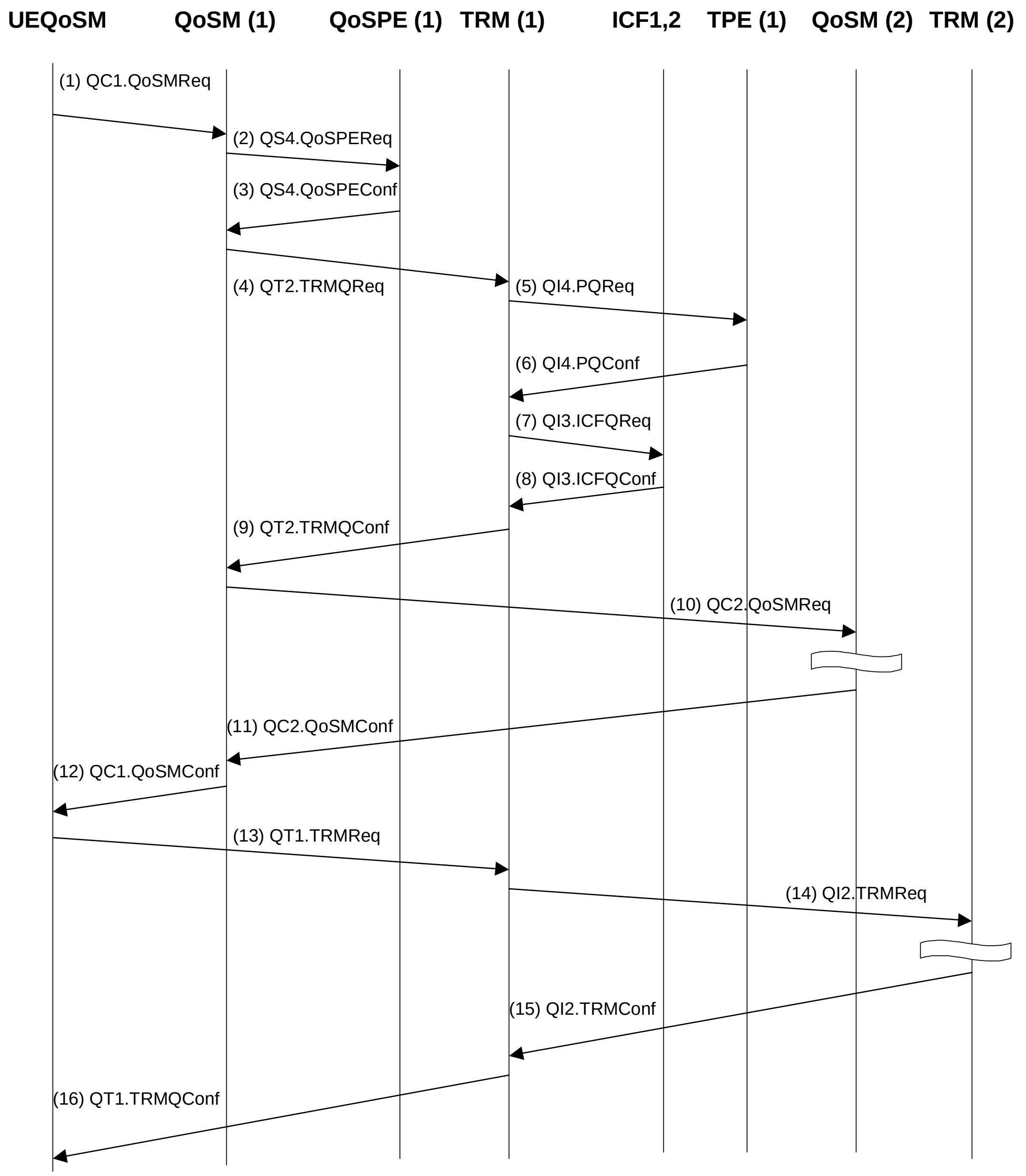


Figure 14: Information Flows for Hybrid Third Party/First Party Bearer Establishment

The flows contain the following parameters.

