International Telecommunication Union

MPEG-64 : MPEG + IPv6 + 4G

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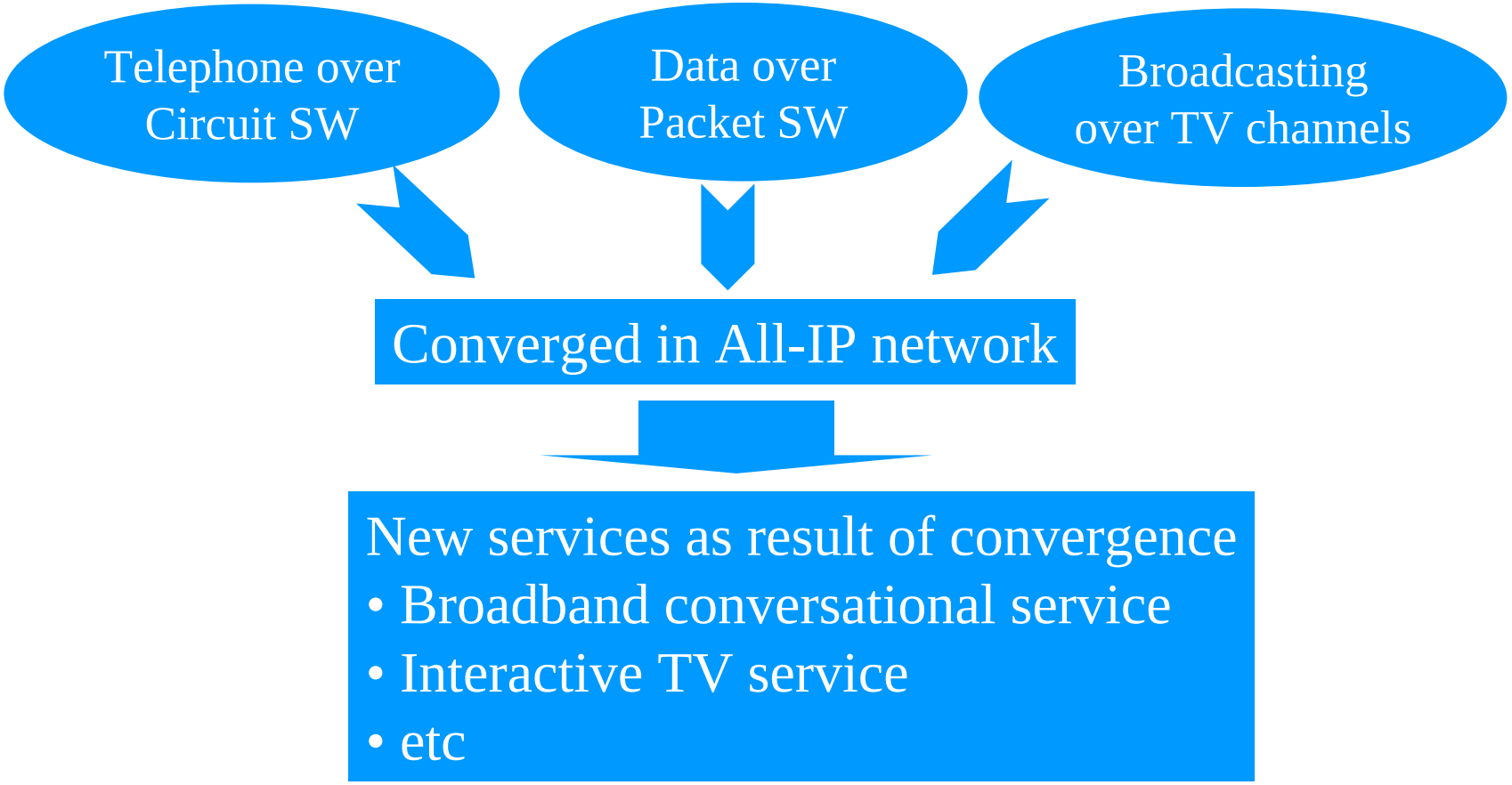
Outline

- Background and goal
- MPEG-64 components
  1. MPEG : SVC, MPEG-21
  2. IPv6 : Anycast(multicast), auto-config.
  3. 4G : OFDMA, QoS classes
  4. Convergence
- MPEG-64 Framework
- Conclusion

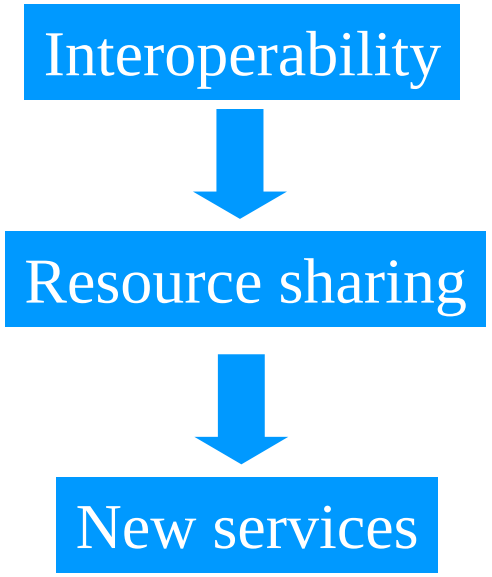
Convergence for triple-play

- Convergence of separate networks



Visions of convergence

- Interoperability
  - Interoperable digital contents
  - Interoperable services
- Sharing resources
  - One source multi-use
  - One network multi-use
  - One terminal multi-use
- Emerging new services



