QoS 적용 방송 콘텐츠의 휴대단 말기 서비스 기술

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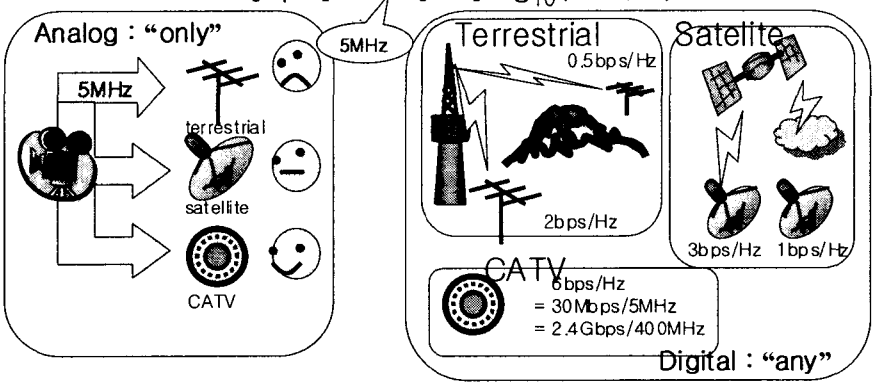
Outline

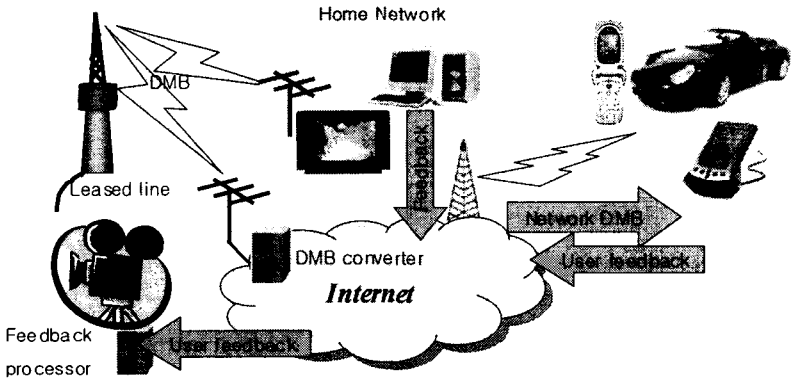
- Digital Broadcasting?
- Multimedia/network QoS
- Evolution of Wireless Networks
- QoS Control Techniques
- Future Works

Broadcasting, Analog to Digital

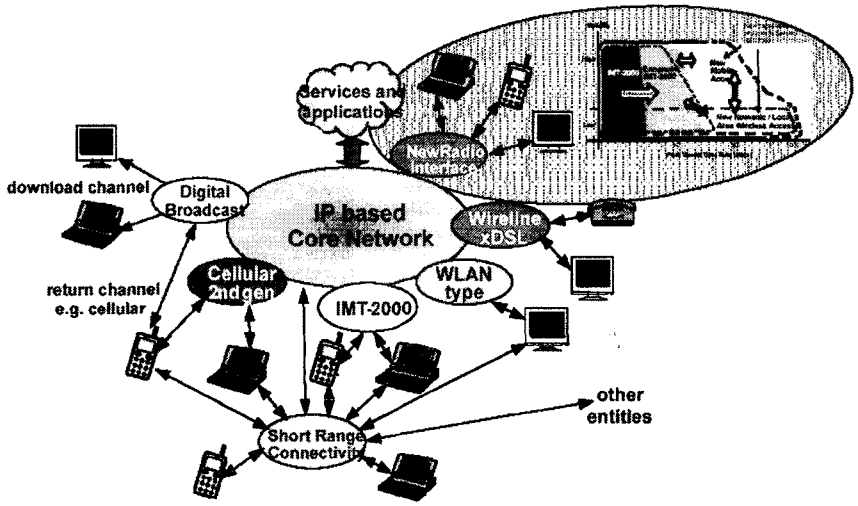
Spectrum Efficiency in [bps/Hz]
Shannon's theorem in 1949
$C\ [bps] = W\ [Hz] \log_{10}(1+S/N)$



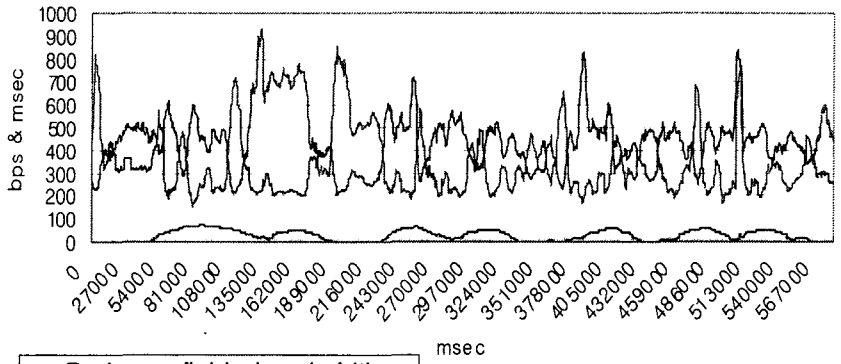
Interactive DMB



Heterogeneous Networks



Time-varying QoS : cdma 1X EV-DO



- Red : available bandwidth
- Blue : RTT
- Black : speed of vehicle

Issues in Digital Broadcasting to Portable Terminal

- Random access?
- Interactivity
- Flexibility of Internet
- Quality of wireless channel