Primitive	Parameter
QC1.QoSMreq	QoS Service Class Codec Type and Packetization Application Data Transport Protocols Packet Transport Protocol Caller and Called ID Originating Transport Address
QS4.QoSPEreq	QoS Service Class Caller and Callee IDs
QS4.QoSPEconf	QoS Service Class Caller and Callee IDs
QT2.TRMQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol
QI4.PQreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol
QI4.PQconf	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism QoS Token
QI3.ICFQreq	Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism (including mechanism parameters) QoS Token
QI3.ICFQconf	Traffic Descriptor Transport Addresses Packet Transport Protocol QoS Mechanism (including mechanism parameters)
QT2.TRMQconf	Transport QoS Parameters Transport Addresses Packet Transport Protocol QoS Token
QC2.QoSMreq	QoS Service Class Codec Type and Packetization Transport QoS Parameters Transport Addresses Application Data Transport Protocols Packet Transport Protocol
QC2.QoSMconf	QoS Service Class Codec Type and Packetization Transport QoS Parameters Transport Addresses Application Data Transport Protocols Packet Transport Protocol
QC1.QoSMconf	QoS Service Class Codec Type and Packetization Transport Addresses Application Data Transport Protocols Packet Transport Protocol QoS Token
QT1.TRMreq	Transport Addresses QoS Token
QI2.TRMreq	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol
QI2.TRMconf	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol

Primitive	Parameter
QT1.TRMconf	Transport QoS Parameters Traffic Descriptor Transport Addresses Packet Transport Protocol

9.4 Terminal Registration

For further study.

Annex A (informative): Examples of end-to-end QoS control

This annex describes a number of different ways in which the general QoS architecture can be used to establish a QoS controlled bearer.

A.1 One service domain/One transport domain

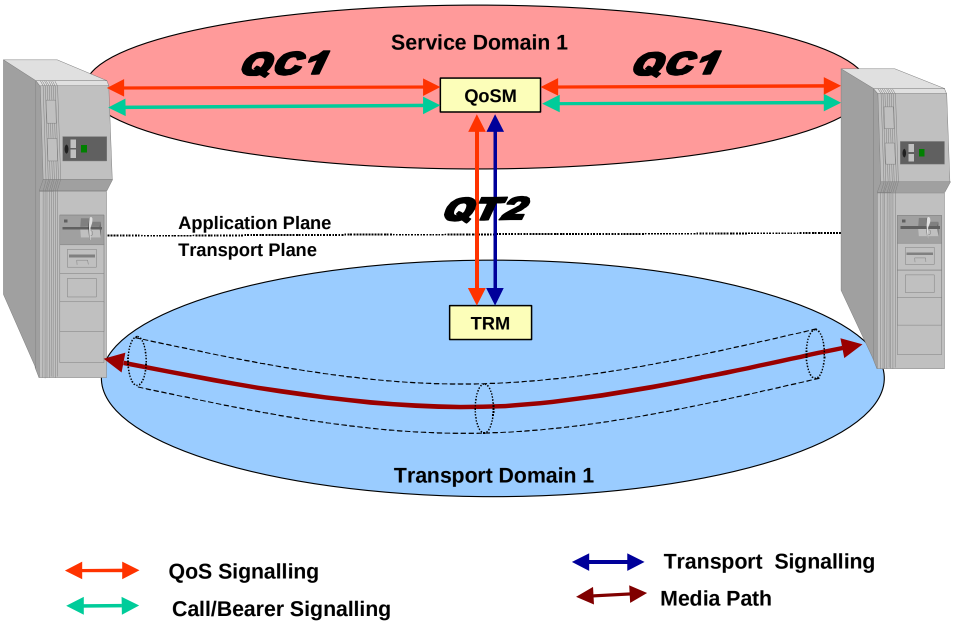


Figure A.1: One service domain/One transport domain

In this scenario one service domain and one transport domain are shown.

