SP-030371

IP QoS Interoperability Issues

Source: SBC Communications, BT
Contact: Randolph Wohlert
Randolph_Wohlert@labs.sbc.com

Industry Trend: IP Based Services

Next Generation Networks

Multi-service packet-based networks that provide both wireline and wireless communication services

- ***Service completion between***

- wireline & wireless networks
- circuit switched & packet networks

- ***Towards*** All-IP Networks supporting

End-to-End Services across networks / domains / platforms

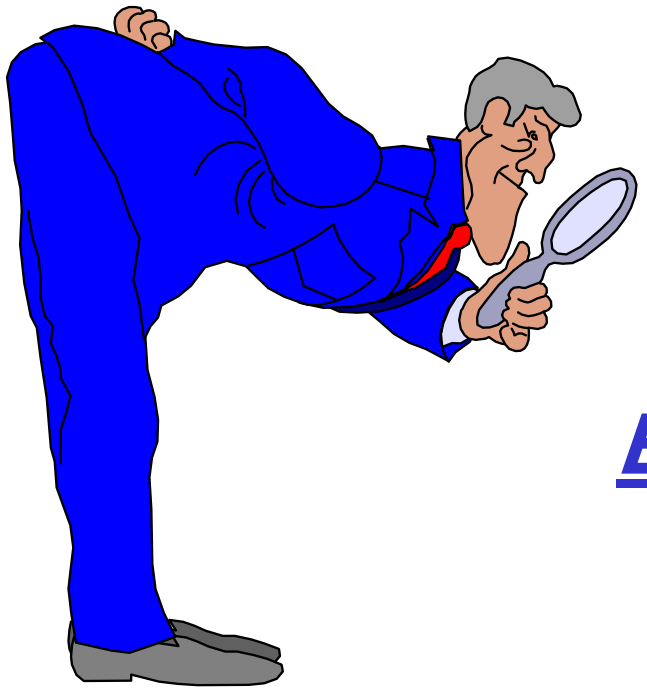
- IP Based Multimedia Services
  - Voice
  - Video
  - Data

Key Issues
Security
QoS

End to End QoS Issue

In next generation networks, how is QoS

- *specified*,
- *signaled*,
- *monitored*,
- *managed*



End-to-End

Across Networks?

Service Requirements

Best Effort Data (Email, Data Download, etc.)

Multimedia Services

Interactive Massively Multiplayer Online Gaming

Presence Services

Speech Enabled Services

Voice

Instant Messaging

Mobile Commerce

Streaming Audio & Video

Push Services

Telecommunications for Disaster Relief

Location Based Services

"E911" Emergency Calls

Multicast

Services (different)

↓ ↑

Requirements (different)

