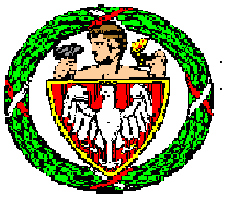

EuQoS IST project: Overview of the QoS framework for EuQoS

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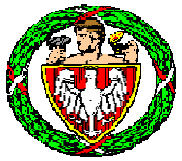


Outline

- Introduction
- EuQoS approach for providing QoS
- Definition of Class of Service
- Example of Class of Service
- EuQoS Classes of Service
- Summary

EuQoS: End to end Quality of Service support over heterogeneous networks

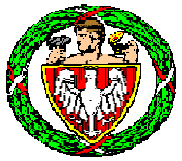
Integrated Project

Provider

SME

Corporate

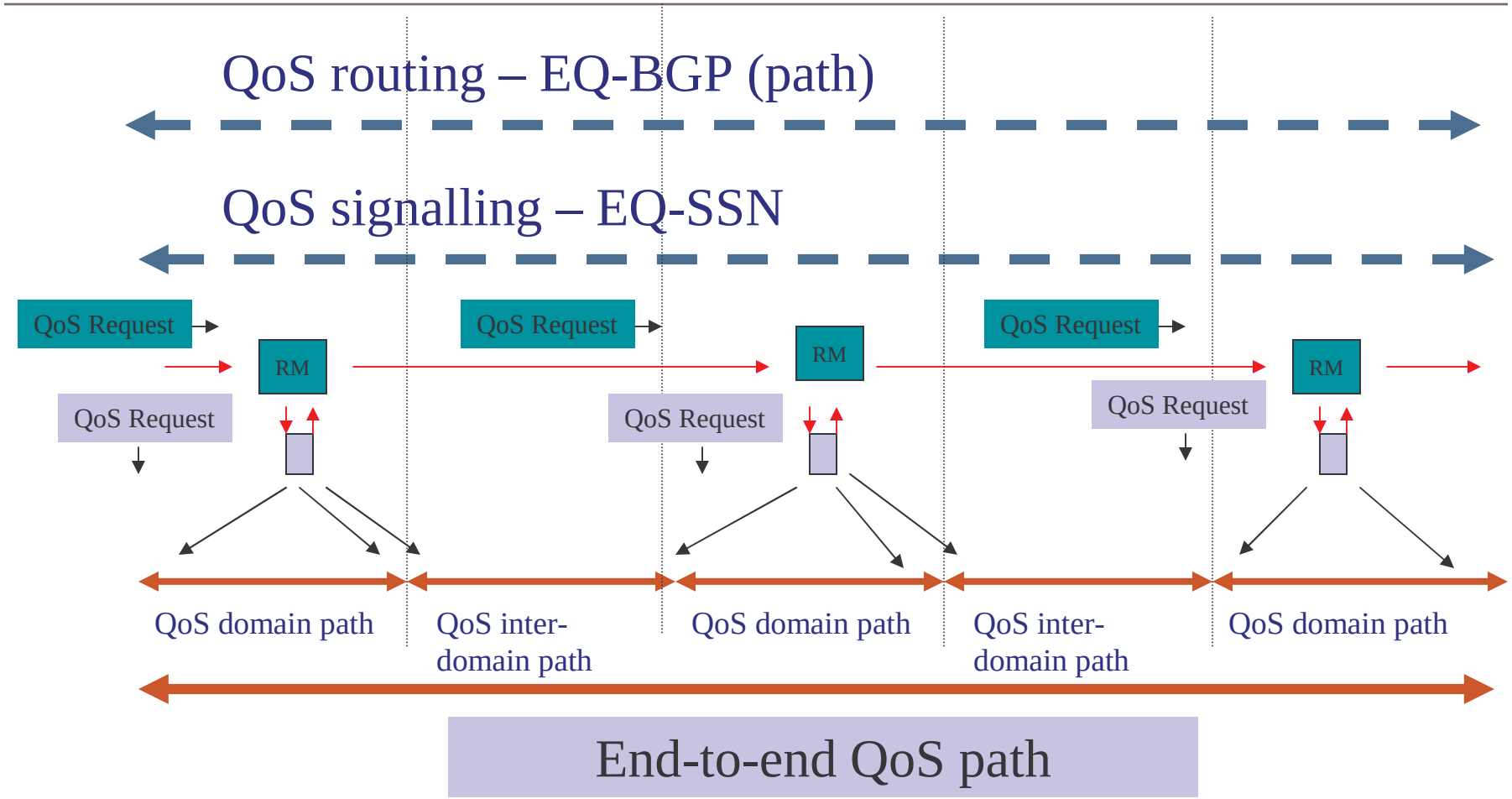