Service Classes in UMTS

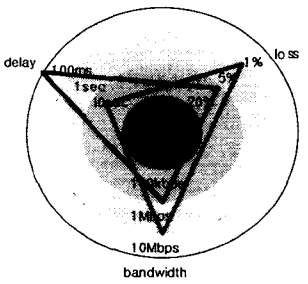
	conversational delay<<1sec	interactive delay 1sec	streaming delay<10sec	background delay>10sec
error tolerant	conversational voice and video	voice messaging	streaming audio and video	fax
error intolerant	telnet, interactive games	e-commerce, WWW browsing	FTP, still image, paging	e-mail arrival notice

UMTS(universal mobile telecommunication system) : 3GPP

QoS(quality of service)

Multimedia QoS

- Network QoS
  - Bandwidth
  - Delay, jitter
  - Loss
  - Priority
  - Security

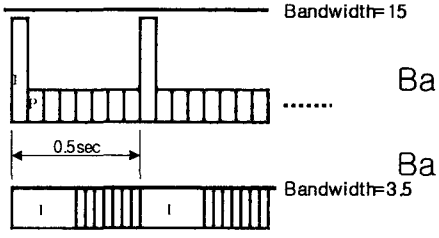


VOD videophone

QoS : quality of service

Tradeoff of bandwidth/delay/loss

- Delivery of video traffic



Bandwidth ⇑ Delay ⇓

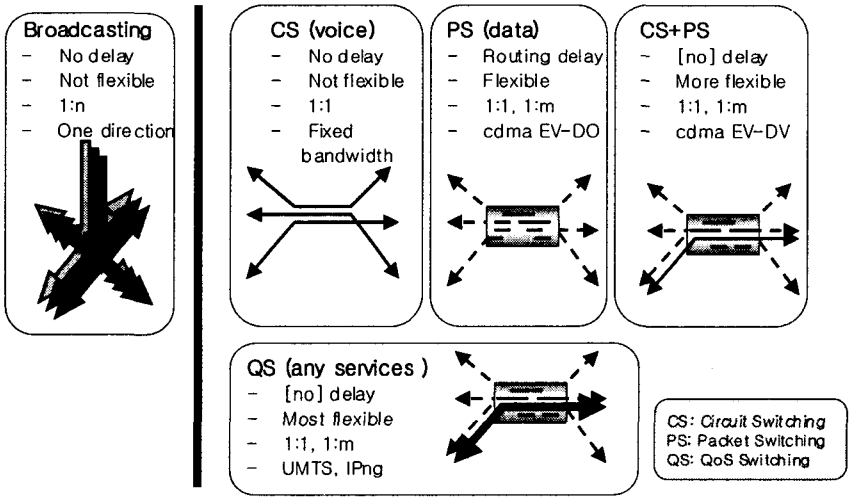
Bandwidth ⇓ Delay ⇑

- Retransmission or FEC — Bandwidth⇑ Loss⇓ Delay⇑
- Encryption — Security⇑ Delay⇑

Classes of networks

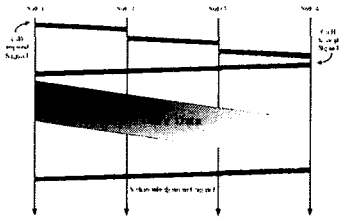
- Switching (1:1 communications)
  - Circuit switching : telephone, modem
    - Fixed QoS (~10kbps)
  - Packet switching : Internet, LAN
    - best effort (shared, no QoS)
    - wireless ~2Mbps, Ethernet ~100Mbps
  - QoS switching : MPLS, UMTS, HPi
    - full QoS negotiable
- Broadcasting (1:n communications)
  - Fixed QoS (HDTV 20Mbps, DTV 5Mbps)

Network classes



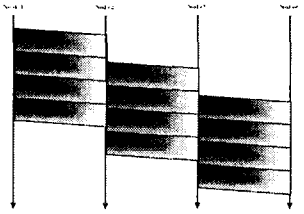
Circuit switching

- Fixed bandwidth
- No delay
- Bit error
- Voice service



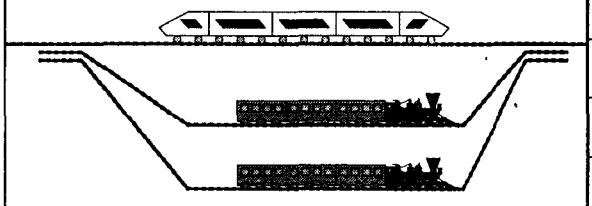
Packet switching

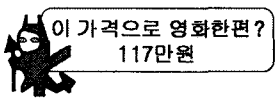
- Shared bandwidth
- Routing delay
- Packet loss
- Data service



QS (QoS Switching)

- IPv6, MPLS, diffServ, RSVP : developed already, not popular yet
- UMTS (3G), IEEE802.16, Hpi (Pre-4G)
- Internet 패킷별 (priority) 가격매기기가 언제 시작되느냐? (realistic price)





