



International Telecommunication Union

ITU-T Study Group 12

Migration from "Loss and Level"
Planning towards "Delay and
Impairment" Planning

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Workshop on QoS and user-perceived transmission quality in evolving networks
Dakar (Senegal), 18 - 19 October 2001



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Transmission Planning (in general)

The aim of transmission planning is to facilitate setting up networks

- o Identification of important transmission impairments
- o Guaranteeing adequate end-to-end speech transmission performance



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Transmission Planning Traditional Approach(1)

Identification of important transmission impairments

- o Analysis of basic network segments
- o Allocation of limits for transmission impairments to specific segments



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Transmission Planning Traditional Approach (2)

Main transmission impairments

- o Loudness rating, delay, noise, stability
- o Loss and level adjustments
- o Specific delay limits
- o Other impairments due to digital equipment not covered



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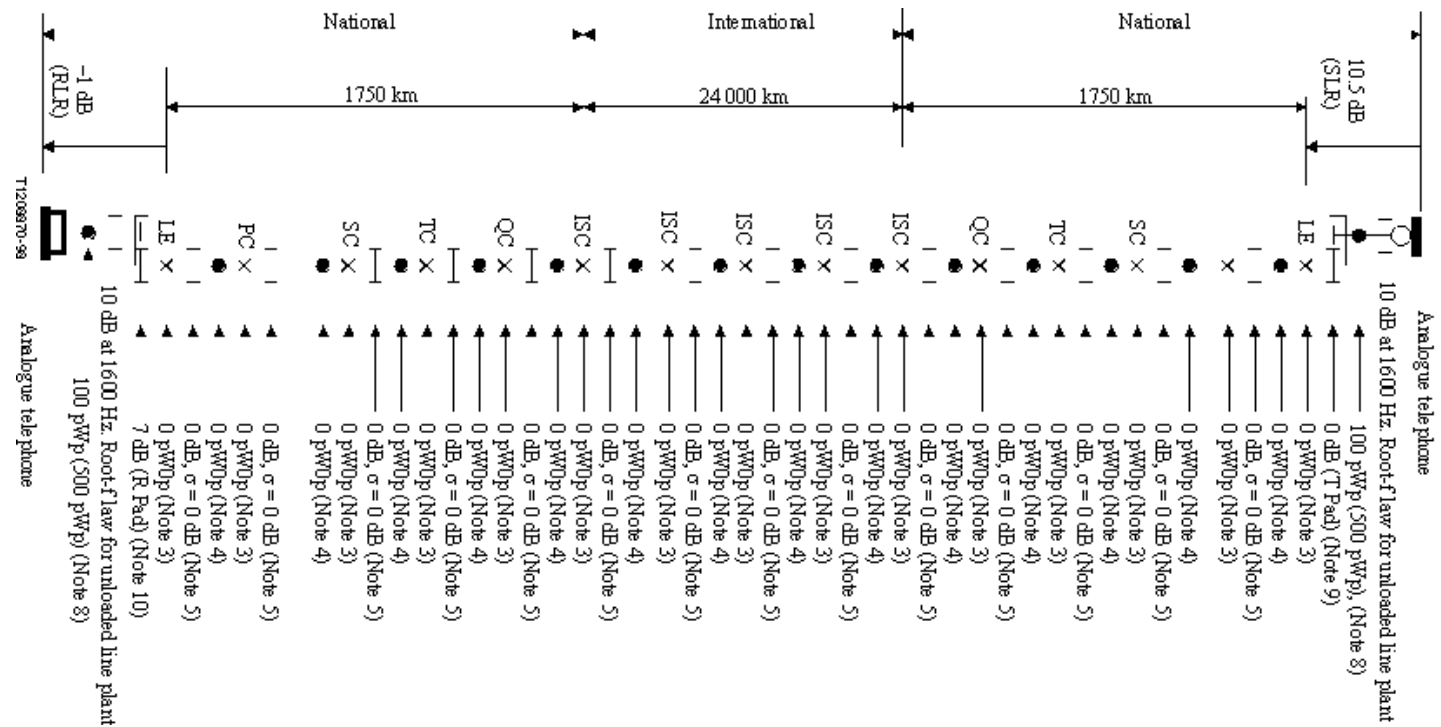
Transmission Planning Traditional Approach (3)

