

**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)**



Reference

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Contents

Intellectual Property Rights	4
Foreword	4
Introduction	4
1 Scope	5
2 References	5
3 Abbreviations	6
4 Introduction to End-to-end Quality of Service (QoS)	6
4.1 Main QoS parameters influenced by TIPHON systems	6
4.2 Further QoS parameters	7
4.3 TIPHON specific QoS relevant factors	7
4.4 Physical components based on which a TIPHON service may be provided	7
4.4.1 IP terminal	7
4.4.2 IP access network	8
4.4.3 IP backbone	8
4.4.4 IWF (gateway/gatekeeper)	9
4.4.5 SCN	9
4.4.6 Voice terminal connected to the SCN	9
5 Depiction of each TIPHON scenario by its reference connection	10
5.1 Reference connection for TIPHON scenario #0	11
5.2 Reference connection for TIPHON scenario #1	11
5.3 Reference connection for TIPHON scenario #2	12
5.4 Reference connection for TIPHON scenario #3	12
5.5 Reference connection for TIPHON scenario #4	13
Bibliography	14
History	15

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Foreword

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

Introduction

The present document forms one of a series of technical specifications and technical reports elaborated by TIPHON Working Group 5 for TIPHON Quality of Service (QoS) classification. The structure of this work is illustrated in Figure 1.

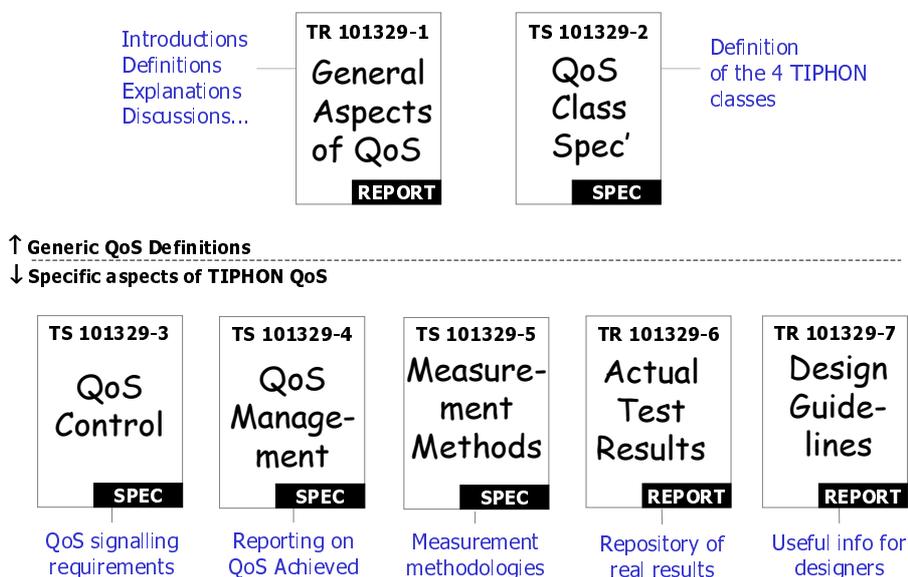


Figure 1: Structure of TIPHON QoS Documentation

1 Scope

The present document presents QoS related background information for IP networks that provide voice telephony in accordance with all TIPHON scenarios.

It contains:

- a depiction of each TIPHON scenario by its reference connection;
- an overview of the physical components based on which a TIPHON service may be provided.

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, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] ETSI EG 202 306 (V1.2): "Transmission and Multiplexing (TM); Access networks for residential customers".
- [2] ETSI TS 101 312 (V1.3): "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON); Network architecture and reference configurations; Scenario 1".
- [3] ETSI TS 101 329-2 (V1.1): "Telecommunications and Internet Protocol Harmonisation over Networks (TIPHON); End to End Quality of Service in TIPHON system; Definition Quality of Service (QoS) Classes".
- [4] ETSI TS 101 329-5 (V1.1): "Telecommunications and Internet Protocol Harmonisation over Networks (TIPHON); End to End Quality of Service in TIPHON system; Part 5: Quality of Service (QoS) Measurement Methodologies in TIPHON Systems".
- [5] ITU-T Recommendation E.600 (03/93): "Terms and definitions of traffic engineering".
- [6] ITU-T Recommendation G.103 (12/98): "Hypothetical reference connections".
- [7] ITU-T Recommendation G.107 (05/00): "The E-Model, a computational model for use in transmission planning".
- [8] ITU-T Recommendation G.177 (09/99): "Transmission planning for voiceband services over hybrid Internet/PSTN connections".
- [9] ITU-T Recommendation I.350 (03/93): "General aspects of quality of service and network performance in digital networks, including ISDNs".
- [10] ITU-T Recommendation P.310 (02/96): "Transmission characteristics for telephone-band (300-3 400 Hz) digital telephones".