A.2 One service domains/multiple transport domains - Case I

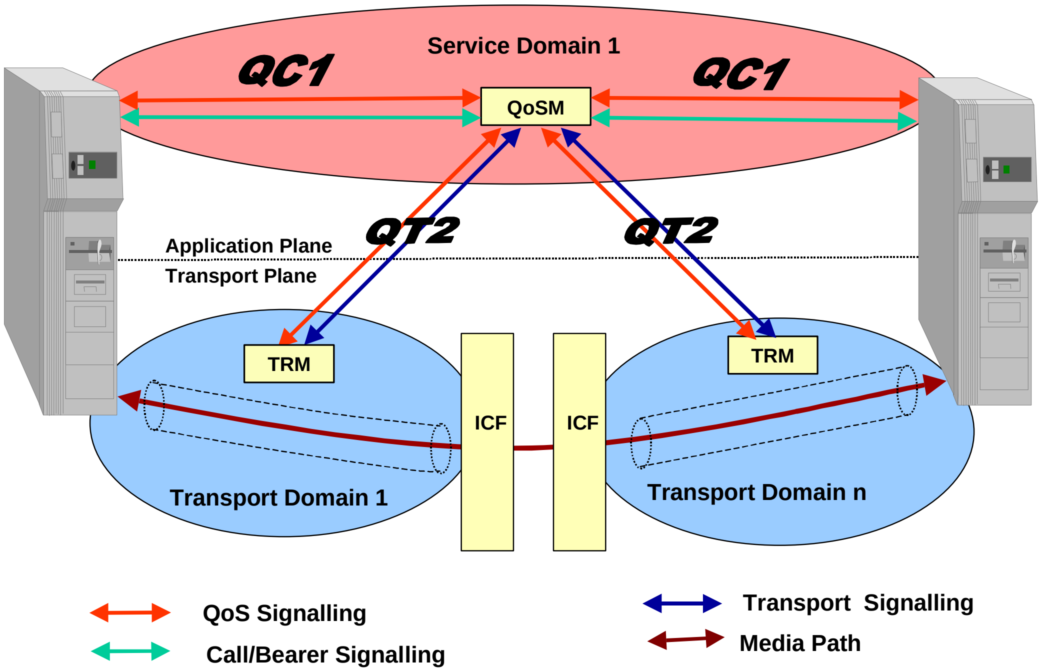


Figure A.2: One Service Domain/Multiple Transport Domains - Case I

In this scenario multiple transport domains are under the control of one service domain.

Each transport domain has a direct relationship with the controlling service domain. The service domain will have to arrange the resources and make sure the transport channel is connected end-to-end.

Such a deployment requires the service domain to be aware of the location of the ICFs of each of the transport domains in order to connect them.