Research



EuQoS system requirements

- Designed for assuring end to end QoS at the packet layer
- Strict QoS should be provided
- EuQoS environment: heterogenous and multiple-domain network
  - Access networks: xDSL, UMTS, WiFi, LAN/Ethernet
  - IP core
- Different applications
  - VoIP, VTC, VoD, Medical application, Tele-engineering, Distributed Classroom

EuQoS scenario



Providing QoS

Defintions of network services/service classes for EuQoS

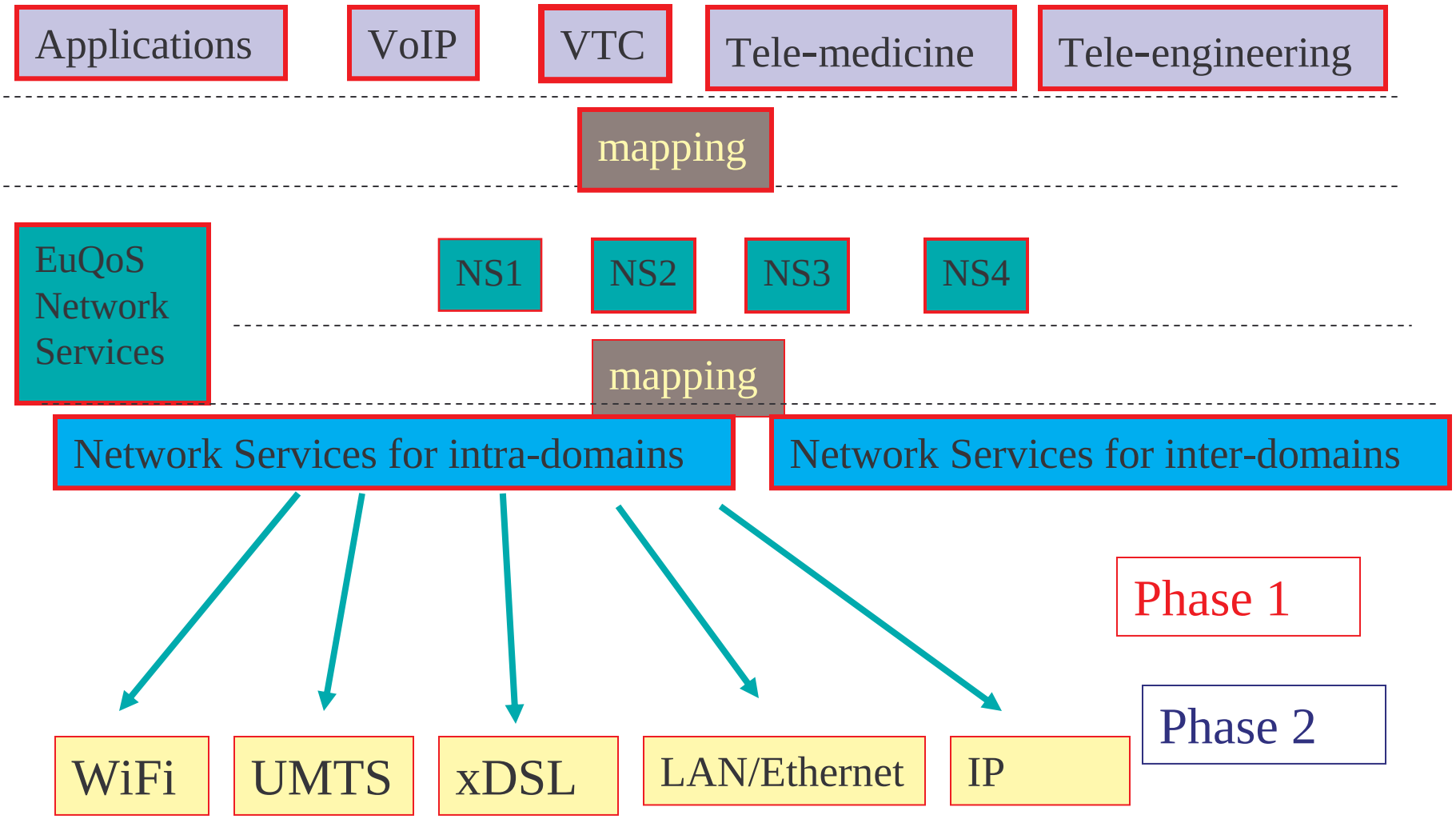
Dimensioning of network resources for EuQoS (longe term scale – days):