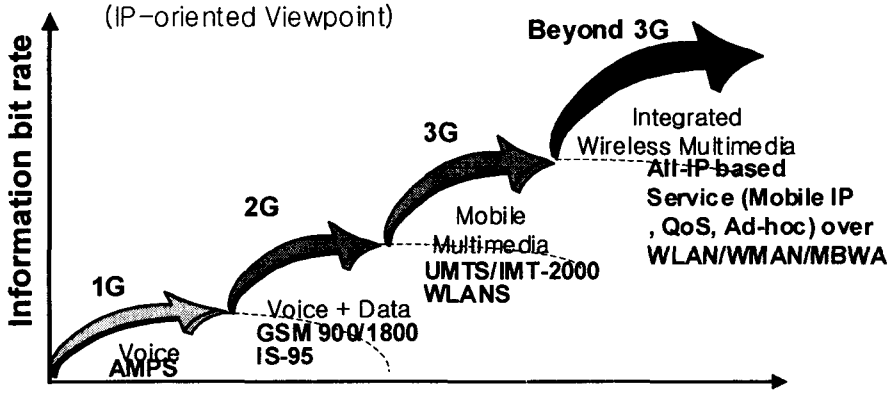
500kbps X 2hours

contents	Rate	service
Text	6.5원 /pkt	Text, still image, etc.
VOD/MOD	1.3원 /pkt	June (Video)
Internet access	1.5원 /pkt	Internet access
Video phone	1.5원 /pkt	Video phone
Download (2~8AM)	0.3원 /pkt	1-15 MBytes

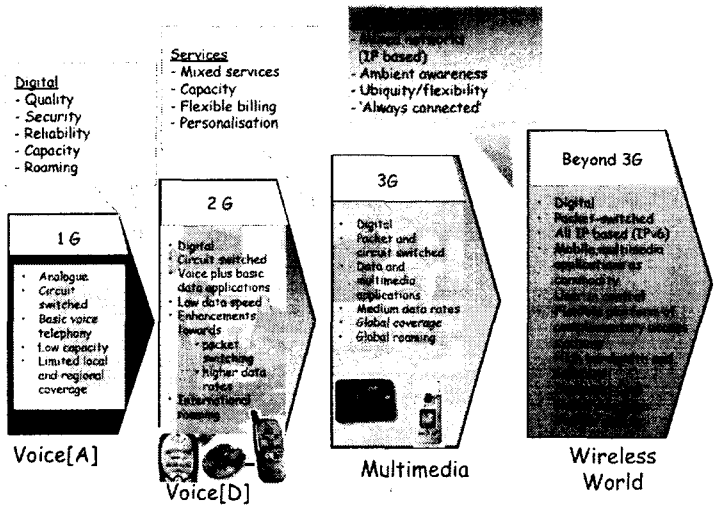
2003 (KTF June)
[pkt=512bytes]

Evolution to All-IP 4G

- 4G시스템은 3G에서 한단계 더 발전한 Mobile/Nomadic System
- 2010년 이후부터 시장에 도입되기 시작할 것으로 예상됨
- WMAN/MBWA를 중심으로 한 휴대인터넷이 4G 네트워크로 간주됨 (IP-oriented Viewpoint)