A.3 One service domain/multiple transport domains - Case II

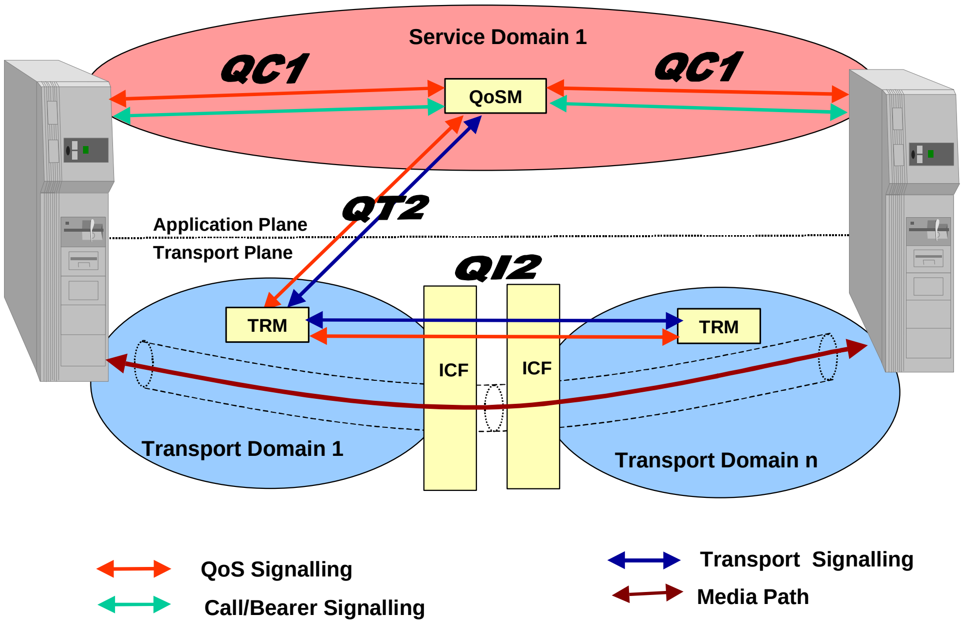


Figure A.3: One Service Domain/Multiple Transport Domains - Case II

In this scenario multiple transport domains are shown for one service domain and there is only one interface between the application and transport planes.

The group of transport domains looks to the service domain as one domain. One transport domain may be the master contractor communicating with the other TRMs (either in parallel or each TRM communicating with the next) to set up the aggregate channel end-to-end.

The communication between the TRMs will look like the signalling across reference point QT2.

Such a deployment requires that all the transport domains for each end-to-end bearer must maintain a uniform set of policies regarding addressing and QoS mechanisms. Potentially, there will also be issues of security to be addressed in passing the QT1 signalling across the boundary of the two transport domains.

A.4 Multiple service domains/multiple transport domains

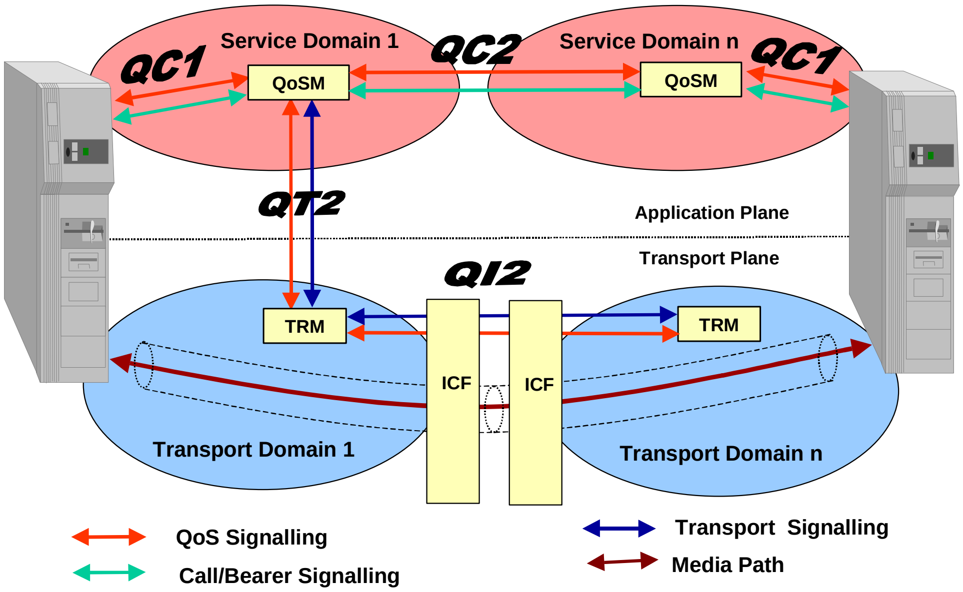


Figure A.4: Multiple Service Domains/Multiple Transport Domains - Case I

In this scenario the communication between multiple service domains is handled by multiple transport domains.

The bearer is established by transport domain 1 as master contract to service domain 1 so that the subsequent transport domains can be considered as extensions of the transport domain belonging to Service Domain 1.

