3rd Generation Mobile Wireless

A Presentation on the Opportunities and Challenges of Delivering Advanced Mobile Communications Services

Warsaw, Poland

October 2, 2001

Contents

CDMA Development Group

Charter

To lead the rapid evolution and deployment of CDMA-based systems, based on open standards and encompassing all core architectures, to meet the needs of markets around the world in an emerging, information-intensive environment

Information Distribution

- Conferences
- Newsletter
- Website
- Etc.

Technical Service Development

- Wireless Local Loop
- Advanced Systems
- Evolution
- Etc.

Deployment Assistance

- Time-to-Market
- Int'l Roaming
- Interoperability
- Etc.

Membership

The CDG is a consortium of 110 member companies from around the world. Members are involved in many aspects of CDMA system deployment and support.

- ***Operators***
- ***Subscriber Equipment***
- ***Components and Subsystems***
- ***Network Infrastructure***
- ***Network Enhancement/ Optimization***
- ***Network Interface & Access***

3rd Generation Mobile Wireless Market Summary

A number of factors are driving the wireless Internet and wireless information...

Societal trends

- Emerging computer literate society
- Increasing travel and mobility
- Desire for entertainment
- Need for enhanced productivity

Technology enablers

- High speed, cost effective mobile systems
- Integrated multimedia applications
- Small, powerful, application-rich user devices

Market trends

- Rapid growth in mobile
- Rapid Internet adoption
- Accelerating pace of electronic commerce (aka M-commerce)
- Rapid growth of portable and palmtop computers

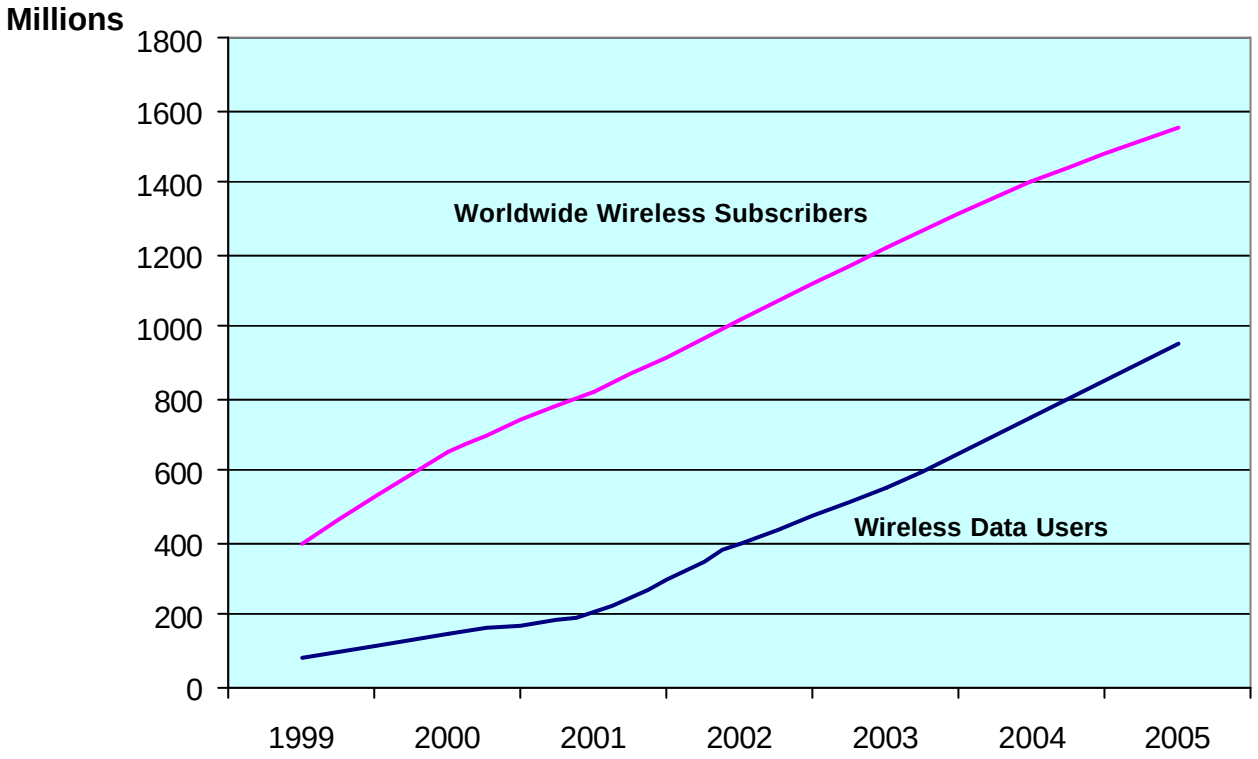
…enabling exciting vertical and horizontal applications