- establishing EQ-BGP tables
- network dimensioning:
  - for inter-domain links
  - for intra-domain - areas

Performing admission control:

- we need the algorithms for particular network services

EuQoS network services/Classes of Service



Definition of a network service/Class of Service

1. QoS objectives: value of pkt losses, delays...
2. Types of connections: p2p, p2m
3. Traffic descriptors: single-, double token bucket, more advanced

Phase 1

Phase 2

A. Provisioning of resources: static, dynamic

B. CAC: based on declarations, based on measurements

C. Tuning mechanisms at the packet level (PHB: classifiers, scheduling, marking, active quieueing..)

Example: definition of Class of Service for VoIP traffic

1. QoS objectives: acceptable for voice codecs
   - losses $< 10^{-4}$, delay < 150msec., jitter < 20msec

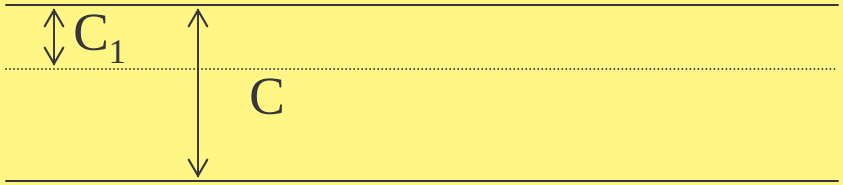
2. Types of connections: p2p

3. Traffic descriptors: single token bucket
   - G,711: PBR= 64kbps, MOS=4.43
   - G.729: PBR = 8 kbps, MOS=4.18
   - G.723.1:
     - PBR=6.3 MOS=4.0
     - PBR=5.3 MOS=3.83