A.5 Multiple service domains/multiple transport domains

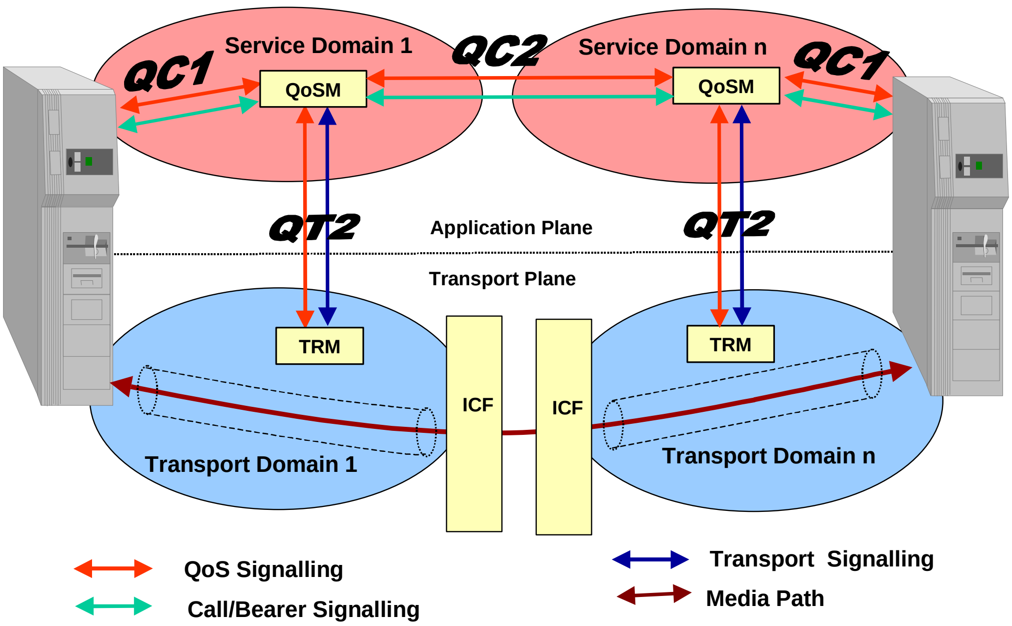


Figure A.5: Multiple Service Domains/Multiple Transport Domains - Case II

Again in this scenario the communication between multiple service domains is handled by multiple transport domains. However several transport domains may be involved in the control of the bearer.

Each transport domain has a direct relationship with its controlling service domain. The service domain will have to arrange the resources and make sure the bearer is connected end-to-end.

As with Scenario in clause A.1 such a deployment requires the service domains to be aware of the location of the ICFs of each of the transport domains in order to connect them.