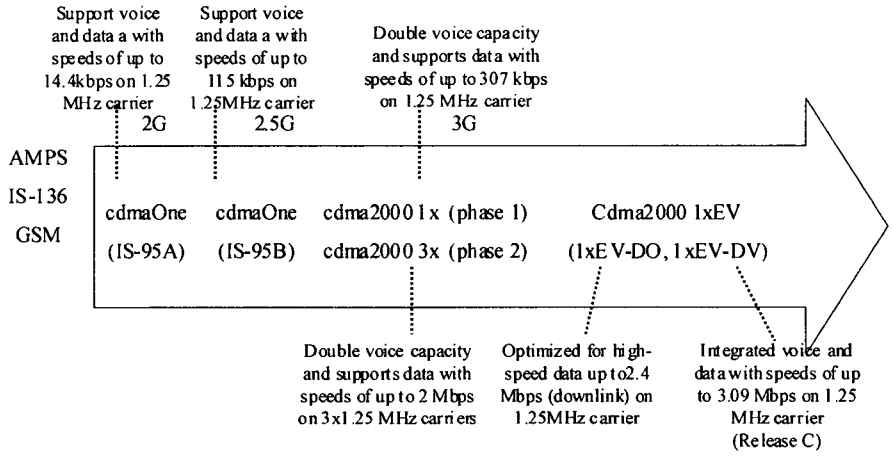


Evolution of Mobile Networks

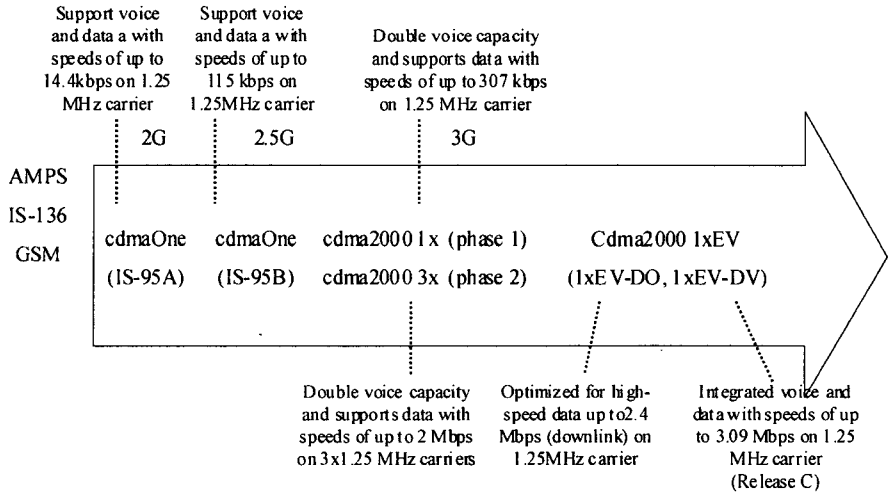


3GPP Evolution

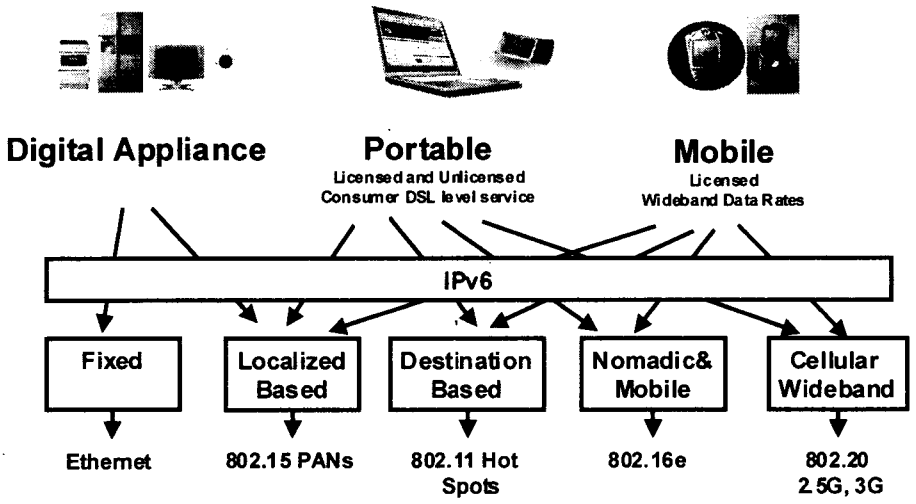
- 3GPP ⊂ {ARIB, CWTS, ETSI, T1, TTA}



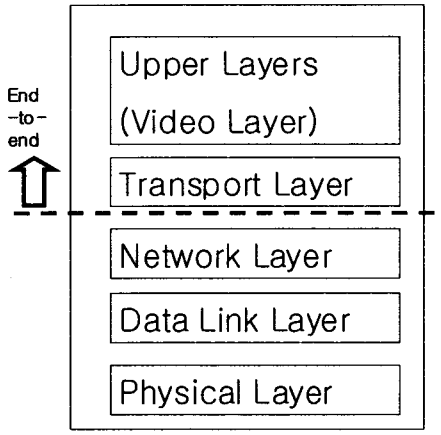
3GPP2 Evolution



IPv6 and Wireless IEEE802/Cellular Technology



QoS control for multimedia

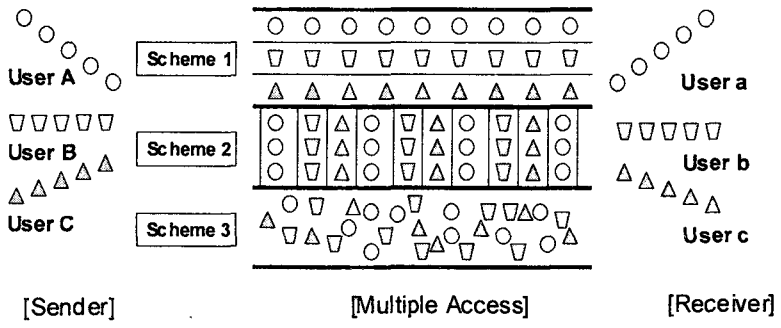


- Error resilience/concealment, scalability coding
- UDP/RTP&RTCP, FEC, retransmission
- IP TOS, RSVP, intServ, diffServ
- FEC, retransmission, MAC
- Power control

