

Information technology — Quality of service — Guide to methods and mechanisms

ICS 35.100.05

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSI
Documents

AVA

Document Sharing Hub

National foreword

This British Standard reproduces verbatim ISO/IEC TR 13243:1999 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee IST/6, Data communications, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the ISO/IEC TR title page, pages ii to v, a blank page, pages 1 to 28, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the DISC Board, was published under the authority of the Standards Committee and comes into effect on 15 July 2000

© BSI 07-2000

ISBN 0 580 34313 8

Amendments issued since publication

Amd. No.	Date	Comments

Information technology — Quality of service — Guide to methods and mechanisms

Technologies de l'information — Qualité du service — Guide pour les méthodes et les mécanismes

Reference number
ISO/IEC TR 13243:1999(E)



Contents

	<i>Page</i>
1 Scope	1
2 Normative references.....	1
2.1 Identical Recommendations International Standards.....	2
3 Definitions	2
3.1 QoS Framework definitions	2
3.2 ODP definitions.....	2
4 Abbreviations	3
5 References to QoS from Recommendations, International Standards and other specifications	3
5.1 QoS in collaborative ITU-T Recommendations and ISO/IEC International Standards	3
5.2 QoS in ISO/IEC International Standardized Profiles	8
5.3 QoS in ISO TC 184 standards	8
5.4 QoS in ITU-T Recommendations.....	8
5.5 QoS in specifications produced by other organizations	9
5.6 Research on QoS management.....	10
6 Methods and mechanisms for the prediction phase	10
7 Methods and mechanisms for the establishment phase	10
7.1 Methods of reaching QoS agreements.....	10
7.2 Resource allocation mechanisms.....	22
7.3 Initialization mechanisms.....	22
8 Methods and mechanisms for the operational phase	22
8.1 Monitoring mechanisms	22
8.2 Maintenance mechanisms.....	23
8.3 Filters.....	24
8.4 Enquiry mechanisms	25
8.5 Alert mechanisms	25
9 QoS verification methods	26
9.1 Introduction	26
9.2 QoS verification at the design stage	26
9.3 QoS verification at the testing stage.....	27
9.4 QoS verification at the operation stage	28
10 References to this Recommendation Technical Report	28

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this Technical Report may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC TR 13242 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*, in collaboration with ITU-T. The identical text is published as ITU-T Rec. X.642.

Introduction

This Recommendation | Technical Report is intended to promote the use of common methods and mechanisms for managing Quality of Service (QoS) in a number of different communications and systems environments.

The collaborative ITU-T and ISO/IEC JTC 1 project for coordination and harmonization of QoS-related initiatives is aimed at encouraging the use of the QoS Framework (see ITU-T Rec. X.641 | ISO/IEC 13236), facilitating the use of common QoS methods and mechanisms, and promoting consistency between different applications and systems in their treatment of QoS. The collaboration has been extended to include QoS in Open Distributed Processing. Efforts are being made to promote maximum consistency between this activity and the work on development of specifications for QoS in CORBA-based systems in the Object Management Group (OMG).

Organizations developing methods or mechanisms for QoS management are encouraged to make use of the concepts and terms defined in the QoS Framework. Any developments that may be re-usable in other contexts should also be proposed for reference in this Recommendation | Technical Report by submitting a reference, together with explanatory text, to the ITU-T or JTC 1 Secretariat.

It is expected that the convergence of QoS methods and mechanisms will be achieved in a stepwise fashion, using such submitted material as a basis. In its first edition, this Recommendation | Technical Report identifies and catalogues current standards and other widely available specifications that incorporate definitions of QoS characteristics and QoS methods and mechanisms; and it includes definitions of some methods and mechanisms that are considered to be widely applicable. These methods and mechanisms are derived from those used or under development in information technology standards, and have been formulated in a manner consistent with the QoS Framework, with the objective that they can be applied widely and, if appropriate, standardized. Subsequent editions of this Recommendation | Technical Report are expected to add further methods and mechanisms, likewise formulated in a manner consistent with the QoS Framework. Through this process, harmonization of QoS approaches and usage across a wide range of environments will be achieved.

Since this Recommendation | Technical Report includes methods and mechanisms developed elsewhere, in cases of conflict between definitions in this Recommendation | Technical Report and definitions in the source specifications, the latter have precedence.

