ITU-BDT Sub-regional Seminar on IMT-2000 for CEE and Baltic States

"Mobile Network Evolution to NGN"

Ljubljana Slovenia
1-3/12/2003
Roland THIES

ARCHITECTS OF AN INTERNET WORLD ALCATEL

Presentation Outline

What is NGN and how it applies in Mobile Networks?

- Mobile Networks Architectures
- Why NGN?

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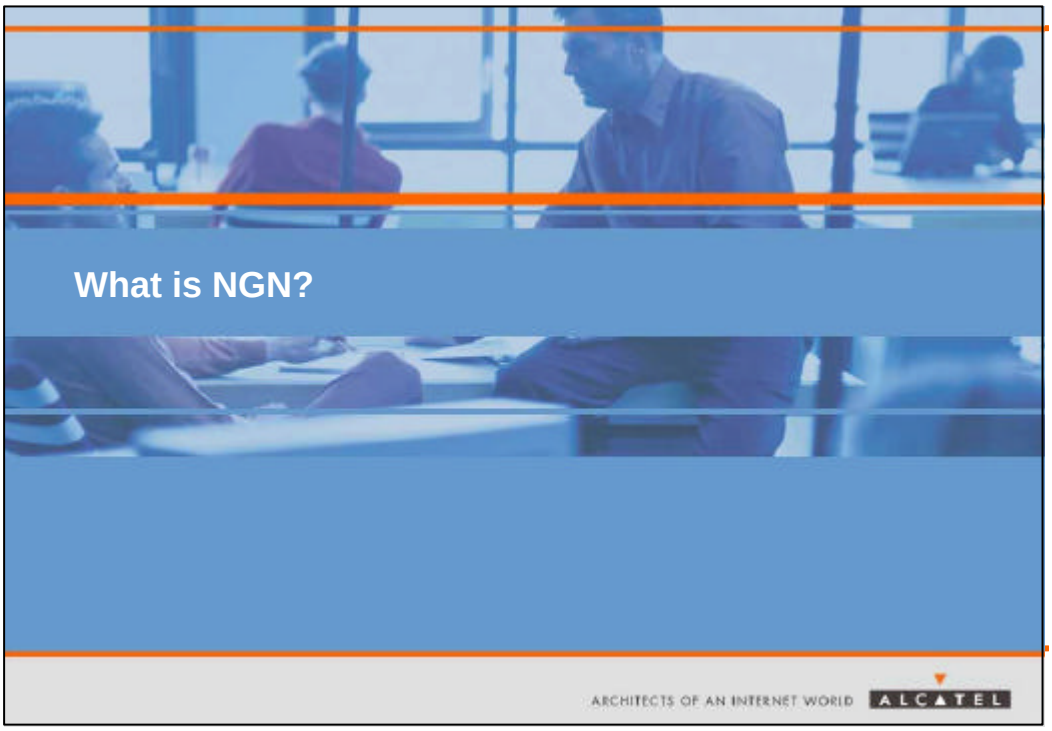

What is NGN?

NGN: Next Generation Networks

- **Separation of**
  - **Access Layer**
  - **Transport Layer**
  - **Control Layer**
  - **Service Layer**
- **with Control & Transport Layers being shared by**
  - **the different Access Type (RAN, Fixed…)**
  - **and Service Layers**
- **with Packet (ATM, IP) Transport converging toward IP transport**
- **for provision of Multimedia Services** (Real Time, Presence, Messaging, Voice, Video, Data...)

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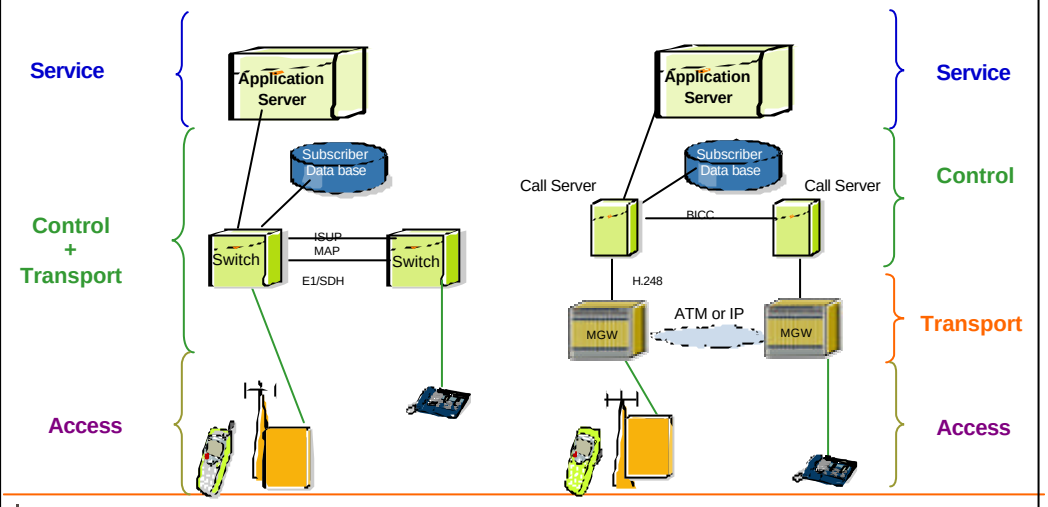
What is NGN?