Guaranteeing adequate end-to-end speech transmission performance

- o Allocation of limits
- o Limits/range of transmission impairments known for single parameters only
- o Combined effect of impairments not taken into account
- o Performance achieved by restriction to “best practice” limitation



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New Implications to Transmission Planning (Overview)

**Traditional transmission planning is
no longer feasible because of**

- o Increased use of new components and technology
- o Convergence of fixed, mobile and IP networks
- o Effects of liberalization



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New Implications to Transmission Planning (1)

Increased use of new components and technology

- o Digital circuit-switched networks
- o Packet-based networks
- o Low-bit rate codecs
- o Mobile and wireless sections



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New Implications to Transmission Planning (2)

Convergence of fixed/mobile and circuit/packet-switched networks

- o New combinations and varieties to be considered
 - Cumulative transmission impairments
 - Network configurations/reference connections
 - Gateways and network interconnections

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New Implications to Transmission Planning (3)

Effects of liberalization

- "National systems" as currently described in G.101 do not exist anymore
- National connections may be as complex as international ones
- CNs may be even more complex as national networks
- Uniform national transmission plan no longer enforceable

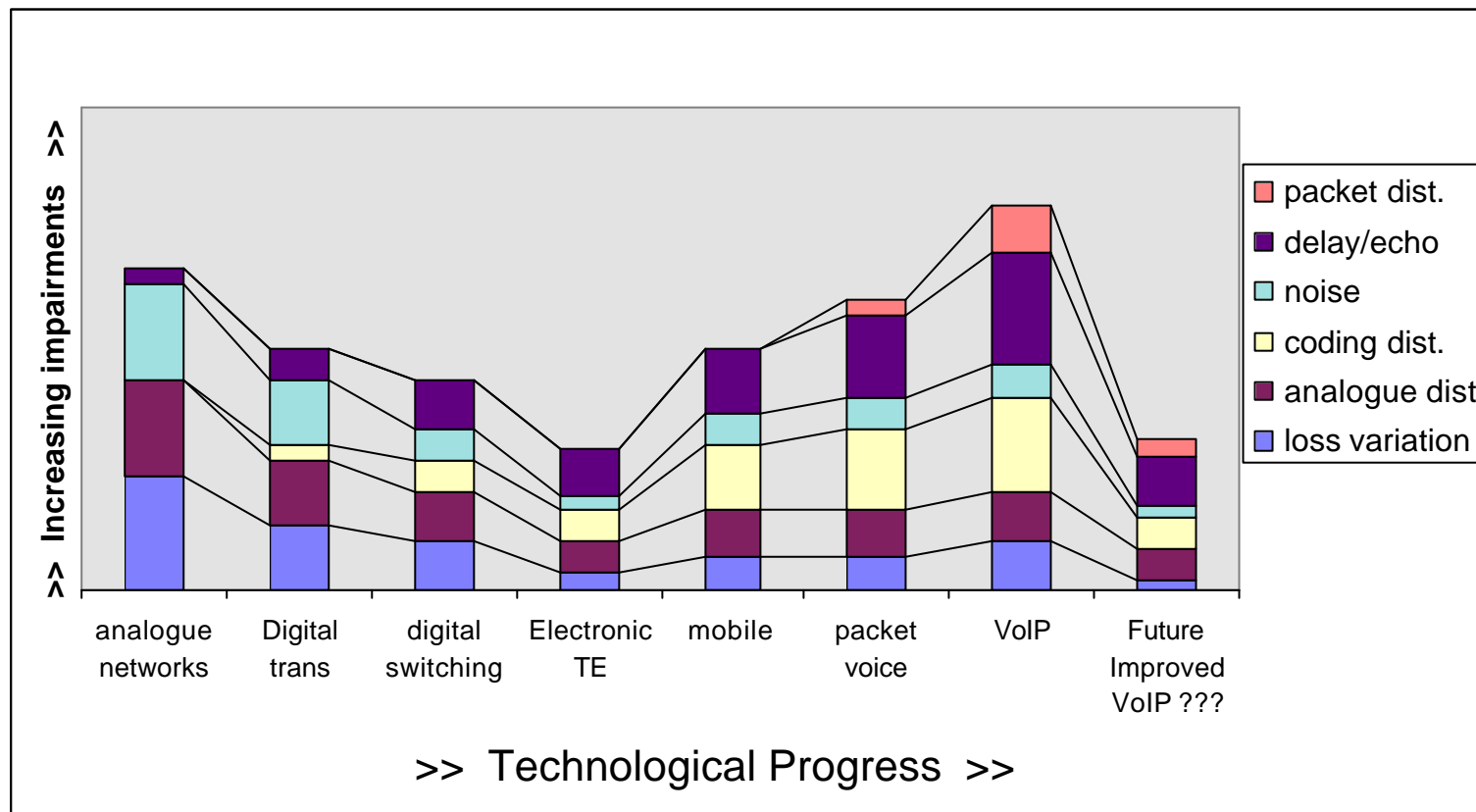
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Development of Transmission Impairments