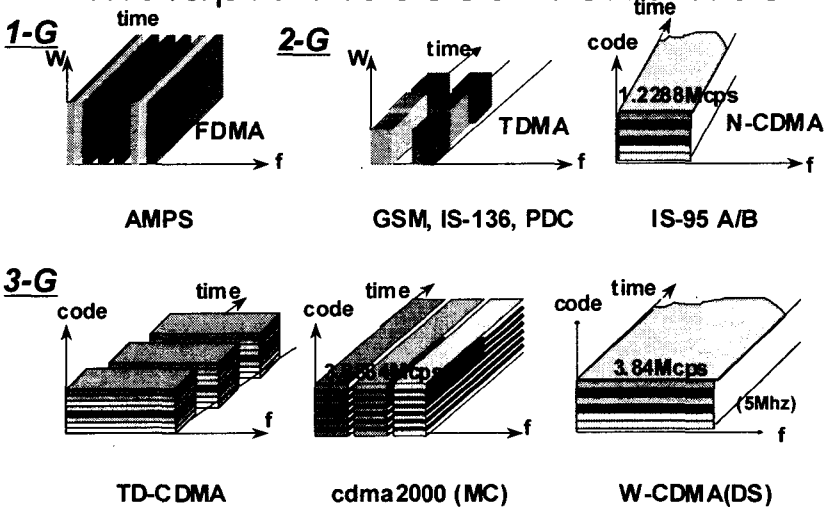
QoS Control Techniques in Wireless Channel

- MAC Protocols
- Scheduling (resource re-allocation)
- Power control
- ARQ/retransmission
- Priority
- Handoff control

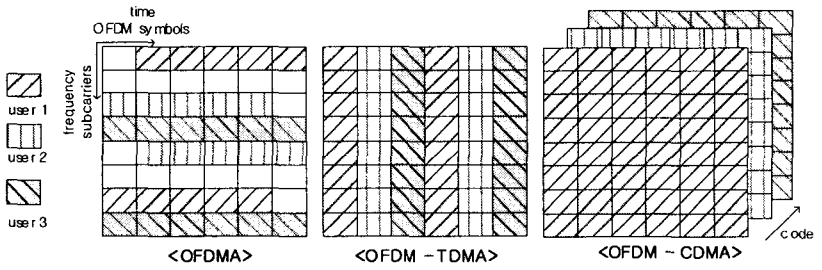
Multiple Access Schemes



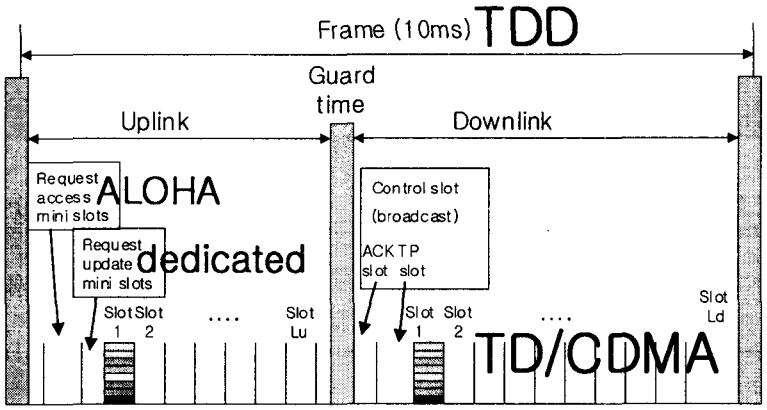
Multiple Access Schemes



New Multiple Access Scheme



Dynamic Allocation in TDD TD/CDMA for 4G



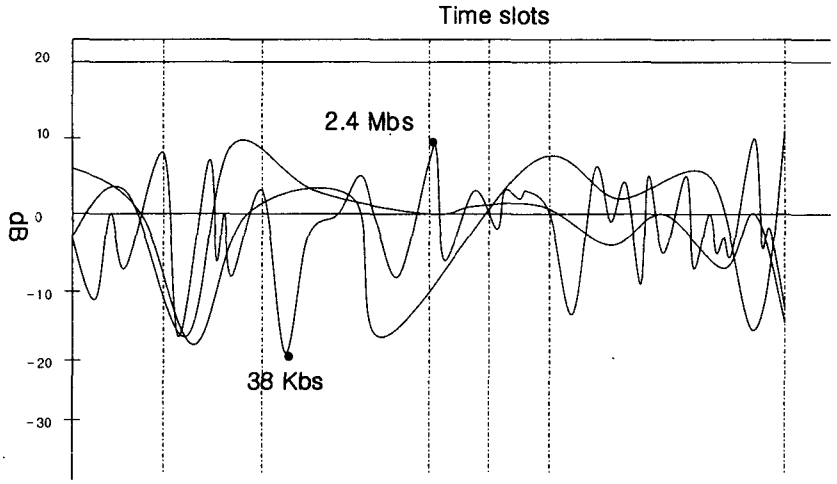
PFRS (Proportional Fair Rate Scheduling)

Data rate requested by MS

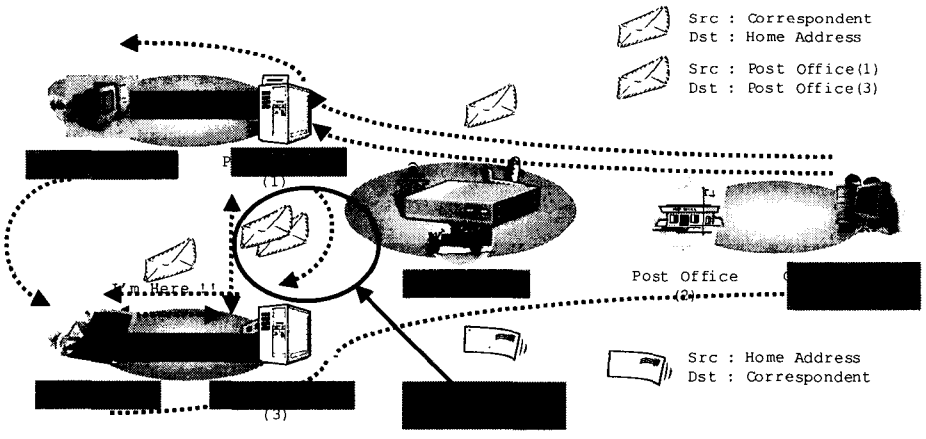
- Select the j-th user of max{ $\frac{C_j(k)}{E_j(k)}$ }
- $E_j(k+1) = (1-\frac{1}{t})E_j(k) + \frac{1}{t}A_j(k)$