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How NGN applies in Mobile Networks?

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How NGN Applies in Mobile Networks?

- **UMTS R99:**
  - **Largely derived from GSM**
  - **Last non-NGN Release**
  - **Features content functionally frozen 12/2000**
  - **Still Change Requests (Mobile Test Plan to be finalised by 2H04)**
- **UMTS R4:**
  - **NGN in Cs Domain with Separation of Control and User layers**
    - **Introduction of Server & MGW**
    - **Introduction of ATM and IP transport instead of TDM**
  - **Standard completed in March 2001 but still essential CR (TrFO...)**
- **UMTS R5:**
  - **NGN for IMS**
  - **Introduction of MM Call Server with SIP Call Control Protocol**
  - **Standard Content frozen in June 2003 (many CR to come)**

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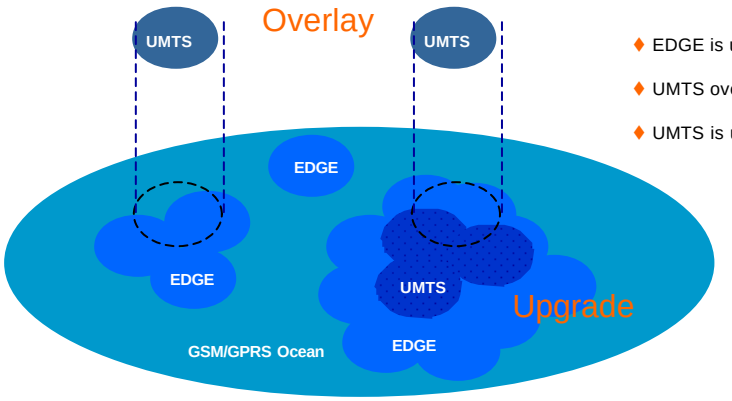
GSM Radio Technology Evolution



- EDGE is upgraded from GSM/GPRS
- UMTS overlays from GSM/GPRS
- UMTS is upgraded from GSM/GPRS

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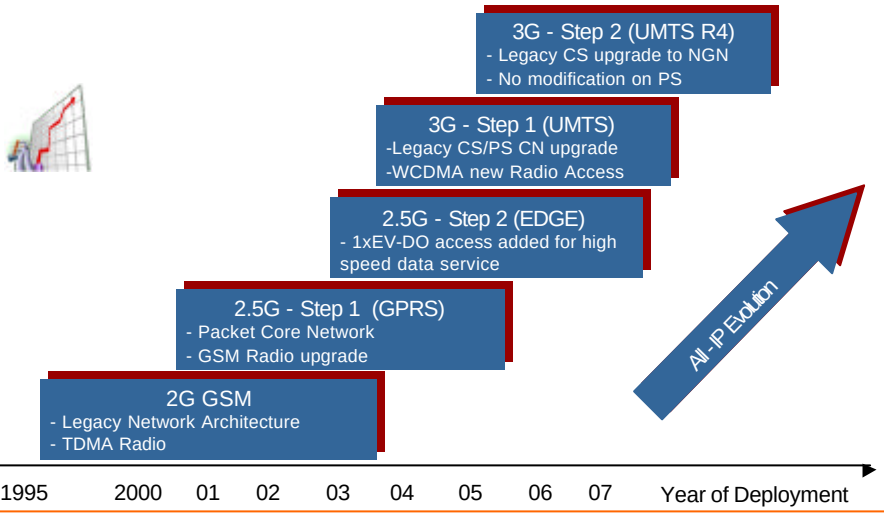
3GPP Network Evolution



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How NGN Applies in Mobile Networks?

- **CDMA 1x RTT:**
  - **Extended radio technology from IS95**
  - **Last non-NGN Release**
  - **Release 0 in commercial service since Oct 2000**
  - **New overlay Packet Data Serving Node**
- **CDMA 1x EV-DO:**
  - **Hybrid CDMA+TDMA technologies for bursty applications (High Speed Data)**
    - **Requires a separate carrier (1.25MHz), mainly deployed for hot zones.**
    - **Could be developed independent of IS95/1xRTT. (No MSC/VLR needed)**
  - **Commercial service in SK, US since 2002**
- **CDMA 1x EV-DV:**
  - **NGN in Cs Domain with Separation of Control and User layers**
  - **Backward compatible with CDMA2000 1xRTT**
  - **Commercial service in 2003**