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Conclusion (1)

Transmission planning becomes more complex

- o More and different types of impairments due to digitalization
- o Convergence of networks with different types of transport media must be considered
- o Reference configurations must take into account a variety of scenarios for the same connection section

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Conclusion (2)

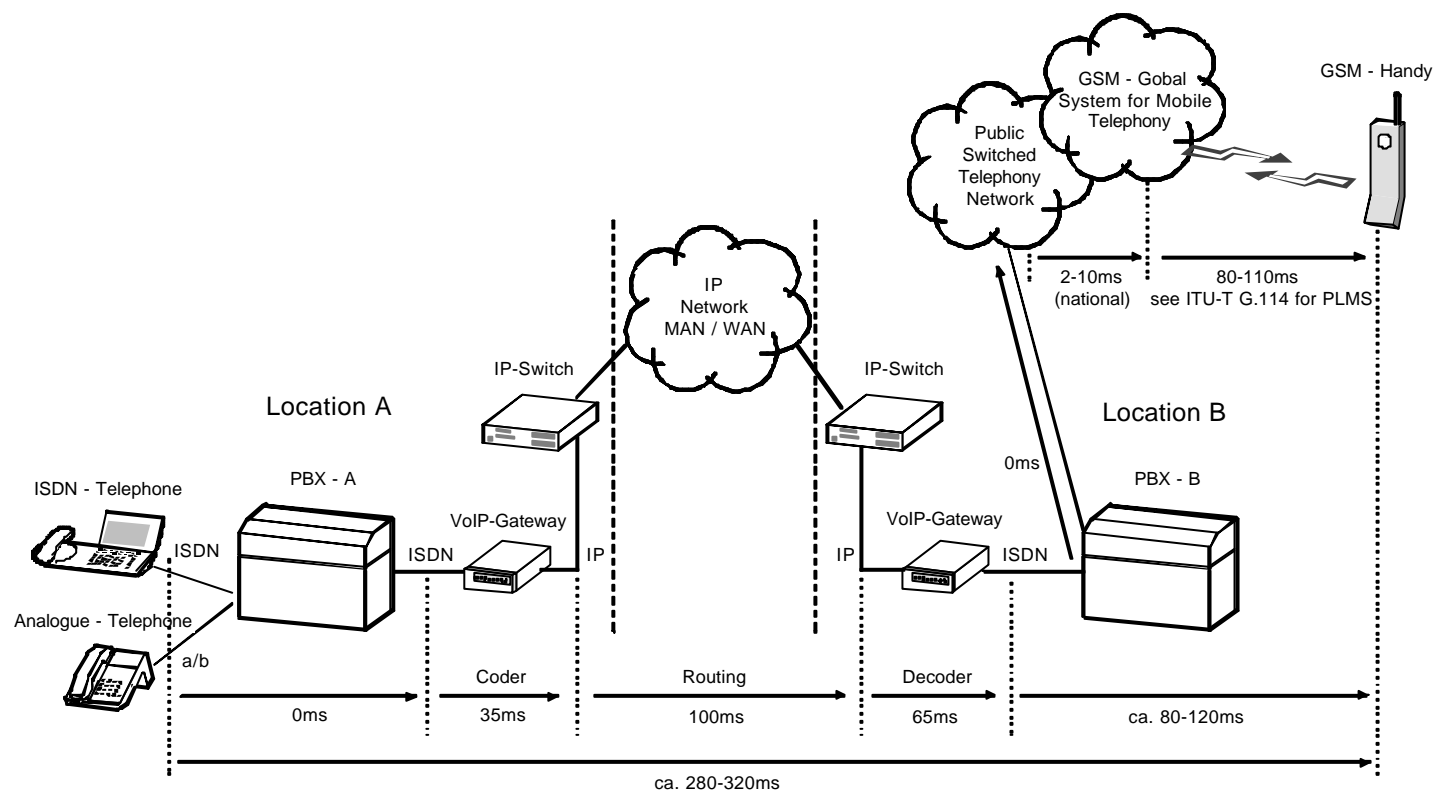
- o Allocation of fixed limits is not practical due to increased complexity
- o Consequently, combined effects of different transmission impairments must be analyzed
- o End-to-end performance is the result of simultaneous interworking of different technologies