↓ ↑

Architecture

↓ ↑

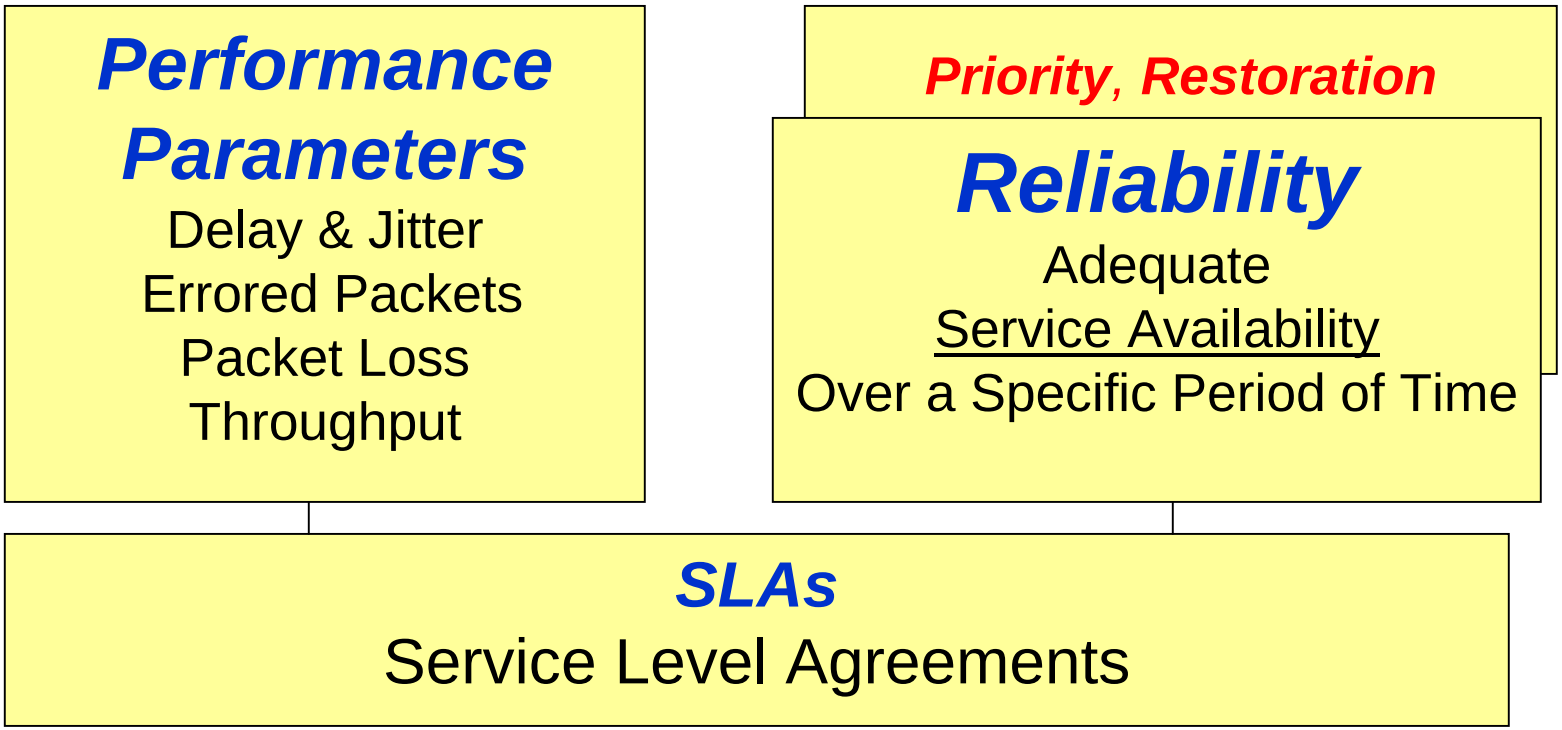
Protocols

Top Down vs Bottom Up approach

Service Requirements vary for different services

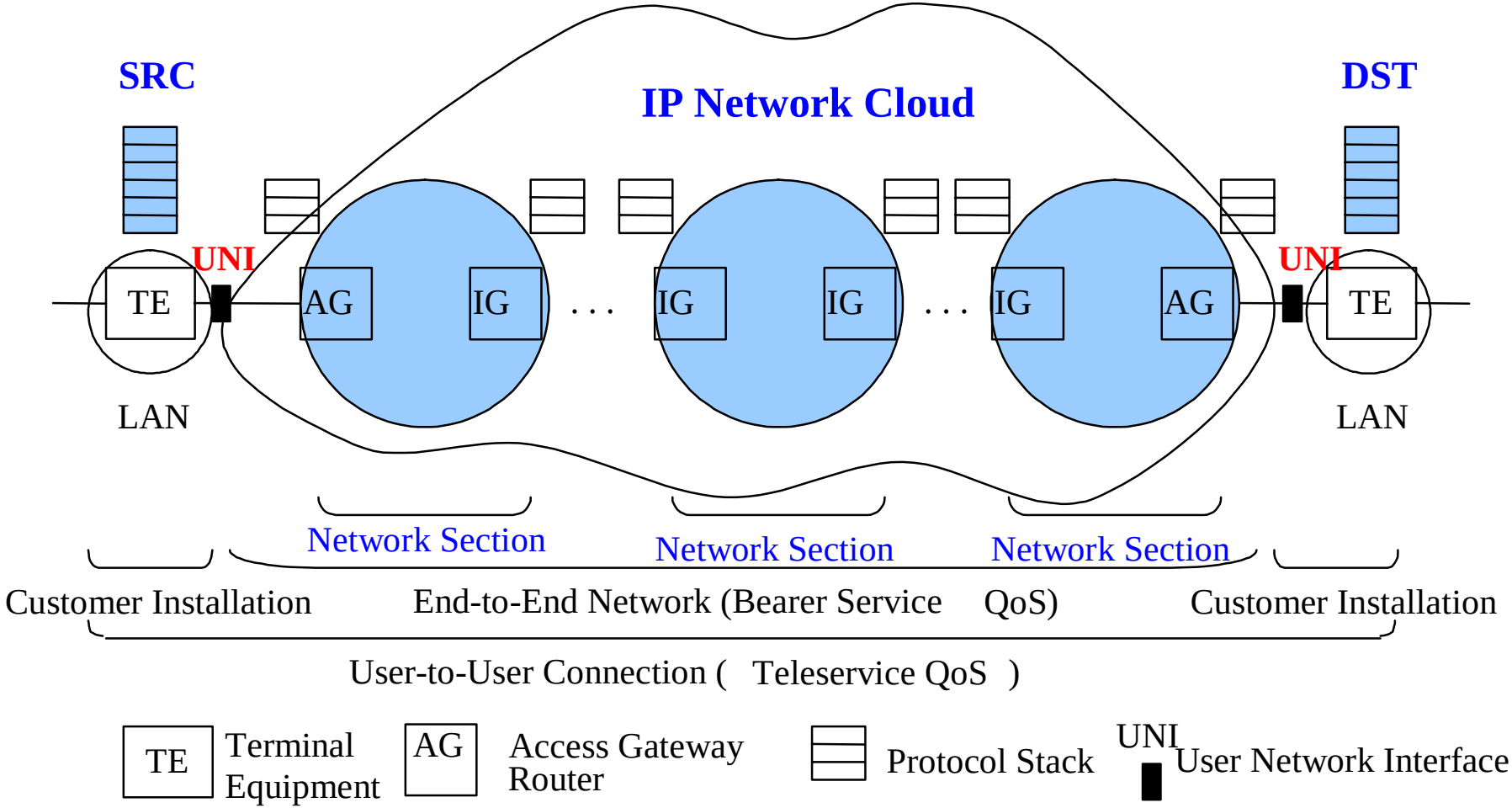
QoS Objectives

It's important to satisfy customer expectations for