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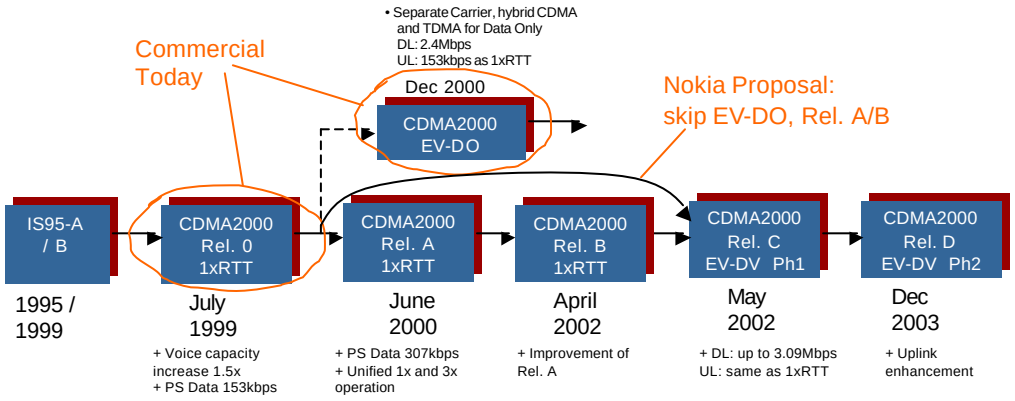
CDMA2000 Radio Technology Evolution



EV-DO: 1x Evolution Data Only , now also called HDR (high data rate)
EV-DV: 1x Evolution Data and Voice
Dates are publication day of version 1.0 standard. (E.g. CDMA2000 Rel. A published version 1.0 in June 2000, and version 6.0 in Feb 2002.)

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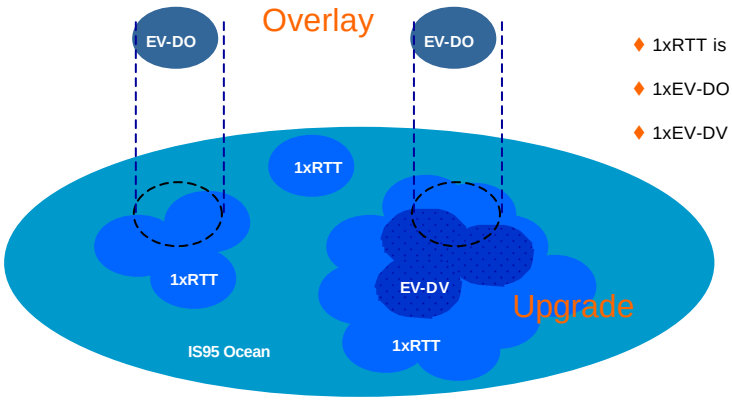
CDMA2000 Radio Technology Evolution



- 1xRTT is upgraded from IS95
- 1xEV-DO overlays IS95/1xRTT
- 1xEV-DV is upgraded from 1xRTT

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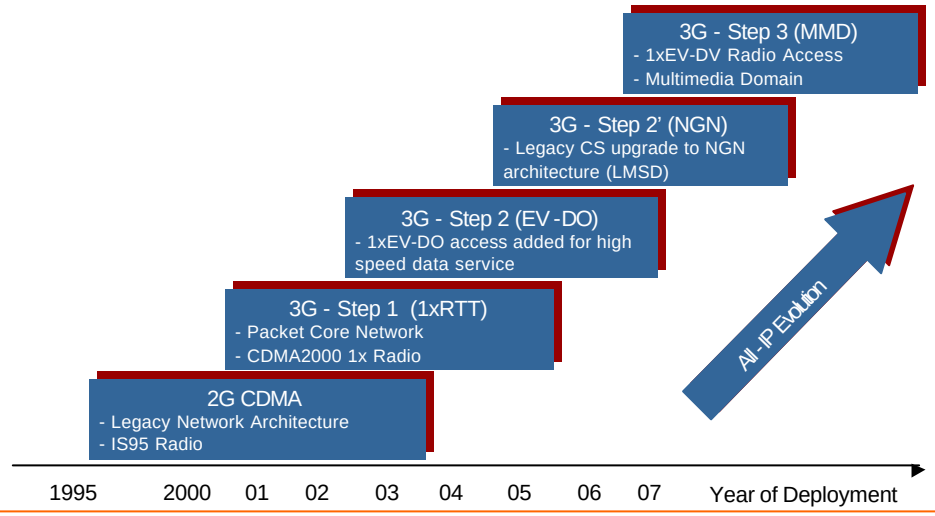
3GPP2 Network Evolution



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Presentation Outline

- What is NGN and how it applies in Mobile Networks?
- **Mobile Networks Architectures**
  - 2G/3G Mobile Networks
  - NGN Evolution
- Why NGN?