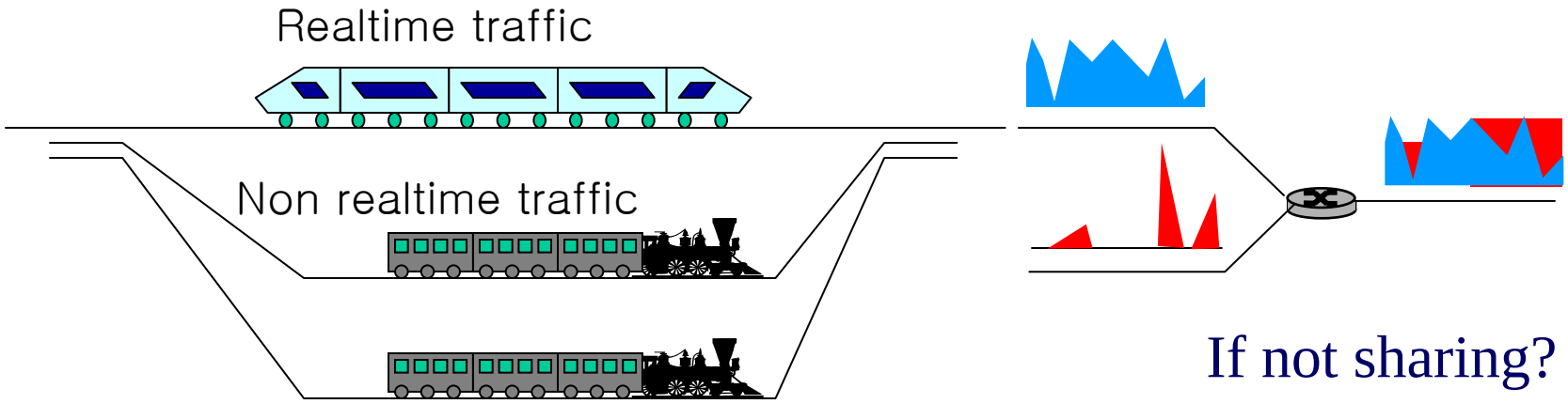
QoS categories

Conversational	Interactive	Streaming	Download
Video phone	Web	VOD	ftp
100s kbps	NA	1-20 Mbps	NA
End-to-end 150ms	After click, 2sec	Initial delay 5-10sec	NA
PLR= ~10%	PLR=0%	PLR=1~10%	PLR=0%

IPTV?
- Encoded contents : Streaming
- Live : Conversational
- Bi-directional : Interactive

Resource sharing (1)

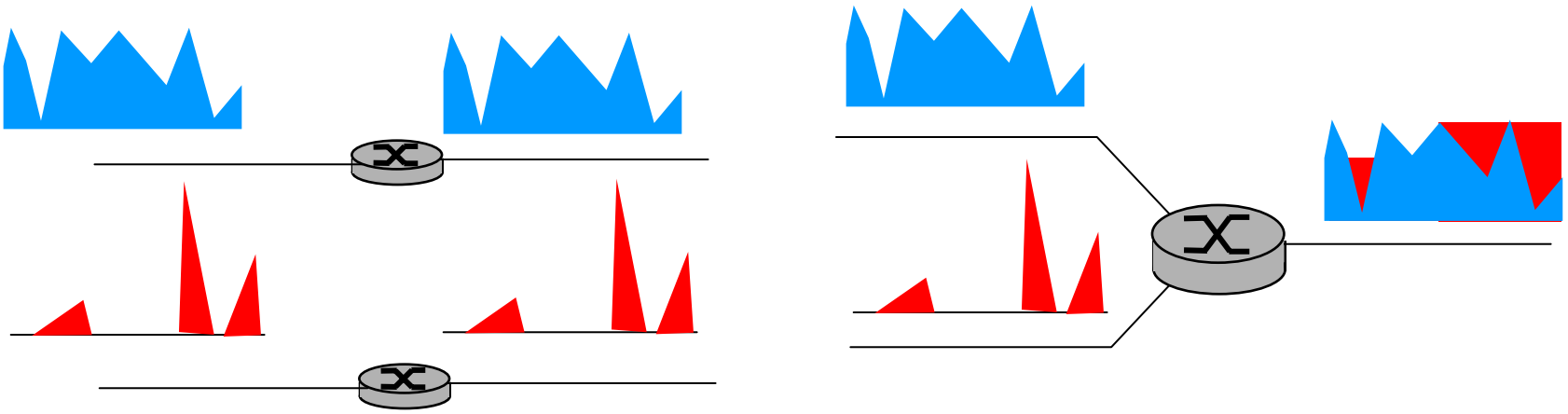
- Resource = bandwidth + buffer
  (realtime) (non-realtime)
- When **realtime service** needs **excess bandwidth**, **non-realtime service** packets are **buffered.**



Resource sharing (2)

- Resource = bandwidth + buffer
  (realtime) (non-realtime)

2 x [50Mbps, 50Mbytes] < [100Mbps, 100Mbytes]

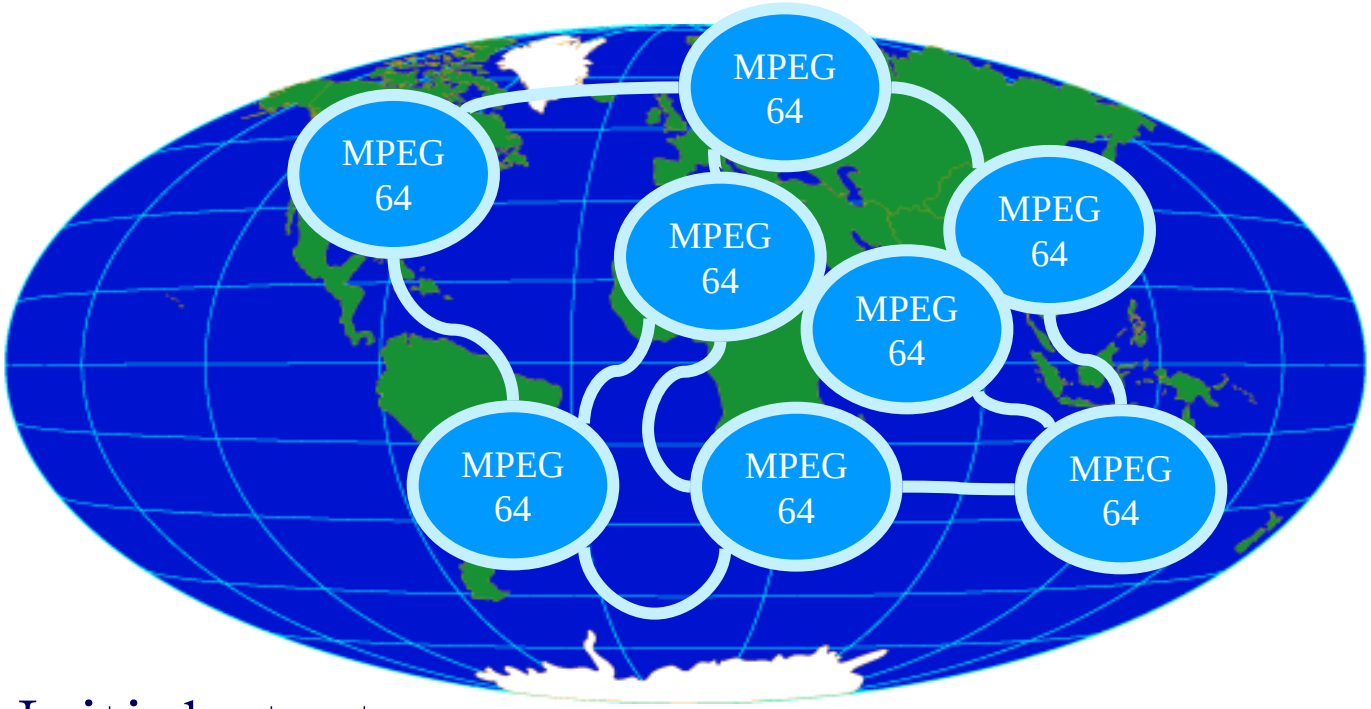


Current approach

- Integration, but not convergence
  - Resource sharing is not efficient, yet.
    - e.g. VoIP service suffers congestion during rush hour.
  - Independent between protocol layers
    - Minimal use of each capability
    - Communication between experts in each layer is not enough.
  - Bottom-up design, but not top-down design
    - No differentiation between time/loss priority

