



International Telecommunication Union

# Quality of Service for TDR Traffic

Jean-Yves Monfort  
ITU-T SG 12 Chair






# End to End QoS for the users

- QoS shall be an end-to-end concept.
- QoS is defined for the benefits of the end users (usability).
- QoS should apply whatever the type of networks, even if specific performance depend on the networks involved in the transmission.
- QoS should be adapted to Voice transmission, but also for other services (eg video, data-as mails-)
- QoS parameters/limits to be defined in SLA contracts, also for emergency situations.



## QoS Classes in ITU-T

- QoS Classes for IP (Y.1541) 
  - 6 classes for IP networks
- Categories of user perceived quality (G.1010)
  - Limits for delays, packet loss for multimedia services
    - Links with mobile service classes (Conversational, streaming, interactive, background) 
- Classes for voice Quality (G.109) based on E-Model (G.107)
  - As an exemple : for voice  $R > 50$  (given by E-Model), but possibility of lower values if the delay is very long. 



## Other QoS activities in ITU-T

- o Management/Routing/Architecture/  
Signalling of QoS
  - Work in progress (draft Rec E. QSC, M.QoS, ..., tentative in progress to combine IP / ATM /SDH-OTN QoS Classes 6- see )
  
- o Monitoring of the real level of QoS (eg : INMD, for voice quality monitoring)





# Not only Quality metrics, but also “degradation metrics and limits” What can be done

- What could be the limits for the parameters for a QoS classes applied to TDR?
- What should be the appropriate QoS signalling and protocols?
- Need of sufficient usability of the available services (speech, but also texts and images), that means definition of “degradation metrics and limits for TDR, instead of “quality metrics and limits”
- Do we need to define coders adapted to TDR, in bad transmission conditions (more focused on intelligibility/ visibility/lisibility) and less sensitive to IP / Mobile degradations ?



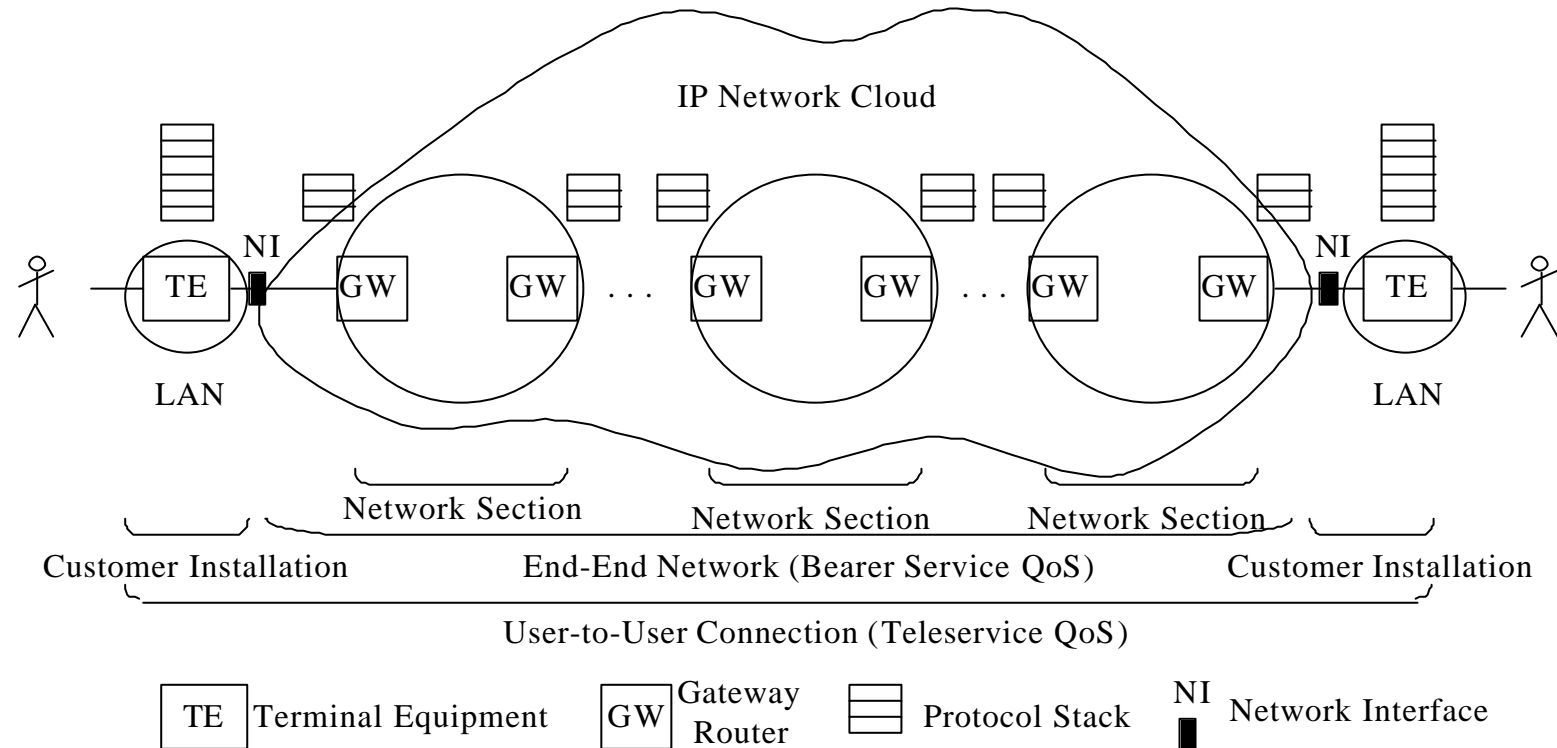
Questions ?

