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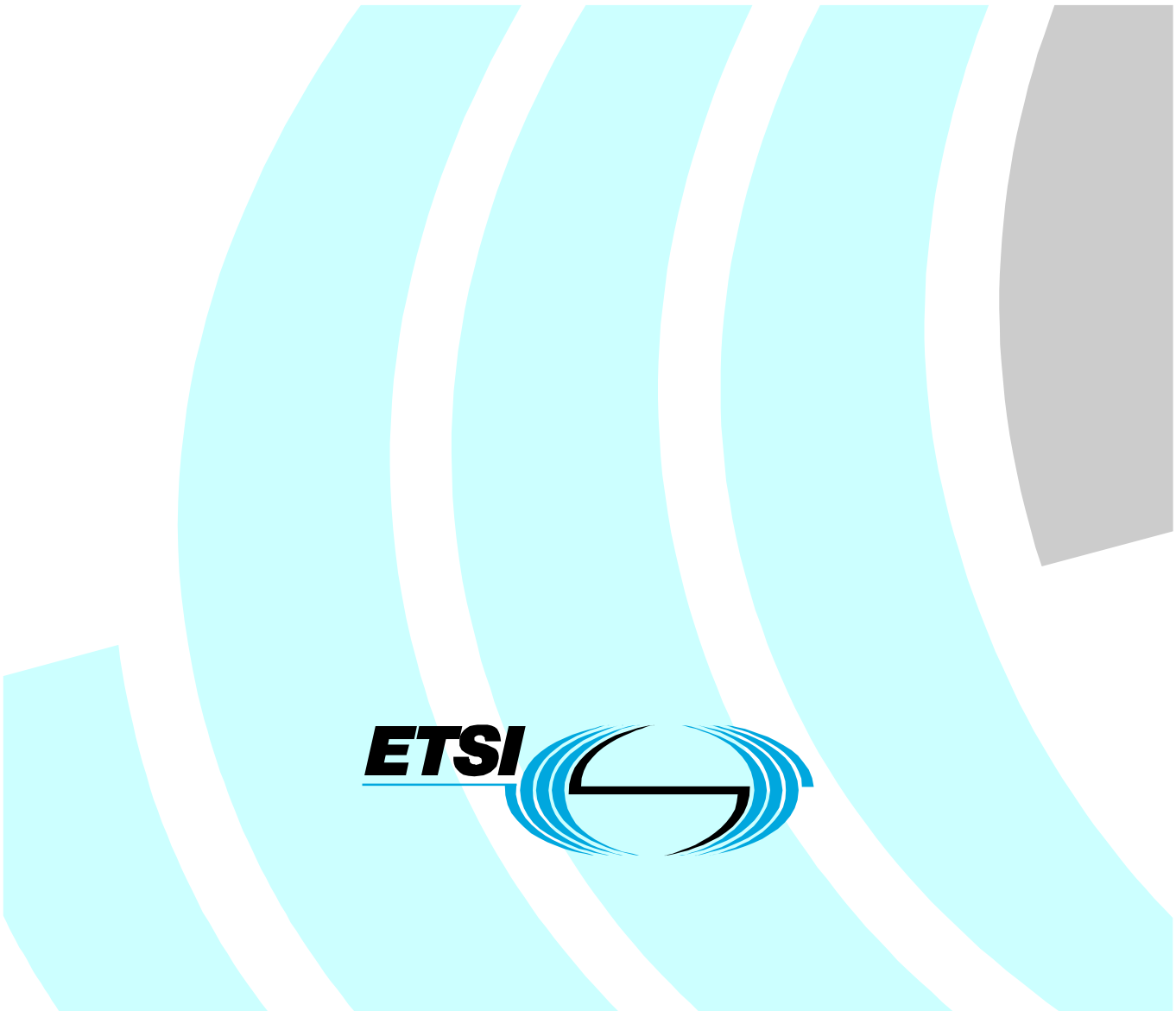
Technical Specification

Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 4; End-to-end Quality of Service in TIPHON Systems; Part 4: Quality of Service Management



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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 4 of a multi-part deliverable covering the End-to-end Quality of Service in TIPHON Systems, as identified below:

TR 102 024-1: "General aspects of Quality of Service (QoS)";

TS 102 024-2: "Definition of Speech Quality of Service (QoS) Classes";

TS 102 024-3: "Signalling and Control of End-to-end Quality of Service (QoS) in a multi-media environment";

TS 102 024-4: "Quality of Service Management";

TS 102 024-5: "Quality of Service (QoS) measurement methodologies";

TR 102 024-6: "Actual measurements of network and terminal characteristics and Performance parameters in TIPHON networks and their influence on voice quality";

TR 102 024-7: "Design Guide for elements of a TIPHON connection from an End-to-end speech transmission performance point of view";

TS 102 024-9: "Call performance Classification (Voice)";

TS 102 024-10: "QoS Requirements for TIPHON Terminals".

