

Convergence: Commercial Deployment of Wireless Systems

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Overview

- **Convergence**
 - Definition
 - Approaches
- **Next Generation CDMA**
 - **CDMA2000 Technology**
 - CMDA2000 1xEV-DO
 - CDMA2000 in 450 MHz
 - **WCDMA Technology**
- **APEC Guidelines Related to Convergence**

The Dimensions of Convergence

- **There are several dimensions of convergence, including the convergence of:**
 - technologies
 - services
 - user perceptions
 - firms

“Convergence involves the ongoing coming together of a number of technologies previously considered separate. There is a need to consider changes in management and regulation associated with this integration of telecommunications, information technology (using computer/internet) and broadcasting. The technology enabled, hybrid applications which are a product of the proliferation of the combined technologies, appear to users through fixed or mobile access, offering voice, data, image pictures, on-line and interactive services simultaneously - as multimedia services.”

APEC TEL 19, March 1999

Support Pro-Competitive Approaches

- Re-examine Legacy Rules
- Promote Opportunities for Further Liberalization

Approaches to Convergence by Governments

- Regulatory institutions are being created reformed
- Licensing approaches are being reformed (e.g., Unified License in India)
- Technology neutrality
- Spectrum flexibility
- Secondary trading

Approaches to Convergence by Corporations

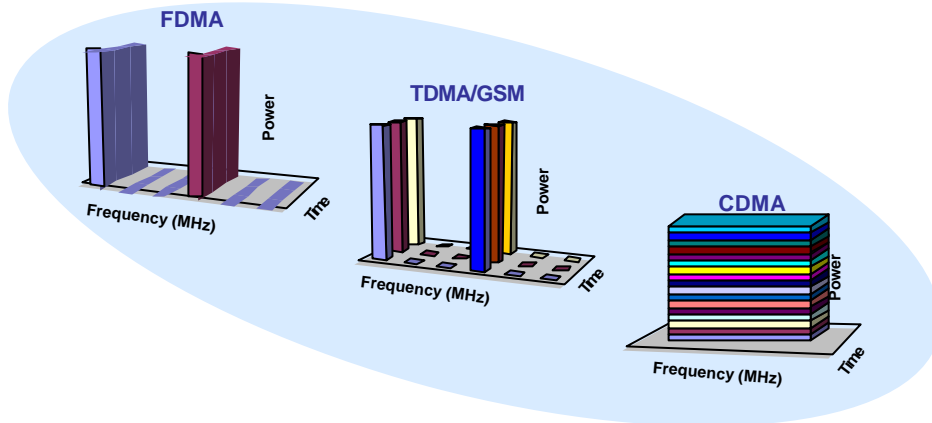
- Companies are reviewing corporate structures
- For example, Deutsche Telekom recently announced that:
 - It would abandon strict separation of four main business units to better react to evolving technologies and changes in the market.
 - Viewing market in terms of connectivity and information technology services
 - Encouraging more collaboration among business units

Wireless Technology Providing Another Delivery Medium for Voice and Broadband Access

- Developments in wireless technologies are offering another platform for delivery of voice and data services.
- Advancements will continue to introduce the delivery of multimedia services to consumers