Enterprise Workgroup	Mobile Professional	Consumer
		
• Specific IT Applications • Business Verticals • Group Chat, Email, Instant Messaging • Wide Area Intranet • Mobile Workforce Management (dispatch), Telematics	• Business General • Horizontal Business • Internet / Intranet • Email, Chat, Instant Messaging • Personal Information Management	• Personal Interest • Horizontal Consumer • Internet • Entertainment, Infotainment, Lottery, Sports • Navigation, Map Search • Electronic Cash (M-Commerce)

Weather, Travel, News, Gaming, Stock Quotes

Email, Intranet Access, Legacy Applications Access, Vertical Applications

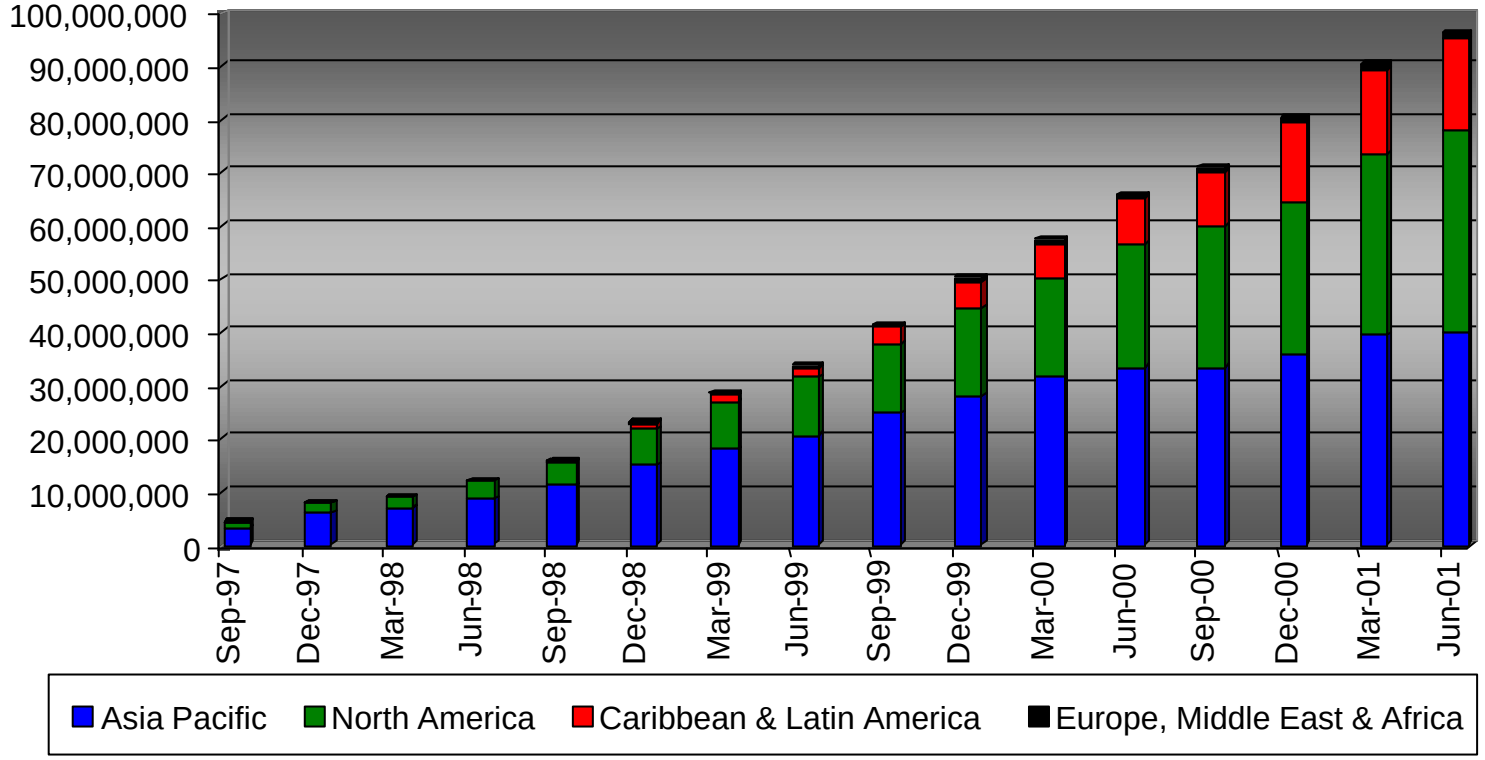
Access to the Internet creates enormous opportunity for the wireless industry