Assigned data rate

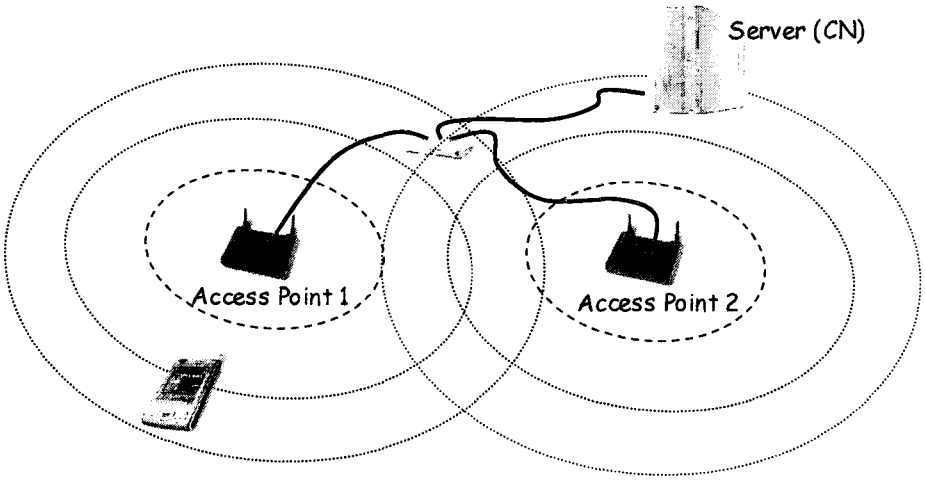
Exploiting Channel State



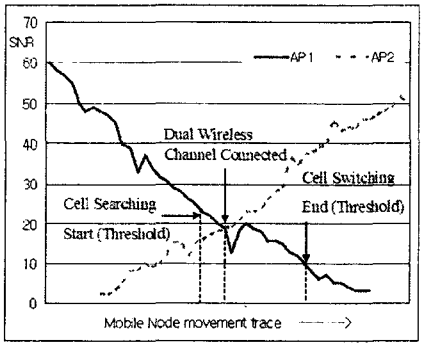
Handoff : Terminology

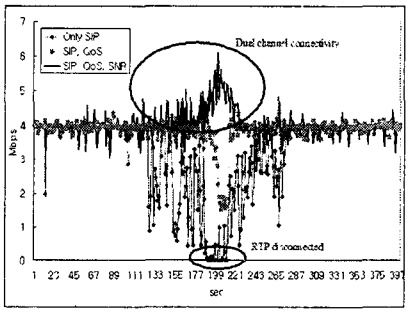


Handoff and multimedia service

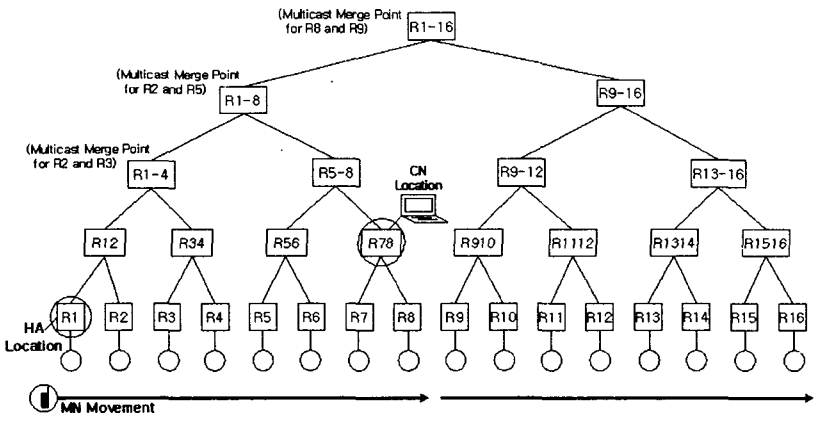


Network quality during handoff

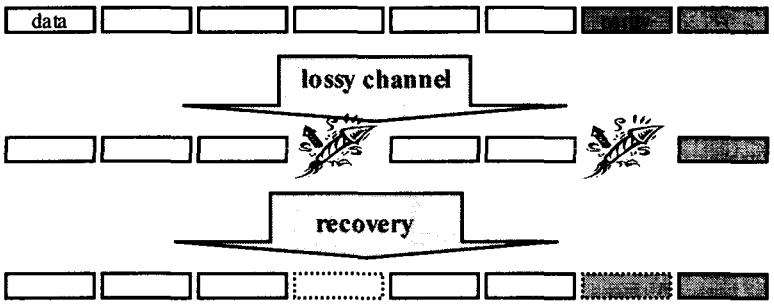




Hierarchical handoff



FEC
(forward erasure correction)



- RFC2733 : XOR-based (one parity packet)
- IETF : draft-ietf-avt-uxp-02.txt, March 2002.