Wireless Technology Evolution

CDMA enables more calls in a given amount of spectrum

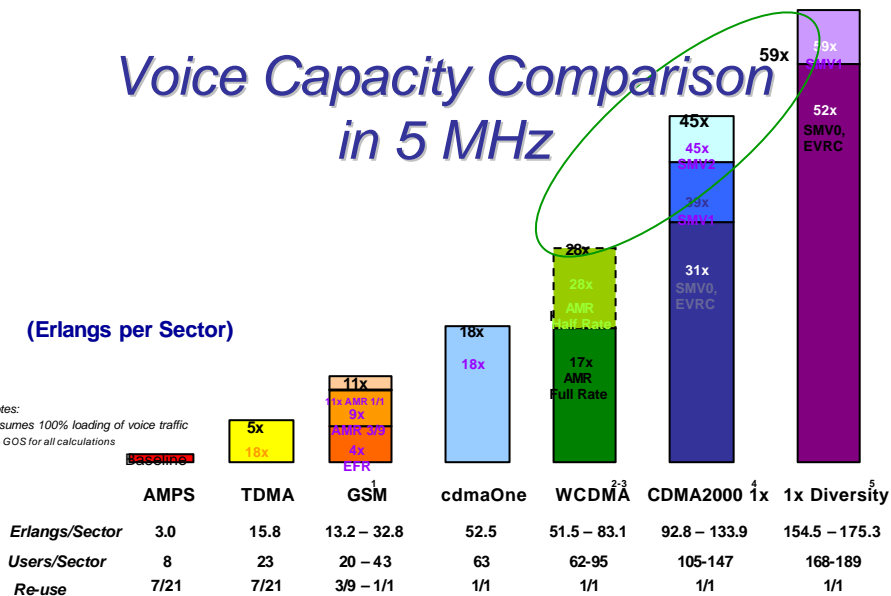


Voice Capacity Comparison in 5 MHz

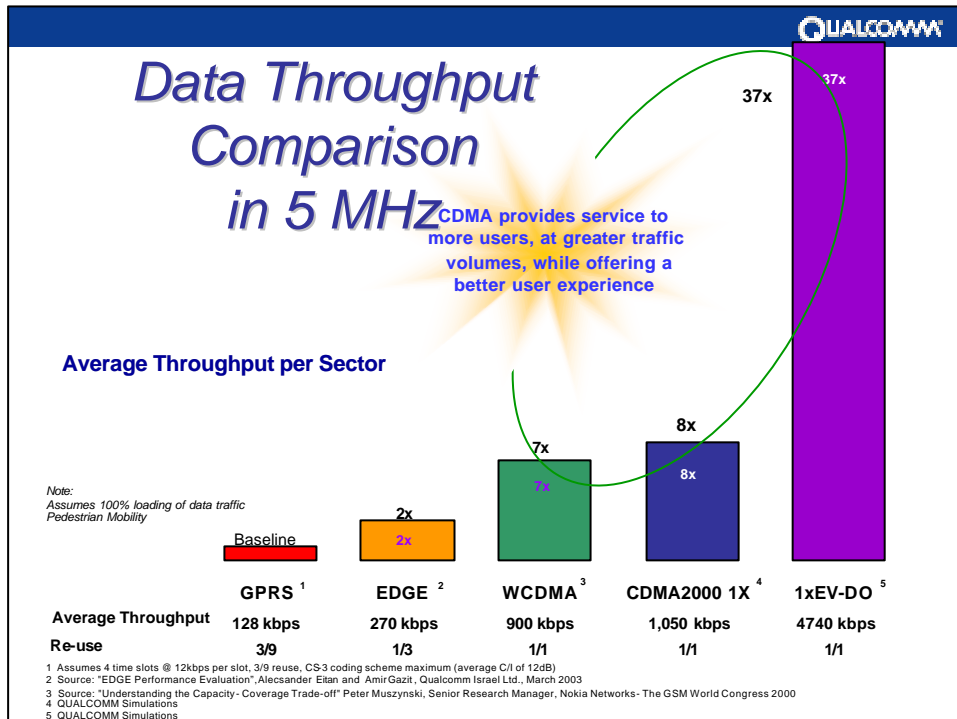
(Erlangs per Sector)