Worldwide Wireless Subscribers Source: *The ARC Group, Wireless Internet Report*
Wireless Data Users Source: *EMC Database, 2001*

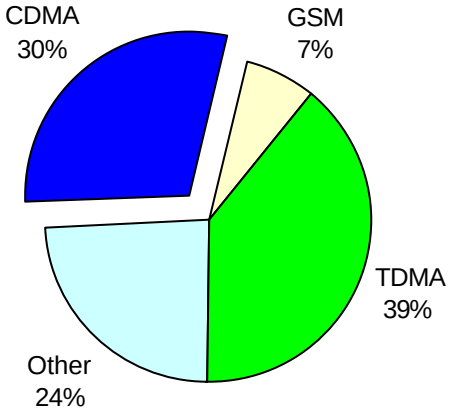
cdmaOne Subscriber Growth History

Worldwide total: 96,313,000

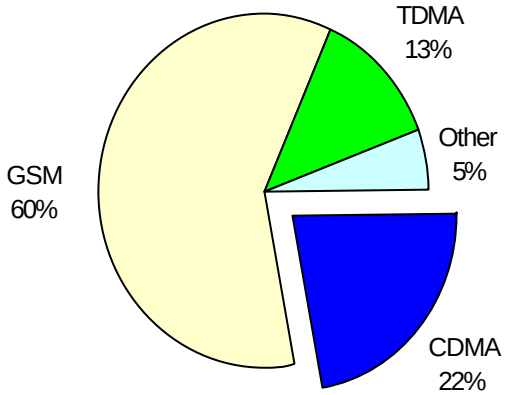


Note: prior to March 1998 the Caribbean and Mexico are included in North America; after March 1998 they are included in Caribbean & Latin America

Looking more closely at wireless technologies, CDMA continues to grow share and is becoming a key enabler of the wireless Internet



