

The 3GPP and 3GPP2 Movements Toward an All-IP Mobile Network

- May 2, 2002
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All-IP network

- Uses IP transport
- Common IP based multimedia call model
- Internet's service
- Internet's distributed architecture
- Keep interoperability with existing networks

Why IP?

- User
 - Superior end-user experience
 - Reduced cycle time to commercialize applications
- Operator
 - Orderly operator migration
 - Reduced cost of ownership

3GPP <http://www.3gpp.org> 3rd Generation Partnership Project

- Develops 3G standards for GSM-based systems
- Based on EDGE and GPRS
- 3G.IP catalyses the move to all-IP network by addressing the requirements for all-IP network.
- Goal: support both stream and best effort service, provide separation of service control from connection control.



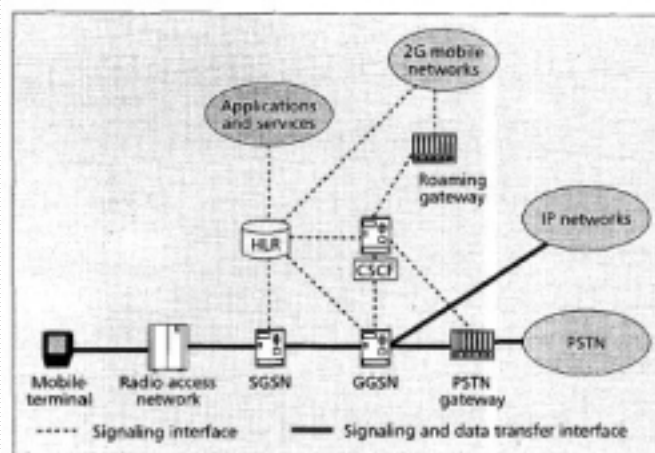
EDGE (Enhanced Data for Global Evolution)

- A technology that gives GSM the capacity to handle services for the 3rd generation of mobile telephony.

GPRS (General Packet Radio Service)

- A non-voice value added service that allows information to be sent and received across a mobile telephone network.

3GPP IP Reference Architecture



■ Figure 1. The 3GPP IP reference architecture.

3GPP Architecture (continued)

- CSCF (call state control function)
 - Performs call control functions, Service switching functions, Address translation functions, Vocoder negotiation functions
- HLR (GPRS home location register)
 - Main database of permanent subscriber information for a mobile network
- PSTN Gateway
 - Provides communication to PSTN
- Roaming Gateway
 - Support roaming to 2G wireless networks

3GPP Architecture (continued)

- SGSN (Serving GPRS Support Node)
 - Responsible for the delivery of data packets from and to mobile stations within its geographical service area.
- GGSN (Gateway GPRS Support Node)
 - Acts as an interface between GPRS backbone network and external packet (radio network and IP network)
 - Converts GPRS packets from SGSN to packet data network

3GPP2

<http://www.3gpp2.org>



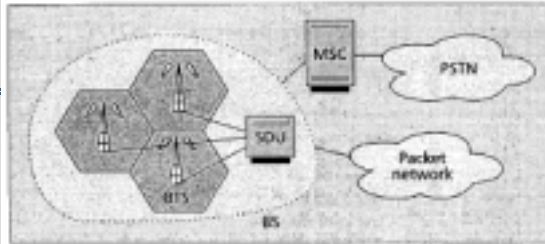
**3RD GENERATION
PARTNERSHIP
PROJECT 2
"3GPP2"**

*"Developing the next
generation of cdma2000
wireless communications"*

The Motivation Behind 3GPP2

- Formed in 1998 with the aim of developing a global CDMA2000-based standard
- In 1999, the Operators Harmonization Group (OHG) agreed upon a global standard that included CDMA2000 and the standard developed by 3GPP, W-CDMA. The two types of systems - direct spread (*DS*) and Multi Carrier (*MC*). W-CDMA is DS based; CDMA2000 is MC based.
- Objective of 3GPP2 - an all-IP architecture

IS-95 and CDMA2000



BTS – Base Transceiver Station
MSC – Mobile Switching Center
SDU – Selection and Distribution Unit
PSTN – Public Switched Telephone Network

Basic architecture of a CDMA cellular network

- CDMAone (IS-95a) - each channel spread over 1.25 MHz; offers voice + 14.4 kb/s data
- Upgrade IS-95b offered voice + 115 kb/s data
- CDMA2000 - new modulation scheme, more codes and wider bandwidths; target of 2Mb/s (set by IMT-2000)
- Now - CDMA2000 3X (formed by joining 3 1.25 MHz channels) and CDMA2000 1X EV-DO (EVolution Data Only) and CDMA2000 1X EV-DV (Data and Voice)

Picture credit : "An Internet Infrastructure for Cellular CDMA Networks Using Mobile IP", McCann and Hiller, IEEE Personal Communications, August 2000