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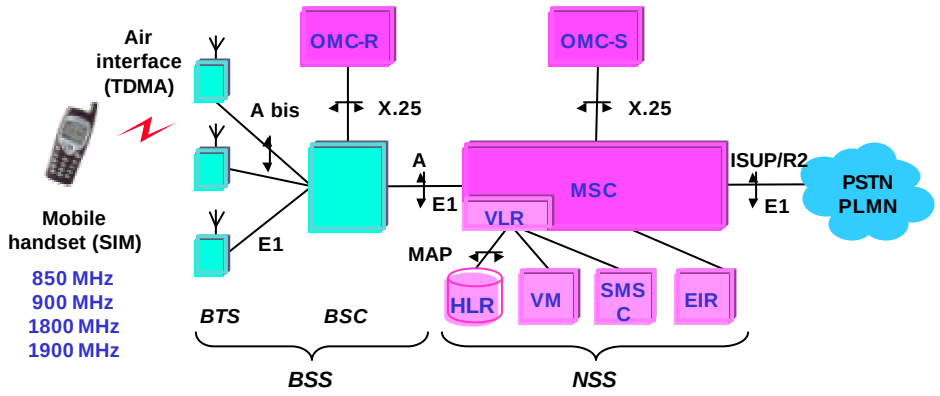
GSM Architecture



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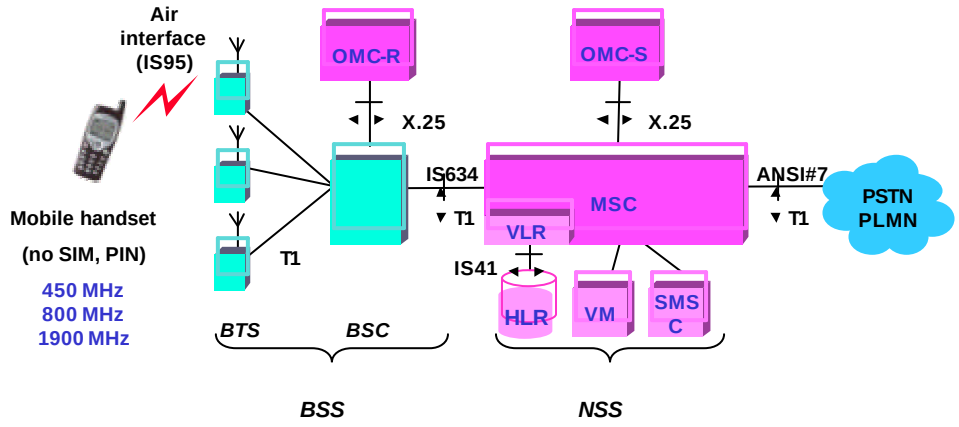
CDMA Architecture



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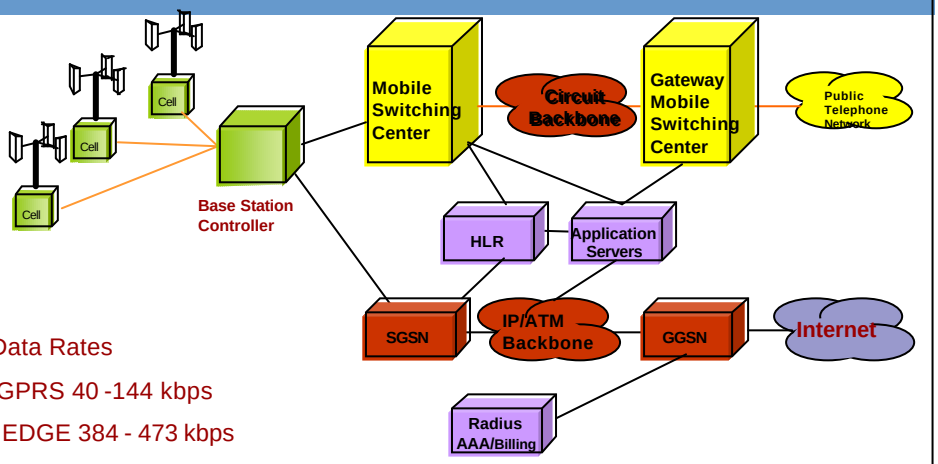
2.5G GPRS/EDGE