end-to-end Quality of Service and Reliability
for all types of transactions and services



End to End Network Model

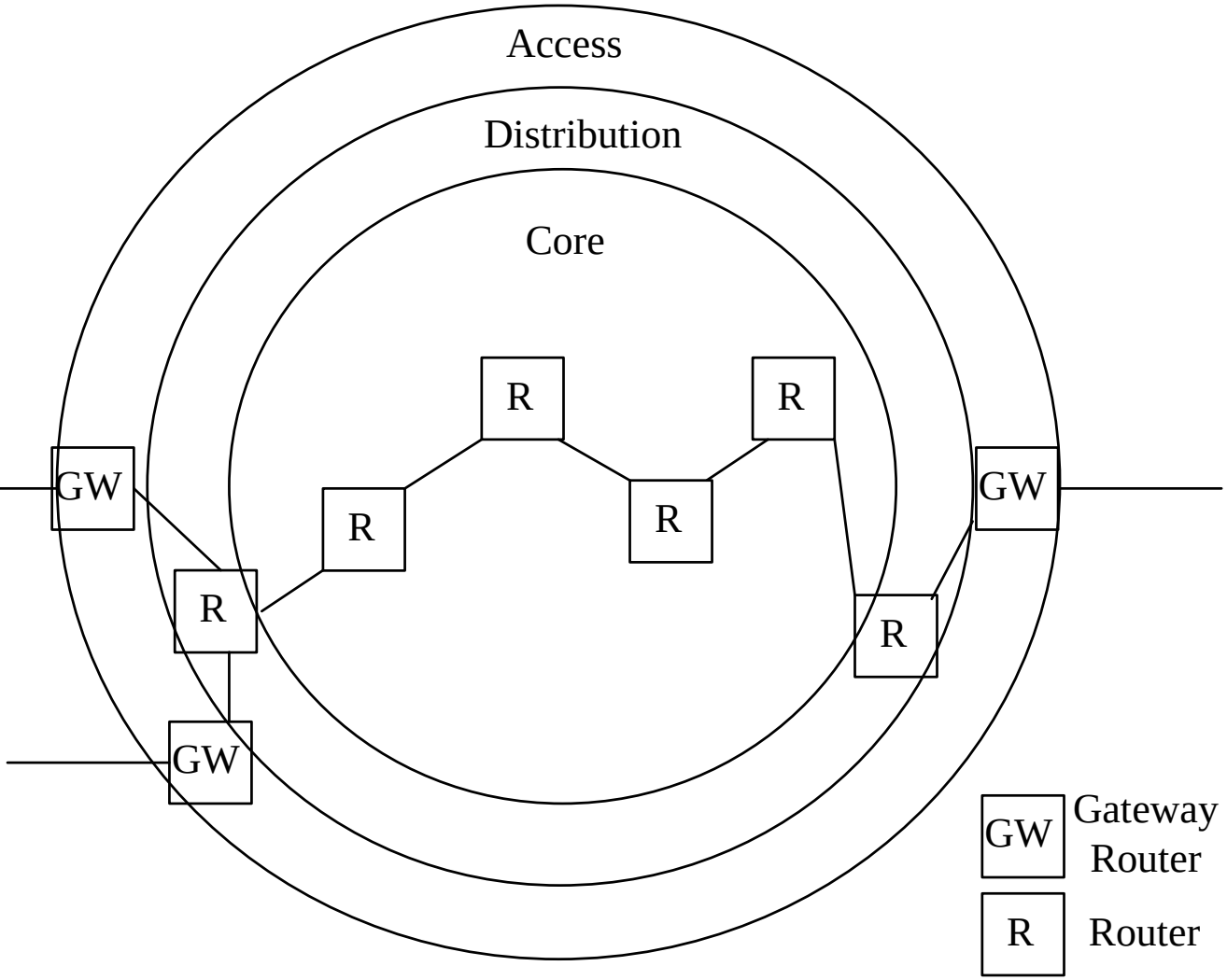
Hypothetical reference path, performance measurement points