Features and Goals of 3GPP2

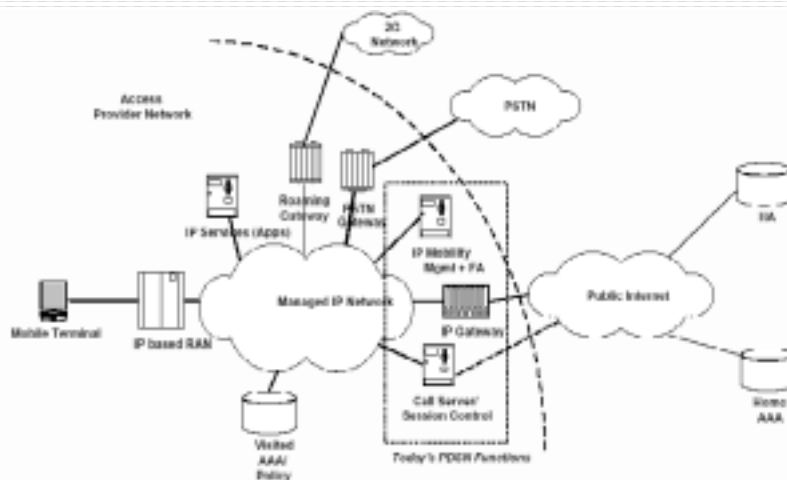
- An all-IP architecture based on the use of Mobile IP, SIP and AAA
- Uses IETF protocols ⇒ synergy with existing technologies
- Target
 - convergence towards an IP-based core network that is independent of the access network
 - mobility across different access networks such as CDMA2000, IEEE 802.11b, Ethernet, W-CDMA etc.
 - integrate access technologies in terminals to allow seamless movement between wireless and wired environments

Some All-IP high level features...

- IP Multimedia Domain
- IP Transport
- IPv6 Support
- IP-based Service Architecture
- Security (IPSec)
- VoIP based on SIP
- Mobility based on Mobile IP
- Authentication, Authorization and Accounting (AAA)
- End-to-End IP connectivity
- Legacy Mobile Station Domain

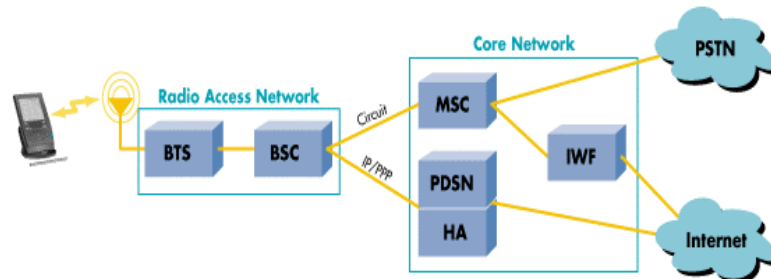
3GPP2 - The Big Picture

The Vision of an All-IP Network



Picture Credit : <http://www.cs.berkeley.edu/~randy/Courses/cs294.s02/113GPP2.ppt>

3GPP2 NAM - a bird's eye view



- BTS - Base Station Transceiver
- BSC - Base Station Controller
- MSC - Mobile Switching Center
- PDSN - Packet Data Serving Node
- HA - Home Agent
- IWF - Interworking Function

Picture credit : <http://www.cs.berkeley.edu/~randy/Courses/cs294.s02/113GPP2.ppt>

Comparison

■ Security and Mobility management

- 3GPP uses GGSN, SGSN nodes.
- 3GPP does not allow heterogeneous access.
- The HLR is likely to be used by the SGSN for authenticating data users. Thus, access and data network authentication are integrated.
- 3GPP2 uses mobile IP and PDSN as FA/HA .
- It allows heterogeneous access.
- The PDSN uses an AAA infrastructure to authenticate data users. Access and data network authentication are separate.

Services

- The 3GPP model has a SIP-like functionality in the 3 types of Call State Control Functions (CSCF).
- Location service in the 3GPP model is tied closely to the access.
- GTP is used to provide link-layer mobility.
- Though the specification is yet to be published, 3GPP2 has decided to use SIP.
- In the 3GPP2 model, location service is more of a database i.e., access-independent.
- Link layer mobility in the 3GPP2 world is viewed as a direct extension of mobile IP.

Thus far...

An approximate timeline constructed from headlines from www.3gnewsroom.com

- August 2001 - Nokia makes the world's first 3G WCDMA voice call on commercial 3GPP system
- October 2001
 - Motorola Takes Leadership Role in 3GPP2 Adoption Of 1xEV-DV Baseline Framework; 3GPP announces new specs
- November 2001 - Nortel Networks and Mercury Complete World's First Multi-Vendor 3GPP Test Voice Call
 - "...to make commercial UMTS service possible in time for 2002 FIFA World Cup." (!)
- January 2001 - Nokia has initiated volume shipments of commercial GSM/EDGE hardware to the US, the first such deliveries from any telecommunications vendor.
- February 2002 – Successful Demonstration of UMTS 3GPP Packet Data Call by Nortel, Samsung, PrairieComm Inc.
- March 2001
 - LG Telecom says no to CDMA2000 1X EV-DO; KDDI confirms launch of CDMA2000 1x 3G wireless service in major Japanese cities; Verizon Wireless and Lucent to launch CDMA2000 1xEV-DO network trial in Washington area

...and whither further?

- Several organizations like the MWIF (Mobile Wireless Internet Forum) and manufacturers are coming together to work towards the convergence of 3GPP and 3GPP2
- The variations in the architectural models have to be addressed; harmonization efforts are essential or dual mode services would become necessary
- There are strong reasons for using IPv6 in 3G networks. But, all commercial 3G networks till date use IPv4 (since it is easier to deploy).
- But who will emerge as the winner? W-CDMA? EDGE? CDMA2000?

The one thing that's clear is that we are moving towards an all-IP solution.



Cartoon from <http://www.cartoonstock.com>

References

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<http://www.3gpp.org/ftp/workshop/Archive/0002IP/Docs/PDF/AIP-000016.pdf>
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<http://www.itu.int/itudoc/itu-t/workshop/rio/s3p2.pdf>
- <http://www.cartoonstock.com> ;-)