Thanks

Next pages : Annexes



# Recommendation Y.1541 QoS Classes: A Basis for IP Network QoS Control



**NI-to-NI Reference Path** for network QoS Objectives

NOTE : Customer installation equipment is shown for illustrative purposes, only



## Recommendation Y.1541 QoS Classes: A Basis for IP Network QoS Control

Network Performance Parameter	Nature of Network Performance Objective	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5 (Un-specified)
IPTD	Upper bound on the mean IPTD	100 ms	400 ms	100 ms	400 ms	1s	U
IPDV	Upper bound on the $1-10^{-3}$ quantile of IPTD minus the minimum IPTD	50 ms	50 ms	U	U	U	U
IPLR	Upper bound on the packet loss probability	$1*10^{-3}$	$1*10^{-3}$	$1*10^{-3}$	$1*10^{-3}$	$1*10^{-3}$	U
IPER	Upper bound	$1*10^{-4}$					U

U means « unspecified » or « unbounded »







# Recommendation G.1010

## End-User Multimedia QoS Requirements

- o Performance expressed by parameters
  - Focused on **user perceivable effects**
  - **Independent of the networks** internal design
- o Parameters
  - Delay; Delay variation; Packet loss Ratio
- o **Model for user-centric performance requirements**  
Mapping can be formalised into model for QoS categories

Error tolerant	Conversational voice and video	Voice/video messaging	Streaming audio and video	Fax
Error intolerant	Command/control (eg Telnet, interactive games)	Transactions (eg E-commerce, WWW browsing, Email access)	Messaging, Downloads (eg FTP, still image)	Background (eg Usenet)
	<b>Interactive</b> (delay <<1 sec)	<b>Responsive</b> (delay ~2 sec)	<b>Timely</b> (delay ~10 sec)	<b>Non-critical</b> (delay >>10 sec)





## E-Model (G.107)

- o applicable to network planning of traditional, narrow-band and handset terminated networks
- o estimates voice transmission quality mouth-to-ear as perceived at receive side
- o renders a transmission factor  $R$

The Rating factor  $R$  is composed of

$$R = R_0 - I_s - I_d - I_{e,eff} + A$$

- o  $R_0$  represents in principle the basic signal-to-noise ratio, including noise sources such as circuit noise and room noise.
- o  $I_s$  is a combination of all impairments which occur more or less simultaneously with the voice signal.
- o  $I_d$  represents the impairments caused by delay and the equipment impairment factor
- o  $I_{e,eff}$  represents impairments caused by low bit rate codecs; it also include impairments due to packet loss of random distribution;
- o  $A$ , the advantage factor, allows for compensation of impairment factors when there are other advantages of access to the user.



# Provisional guide for the relation between R-value and user satisfaction (Annex B of G.107)



R-value (lower limit)	MOS (lower limit)	GoB (%) (lower limit)	PoW (%) (upper limit)	User satisfaction
90	4.34	97	~0	Very satisfied
80	4.03	89	~0	Satisfied
70	3.60	73	6	Some users dissatisfied
60	3.10	50	17	Many users dissatisfied
50	2.58	27	38	Nearly all users dissatisfied



# Non-intrusive techniques

- The non-intrusive measurement techniques
  - can be implemented as part of network equipments (switches) or in stand-alone devices
  - do not require tests signal since they are performed on real communications.
  - tools used to perform those measurement are generally called I.NM.D.s (for In service Non-intrusive Measurement Devices).
- Four classes depending on the type of networks and Round trip delay (Classe D is for Packet-switched networks and a maximum value of 1000 ms for Round Trip Delay)
- The parameters that one can measure with non-intrusive systems are of two kinds :
  - related to protocol or signalling
    - calling and called number, call duration, packet loss, one point and two point jitter, RTP delay, etc.
  - derived from the analysis of the voice signal
    - echo, noise and speech levels, etc...
    - IP packet loss ratio, etc...for Class D
    - clipping, voice quality, etc.
- The analysis of measurement results can be done for individual parameters or by combining several parameters : use of a customer opinion models (E model -G.107- CCI -Call Clarity Index -P.562-). New Model under development in Q.16/12.