3 Abbreviations

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

ADSL	Asymmetric Digital Subscriber Line
BRAN	Broadband Radio Access Networks
FDM	Frequency Division Multiplex
GSM	Global System for Mobile communications
ISDN	Integrated Services Digital Network
IP	Internet Protocol
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector (former CCITT)
IWF	Inter Working Function
LAN	Local Area Network
PSTN	Public Switched Telephone Network
QoS	Quality of Service
SCN	Switched Communications Network
TDM	Time Division Multiplex
UMTS	Universal Mobile Telecommunications System
VDSL	Very High Speed Digital Subscriber Line
xDSL	ADSL, VDSL and other Digital Subscriber Line Techniques

4 Introduction to End-to-end Quality of Service (QoS)

4.1 Main QoS parameters influenced by TIPHON systems

End-to-end QoS in a TIPHON system is characterized in the TIPHON QoS documentation under two broad headings:

- call set-up quality; and
- call quality.

Call set-up quality is mainly characterized by the call set-up time which is perceived by the user as the responsiveness of the service. Call set-up time is the time elapsed from the end of the user interface command by the caller (keypad dialling, E-mail alias typing, etc.) to the receipt by the caller of a meaningful progress information. The present document provides the exact definition of the various call set-up times for use in TIPHON systems, whereas ITU-T Recommendation E.600 [5] provides more information on the definition of post-dialling delay in SCN systems.

Call quality is characterized by the overall transmission quality rating R. Overall transmission quality rating (R) describes the full acoustic-to-acoustic (mouth to ear) quality, experienced by a user, for a typical situation using a 'standard' telephony handset. The overall transmission quality rating is calculated using the E-Model (see ITU-T Recommendation G.107 [7]). For calculation purposes the use of traditional telephone handsets (see ITU-T Recommendation P.310 [10]) at both sides of the connection is assumed.

Within the overall transmission quality two major factors contribute to the overall QoS experience of the user of the TIPHON system:

- end-to-end delay: this mainly impacts the interactivity of a conversation. The measurement is done from the mouth of the speaker to the ear of the listener; and
- end-to-end speech quality: this is the one way speech quality as perceived in a non interactive situation.

The measurement methodologies for these parameters are specified in ETSI TS 101 329-5 [4], while the requirements for these parameters with respect to the various TIPHON QoS classes are defined in ETSI TS 101 329-2 [3].

ETSI TR 101 329-7 (see bibliography) provides guidance on these parameters with respect to the practical design phase of equipment and networks.

4.2 Further QoS parameters

In general, Quality of Service (QoS) is determined by a multitude of further QoS parameters; guidance in this field is provided by ITU-T Recommendation I.350 [9].

For the complexity of other QoS parameters it is considered that:

- they either do not apply to TIPHON systems; or
- the TIPHON systems have similar influence on those parameters like other telephony systems.

4.3 TIPHON specific QoS relevant factors

Examples of TIPHON specific QoS relevant factors are:

- number of hops;
- possible variation of the geographical length of one connection during the talking state;
- occurrence of congestion;
- use of prioritization or bandwidth reservation schemes.

ETSI TR 101 329-7 (see bibliography) provides guidance on these factors with respect to the practical design phase of equipment and networks.

4.4 Physical components based on which a TIPHON service may be provided

The following components may be present in a TIPHON system and may each contribute to the overall end-to-end QoS performance of the system:

- IP terminal;
- IP access network;
- IP backbone;
- IWF (gateway/gatekeeper);
- SCN;
- voice terminal(s) connected to the SCN(s).

4.4.1 IP terminal

For the purposes of the TIPHON QoS documentation only those IP terminals will be considered to which the following description of a TIPHON terminal applies:

TIPHON terminal:

A terminal that is either dedicated (e.g. a telephone set) or general purpose (e.g. a computer running an application that performs the terminal function) and that:

- is intended for connection to an IP-network;
- provides the functionality defined in ETSI TS 101 312 [2]; and
- meets at least one of the TIPHON terminal quality of service classes defined in ETSI TS 101 329-2 [3].

Examples of different terminal types which may serve as IP terminals are:

- 4-wire telephones;
- cordless telephones;
- headsets.