Based on ITU-T Y.1541 figures 1 & 5

Network Section

Different types of nodes introduce different amounts of delay and variance



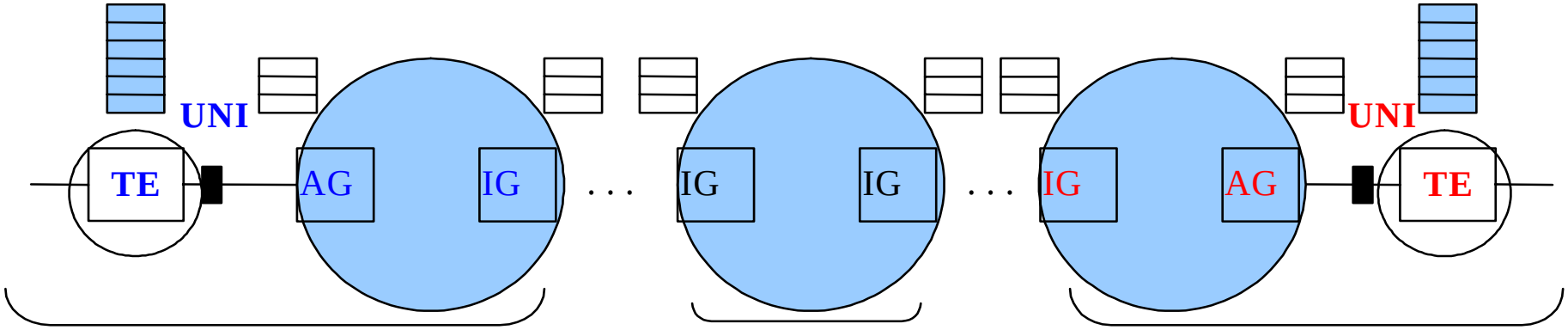
Source ITU-T Y.1541

Wireless/Wireline Interoperability

What happens when IP based services are offered between IP Networks based on Wireless (3GPP / ITU-R) standards and Wireline (ITU-T)standards ?

Source

Dest



3GPP Network Section

Network Section

ITU-T Network Section

Based on ITU-T Y.1541 figures 1 & 5

Key QoS Standards Overview

	Wireline	Wireless
Key Standards	ITU-T	3GPP
Perf. Parameters	Y.1540	TS 22.105
QoS Classes	Y.1541	TS 23.107

ITU-T Y.1540 IP Availability Performance Parameters

ITU-T Y.1541 Network Performance Objectives for IP-Based Services

3GPP TS 22.105 Services and Service Capabilities

3GPP TS 23.107 QoS Concept and Architecture

Related Specifications:

ITU-T Y.1221 Traffic Control and Congestion

ITU-R M.1079 Performance and QoS Requirements for IMT-2000

3GPP TS 23.207 End to End QoS Concept and Architecture

3GPP TS 29.207 Policy Control over Go interface

ITU-T Y.1540 Network Performance Parameters

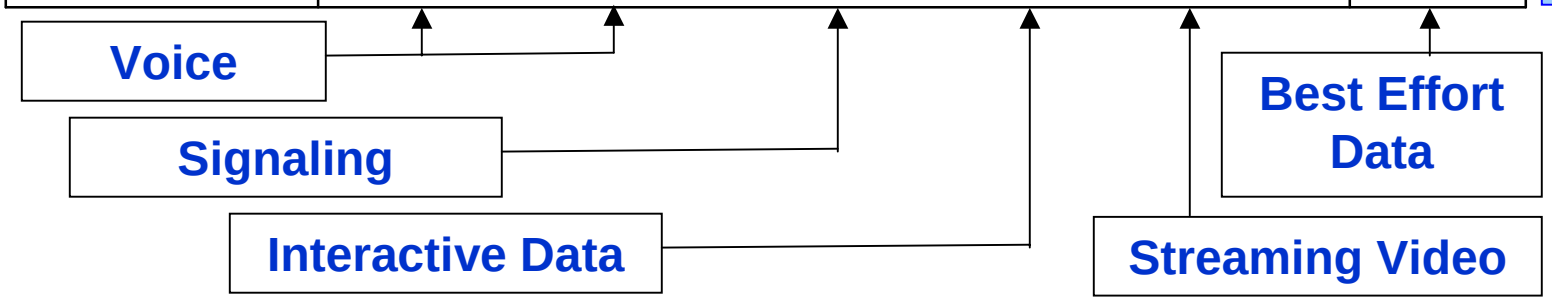
- **IP Transfer Delay (IPTD)**
  - Propagation Delay: function of distance
  - Transport Delay: function of processing in nodes
  - Codec Delay: signal conversion
  - Jitter Buffer Delay: smoothing delay variability
- **IP Delay Variability (IPDV) (Jitter)**
- **IP Packet Loss Ratio (IPLR)**
  - congestion discards, delay variation discards
  - Bursts or random
- **IP Packet Error Ratio (IPER)**
- **Spurious IP packet Rate (SIPR)**

} Corruption, duplication, misrouting

ITU-T Y.1541 QoS Classes

Network Performance Parameter	Y.1541 QoS Classes					
	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5
IPTD	100ms	400ms	100ms	400ms	1 s	U
IPDV	50ms	50ms	U	U	U	U
IPLR	$1*10^{-3}$	$1*10^{-3}$	$1*10^{-3}$	$1*10^{-3}$	$1*10^{-3}$	U
IPER	$1*10^{-4}$					U