A.6 Roaming

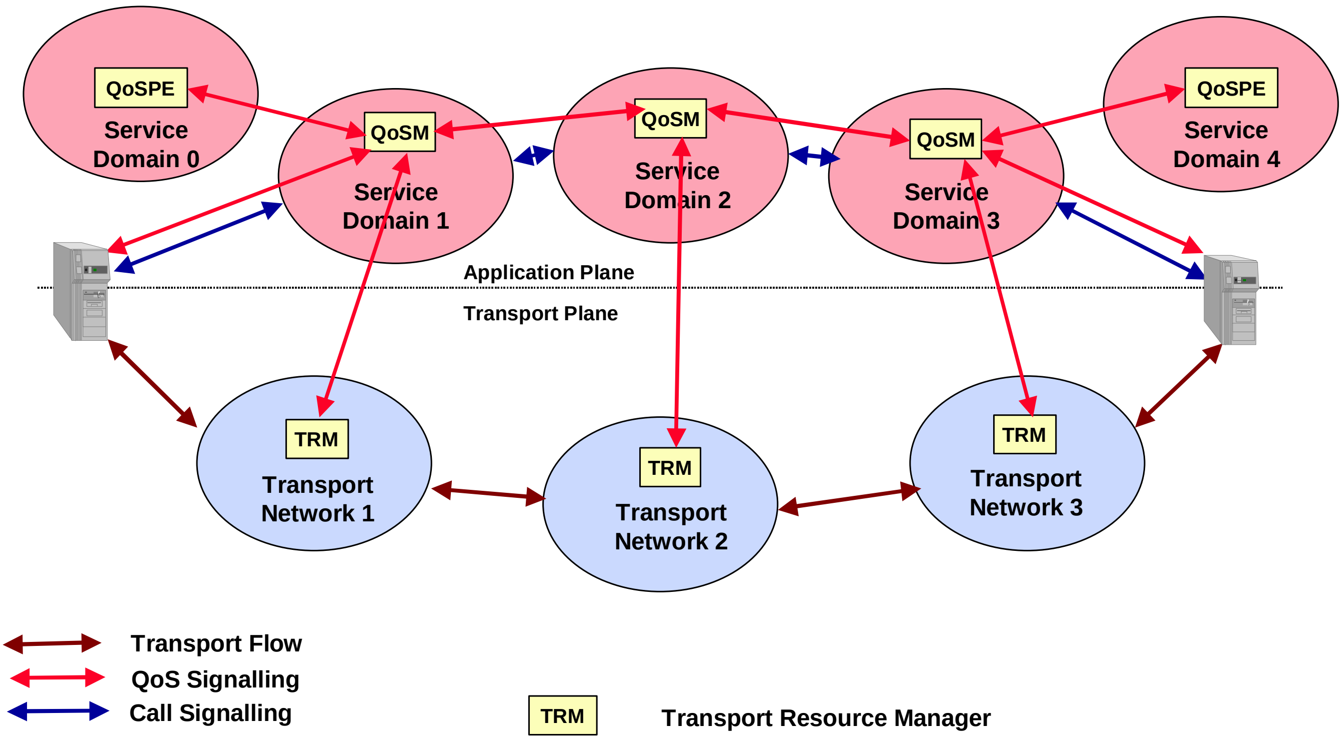


Figure A.6: Multiple Service Domains/Multiple Transport Domains - Roaming

In this scenario a user, registered in Service Domain 0, is visiting Service Domain 1 and sets up a call via Service Domain 1. The QoSM in Service Domain 1 contacts the QoSPE in Service Domain 0 to ascertain the service profile of the visiting user before proceeding to set up the call.