Notes:
Assumes 100% loading of voice traffic
2% GOS for all calculations

Baseline



1 Source: "GSM AMR VOCODERS: FACTS ABOUT INCREASED VOICE CAPACITY" QUALCOMM Internal Paper: Rao Yallapragada
 2 Source: "WCDMA for UMTS", Radio Access for Third Generation Mobile Communications, John Wiley & Sons, LTD., copyright 2000
 3 Source: "The Rise of the 3G Empire", Deutsche Banc Alex Brown, September 2001
 4 Source: "SMV Capacity Increases", Andy Dejaoc (QUALCOMM) - reference: CDG-C11-2000-1016010, October 16, 2000. Assumes EVRC = 35users and 2dB power control factor
 5 Source: "Further Capacity Improvements in CDMA Cellular Systems", QUALCOMM Inc. Roberto Padovani (Calculations based on 1% Blocking)



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CDMA Advantages Introducing a New Platform for Offering Voice and Data

Bigger Cells

- In rural deployments in markets such as Australia, CDMA has demonstrated coverage in excess of 90 Km
 - Due to system timing constraints, these ranges are not possible using GSM

Higher Voice Capacity

- 4 to 5.5 Times Voice Capacity

Higher Data Rates

- Peak rates of 2.4 Mbps possible, commercially supports ~500 to 700 kbps average

Fewer CDMA base stations are required, leading to lower CAPEX and OPEX

Evolution of Mobile Services

Technology and Spectrum/Cost Efficiencies
Make New Services Possible

Past

- Mobility for Voice Svcs
- Roaming
- Increased capacity
- Basic Ringtones
- SMS, and basic email

Present

- Polyphonic Ring tones
- Mobile Web Access
- Location-based Services
- Video-On-Demand
- Broadband Access
- PTT
- Video Telephony

Enabled by 3G

- Broadcast Media
- Multimedia
- Telemedicine
- e-Government
- e-Commerce
- e-Education/Training
- Network-based Games



Location-based Services



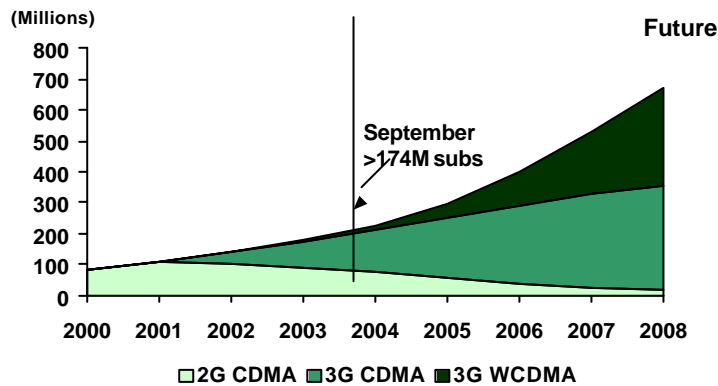
Broadcasting Media

Next Generation CDMA

Now Commercial : CDMA2000® and WCDMA

Over 91M Subscribers, 74 Operators, 37 Countries, 378 Handsets, 43 Vendors

Worldwide CDMA Subscriber Evolution Forecast



Source: Strategy Analytics, April 2003 and www.3gtoday.com as of December 2003, CDG September 2003

CDMA2000 1xEV-DO Highlights: Convergence of Voice and Data



- EV-DO stands for Evolution Data Optimized
- 1xEV-DO is a high-performance and cost-effective Internet access solution
- Today systems offering up to 2.457 Mbps forward link and 153.6 Kbps reverse link peak data rate in 1.25 MHz
- CDMA2000 1xEV-DO Release A approved in April 2004 offering 3.1 Mbps forward link and 1.8 Mbps reverse link

* all figures are per sector/1.25 MHz

What's Next for CDMA2000 1xEV-DO? Further convergence of wireless technologies...