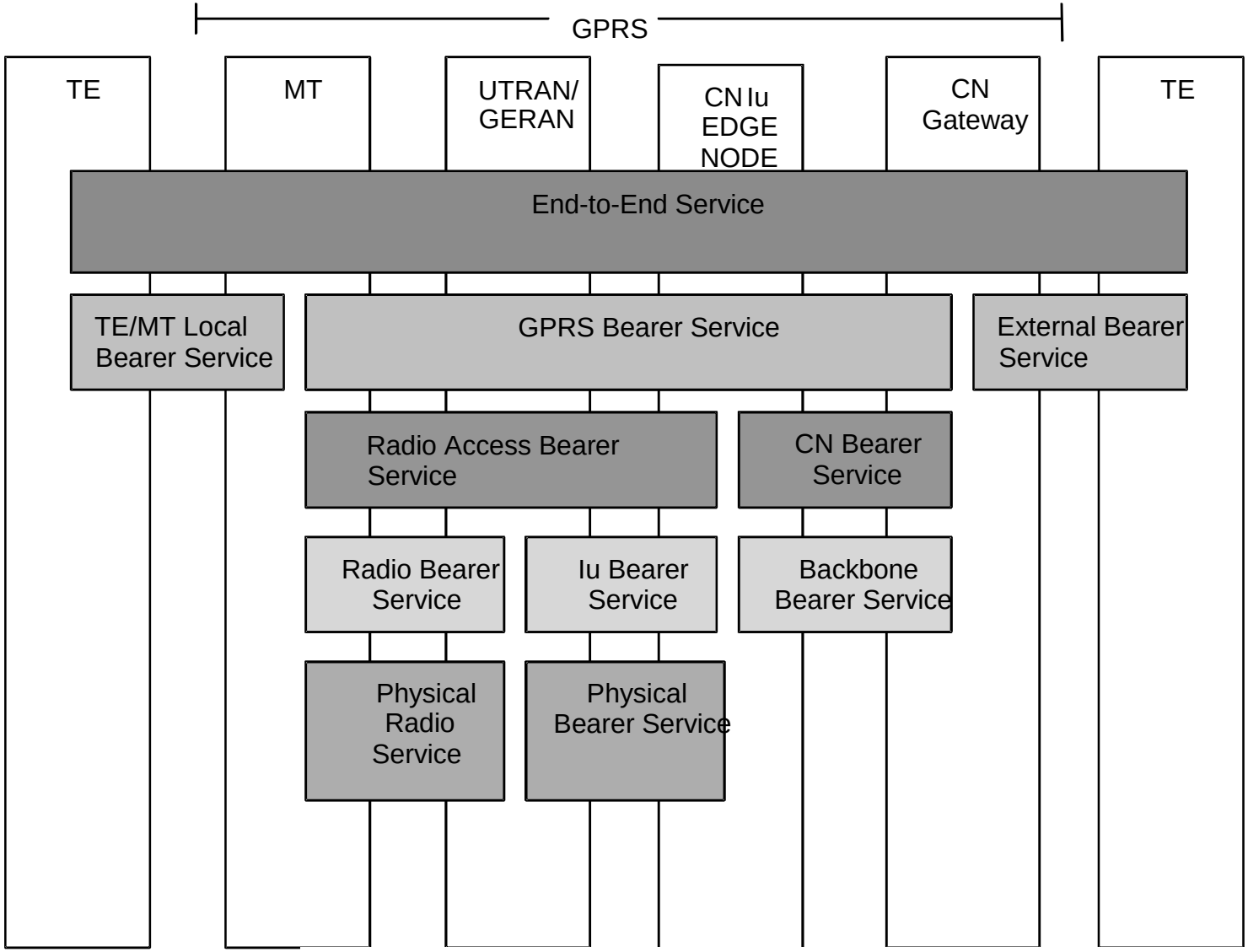
Classes resolve scaling issues



Example Service Mappings

*Note that **delay variability** is the distinguishing difference between Classes 0,1 and 2,3*

TS 23.107
3GPP e2e QoS Concept



Source: 3GPP TS 23.107 v5.6.0 (2002-12)QoS Concept and Architecture (Rel5), figure 1

TS 22.105 Services and Service Parameters

- **5.4 Range of QoS Requirements**
- **It shall be possible for one application to specify its QoS requirements to the network by requesting a bearer service with any of the specified traffic type, traffic characteristics maximum transfer delay, delay variation, bit error ratios & data rates.**

Various tables indicate various ranges of values that shall be supported

Similar Network Performance Parameters to ITU-T, no mention of Loss Ratio (important for Voice)

TS 23.107
3GPP Performance Parameters

Various tables describe various bearer attributes with various ranges of values for the various bearers.

For example, this is the UMTS Bearer Service Attributes Table

NOTE: Delay Variability parameter not present

Traffic class	Conversational class	Streaming class	Interactive class	Background class
Maximum bitrate (kbps)	<= 2 048 (1) (2)	<= 2 048 (1) (2)	<= 2 048 - overhead (2) (3)	<= 2 048 - overhead (2) (3)
Delivery order	Yes/No	Yes/No	Yes/No	Yes/No
Maximum SDU size (octets)	<=1 500 or 1 502 (4)	<=1 500 or 1 502 (4)	<=1 500 or 1 502 (4)	<=1 500 or 1 502 (4)
SDU format information	(5)	(5)		
Delivery of erroneous SDUs	Yes/No/- (6)	Yes/No/- (6)	Yes/No/- (6)	Yes/No/- (6)
Residual BER	$5*10^{-2}$, 10^{-2}, $5*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}	$5*10^{-2}$, 10^{-2}, $5*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}	$4*10^{-3}$, 10^{-5}, $6*10^{-8}$ (7)	$4*10^{-3}$, 10^{-5}, $6*10^{-8}$ (7)
SDU error ratio	10^{-2}, $7*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}	10^{-1}, 10^{-2}, $7*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}	10^{-3}, 10^{-4}, 10^{-6}	10^{-3}, 10^{-4}, 10^{-6}
Transfer delay (ms)	100 – maximum value	280 (8) – maximum value		
Guaranteed bit rate (kbps)	<= 2 048 (1) (2)	<= 2 048 (1) (2)		
Traffic handling priority			1,2,3	
Allocation/Retention priority	1,2,3	1,2,3	1,2,3	1,2,3
Source statistic descriptor	Speech/unknown	Speech/unknown		