A.7 Provisioned VPN

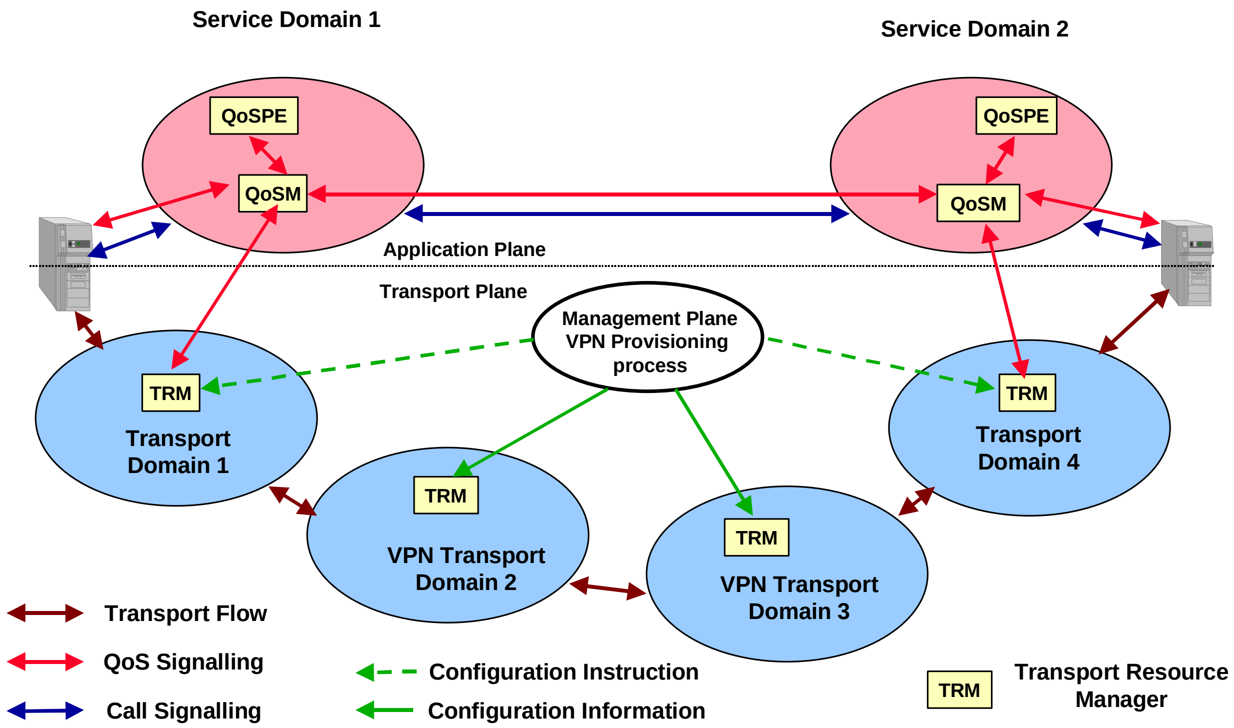


Figure A.7: Multiple Service Domains/Multiple Transport Domains - Provisioned VPN

Annex B (informative): Examples of Mapping of QoS Architecture Functional Elements to Physical Elements

This clause illustrates several different ways in which the functional elements defined in the present document may be incorporated into Network or User equipment. The table lists some of these possibilities.

Table B.1

Functional Element	Physical Element
QoSM	H.323 Terminal, SIP client, H.323 Gatekeeper, SIP Proxy, SoftSwitch, H.323 Border Element, 3GPP CSCF
QoSM (BC part)	Media Gateway Controller, 3GPP MGCF
QoSM (MC part)	3GPP MRF, Media Gateway
QoSPE	H.323 Gatekeeper, SIP Proxy, SoftSwitch, 3GPP HSS
TRM	Router, edge router, Bandwidth Broker
TRM proxy	Firewall
ICF	Firewall, edge router
TF	Router, edge router
TPE	Policy Server

Similarly Reference points will may be associated with physical interfaces on Network or User equipment. Some possibilities are listed in table B.2.

Table B.2

Physical Element	Reference Points
H.323 Terminal	QC1, QT1
SIP client	QC1, QT1
H.323 Gatekeeper	QC1, QC2, QT2
SIP Proxy	QC1, QC2, QT2
SoftSwitch	QC1, QC2, QT2
H.323 Border Element	QC2, QT2
Media Gateway Controller	QC2
Media Gateway	QT1,
Signalling gateway	QC2
Router	QI5, QT1 (e.g. for RSVP),QI4
Firewall	QI3, QT1 (e.g. for RSVP)
edge router	QI5, QI3, QT1 (e.g. for RSVP),QI4
Policy server	QI4
Bandwidth broker	QT2, QI1, QI2, QI3, QI4, QI5
3GPP CSCF	QC1, QC2, QT2,
3GPP HSS	QS4
3GPP MGCF	QC2
3GPP MRF	QT1

Annex C (informative): Bibliography

ETSI TR 101 329-1: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON); End-to-end Quality of Service in TIPHON Systems; Part 1:General aspects of Quality of Service (QoS)".

IETF RFC 1633: "Integrated Services in the Internet Architecture: an Overview".

IETF RFC 2205: "Resource ReSerVation Protocol (RSVP) - Version 1 Functional Specification".

IETF RFC 2210: "The Use of RSVP with IETF Integrated Services".

IETF RFC 2475: "An Architecture for Differentiated Service".

IETF RFC 3031: "Multiprotocol Label Switching Architecture".

ETSI TS 102 024: TIPHON Release 4 QoS documents.

ETSI TS 102 025: TIPHON Release 5 QoS documents.

History

Document history		
V1.1.1	January 2001	Publication (Historical)
V2.1.1	September 2001	Publication
V2.1.2	January 2002	Publication