Goal of MPEG-64

- Converge QoS tools in MPEG/IPv6/4G



- Initial strategy
  - Regardless of the legacy environments
  - MPEG-64 islands and global backbone

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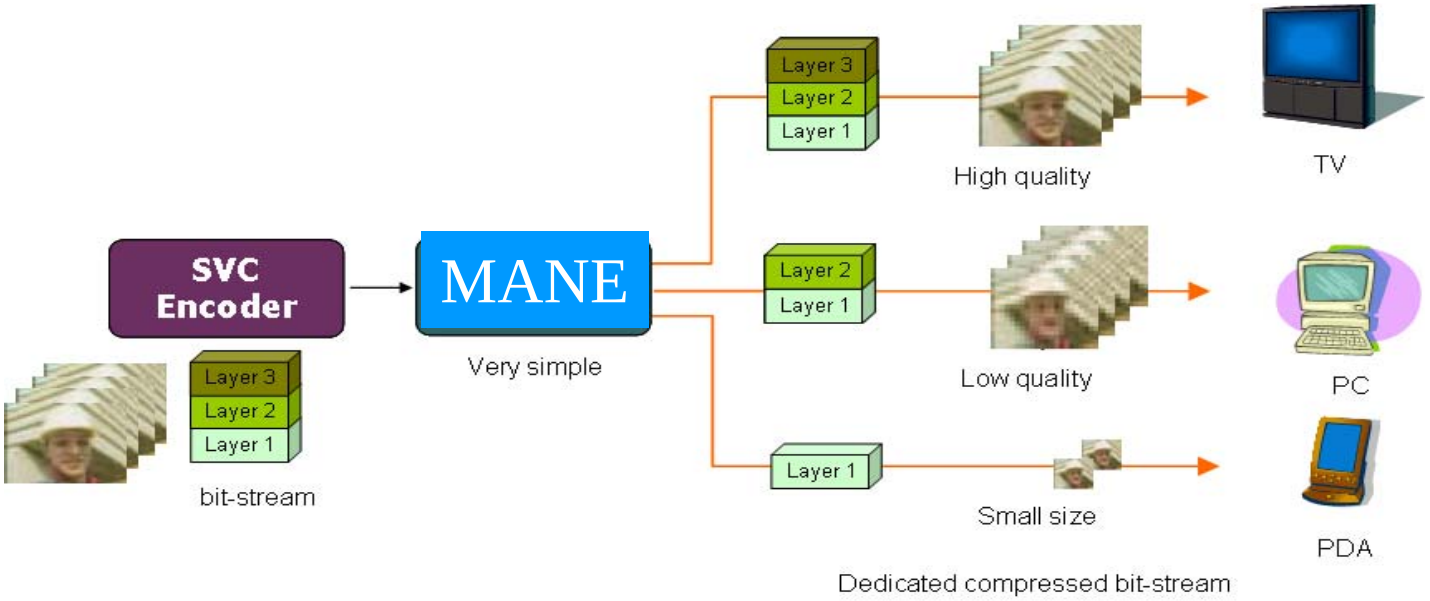
MPEG features for MPEG-64 (1)

- Temporal QoS
  - For streaming service
    - To maximize coding efficiency regardless of codec delay
    - Hierarchical B pictures, multi-reference
  - For conversational service
    - Low delay mode (IPPP..)
    - 0 sec delay for encoding and decoding
  - For random accessibility and SI/SP in SVC
    - To reduce zapping delay

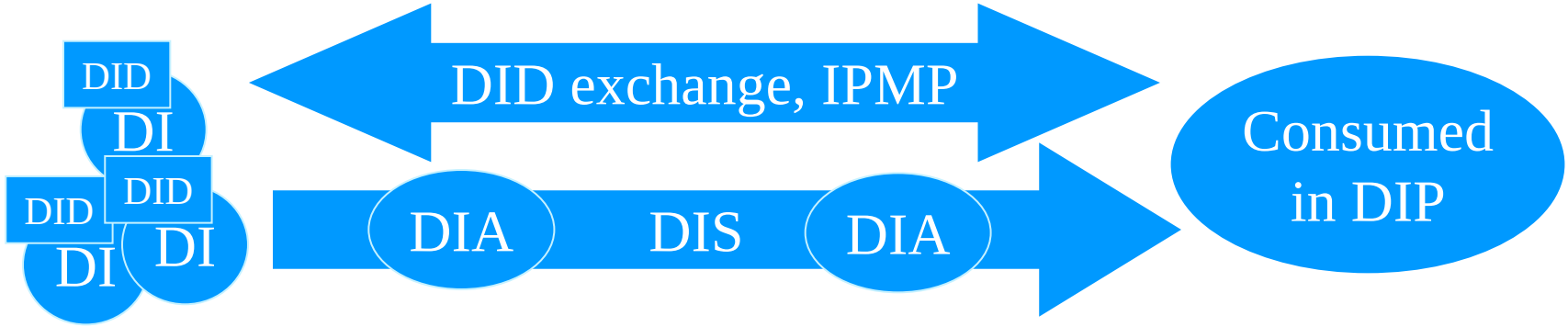
MPEG features for MPEG-64 (2)

- Inter-operability and Video Codec
  - SVC for heterogeneous network/terminal/users
    - SVC (Scalable Video Coding) : multi-loss priority
    - MANE (Media Aware Network Element) : in server or gateway
  - Error resilience (PLR = ~20%) for lossy network



MPEG features for MPEG-64 (3)