Example: VoIP

A. Provisioning of resources:

- Static C_1 bandwidth dedicated for VoIP NS



Example: VoIP

B. CAC: based on declarations

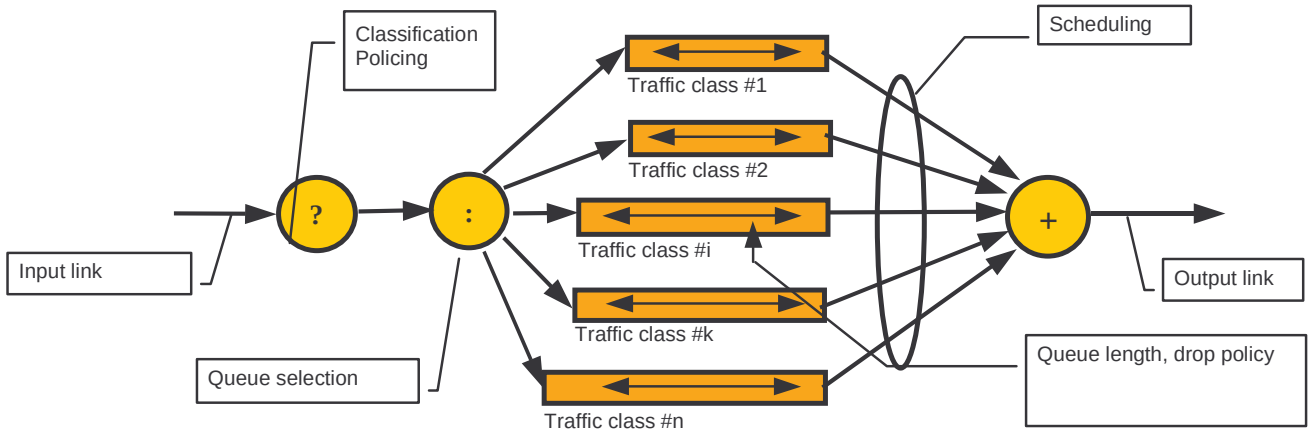
- Peak rate allocation scheme
- Flows are characterised by: Single Token Bucket (peak bit rate (PBR); peak bit rate tolerance (PBRT)).
- New flow is admitted if:

$$PBR_{new} + \sum_{i=1}^{N1} PBR_i \leq \rho C_1$$

- Parameter ρ ($\rho<1$) specifies the admissible load of capacity allocated to the VoIP class. The value of ρ can be calculated from the analysis of M/D/1/B system taking into account the target packet loss ratio and the buffer size.

Example: VoIP

C. Tuning mechanisms at the packet level – border routers (PHB: classifiers, scheduling, marking, active quieueing..)



CoSs: IETF proposal (draft-ietf-tsvwg-diffserv-service-classes-00)

Inter-Provider Service Class (Aggregate)	Tolerance To			PHB	End-To-End Service Class	Tolerance To			DSCP Name	DSCP Value
	Loss	Delay	Jitter			Loss	Delay	Jitter		
Ctrl	Low	Low	Yes	CS	Network Control	Low	Low	Yes	CS7	111000
Real Time	VLow	VLow	VLow	EF	Telephony	VLow	Vlow	VLow	EF	101110
					Signalling	Low	Low	Yes	CS5	101000
					MM Conferencing	L-M	Vlow	Low	AF4x	100xx0*
					RT Interactive	Low	Vlow	Low	CS4	100000
					Broadcast Video	VLow	Med	Low	CS3	011000
None Real Time	Low	LIM	Yes	AF	MM Streaming	L				
					Low Latency Data	L				
					OAM	L				
					High ThruPut Data	L				
Best Effort	NS	NS	NS	DF	Standard	N				

11 basic CoSs and 4 aggregated CoSs

Aggregated types of CoSs	Types of CoSs	Examples of applications
CTRL	Network control	Network routing
Real Time	Telephony	IP telephony bearer
	Signalling	IP telephony signaling
	MM conferencing	H.323/V2 videoconferencing (elastic)
	RT interactive	Video conferencing and interactive gaming
	Broadcast video	Broadcast TV and live events
Non-Real Time	MM streaming	Streaming video and audio on demand
	Low-latency data	Client/Server transactions Web-based ordering
	OAM	Non-critical OAM&P
	High throughput data	Store and forward applications
Best Effort	Standard	Undifferentiated applications