Examples of operational modes for these terminal types are:

- with traditional handset;
- with so-called modern handsets;
- with loudspeaking function;
- totally hands-free.

The way in which each of these techniques is implemented has implications for end-to-end Quality of Service.

4.4.2 IP access network

A variety of access network transport media may be used to interconnect TIPHON IP terminals with IP backbone networks. ETSI EG 202 306 [1] provides guidelines.

Examples of methods that can be used for IP access layer transport are:

- LAN Access;
- PSTN Access;
- xDSL Access;
- Cable Modem Access;
- BRAN Access;
- DECT Access;
- UMTS Access;
- ISDN Access;
- GSM Access.

The way in which each of these techniques is implemented has implications for end-to-end Quality of Service.

4.4.3 IP backbone

A variety of equipment may be used to provide IP backbone networks for TIPHON services.

Examples of equipment that can be used for IP backbones are:

- Routers;
- High-speed facilities.

The way in which each of this equipment is implemented has implications for end-to-end Quality of Service.

4.4.4 IWF (gateway/gatekeeper)

Factors affecting QoS in the Gateway mirror those in the IP terminal:

Interworking functions (IWFs) may be realized in various ways; examples are:

- local;
- distributed.

The way in which each of these techniques is implemented has implications for end-to-end Quality of Service.

4.4.5 SCN

A variety of various branches of the SCN follow a multitude of different national or international regulations or standards.

Examples of different types of branches of the SCN are:

- Analogue networks;
- Digital networks;
- Cordless networks;
- Mobile networks.

Examples of the different technologies on which those networks may be based are:

- Analogue lines;
- FDM systems;
- Digital lines;
- TDM systems;
- Optical Fiber Systems;
- Wireless Systems.

Examples of the different status which those networks may have are:

- International Sections between national networks;
- Public National networks, accessible for the general public;
- Private networks (e.g., Corporate Networks), accessible for closed user groups only.

The way in which each of these techniques is implemented has implications for end-to-end Quality of Service.

4.4.6 Voice terminal connected to the SCN

A variety of voice telephony terminals interconnected to various branches of the SCN and follow a multitude of different national or international regulations or standards.

Examples of different terminal types interconnected to SCN are:

- 2-wire analogue telephones;
- 4-wire analogue telephones;
- digital telephones;

- cordless telephones;
- mobile telephones;
- headsets.

Examples of operational modes for these terminal types are:

- with traditional handset;
- with so-called modern handsets;
- with loudspeaking function;
- totally hands-free.

The way in which each of these techniques is implemented has implications for end-to-end Quality of Service.

5 Depiction of each TIPHON scenario by its reference connection

For general transmission planning purposes ITU-T Recommendation G.103 [6] provides guidance and definitions with regard to reference connections.

For the purposes of TIPHON however, the recommendations provided by G.103 [6] are not sufficient or may not be applicable. Therefore, the present document gives additional information on the reference connection for all TIPHON scenarios.

The terms of reference of the TIPHON project set out five scenarios for interoperability between IP telephony systems and Switched Communication Networks (SCN).

The maximum geographical length of reference connections for each of the TIPHON scenarios is not defined.

Table 1 relates the reference connections for the five TIPHON scenarios to the connection arrangements defined in ITU-T Recommendation G.177 [8].

Table 1: Comparison of TIPHON Scenarios with G.177 [8]

TIPHON Scenario #	G.177 [8] connection arrangement
0	see note
1	(1)
2	(2)
3	(3)
4	(4)
NOTE: TIPHON scenario #0 is not covered by ITU-T Recommendation G.177 [8]; however work in this area is underway in ITU-T Study Group 12, Question, 23/12 during the Study Period 1997 - 2000.	