1 Scope

The present document establishes and defines the high-level requirements for the management of TIPHON End-to-end Quality of Service (QoS).

TS 101 303 (see bibliography) describes the general principles of network management within a TIPHON environment and the framework upon which the present document is based.

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.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ETSI TS 101 303: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 4; Service Independent Requirements Definition; Service and Network Management Framework; Part 1: Overview and Introduction".

[2] ETSI EN 300 292: "Telecommunications Management Network (TMN); Functional specification of call routeing information management on the Operations System/Network Element (OS/NE) interface".

[3] ITU-T Recommendation E.416: "Network Management Principles and Functions for B-ISDN Traffic".

[4] ITU-T Recommendation E.417: "Framework for the network management of IP-Based networks".

[5] ITU-T Recommendation G.107: "The E-Model, a computational model for use in transmission planning".

3 Abbreviations

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

ALC	Automatic Level Control
IP	Internet Protocol
QoS	Quality of Service
SCN	Switched Circuit Networks
SLA	Service Level Agreement

4 QoS requirements and assumptions

4.1 Introduction

TS 101 303 (see bibliography) describes the TIPHON approach to network management and the overall framework into which these requirements fit. The monitoring and control of Quality of Service (QoS) has previously been given little consideration in network management procedures. QoS is implicit in a Switched Circuit Network (SCN) and the current Internet Model assumes a non-blocking "best effort" approach with no QoS guarantees. The TIPHON concept is based on the provision of guaranteed End-to-end QoS and this has implications for network management.

4.1.1 Assumptions

In order to guarantee End-to-end speech quality, the following assumptions are made:

1) Service provider equipment meets specified performance requirements and is correctly configured by service providers;

2) All underlying transport networks involved in a call (IP as well as SCN) are designed to deliver specific performance criteria at all times. It is implicit that guarantees can only be achieved over managed IP networks which have been engineered to deliver a given level of performance and where traffic levels are controlled;

3) The realization of End-to-end speech quality in a TIPHON system is affected by network transmission planning;

4) The following management steps are involved in implementing a TIPHON system:

   - planning and configuration;
   - maintenance; and
   - monitoring and verification.

4.1.2 QoS management requirements

4.1.2.1 Transmission planning

In order to deliver the intended End-to-end speech transmission quality in TIPHON systems, transmission planning should be performed during the design phase of TIPHON related equipment. It is not sufficient to design equipment or networks just along the requirement limits of the respective TIPHON class.

Any variation of transmission parameters should only be judged on the basis of E-model calculations [5] for critical End-to end connections. Any assumption whether or not a specific parameter variation will be perceived by the user should always be based on E-model calculations.

Special care should be taken with devices which dynamically vary one or more transmission parameters, e.g. Automatic Level Control (ALC) devices. Experience with such devices has shown that they have the potential to impact End-to-end speech transmission quality, severely.

4.1.3 Maintenance

After TIPHON equipment and networks have been designed, planned and rendered operative in compliance with one of the TIPHON QoS classes, it might, nevertheless, occur that users complain about inferior speech quality.

In such cases, it is very important to be able to carry through a diagnosis of End-to-end speech transmission performance. Consequently, it is necessary to keep track of all parameter changes (e.g. of Send and Receive Loudness Rating) carried out either automatically or by user interaction.

This should be considered during the design phase of TIPHON equipment and networks by, for example, providing tools to set parameters back to default values or by providing a log file function.

4.1.4 Monitoring and verification

Even if a specific TIPHON system has been operated for some time at the desired level of customer satisfaction it should be continuously monitored to ensure that the End-to-end speech transmission quality is maintained.

Verification requires access to the actual settings of all major transmission parameters - including those which are accessible to the user.

5 Additional considerations

5.1 QoS management

A number of management processes impact the QoS offered by a TIPHON network. The key management processes are:

- capacity planning;
- routing table management; and
- traffic management.

In order to monitor and report on the QoS achieved, the following additional management processes will be required:

- performance monitoring.

These management processes are required irrespective of the mechanisms used to provide QoS.

5.1.1 Capacity planning

For a network to provide any sort of guaranteed QoS, it must be designed to carry the predicted traffic load.

Where the delivery of calls requires co-operation between networks, it will be necessary to agree, via Service Level Agreements (SLAs), the traffic that the network will be requested to carry.

An SLA should also identify how traffic not conforming to the agreement is to be handled (e.g. if the bandwidth agreed is exceeded how are additional call requests dealt with). For example the agreement could be to carry additional calls as "best efforts" regardless of the requested QoS, or maybe to connect at requested QoS at a higher cost.

The SLA could, in addition, identify the penalties if the network does not meet capacity/QoS agreements.

Possible SLA parameters for each destination (or group of destinations) are:

- planned volume/capacity required/paid minutes:
  - per time of day;
  - per traffic type;
- QoS level;
- price;
- price/arrangements for excess traffic;
- compensation/arrangements for failure to meet QoS.