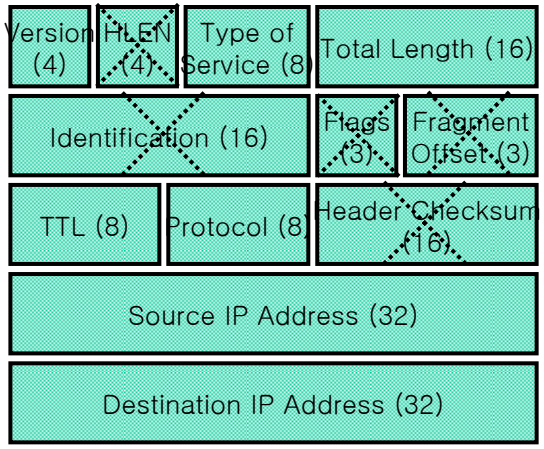
- MPEG-21 "Multimedia framework"
  - Meta-data and procedures for 'interoperability'
    - for DID (identification, resource reservation), DIS (streaming), DIA (adaptation), DIP (processing), IPMP (security, DRM)

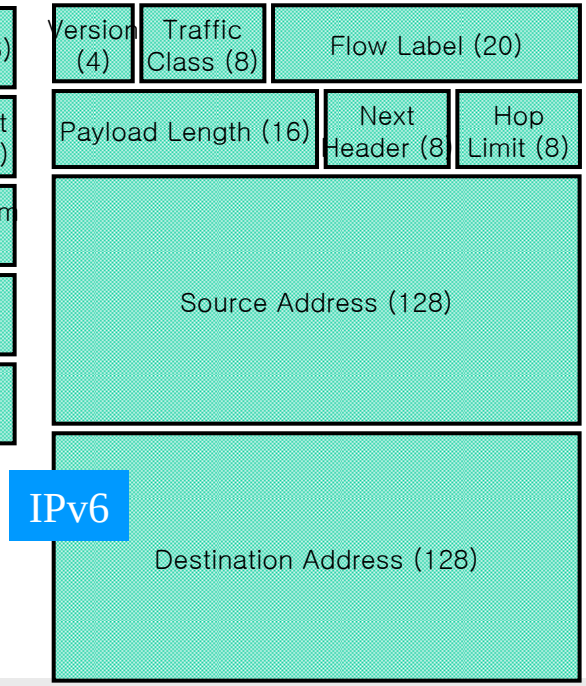


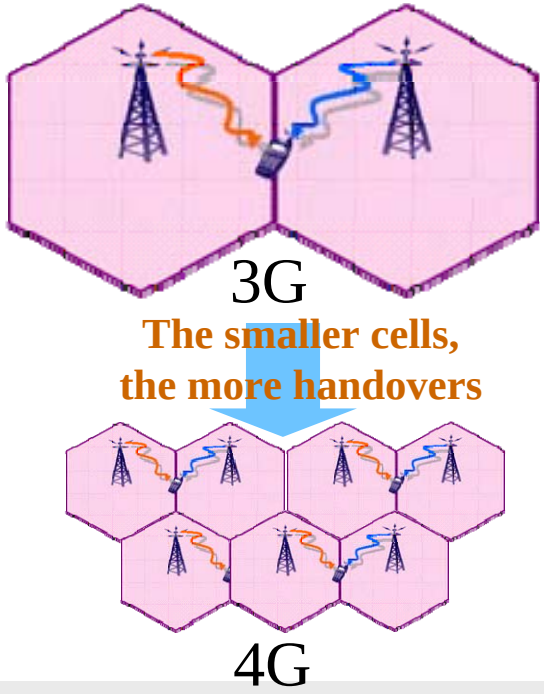
* DI (digital item) : video, audio, or text bit-streams

IPv6 features for MPEG-64 (1)

- Temporal QoS
  - Simplified header : header processing speed
  - Auto-configuration
    - More frequent handover in 4G (smaller cells)
    - RTT level (100s ms) ➔ Packet level (100s μs)



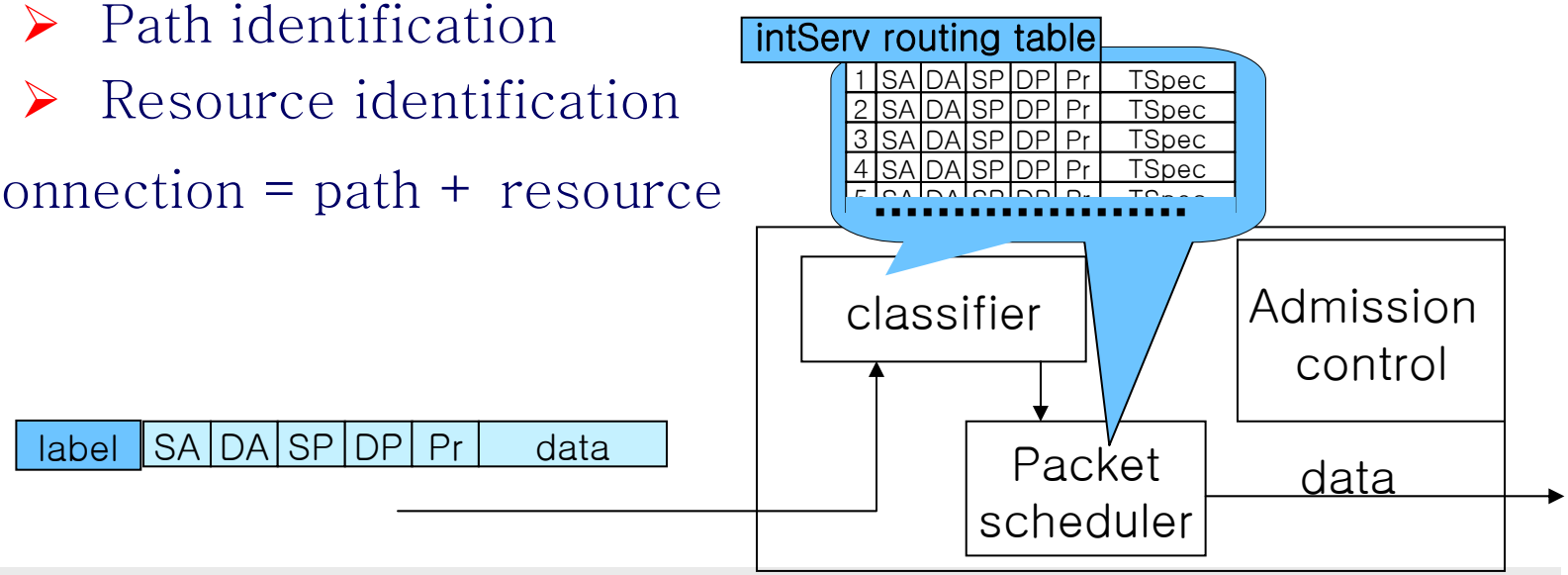




IPv6 features for MPEG-64 (2)