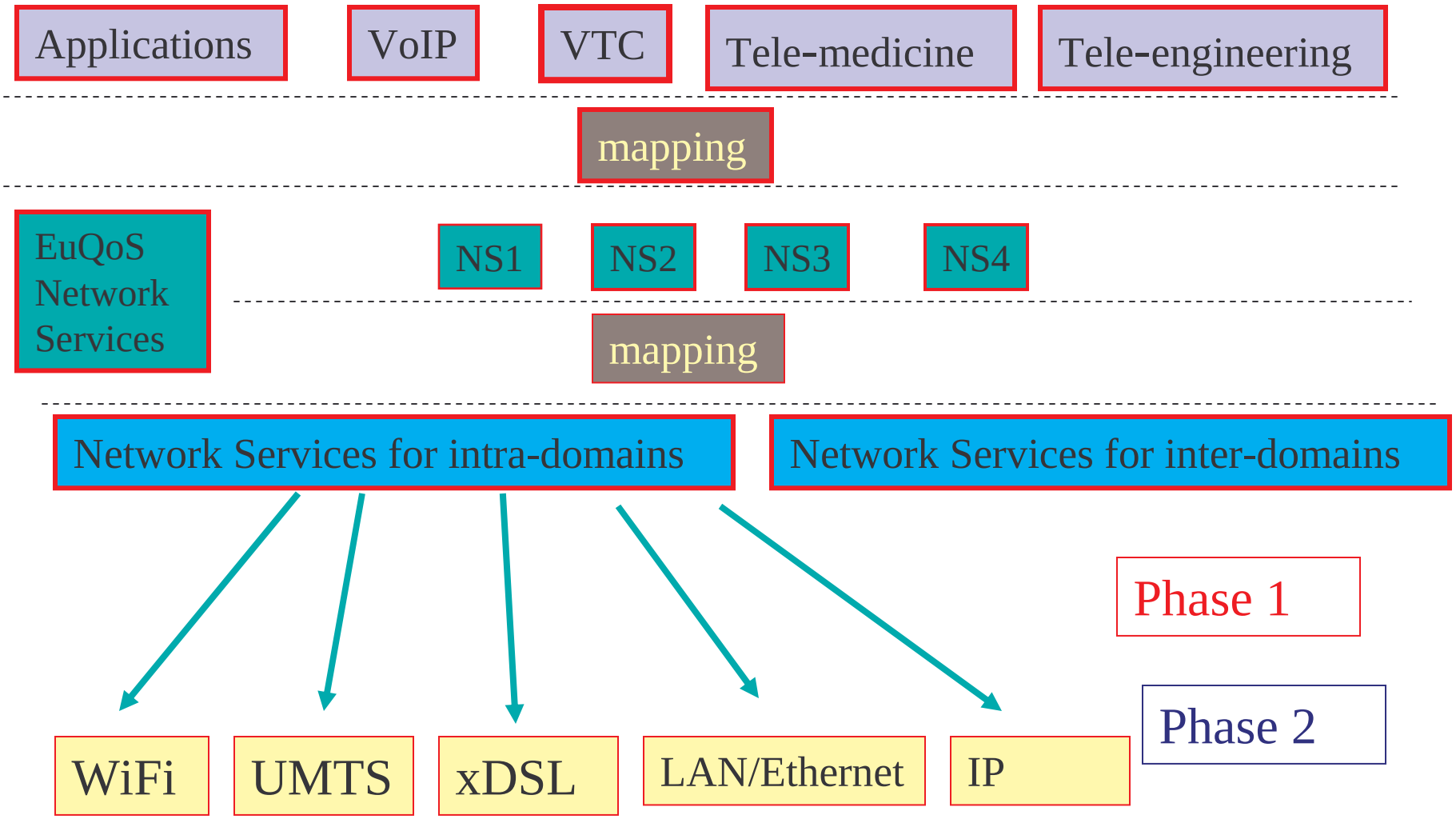
CoSs: ITU proposal (Y.1541)

ITU Classes of Service									
Network performance parameter	Nature of network performance objective	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
IPTD Delay	Upper bound on the mean IPTD (Note 1)	100ms (Note 3)	400ms	100ms (Note 3)	400ms	1s	U (Note 4)	100ms (Note 3)	400ms
IPDV Jitter	Upper bound on the 1 - 10^{-3} quantile of IPTD minus the minimum IPTD (Note 5)	50ms (Note 6)	50ms (Note 6)	U	U	U	U	50ms (ffs if this should be lower)	50ms (ffs if this should be lower)
IPLR	Upper bound on the packet loss probability	1×10^{-3} (Note 7)	1×10^{-3} (Note 7)	1×10^{-3}	1×10^{-3}	1×10^{-3}	U	1×10^{-5}	1×10^{-5}
IPER	Upper bound	1×10^{-4} (Note 8)	1×10^{-4} (Note 8)	1×10^{-4} (Note 8)	1×10^{-4} (Note 8)	1×10^{-4} (Note 8)	U	1×10^{-6} (Note 8)	1×10^{-6} (Note 8)
IPRR	Upper bound							1×10^{-6} (Note 9)	1×10^{-6} (Note 9)