Americas Market Share: Subscriptions June 2001



World Market Share: Subscriptions end of 2005

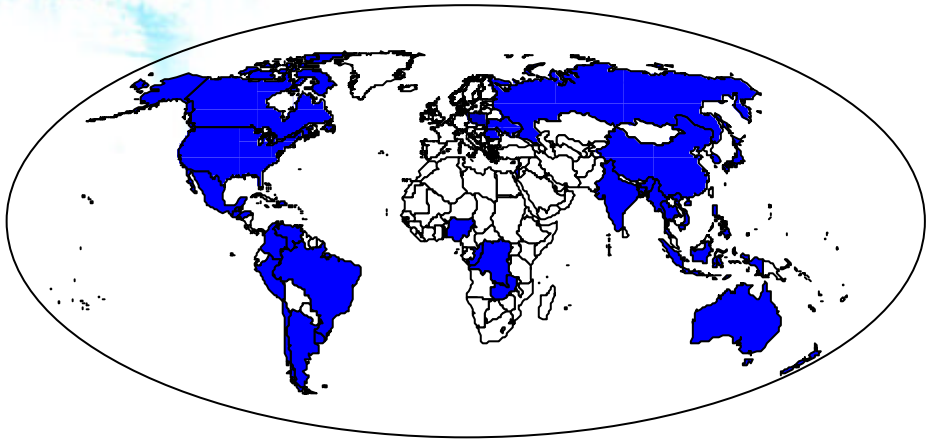
CDMA in the Americas accounted for 30% of the wireless marketplace while GSM was just 7%

Worldwide, CDMA will account for 22% of the wireless marketplace

Source: EMC Database, June 2001

CDMA (2G and 3G) will very likely be the predominant global wireless technology

Going forward, addressable population will be a key driver of technology market share



Countries with Commercial CDMA Networks

Countries able to deploy CDMA2000 in existing **cdmaOne** networks represent **over 4.18 billion** pops

Sources: CIA World Factbook, EMC World Cellular Database June 2001, CDG 2001, Public Announcements

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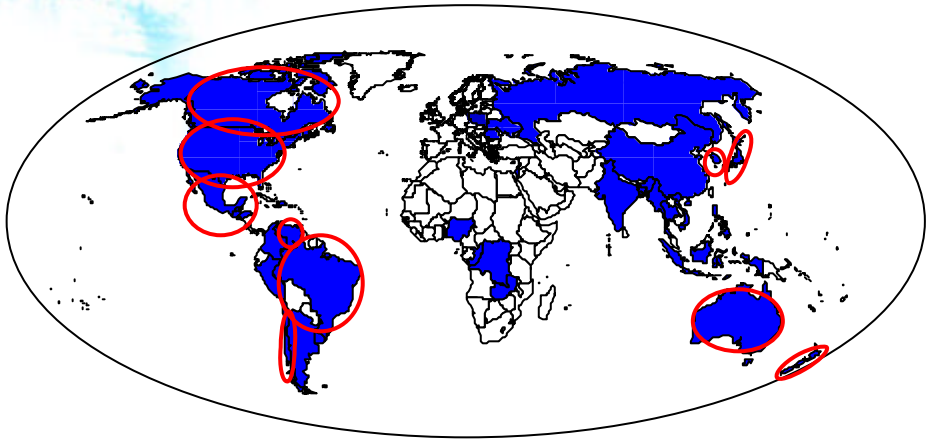

Countries with Commercial CDMA Networks

Countries with CDMA2000 Networks, Plans or Trials

Countries able to deploy CDMA2000 in existing **cdmaOne** networks represent **over 4.18 billion** pops

Countries announcing CDMA2000 deployments represent **806.5 million** pops

Sources: CIA World Factbook, EMC World Cellular Database June 2001, CDG 2001, Public Announcements

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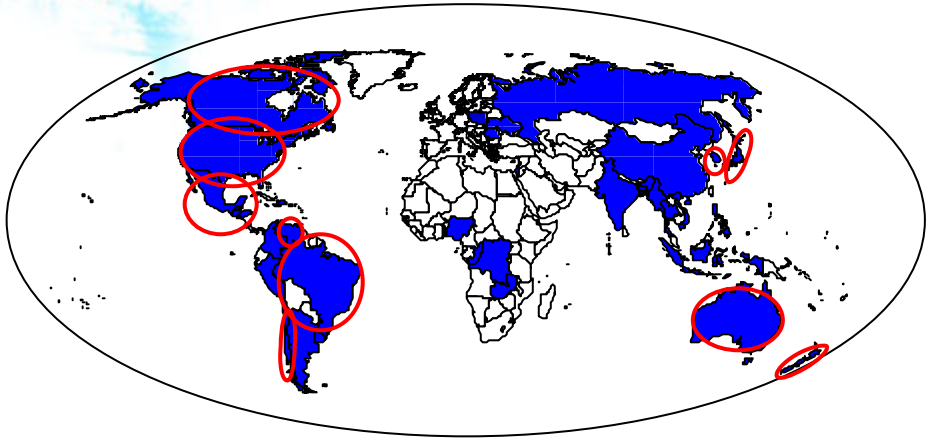