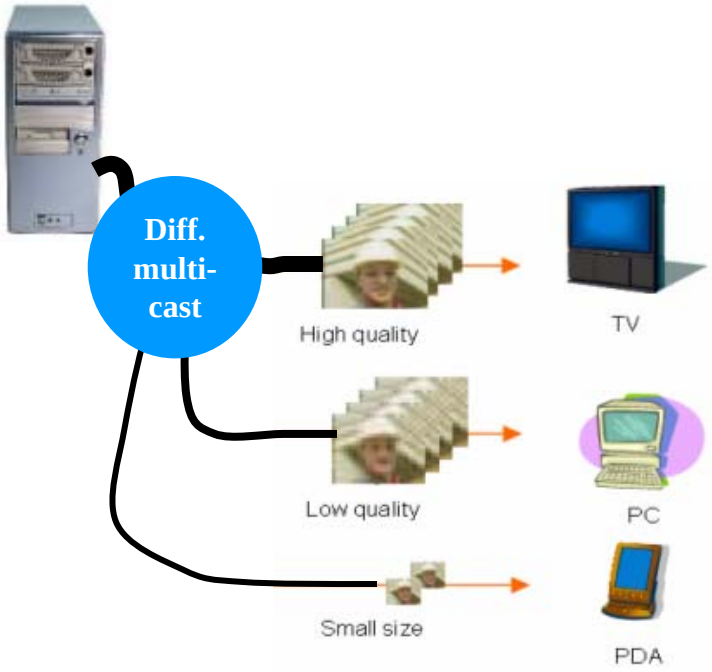
- QoS differentiation
  - COS (Class of Service, 6bits) for diffServ
    - Time priority : BE < AF1, AF2, AF3, AF4 < EF
    - Loss priority : 3 levels for loss precedence in AF's
  - Flow label (20bits) for label switching in
    - Path identification
    - Resource identification

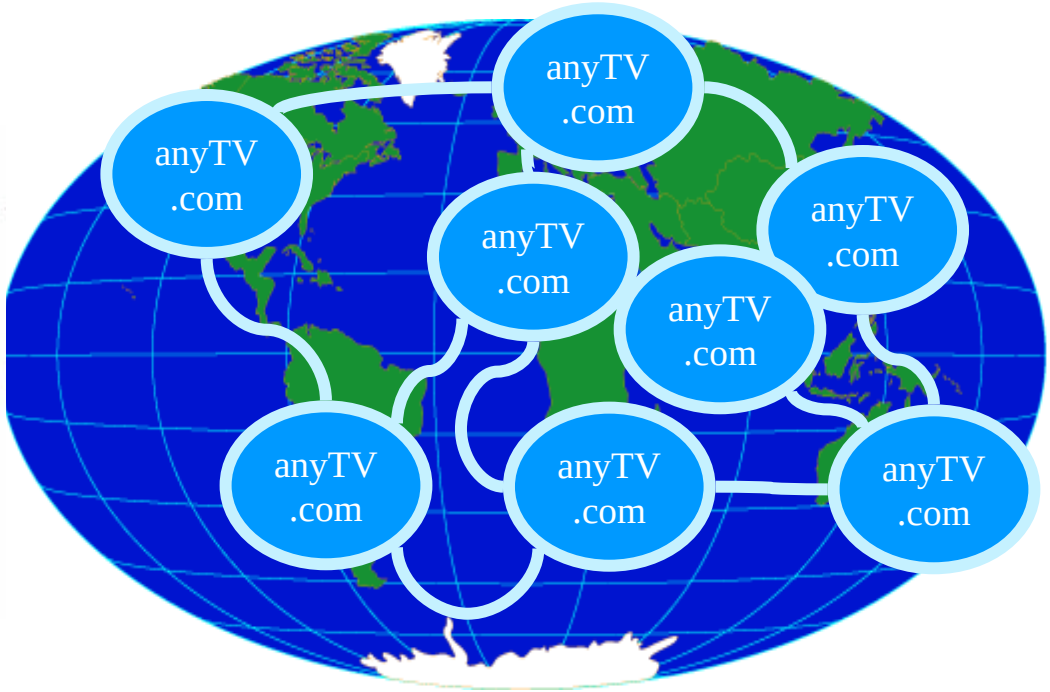
* Connection = path + resource



IPv6 features for MPEG-64 (3)

- Abundant addresses (32bits ➔ 128bits)
  - QoS differentiated multicast
  - Global anycast (served by the nearest server)