TECHNICAL REPORT**ITU-T RECOMMENDATION****INFORMATION TECHNOLOGY – QUALITY OF SERVICE –
GUIDE TO METHODS AND MECHANISMS****1 Scope**

This Recommendation | Technical Report uses the concepts and terminology of the Quality of Service Framework, ITU-T Rec. X.641 | ISO/IEC 13236. It is intended to support those designing, testing and specifying Information Technology (IT) systems, data communications services and protocols, those defining QoS management functions and QoS mechanisms for particular data environments and technologies, and those engaged in other QoS-related activities such as system testing, by providing a source of reference material on QoS. To do this, it brings together references to methods and mechanisms from a variety of sources, and in some cases documents them in a style which will permit their use in many data different environments.

The term "method" is used in a very general sense to include any process, function, etc., that is relevant to QoS at any stage in the life-cycle of a system.

The criterion for reference to or inclusion of definitions or specifications of QoS methods and mechanisms in this Recommendation | Technical Report is that they are thought to be of potentially wider application than solely the environment for which they were originally developed, although still in a data context.

Clause 5 identifies sources of definitions of QoS characteristics and related information. Clauses 6, 7 and 8 discuss methods and mechanisms appropriate to the phases of QoS activity that are defined in the QoS Framework: clause 6 deals with the prediction phase, clause 7 with the establishment phase and clause 8 with the operational phase. Clause 9 describes methods for verification of system behaviour related to QoS. Clause 10 covers the relationships between this Recommendation | Technical Report and Recommendations, International Standards or Technical Reports that reference it.

This Recommendation | Technical Report contains detailed definitions of some QoS mechanisms. Some peer-to-peer QoS negotiation mechanisms are defined in 7.1.1. These involve two peer entities and in most cases also the provider of a communications service between them. Subclause 7.1.2 provides an initial specification of some QoS negotiation mechanisms for $1 \times N$ multicast connections, based on those in 7.1.1. Subclause 7.1.3 discusses QoS negotiation mechanisms for $M \times N$ multicast, some of which can make use of those in 7.1.2. Subclause 8.2.1 defines some QoS management mechanisms to support time-critical applications.

This Recommendation | Technical Report does not include methods and mechanisms for security.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | Technical Report. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | Technical Report are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.641 (1997) | ISO/IEC 13236:1998, *Information technology – Quality of Service: Framework*.
- ITU-T Recommendation X.902 (1995) | ISO/IEC 10746-2:1996, *Information technology – Open distributed processing – Reference Model: Foundations*.

3 Definitions

For the purposes of this Recommendation | Technical Report, the following definitions apply.

3.1 QoS Framework definitions

This Recommendation | Technical Report uses the following terms drawn from the Quality of Service Framework, ITU-T Rec. X.641 | ISO/IEC 13236:

- compulsory (level of agreement);
- connection-wide (negotiation);
- controlled highest quality;
- establishment phase;
- guaranteed (level of agreement);
- highest quality attainable;
- lowest quality acceptable;
- operating target;
- operational phase;
- prediction phase;
- QoS alert;
- QoS characteristic;
- QoS enquiry;
- QoS filter;
- QoS maintenance;
- QoS measure;
- QoS mechanism;
- QoS monitoring;
- QoS negotiation;
- QoS parameter;
- QoS threshold;
- QoS verification;
- receiver-selected (negotiation).

3.2 ODP definitions

This Recommendation | Technical Report uses the following term drawn from the Reference Model of Open Distributed Processing: Foundations, ITU-T Rec. X.902 | ISO/IEC 10746-2:

- Quality of Service (QoS): A set of qualities related to the collective behaviour of one or more objects.

4 Abbreviations

For the purposes of this Recommendation | Technical Report, the following abbreviations apply:

AGI	Active Group Identity
CHQ	Controlled Highest Quality
CORBA	Common Object Request Broker Architecture
CW	Connection-Wide (negotiation)
FDT	Formal Description Technique
HQA	Highest Quality Attainable
LQA	Lowest Quality Acceptable
ODP	Open Distributed Processing
OMG	Object Management Group
PCO&M	Point of Control, Observation and Measurement
PDU	Protocol Data Unit
QoS	Quality of Service
RFC	Request for Comment
RSVP	Resource Reservation (setup) Protocol
SUT	Service under Test
TCNM	Network Management for Time Critical Communications Systems

5 References to QoS from Recommendations, International Standards and other specifications

This clause identifies sources of definitions of QoS characteristics that have been developed by standards bodies and other organizations as an aid to those wishing to design QoS methods and mechanisms, together with sources of associated definitions and tutorial or other related information.