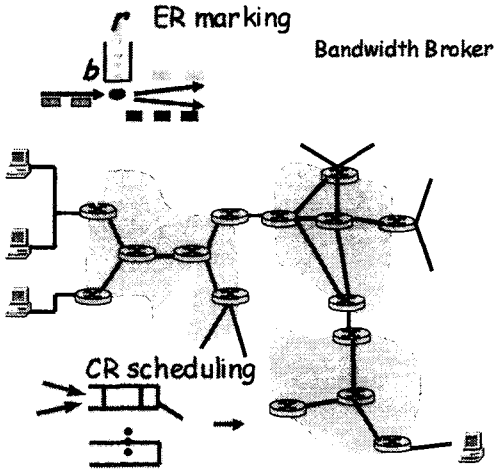
Diffserv Architecture

Edge router:

- per-flow service
- marks packets of in- or out-profile

Core router:

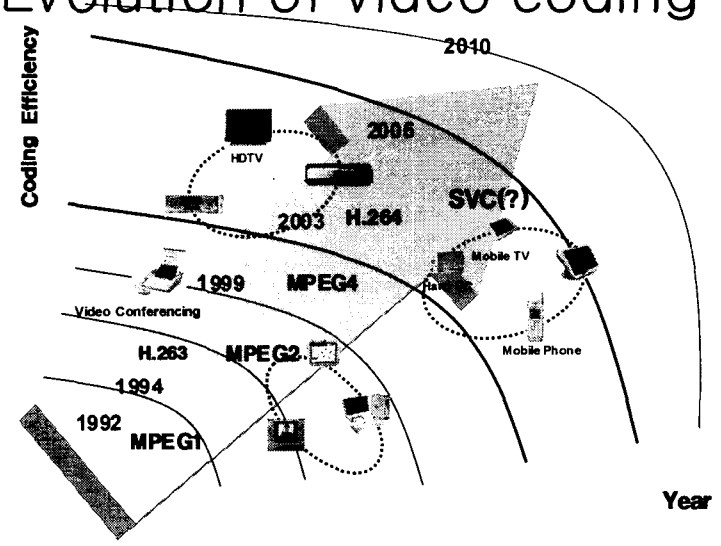
- per class service
- buffering and scheduling
- preference to in-profile packets
- Assured Forwarding



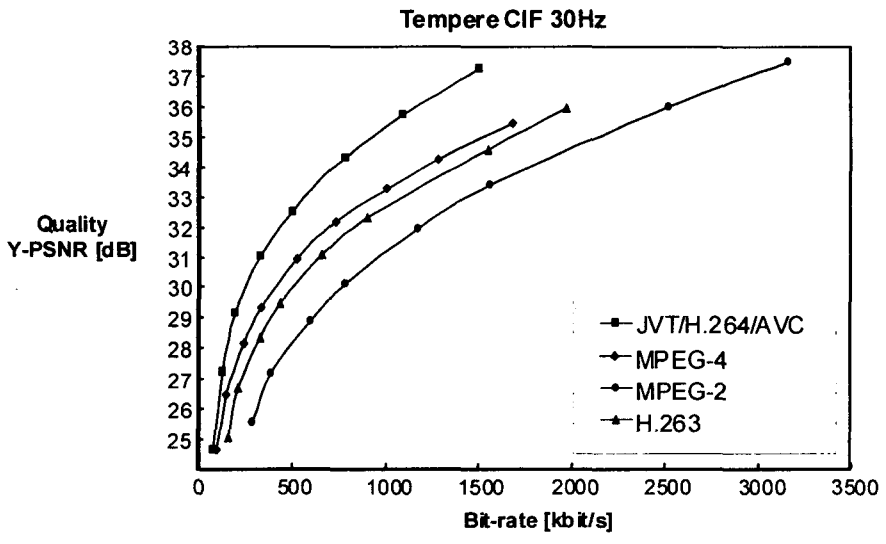
QoS Parameters in UMTS

- [Maximum bitrate(bps), Maximum SDU size(octet)] cf. [PCR, CDVT]
  - possible bitrates per subflow in CS case <= inter PDU transmission interval (IPTI)
- [Guaranteed bitrate, k*Maximum SDU size] cf. [SCR, BT+CDVT]
  - to capture burstness
  - minimum resource requirements => resource sharing
- delivery order(y/n)
- SDU format information(bits)
- SDU error ratio : loss+damaged
- residual bit error ratio
- delivery of erroneous SDUs(y/n/-) : '-' implies no error detection.
- transfer delay(ms) : 95% quantile
- traffic handling priority : per flow
- allocation/retention priority : per bearer which is not negotiated from the MT