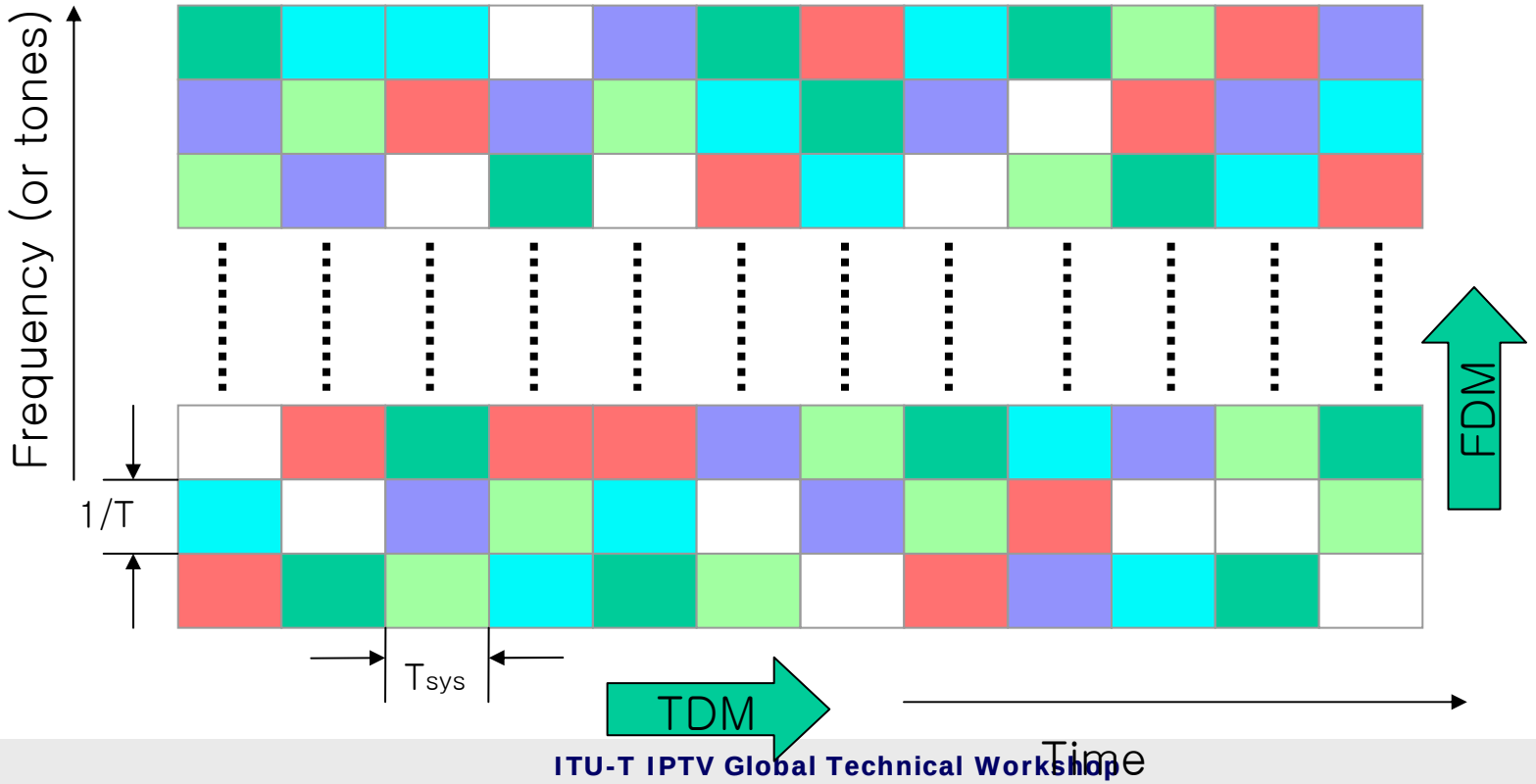


4G and MPEG-64 (1)

- Wide vision and interoperability
  - "Ubiquitous & seamless" = interoperable
- Two trends over OFDMA
  - Evolution (B3G, LTE)
    - 3.5G: 3GPP-HSOPA (OFDM and MIMO)
  - Revolution (4G)
    - New technology: IEEE 802.16e (Mobile WiMAX, WiBro), IEEE802.20 (Qualcomm's)

4G features for MPEG-64 (2)

- OFDMA in WiBro, WiMax (20~100Mbps/call)
  - OFDMA = OFDM + TDM
  - Allocate time-frequency bins to uplink or downlink



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4G features for MPEG-64 (3)

QoS Class	Applications	Data Delivery Services	QoS Parameters	Uplink Scheduling Services	Packet Scheduling Discipline/Algorithm
Hard QoS	- T1/E1 - VoIP without silence suppression	**UGS**	- Tolerated jitter - SDU size - Min. reserved traffic rate - Max. latency - Request/Transmission policy - Unsolicited grant interval	UGS	Round-robin (Periodic/fixed assignment)
	- VoIP with silence suppression	**RT-VR**	- Maximum latency - Min. reserved traffic rate - Max. sustained traffic rate - Traffic priority - Request/Transmission policy - Unsolicited polling Interval	ertPS	Round-robin (Periodic/dynamic assignment)
	- Streaming Video - Video Phone	**RT-VR**		rtPS	Round-robin (Dynamic assignment with delay constraint)
Soft QoS	- FTP (Download)	**NRT-VR**	- Min. reserved traffic rate - Max. sustained traffic rate - Traffic priority - Request/Transmission policy	nrtPS	Max C/I PF Scheduling
	- HTTP - Instant Messenger	**BE**	- Max. sustained traffic rate - Traffic priority - Request/Transmission policy	BE	

RT-VR: Real-time Variable Rate Service NRT-VR: Non-Real-Time Variable Rate Service