5.1 Reference connection for TIPHON scenario #0

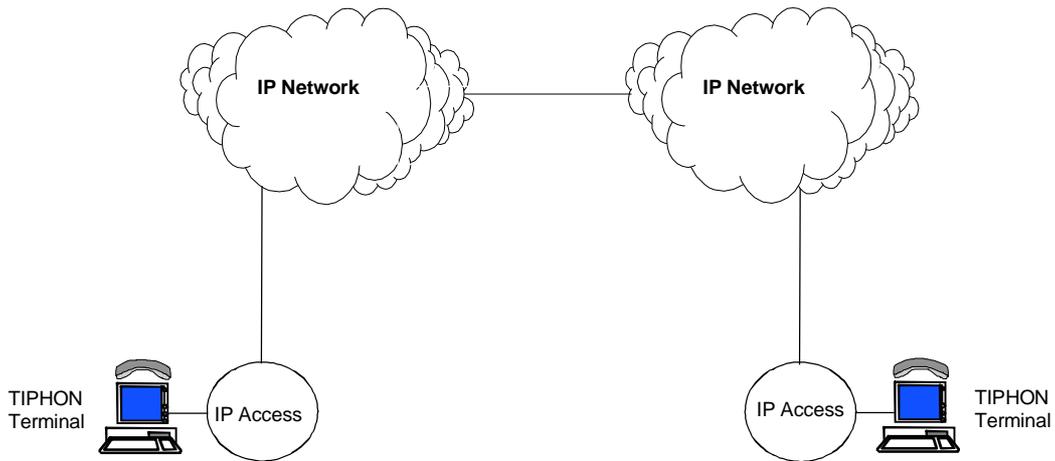


Figure 2: Scenario 0 - IP network to IP network

5.2 Reference connection for TIPHON scenario #1

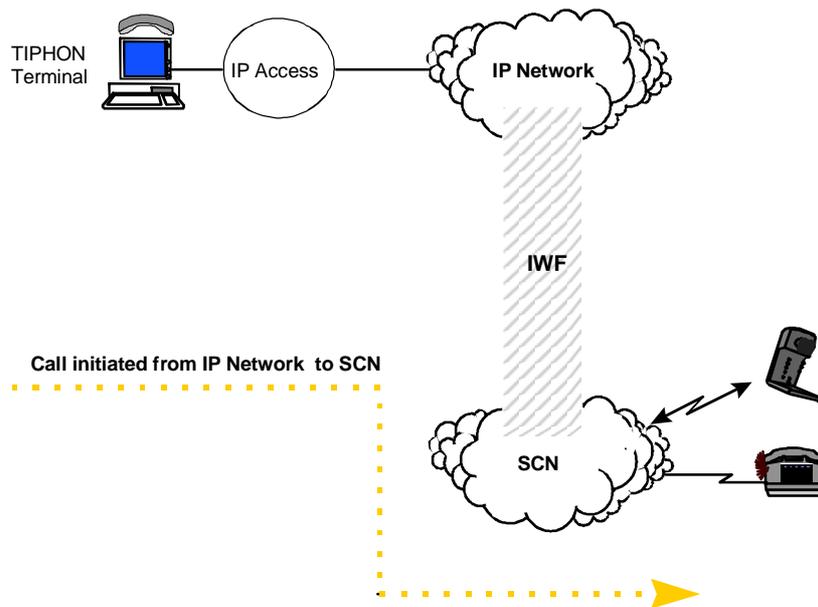


Figure 3: Scenario 1 - Call from IP Network to SCN

5.3 Reference connection for TIPHON scenario #2

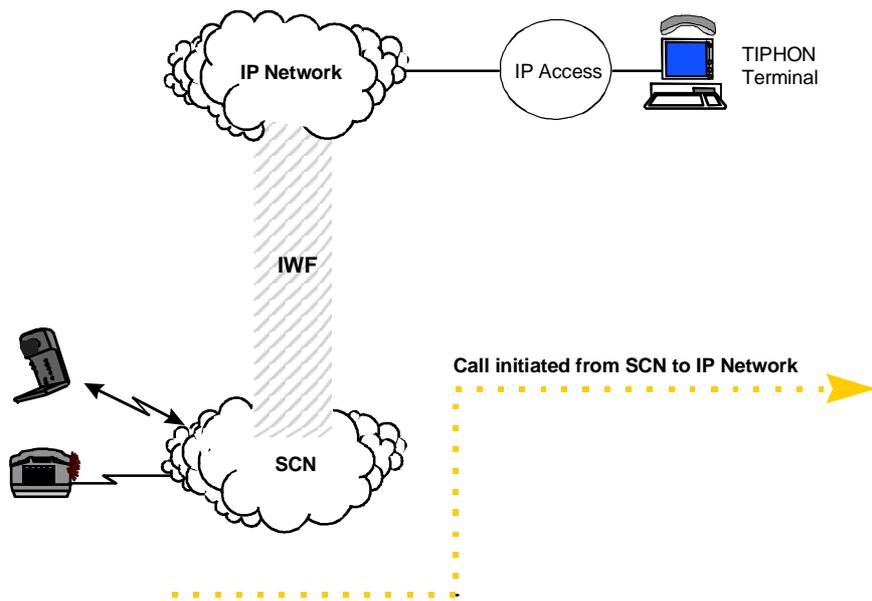


Figure 4: Scenario 2 - Call from SCN to IP Network

5.4 Reference connection for TIPHON scenario #3

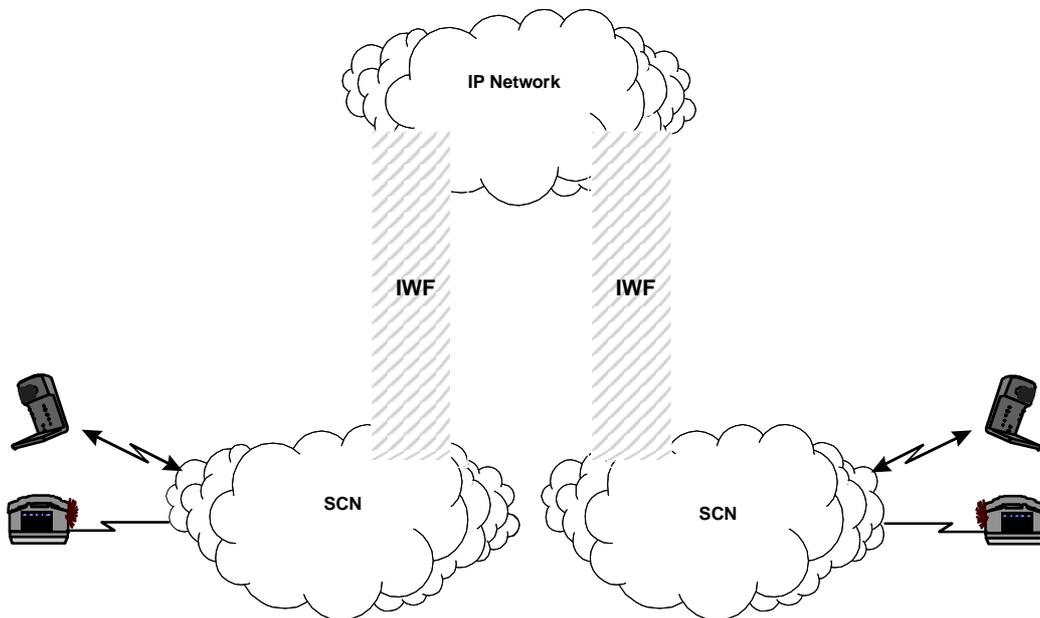


Figure 5: Scenario 3 - SCN to SCN over IP network

5.5 Reference connection for TIPHON scenario #4