8 CoSs

ITU Classes of Service	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
Applications (examples)	Real-time, jitter sensitive, high interaction (VoIP, VTC)	Real-time, jitter sensitive, high interaction (VoIP, VTC)	Transaction data, highly interactive (signalling)	Transaction data	Low loss only (short transactions, bulk data, video streaming)	Traditional applications of default IP networks		

EuQoS network services/Classes of Service



Applications: requirements from the network

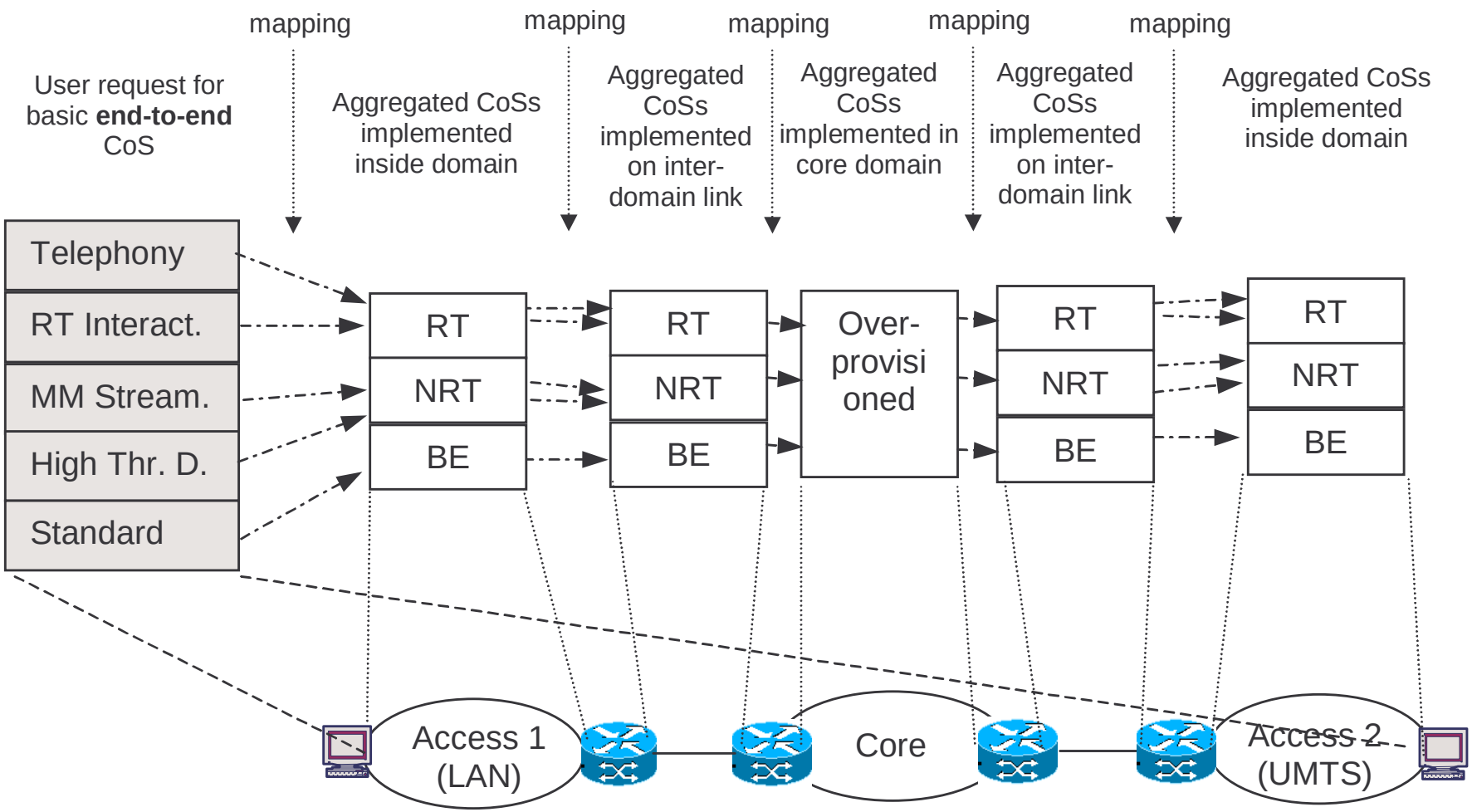
		VoIP	*VTC (voice)*	*VTC (video)*	*VoD*	*MEDI-GRAF (voice)*	*MEDI-GRAF (video)*	*MEDI-GRAF (data trans-fer)*	*MEDI-GRAF (chat)*
Throughput		8-64 kb/s	6-128 kb/s	64-2000 kb/s	400-17000 kb/s	64 kb/s	384-1534 kbps	Depends on file size and acceptable transfer time	N/A
End-to-end require-ments (applica-tion level)	***Delay***	<150 ms (local) <400 ms (long-distance)	<150 ms (local) <400 ms (long-distance)	<150 ms (local) <400 ms (long-distance)	< 10s	<150 ms (local) <400 ms (long-distance)	<150 ms (local) <400 ms (long-)	File transfer time < 15s (preferred), <60s (ac-ceptable)	Mes-sage transfer time < 2s (pre-ferred), < 4s (accept-able)
	Jitter	<1 ms	< 1ms	Negligible	Negligible	< 1ms	Negligible	N/A	N/A
	Loss	<3%	< 3%	<1%	<1%	< 3%	<1%	0	0
Additional re-quirements			Lip-synch < 80ms	Lip-synch < 80ms		Lip-synch < 80ms	Lip-synch < 80ms		