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MPEG-64 networks

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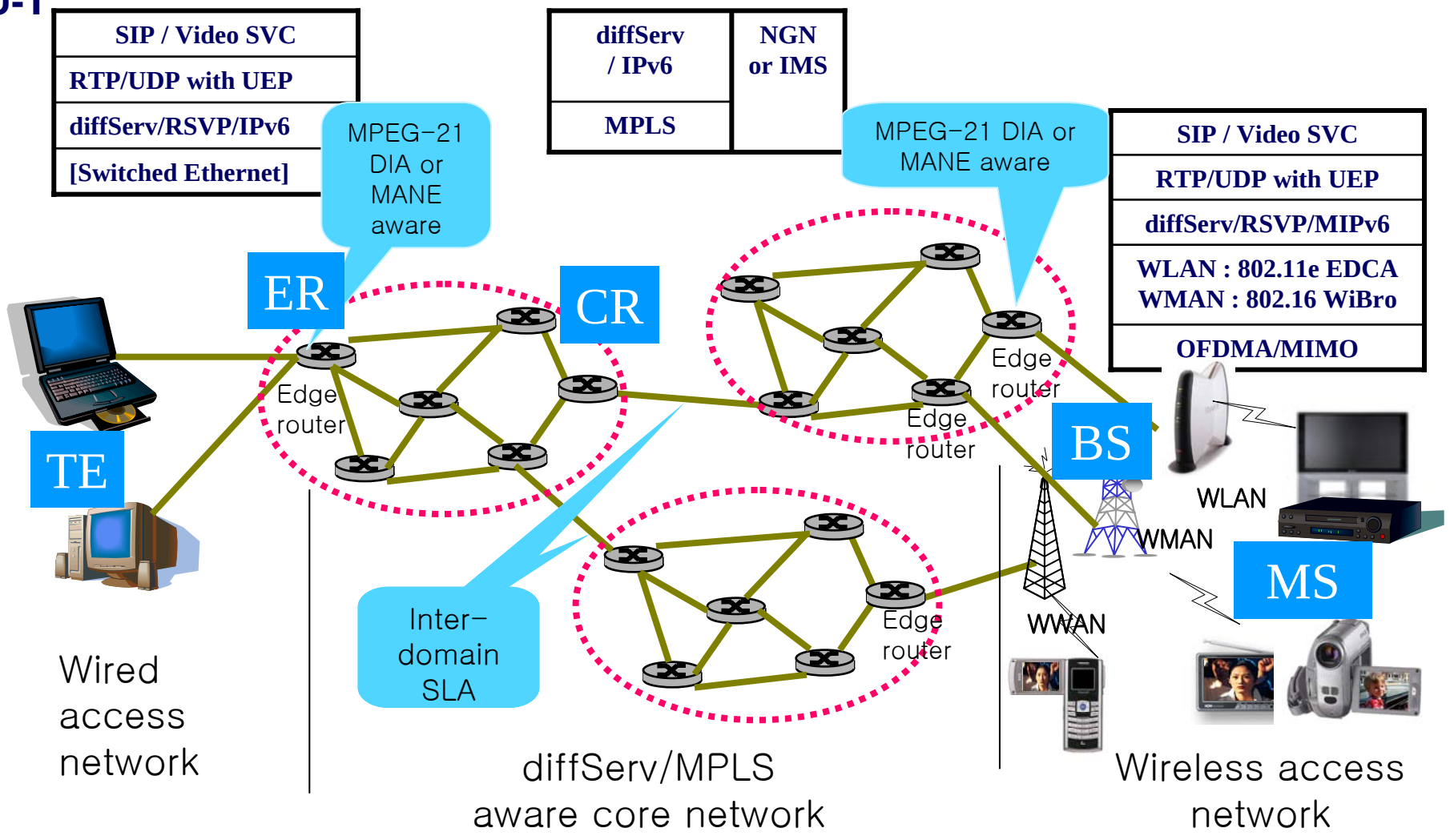
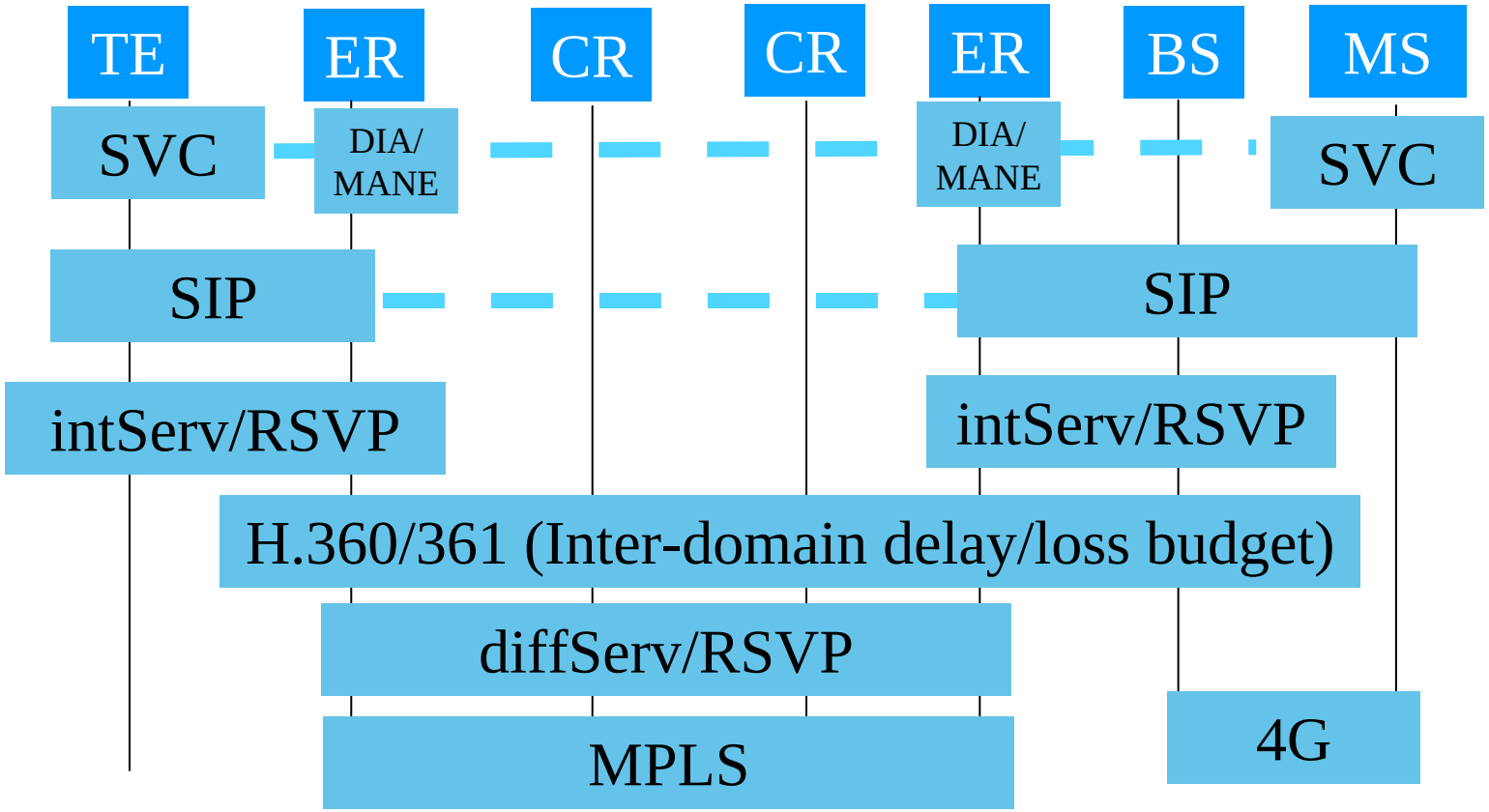


QoS protocol stack



Service categories and MPEG-64

	Conversational	Streaming	Broadcasting
MPEG	Low delay coding	SVC, MANE, MPEG-21	SVC, MANE, MPEG-21
Transport layer	RTP/RTCP, FEC	RTP/RTCP, ULP, retransmit	RTP/RTCP, ULP
IPv6 with RSVP, MPLS	Flow label, auto-config., intServ, MPLS	COS/diffServ, auto-config., MPLS	COS/diffServ, anycast, auto-config., MPLS
4G	UGS, ertPS	ertPS, rtPS	ertPS, rtPS