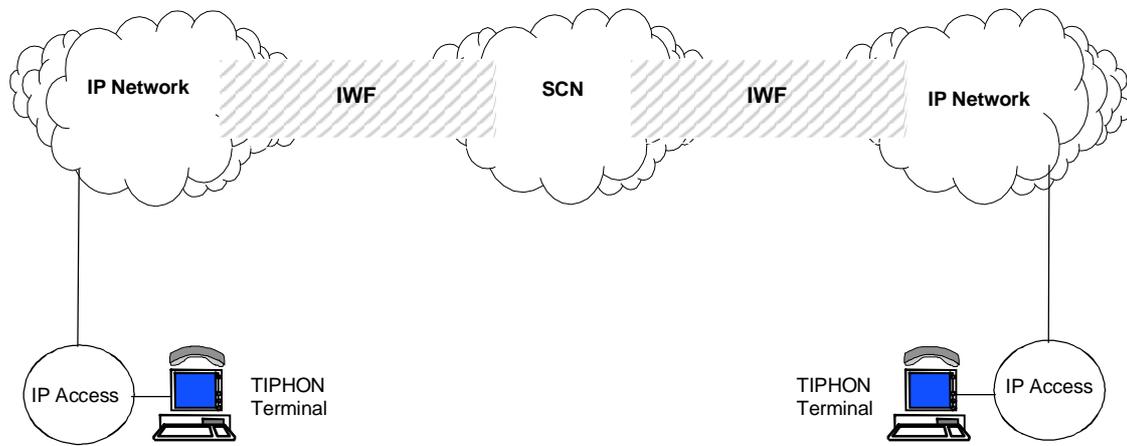


Figure 6: Scenario 4 - IP network to IP network over SCN

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

- ETSI Draft TR 101 329-7: "Telecommunications and Internet Protocol Harmonisation over Networks (TIPHON); End to End Quality of Service in TIPHON system; Design Guide for Elements of a TIPHON connection from an end-to-end speech transmission performance point of view".

History

Document history		
V1.2.5	October 1998	Publication as TR 101 329
V2.1.1	June 1999	Publication as TR 101 329
V3.1.1	July 2000	Publication