End-to-end require-ments (network level)	***IPTD***	<100 ms (local) <350 ms (long-distance)	<100 ms (local) <350 ms (long-distance)	<100 ms (local) <350 ms (long-distance)	Not critical	<100 ms (local) <350 ms (long-distance)	<100 ms (local) <350 ms (long-distance)	N/A	N/A
	IPDV	<50 ms	<50 ms	<50 ms	Not critical	<50 ms	<50 ms	N/A	N/A
	IPLR	$<10^{-3}$	$<10^{-3}$	$<10^{-3}$	$<10^{-3}$	$<10^{-3}$	$<10^{-3}$	N/A	N/A
Additional re-quirements			Lip-synch < ?	Lip-synch < ?		Lip-synch < ?	Lip-synch < ?	Guaranteed throughput	

Proposed set of Classes of Service

Aggregated CoS	Basic CoS (end-to-end)	QoS Objectives		
		IPLR	Mean IPTD	IPDV
RT	**Telephony**	10^{-3}	100 ms	50 ms
	RT Interactive	10^{-3}	100 ms	50 ms
NRT	**MM Streaming**	10^{-3}	1 s	U
	High ThruPut Data	10^{-3}	1 s	U
Best Effort	**Standard**	U	U	U

- Basic CoSc – visible by the users and can be deployed in some access networks (e.g. in LAN/Ethrenet)
- Aggregated CoSs – can be deployed in some parts of the network (e.g. Inter-domain links, IP core)

A plan for developing CoSs in EuQoS



Summary and next steps

- The next step is to specify in which way we implement each of required CoSc in particular networks (UMTS, xDSL, WiFi, LAN/Ethernet, IP core) and in the inter-domain links.
- Anyway, for each CoS we need specification of the QoS mechanism (schedulers, admission control rules) to meet the assumed QoS objectives.
- Furthermore, for making adequate resource provisioning for particular part of networks we need to specify a scheme for QoS responsibilities for particular parts of end-to-end path.