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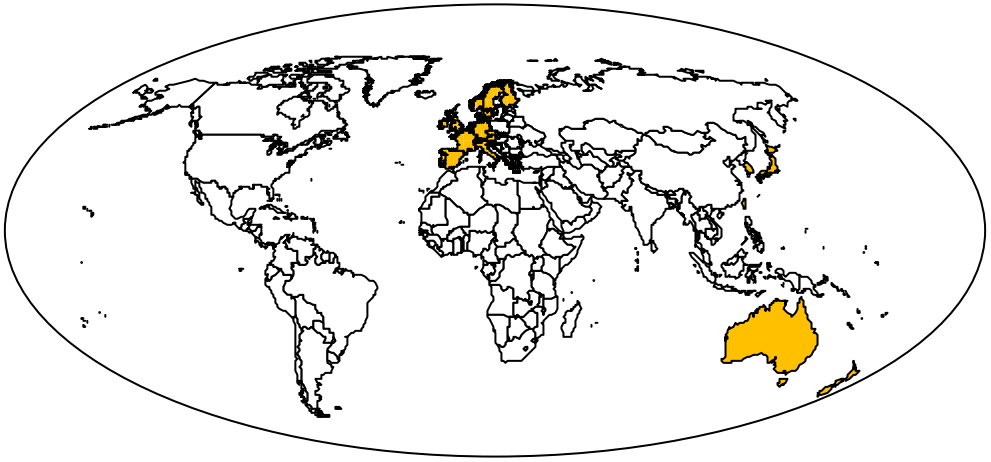
Countries with Commercial CDMA Networks

Countries with CDMA2000 Networks, Plans or Trials

Countries that have awarded UMTS spectrum represent only 607 Million pops:

J-WCDMA = 175 million
(Japan, Korea)

UMTS = 432 million
(Western Europe/Asia)



Countries with **UMTS** Licensed Spectrum at 2.1 GHz

Sources: CIA World Factbook, EMC World Cellular Database June 2001, CDG 2001, Public Announcements

3G Drivers and Key Considerations

Certain factors are critical for making 3G a success

- Solutions that are globally recognized and meet adopted, international standards
- Solutions that work, enable quick time-to-market and meet industry expectations
- Spectrum flexibility, efficiency and cost
- Capacity to meet future demand
- Seamless and cost effective migration from today's systems
- Broad range of competitively-priced devices for end users (consumers, enterprises)
- Broad range of applications for end users

This section addresses each of these success factors

✓	Solutions that are globally recognized and meet adopted, international standards
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The ITU formed the IMT-2000 program to coordinate standards to meet these needs

IMT-2000 Terrestrial Radio Interfaces

IMT-2000 CDMA Direct Spread	IMT-2000 CDMA Multi-Carrier	IMT-2000 CDMA TDD	IMT-2000 TDMA Single Carrier	IMT-2000 FDMA/ TDMA
WCDMA (UMTS)	CDMA2000	UTRA TDD & TD-SCDMA	UWC-136/ EDGE	DECT

3G CDMA

Although there are five terrestrial standards, most of the attention and energy in the industry has been toward the CDMA standards