Data Rates

GPRS 40 -144 kbps

EDGE 384 - 473 kbps

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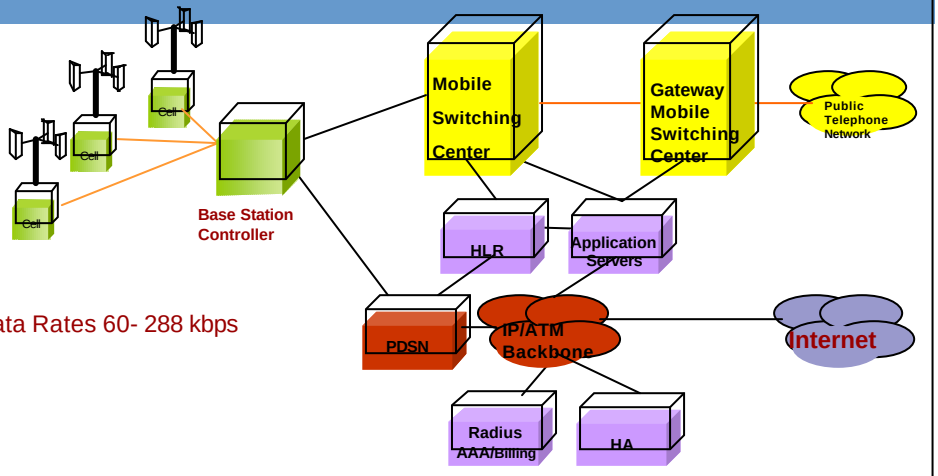
2.5G CDMA 1XRTT



Data Rates 60- 288 kbps

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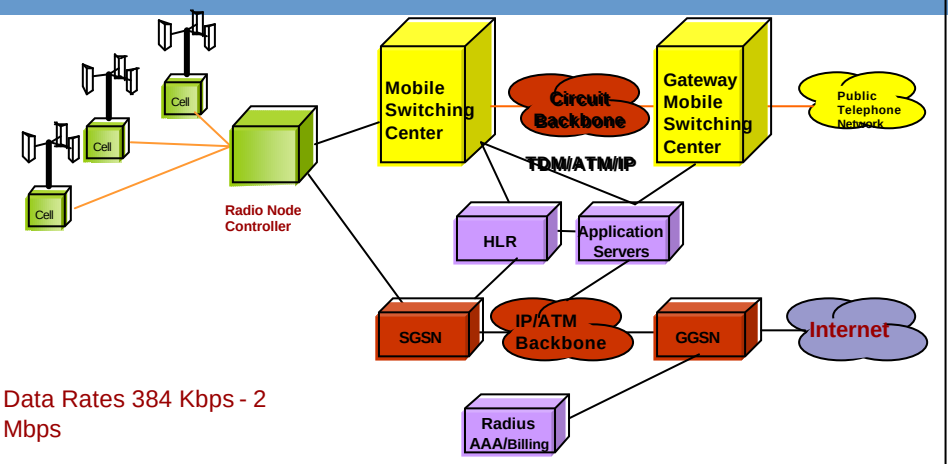
3G W-CDMA R3 (R99)



Data Rates 384 Kbps - 2 Mbps

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Presentation Outline

- What is NGN and how it applies in Mobile Networks?
- **Mobile Networks Architectures**
  - 2G/3G Mobile Networks
  - NGN Evolution
- Why NGN?

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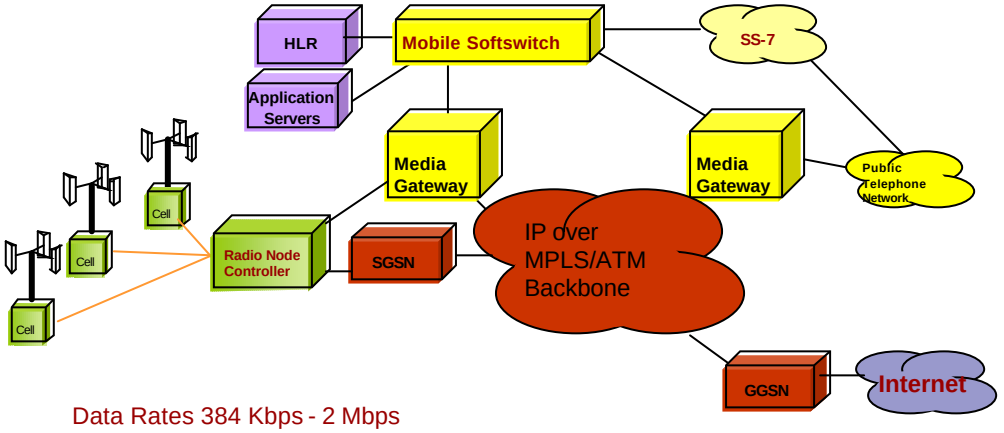
3G W-CDMA R4