Per-class services

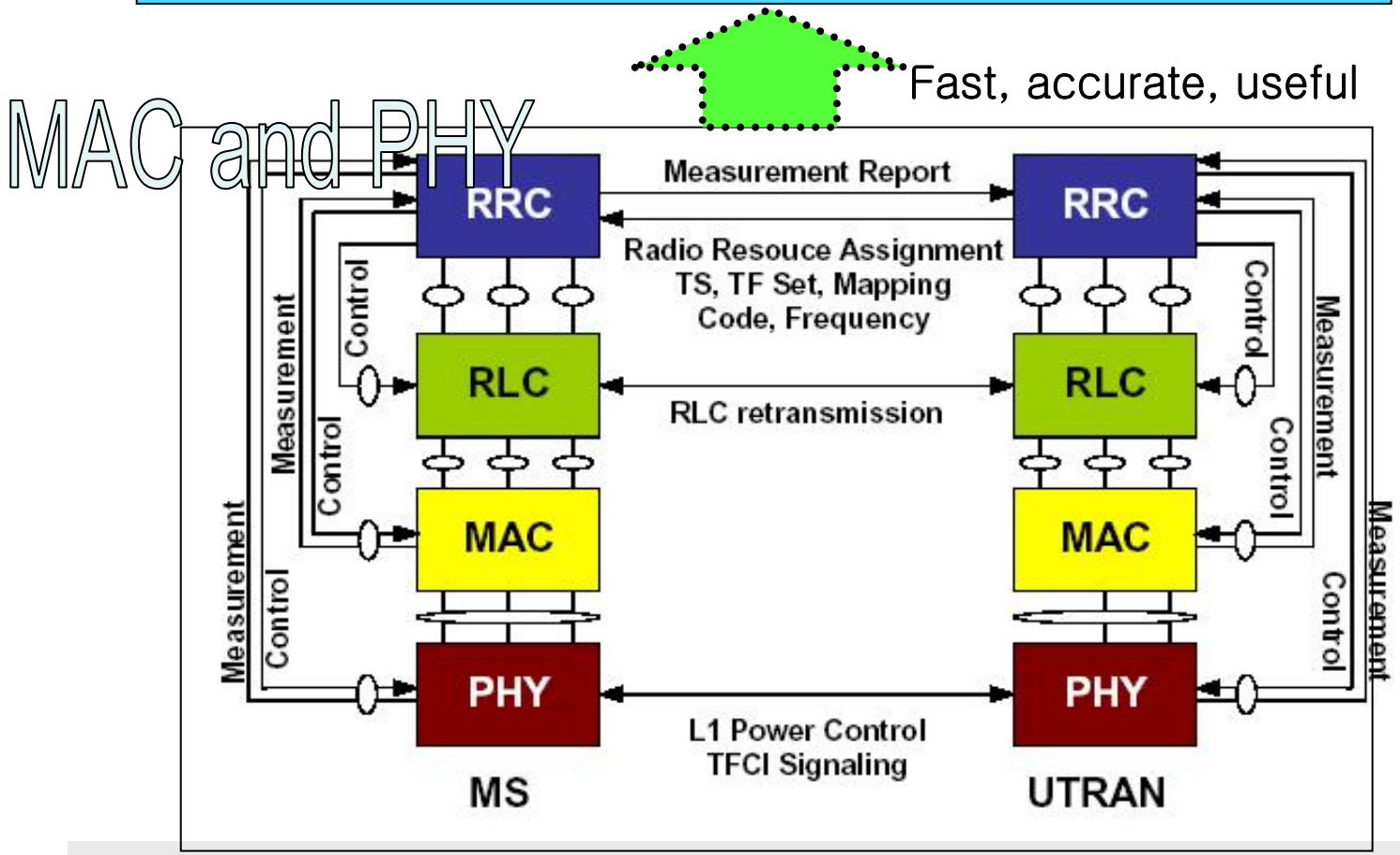
bronze silver gold

- SVC : enhancement layers, base layer
- RTP : ULP (Unequal Loss Protection)
- diffServ : BE, AF1, AF2, AF3, AF4, EF
- 802.11e : BK, BE, EE, CL, VI, VO, NC, TxOP
- 802.16e : BE, nrtPS, rtPS, ertPS, UGS

- How to map them?
  - Temporal priority, loss priority

Cross layer QoS control

Multimedia APPLICATIONs



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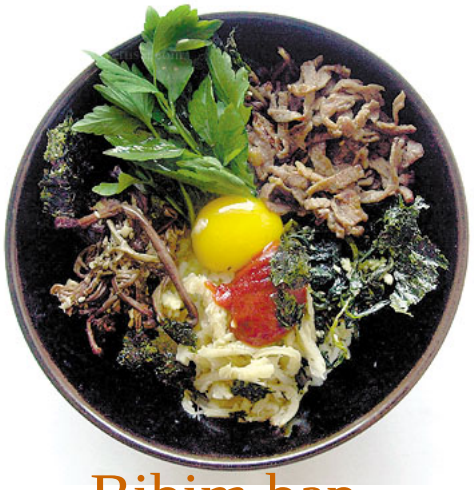
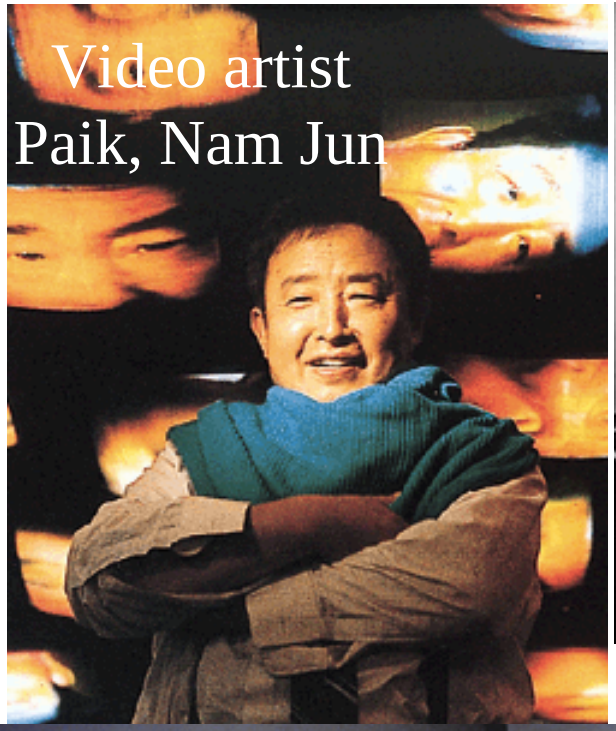
Conclusion

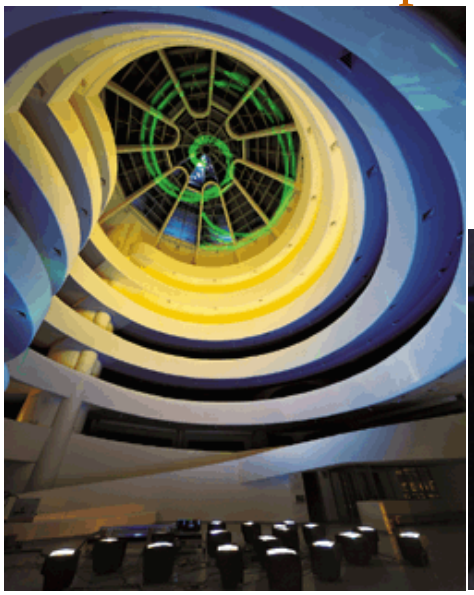
- Top-down approach for convergence
  - Integration is not enough. Convergence!!
  - Exploit all QoS tools in MPEG/IPv6/4G
  - Heterogeneous QoS control is more effective than IPTV service only.
- Interoperable? Resource sharing?
- Open to future use?

Thank you!!



Bibim bap





Bibim bap is one of the most popular Korean foods. Paik, who converged art and technology, said that his idea of convergence originated from 'bibim bap.' We need the concept of 'bibim bap' for IPTV.