Multimedia Services, Increase Data Rates and System Capacity, and Lower Costs

Quality of Service (QOS)
Different levels of priority

Instant Multi-media
Audio and video together

•Personal Media
–Multiple channels of video/audio

Equalizer
Increase sector capacity 20-60%



Receive Diversity
4X capacity in 1.25 MHz

2x Multicarrier
Two 1xEV-DO carriers simultaneously, doubling data rates

Location-based services (LBS)
High resolution locations

CDMA Deployments

- **CDMA is being deployed in various frequencies – 450 MHz, 800 MHz, 900 MHz, 1900 MHz, 2100 MHz.**
- **Number of CDMA450 systems continues to grow with commercial deployments or trials taking place in many countries including Belarus, Brazil, Indonesia, Romania, Russia, and VietNam.**
- **Over 98 million 3G CDMA subscribers using CDMA2000 and WCDMA systems**

Commercial CDMA2000 Networks (1/3)

Country	Operator	Date	Technology	Frequency Bands
Korea	SK Telecom	Oct. 1, 2000	CDMA2000	800 MHz
Korea	LG Telecom	May 1, 2001	CDMA2000	1800 MHz
Korea	KT Freetel	May 2, 2001	CDMA2000	1800 MHz
USA	Monet	Oct. 21, 2001	CDMA2000	1900 MHz
Romania	Zapp Mobile	Dec. 7, 2001	CDMA2000	450 MHz
Brazil	Telesp	Dec. 10, 2001	CDMA2000	800 MHz
USA	Leap Wireless	Jan. 17, 2002	CDMA2000	1900 MHz
USA	Verizon Wireless	Jan. 28, 2002	CDMA2000	800 and 1900 MHz
USA	MetroPCS	Feb. 1, 2002	CDMA2000	1900 MHz
Canada	Bell Mobility	Feb. 12, 2002	CDMA2000	800 and 1900 MHz
Japan	KDDI	Apr. 1, 2002	CDMA2000	800 MHz
Puerto Rico	Centennial Wireless	Apr. 4, 2002	CDMA2000	1900 MHz
Brazil	Telefonica Celular	Apr. 16, 2002	CDMA2000	800 MHz
Canada	Telus Mobility	June 3, 2002	CDMA2000	800 and 1900 MHz
New Zealand	Telecom N.Z.	July 22, 2002	CDMA2000	800 MHz
Chile	Smartcom PCS	July 26, 2002	CDMA2000	1900 MHz
USA	Sprint PCS	August 8, 2002	CDMA2000	1900 MHz
USA	Cellular South	Sept. 9, 2002	CDMA2000	800 MHz

*Source: company press releases

Commercial CDMA2000 Networks (2/3)

Country	Operator	Date	Technology	Frequency Bands
Moldova	Interdnestrcom	Sept. 30, 2002	CDMA2000	800 MHz
Israel	Pele-Phone	Oct. 1, 2002	CDMA2000	800 MHz
Colombia	EPM-Bogota	Oct. 2, 2002	CDMA2000	1900 MHz
India	TataTeleservices	Nov. 7, 2002	CDMA2000	800 MHz
Venezuela	Telcel	Nov. 13, 2002	CDMA2000	800 MHz
USA	KiwiPCS (Comscape)	Nov. 14, 2002	CDMA2000	1900 MHz
Venezuela	Movilnet	Nov. 20, 2002	CDMA2000	800 MHz
Canada	Aliant Mobility	Nov. 25, 2002	CDMA2000	800 MHz
Canada	MTS Mobility	Nov. 27, 2002	CDMA2000	1900 MHz
Indonesia	Telecom Flexi	Dec. 1, 2002	CDMA2000	800 MHz
Australia	Telstra	Dec. 1, 2002	CDMA2000	800 MHz
Ecuador	Bell South	Dec. 3, 2002	CDMA2000	800 MHz
Panama	Bell South	Dec. 3, 2002	CDMA2000	800 MHz
Russia	Delta Telecom	Dec. 16, 2002	CDMA2000	450 MHz
Mexico	IUSACELL	Jan. 24, 2003	CDMA2000	1900 MHz
Puerto Rico	Verizon Wireless	Feb. 4, 2003	CDMA2000	800 MHz
Belarus	Belcel	Feb. 10, 2003	CDMA2000	450 MHz
Thailand	Hutchison CAT	Feb. 27, 2003	CDMA2000	800 MHz