Data Rates 384 Kbps - 2 Mbps

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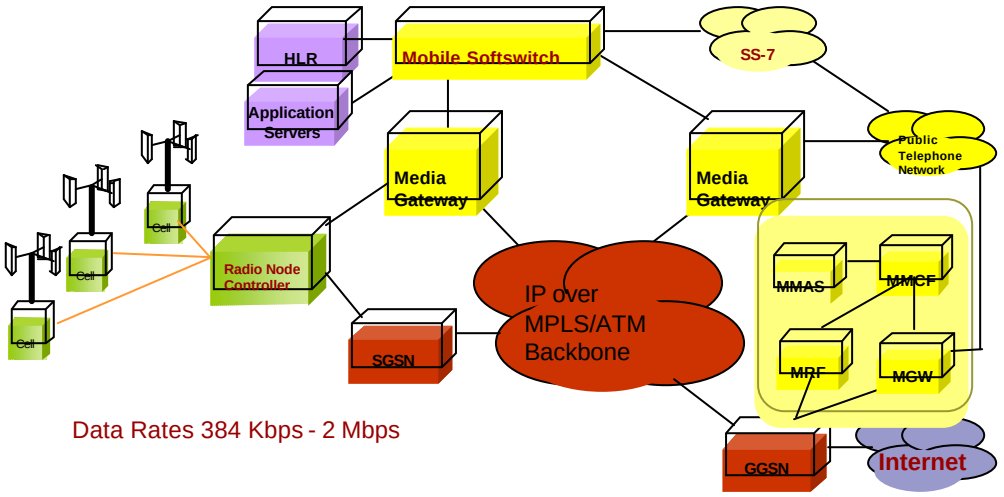
3G W-CDMA R5 (IMS)



Data Rates 384 Kbps - 2 Mbps

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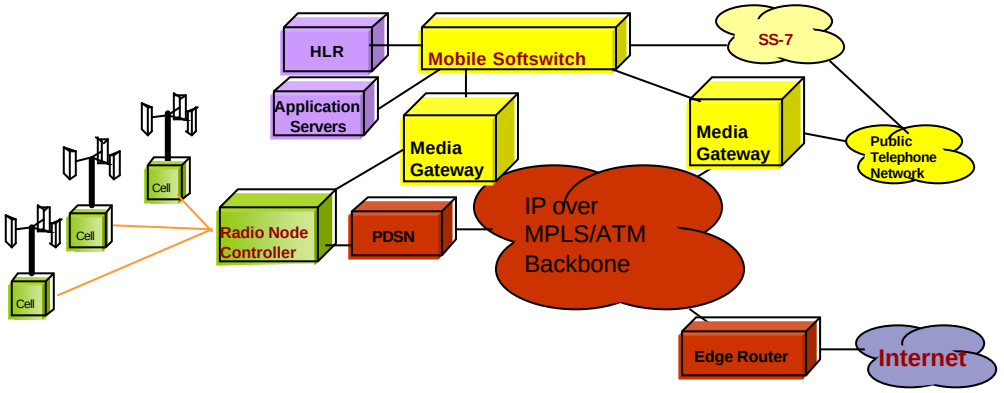
3G CDMA 2000



Data Rates 2 - 5 Mbps

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Presentation Outline

> What is NGN and how it applies in Mobile Networks?

> Mobile Networks Architectures

> **Why NGN?**

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Why NGN?

1 - Transport Network Simplification

2 - Higher Network Scalability

3 - Bandwidth Saving

4 - New Services

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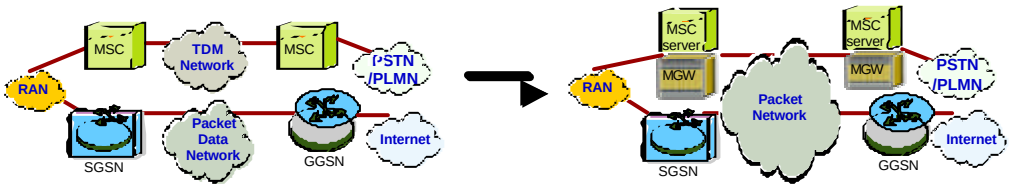
Why NGN?
1- Transport Network Simplification - Common Cs/Ps Backbone

- **Only one transport backbone for Voice, Data on ATM or IP**
  - **improved resources use efficiency**
    - **resources sharing**
    - **one network management**



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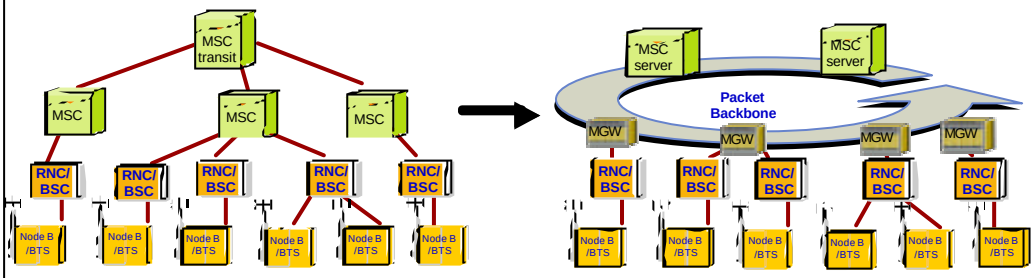
Why NGN?
1- Transport Network Simplification - No Transit Layer