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Reference Configurations Example



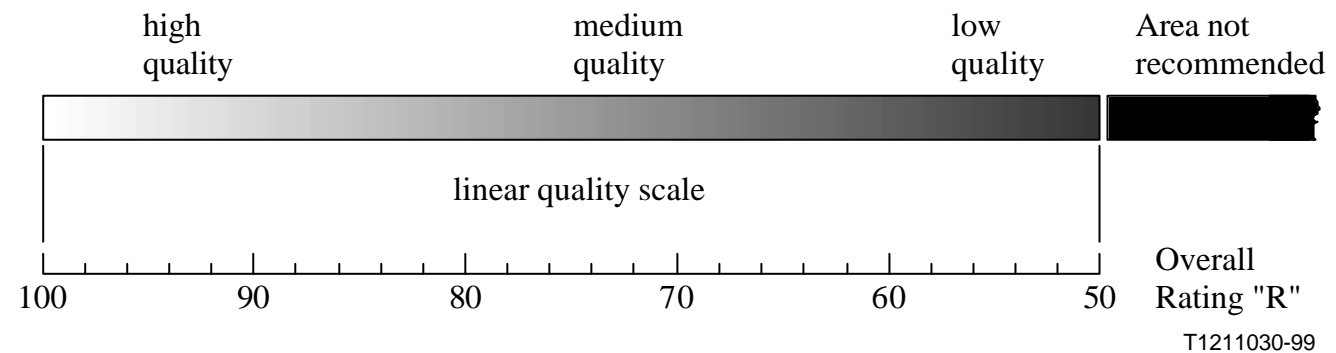


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New Approach (1)

Assessing the end-to-end quality by one single value that takes into account all impairments simultaneously





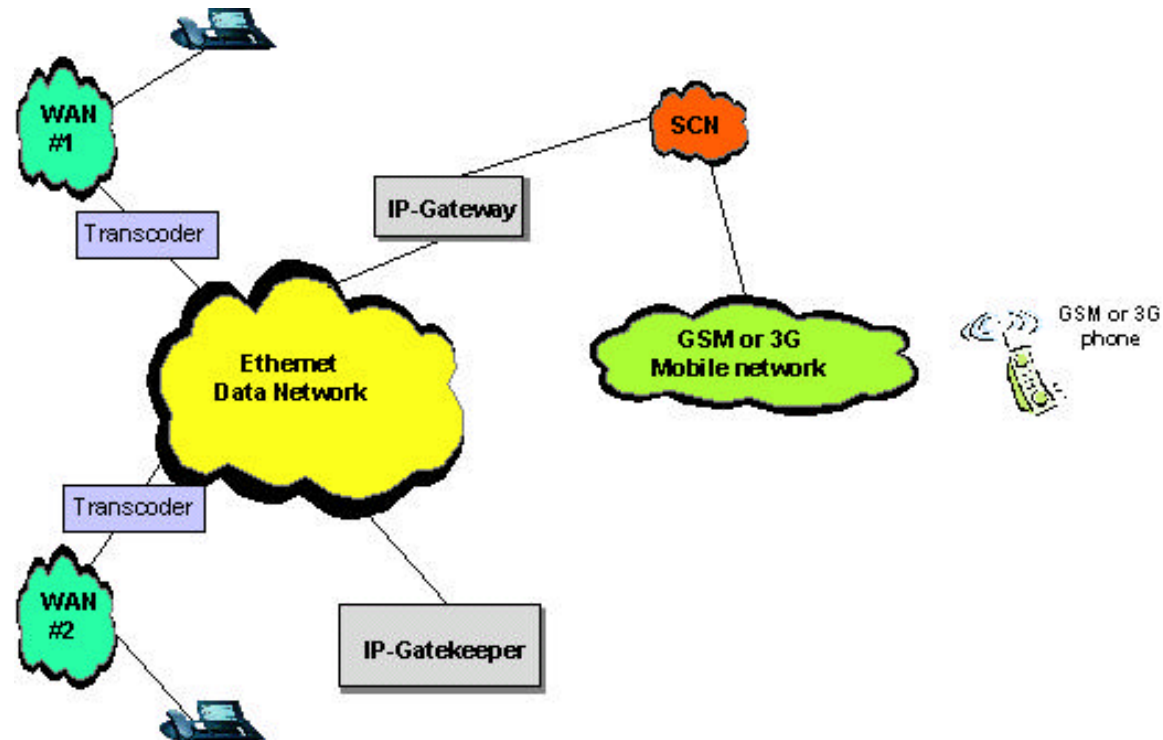
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New Approach (2)