Commercial CDMA2000 Networks (3/3)

Country	Operator	Date	Technology	Frequency Bands
Nicaragua	BellSouth	Mar. 26, 2003	CDMA2000	800 MHz
Dominican Republic	Centennial Dominicana	Mar. 27, 2003	CDMA2000	1900 MHz
China	China Unicom	Mar. 28, 2003	CDMA2000	1900 MHz
Canada	Sasktel Mobility	April 10, 2003	CDMA2000	800 MHz
Columbia	BellSouth	April 15, 2003	CDMA2000	800 MHz
Brazil	Giro (Vesper)	May 01, 2003	CDMA2000	800 MHz
India	Reliance Infocomm	May 1, 2003	CDMA2000	800 MHz
Russia	SOTEL-Video	May 10, 2003	CDMA2000	450 MHz
India	Garuda 1X	May 19, 2003	CDMA2000	800 MHz
Guatemala	BellSouth	May 20, 2003	CDMA2000	1900 MHz
USA	Midwest Wireless	June 16, 2003	CDMA2000	1900 MHz
Vietnam	S-Fone	Jul. 01, 2003	CDMA2000	800 MHz
Taiwan	APBW	Jul. 29, 2003	CDMA2000	800 MHz
Guatemala	PCS	Jul. 15, 2003	CDMA2000	1900 MHz
Chile	BellSouth	Aug. 11, 2003	CDMA2000	1900 MHz
Russia	MCC	Nov. 1, 2003	CDMA2000	450 MHz
Peru	Telefonica Moviles	Dec. 1, 2003	CDMA2000	800 MHz
Ecuador	Telecsa	Dec. 2, 2003	CDMA2000	1900 MHz

India's Regulatory Reform

- *The Telecom Regulatory Authority of India (TRAI) adopted the concept of unification of both fixed and mobile services under a Unified License. The recommendations of TRAI were accepted by the Government making it a part of the telecom policy in October 2003. This policy change entitled all fixed line operators to move to a Unified License by depositing a certain entry fee and thereby being able to offer both fixed and mobile services on the CDMA platform.*
- *Permitting move from fixed to mobile offerings, CDMA technology in India have contributed to overall subscriber growth in the country – growing from 135,000 subscribers in January 2002 to more than 8 million as of January of 2004.*
- *The Government has made significant progress in removing unnecessary regulatory distinctions in the wireless industry by introducing the Unified License. This decision offers a good example of the importance and impact regulatory and policy issues can have on a country's overall economy and is a model for other countries in the region.*

Guidelines from APEC on Convergence

- Principle One: Establish regulatory and market structures that provide users with choices, enable suppliers of telecommunication services to extend their business activities, and implement competitive safeguards for the market to grow.
- A liberalized telecommunications market is critical to accommodate converging technologies and services.

Guidelines (con.)

- Principle Two:
 - Establish open dialogue with industry to gain greater insight into prospects for or markets where convergence may be occurring and to aid regulators in gathering information to determine trends towards convergence.

Guidelines (con.)

- Principle Three:
 - Exert caution in assuming current regulatory rules applied to dominant providers or monopolies can be applied in converging markets

Guidelines (con.)

- Principle Four :
 - Given fluidity of convergence, regulators should be flexible in their policy approaches to address convergence and be able to modify their rules without facing overly burdensome procedures

Guidelines (con.)

- Principle Five :
 - Measures should be adopted that rely on continual review of the regulatory authority including its organizational structure and existing rules

Guidelines (con.)

- Principle Six :
 - When dealing with convergence regulators should avoid interim solutions that attempt to achieve regulatory commonality at the costs of precluding consumers of obtaining services at affordable rates

Regulatory Options Report

- Principle Seven:
 - As new players in a market begin to compete with existing/dominant providers, regulators should commence deregulating the dominant provider

Thank you!