- **No Need for Transit Layer MSC**
  - **Dynamic connection establishment between nodes**
  - **in ATM through SVC, in IP through routing**



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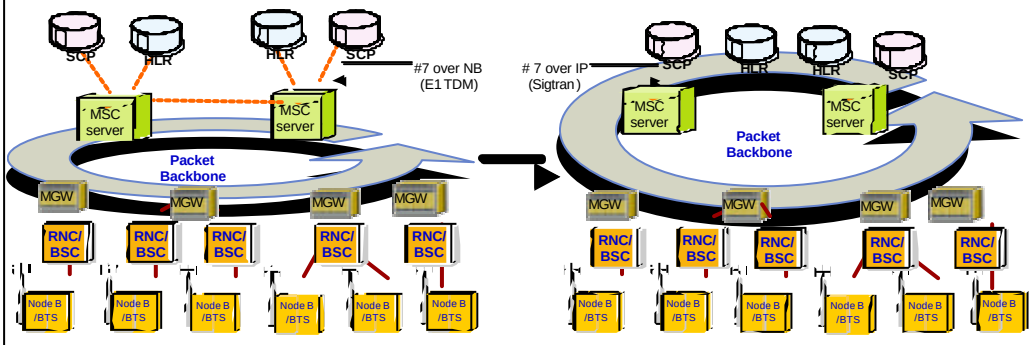
Why NGN?
1- Transport Network Simplification - Common Signalling/Packet Backbone

- **With Signaling over IP, no Need for Dedicated Signalling Network**
  - **simplification of transport network**
  - **improved resource use efficiency**



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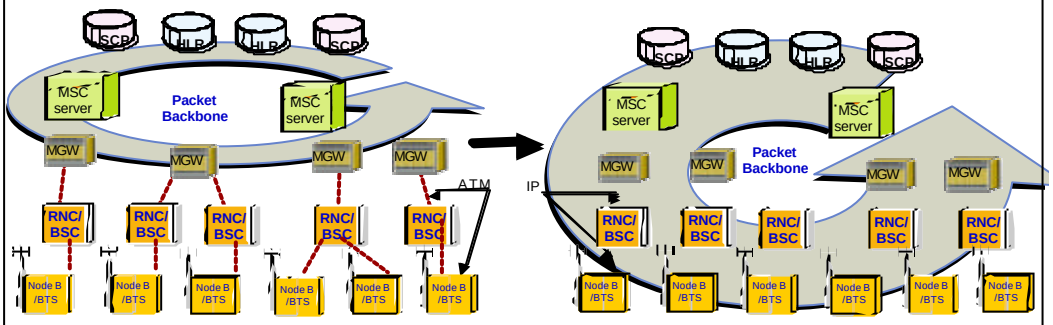
Why NGN?
1- Transport Network Simplification - Common CN/RAN backbone

- **With IP in RAN in R5, Merge of CN & RAN IP Transport Networks**
  - **simplification of transport network**
  - **improved resource use efficiency**



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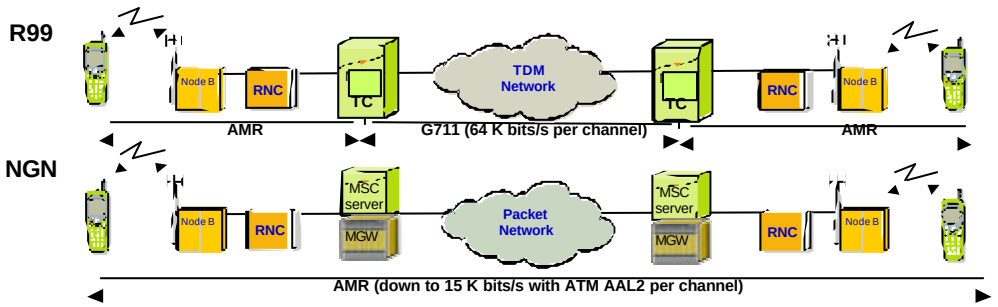
Why NGN?
2- Bandwidth Saving

- **End to End AMR voice transport (3G/3G Call)**
  - **Bandwidth optimisation**
  - **Transcoder saving**
  - **Voice quality improvement**



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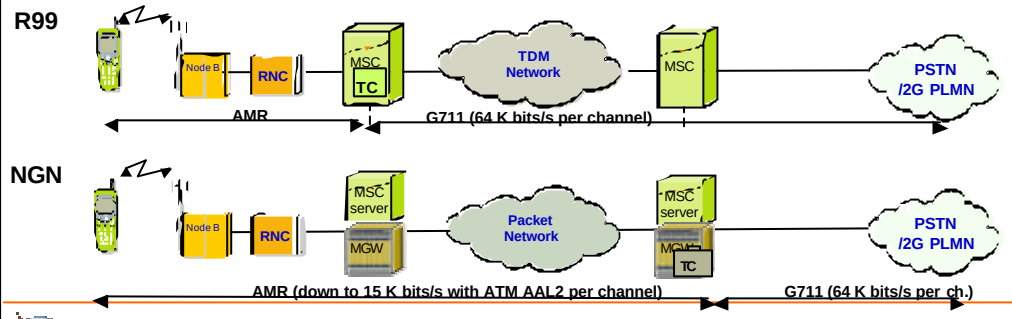
Why NGN?
2- Bandwidth Saving