NOTE – ITU-T and ISO maintain catalogues of their Recommendations and International Standards, together with other useful information, on their World Wide Web servers at <http://www.itu.int/> and <http://www.iso.ch/> respectively. Readers are encouraged to consult these in order to ensure that they use the most up-to-date references.

5.1 QoS in collaborative ITU-T Recommendations and ISO/IEC International Standards

Standardization for various kinds of data transmission networks is undertaken within ITU-T and within ISO and IEC in ISO/IEC JTC 1. Frequently, the results of this effort are needed by both ITU-T and ISO/IEC and the work is therefore developed on a collaborative basis leading to identical or technically aligned ITU-T Recommendations and ISO/IEC International Standards. Both OSI and non-OSI environments are addressed, as are peer-to-peer and multipeer associations.

5.1.1 ITU-T Recommendations and ISO/IEC International Standards that reference QoS for the lower layers

The Recommendations and International Standards involved in this area cover service definitions, attachment standards and protocol specifications for a variety of technologies including:

- circuit-switched networks (both analogue and digital);
- packet-switched networks (e.g. those conforming to the ITU-T Rec. X.25);
- local and metropolitan area networks following the ISO/IEC 8802 family of standards;
- frame relay and broadband ISDN networks;
- simple peer-to-peer and multipeer data-links.

Many Recommendations | International Standards in this area make reference to various aspects of QoS. Table 5-1 lists the Recommendations | International Standards and shows which QoS characteristics they define or use. Table 5-2 provides a reverse index to the source documents: it lists the QoS characteristics or related QoS parameters that have been defined in the Recommendations | International Standards and identifies the documents in which they can be found. In addition, there is a *where-used* table in 7.1.1.2 (Table 7-1), which identifies the Recommendations | International Standards that utilize the QoS mechanisms defined in that subclause.

Table 5-1 – QoS characteristics and parameters in joint ITU-T and ISO/IEC lower layer standards

Recommendation International Standard	Characteristic or parameter
ITU-T Rec. X.25 and ISO/IEC 8208 (X.25 Packet Layer Protocol)	throughput class transit delay selection and indication minimum throughput class end-to-end transit delay priority protection
ITU-T Rec. X.213 ISO/IEC 8348 (Connection-mode network service definition)	throughput transit delay priority protection
ITU-T Rec. X.213 ISO/IEC 8348 (Connectionless-mode network service definition)	transit delay cost determinants
ITU-T Rec. X.223 ISO/IEC 8878 (Use of X.25 to provide the connection-mode network service)	throughput transit delay priority
ITU-T Rec. X.233 ISO/IEC 8473-1 (Protocol for providing the connectionless-mode network service)	sequencing vs. transit delay transit delay vs. cost residual error probability vs. transit delay residual error probability vs. cost.
CCITT Rec. X.612 ISO/IEC 9574 (Connection-mode network service by packet-mode terminal connected to an ISDN)	throughput transit delay
ITU-T Rec. X.622 ISO/IEC 8473-3 (Connectionless-mode network protocol over X.25)	priority transit delay and throughput
ITU-T Rec. X.214 ISO/IEC 8072 (Transport service definition)	establishment delay establishment failure probability throughput transit delay residual error rate transfer failure probability release delay release failure probability protection priority resilience
ITU-T Rec. X.224 ISO/IEC 8073 (Connection-mode transport protocol)	throughput residual error rate transit delay priority
ITU-T Rec. X.234 ISO/IEC 8602 (Connectionless-mode transport protocol)	QoS parameter defined by connectionless-mode transport service
ITU-T Rec. X.605 ISO/IEC 13252 (Enhanced communications transport service definition)	throughput transit delay transit delay jitter corrupted data unit error rate lost data unit error rate ordering protection precedence