Allowing for transmission planning of different reference configurations



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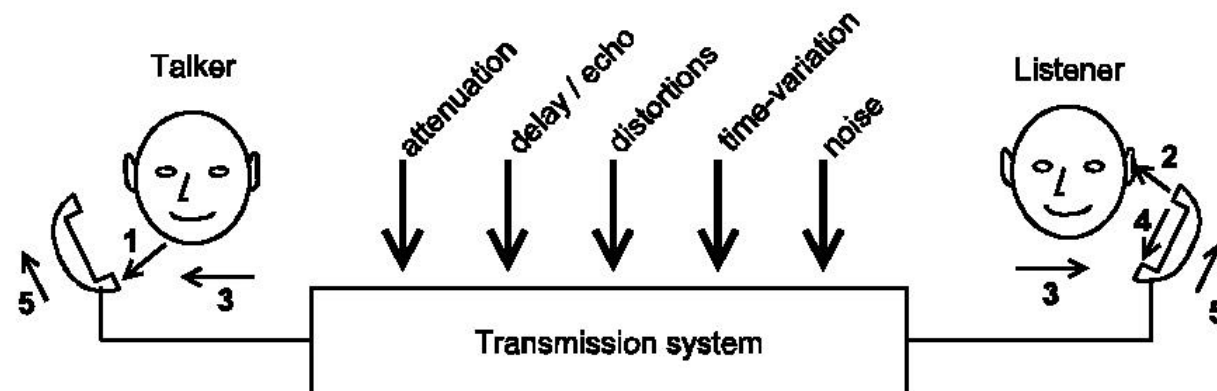


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New Approach (3)

Transmission planning tool given by Recommendation G.107 (E-Model)



1. Sound pressure produced by the talker
2. Transmission path between earphone and eardrum
3. Ambient (room) noise
4. Loss between earphone and microphone
5. Loss between microphone and earphone

Transmission parameters influencing the quality of a handset telephone connection



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Abbreviations

o %GoB	Percentage Good or Better
o %PoW	Percentage Poor or Worse
o ANSI	American National Standards Institute
o CN	Corporate Network
o EC	Echo Canceller
o EIA	Electronic Industries Alliance
o ETSI	European Telecommunications Standardization
o EU	European Union
o le	Equipment Impairment Factor
o IP	Internet Protocol
o LSQ	Listener Speech Quality
o MOS	Mean Opinion Score
o OLR	Overall Loudness Rating
o OVR	Overall Speech Quality Rating
o PSTN	Public Switched Telephone Network
o QoS	Quality of Service
o R	E-Model Rating
o TCLw	Terminal Coupling Loss (weighted)
o TELR	Talker Echo Loudness Rating
o TIA	Telecommunications Industry Association
o TIPHON	Telecommunications & Internet Protocol Harmonization Over Networks
o WEPL	Weighted Echo Path Loss

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