- **AMR in CN for 3G<->PSTN/2G PLMN Voice Call (R4)**
  - **Bandwidth optimisation**



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Why NGN?
3- Bandwidth Saving (CS domain)

Transport Bandwidth Efficiency (from R4 & beyond)

transport type / kb/s per channel	G711 over TDM (reference)	AMR over ATM AAL2	AMR over POS IP V4	AMR over POS IP V6	AMR over GE IP V4	AMR over GE IP V6	AMR over IP V4 over ATM AAL5	AMR over IP V6 over ATM AAL5	G711 over ATM AAL2
kb/s per **voice** channel	64	**15 85**	34	44	49	59	51	51	85
kb/s per **64kb data** ch	64		121	141	151	171	153	204	N/A

- **ATM AAL2:** the most efficient for both Voice and 64kb/s Data
- **POS:** the most efficient of the IP transport
- **64kb/s Data:** Packet transport brings degradation
  but data traffic on Cs should be low w/r to voice traffic

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Why NGN?
3- Bandwidth Saving (PS domain)

Transport type / Byte per packet	IP over SDH	IP over ATM AAL5
256 byte IP packet	**267**	318
512 byte IP packet	**525**	583

- IP over SDH more efficient than IP over ATM (10 to 20%)

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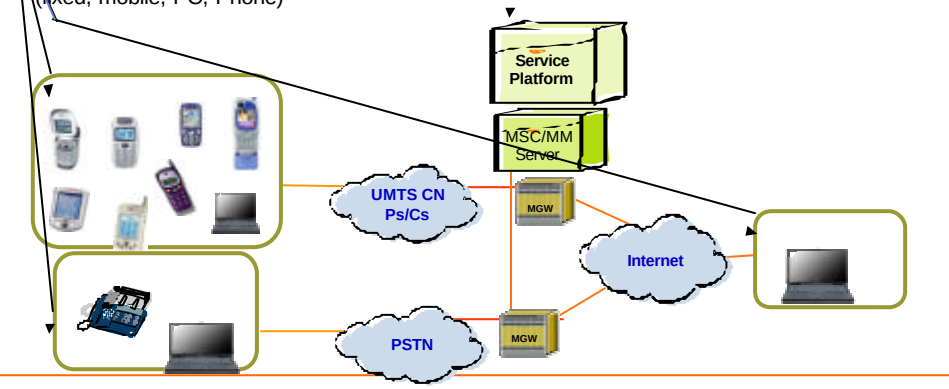
Why NGN?
4- New Services **Unified Services through standardized Interfaces**

- **services independent of access layer type** (fixed, mobile, PC, Phone)
- **one Service Platforms whatever the access layer types** (unlike IN, Voice Mail for Mobile, email for fixed Internet…)



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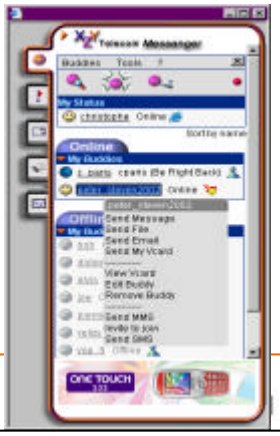
Why NGN?
4- New Services

- **IP as target transport layer with benefit of existing IP services**
- **Merge and combination of existing services**
  - **Standardized Video Communication** (between fixed & mobile, video conferencing & video mail)
  - **Unified messaging** one mail box whatever the message (voice, text, video) & device type
  - **Multimedia Messaging**
  - **Instant Messaging**



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Why NGN?

Summary	CAPEX OPTIMIZER	OPEX OPTIMIZER	REVENUE ASSURANCE
Transport Network Simplification	■	■	
Higher Network Scalability	■	■	
Bandwidth Saving	■	■	
New Services			■

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Conclusion

- **NGN is the separation between Control and Transport**
- **NGN is mainly introduced in 3G UMTS R4/R5 and CDMA2000 1x EV-DV**
- **Only one transport backbone for Voice, Data on ATM or IP**
- **Bandwidth optimisation,Transcoder saving & Voice quality improvement when Mobile to Mobile/PSTN calls using TrFO**
- **Unified Services through standardized Interfaces independent of access layer type** (fixed, mobile, PC, Phone)
- **News Services (Merge and combination of existing services):**
  - **Standardized Video Communication**
  - **Unified messaging**
  - **Multimedia Messaging**
  - **Instant Messaging**

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