5.1.2 Routing table management

Once the network has been dimensioned to carry the predicted traffic, the routing tables can be set up to maximize the use of the available capacity within each domain.

Routing decisions could be based on one or more of the following:

- destination;
- originating network (or customer);
- QoS requested;
- time of day;
- cost of routing;
- call within/outside capacity agreement.

As part of routing management it will be necessary to operate some type of access control to a domain. The purpose will be to prevent unauthorized traffic entering the network and degrading the QoS of existing calls.

EN 300 292 [2] specifies the structure of a routing management model. This model should be extended within TIPHON to include "QoS requested" as an attribute as shown in figure 1.

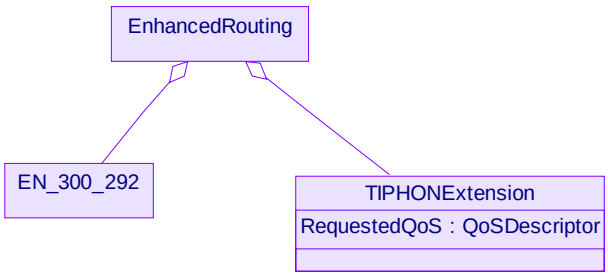

Figure 1: UML class diagram showing the extension of EN 300 292 [2] routing model

The QoSDescriptor data type can then be specified as shown in figure 2.

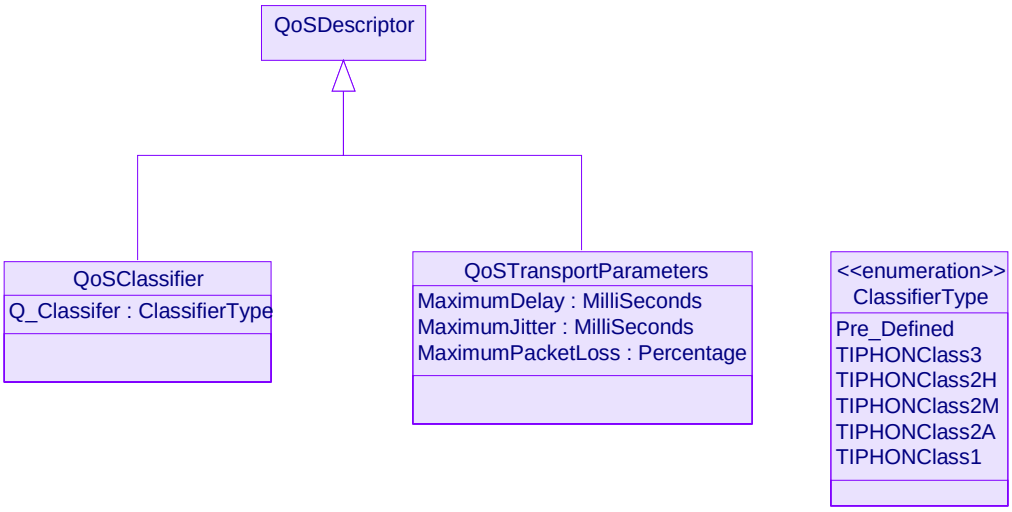

Figure 2: UML specification of the QoSDescriptor data type

5.1.3 Traffic management

In order to maintain the QoS offered by the network it is necessary to manage aggregate traffic in real time, or near real time.

This requires the ability to monitor and, as a result, control the network. For the purposes of managing guaranteed QoS, the following need to be available:

- congestion level alarms (raised by a transport domain at various levels of congestion, for example, at 85 %, 90 % and 95 %); and
- modification of routing tables based on reported congestion or equipment failures.

ITU-T Recommendations E.416 [3] and E.417 [4] specify the broader requirements for traffic management.

5.1.4 Performance monitoring

In order to provide reports to support the QoS agreements with the customers and other service providers, it will be necessary to monitor performance of the service and/or network. QoS-related parameters that should be monitored are:

- packet loss (as a percentage averaged on a per call basis);
- packet loss (as a percentage averaged over a known period);
- packet delay (as a percentage averaged on a per call basis);
- packet delay (measured over a known period):
  - minimum value;
  - mean value;
  - maximum value.

Figure 3 shows QoS performance management information as a UML class specification.

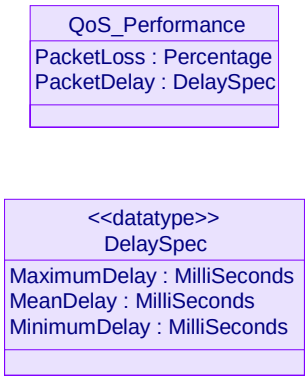

Figure 3: QoS performance management information

Annex A (informative): Bibliography

ETSI TS 101 303: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 4; Service Independent Requirements Definition; Service and Network Management Framework; Part 1: Overview and Introduction".

History

Document history		
V4.1.1	January 2003	Publication