Source: 3GPP TS 23.107 v5.6.0 (2002-12), QoS Concept and Architecture (Rel5), Table 4

TS 23.107
3GPP QoS Classes

Traffic class	Conversational class *RT*	Streaming class *RT*	Interactive class *Best Effort*	Background class *Best Effort*
Fundamental characteristics	-Preserve time relation (variation) between information entities of the stream Conversational pattern (stringent and **low delay**)	- Preserve time relation (variation) between information entities of the stream	- Request response pattern - Preserve payload content	- Destination is not expecting the data within a certain time - Preserve payload content
Example application	- voice	- streaming video	- Web browsing	- background download of emails

Source: 3GPP TS 23.107 v5.6.0 (2002-12) QoS Concept and Architecture (Rel5), Table 1

IP QoS Train Wreck Coming?

What's Important

- IP based services: Voice, Video, Data, TDR *
- Globally Standardized Interworking between
  Wireless (ITU-R/3GPP) and Wireline (ITU-T) networks

Key Question

- How will e2e QoS be provided across networks?
  Wireless / Wireline Standards are different
  (*incompatible?*)
    - Is standardized interworking feasible?
    - Can alignment be achieved?

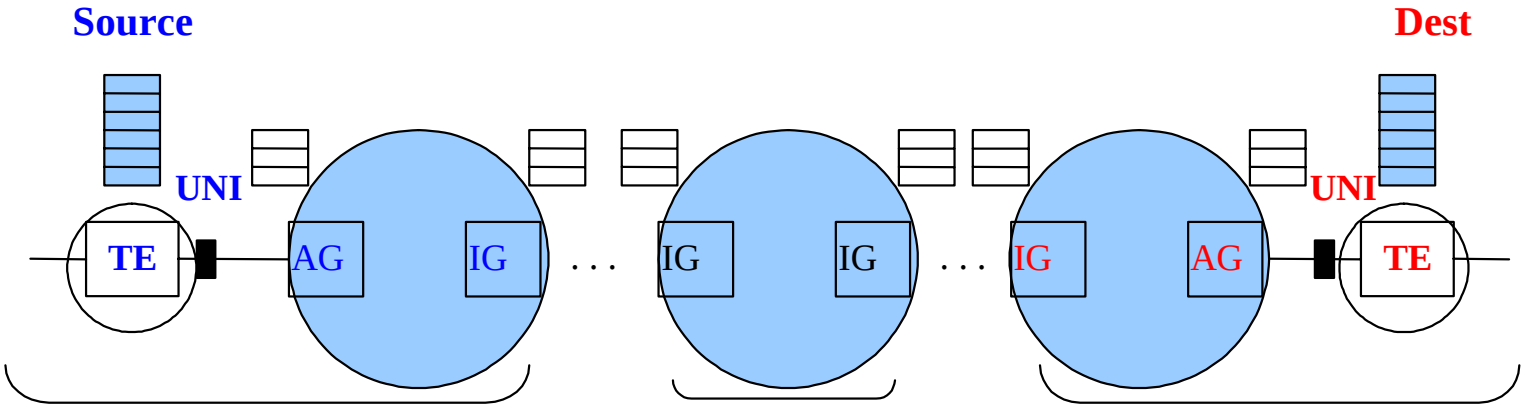
- **IF NOT..**
  - **Service interoperability will be hindered**

* TDR = Telecommunications for Disaster Relief

Apportionment Issues

How will network performance parameter values be apportioned amongst network sections?

Performance Parameters → Classes → Apportionment?



ITU-T Y.1541 Class 1: 400 ms end to end IPTD

T1A1 now beginning work on apportionment issues

3GPP SA Questions

3GPP SA: What is the way forward?

- For end to end service delivery, industry convergence on a single set of QoS Classes to be signaled end to end is desirable
- The ITU-T QoS Classes should be globally supported
  - Currently: ITU-R/3GPP (*and others?)* differ
  - Interworking or Alignment is needed

What is the way forward?

- Other end to end QoS issues require further consideration
  - Apportionment

Thank You

IP QoS Interoperability Issues

Randolph Wohlert
SBC Communications, Inc.
9505 Arboretum Blvd.
Austin, Texas 78726

Email: Randolph_Wohlert @ labs.sbc.com