Evolution of video coding

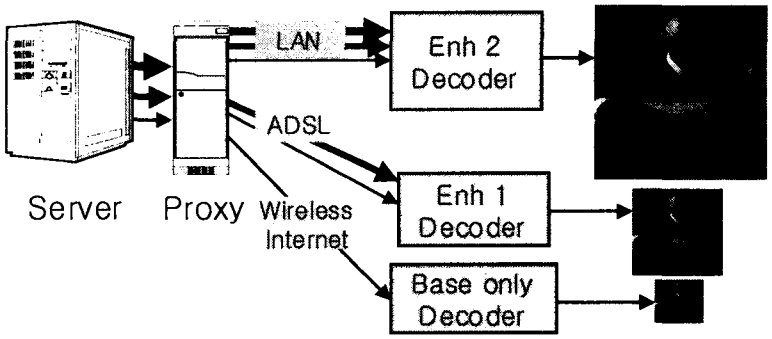


Coding efficiency

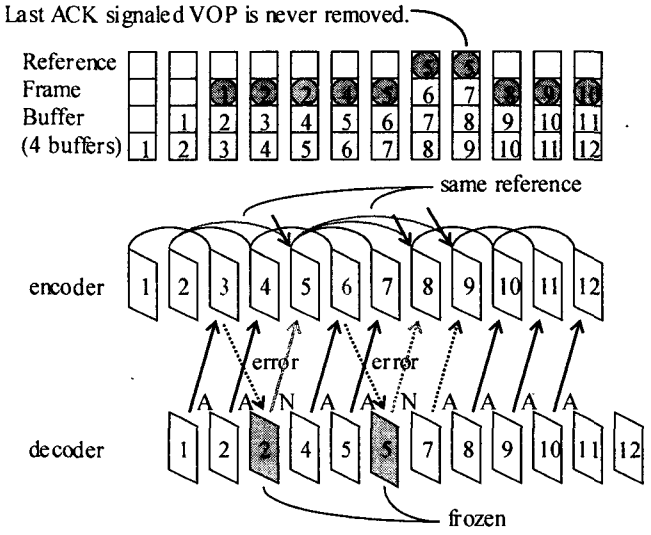


Scalable encoding

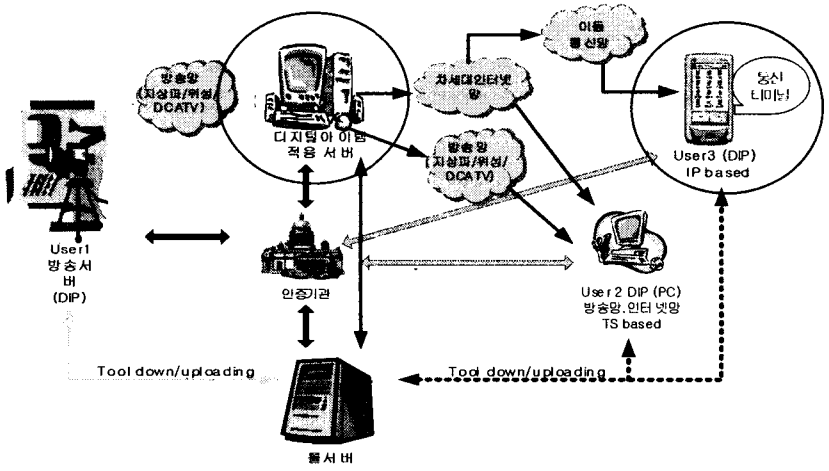
- Layers differ in
  - Spatial/temporal resolution : Spatial/temporal scalable
  - Quality : SNR scalable coding



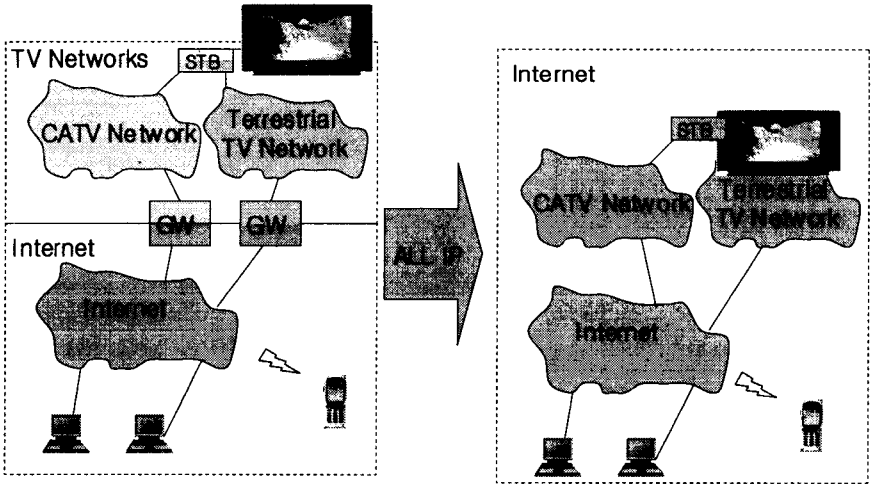
Error Resilience



Future Works : MPEG-21 and convergence



Future Works : Seamless with All IP



Future Works : Cross-Layer QoS