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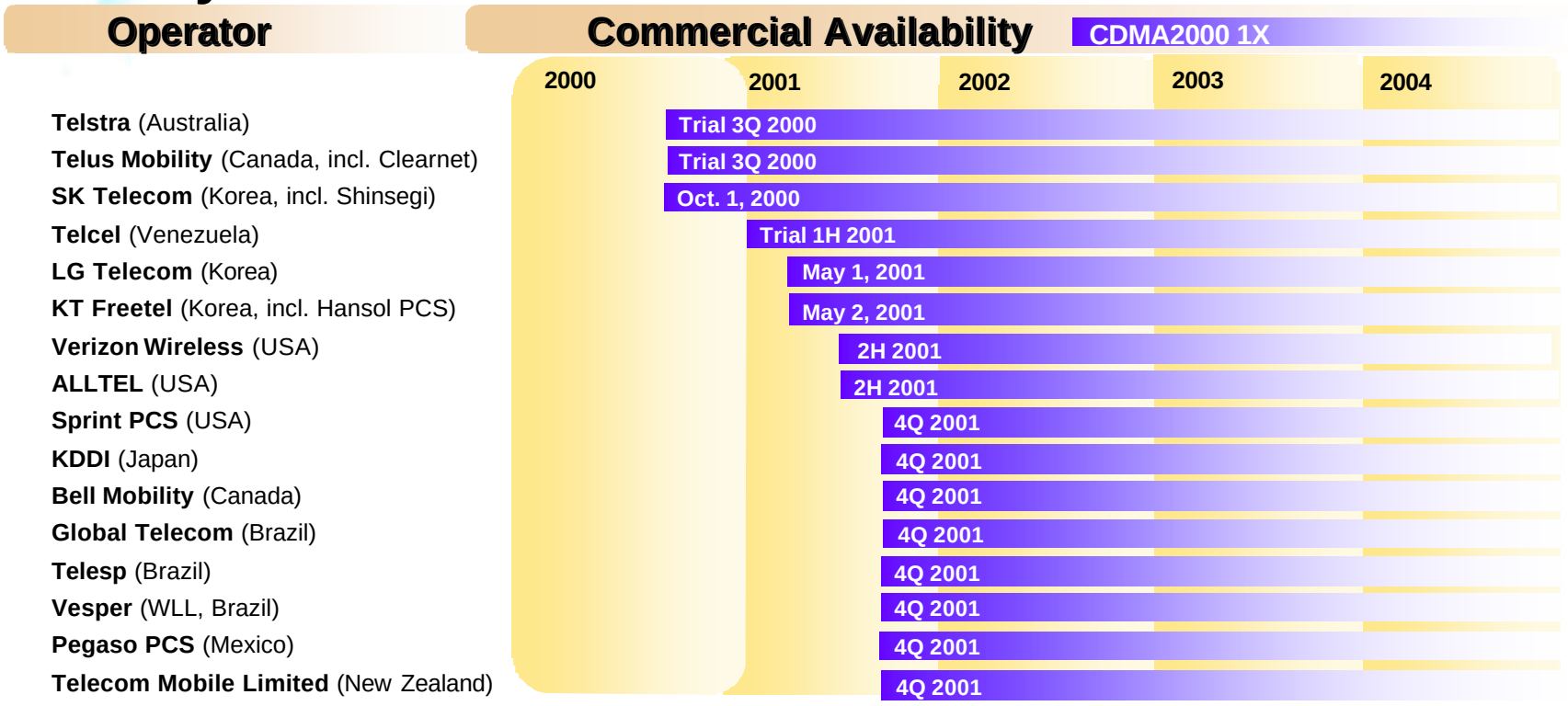
More importantly, 3G services are available today with CDMA2000



Sources: Company Press Releases and Statements, News Articles and Analyst Reports

Three commercial networks
- More than 1 million subscribers
- 5,000 base stations
- Data speeds 150 Kbps

Thirteen additional networks in Asia, North and South America will be launched in 2001

Migration to 3G in Central and Eastern Europe

There are over 13 countries in Central and Eastern Europe that have operational analogue NMT 450 systems in the 450-470 MHz band

Since 1999, the NMT Association has conducted studies of the technology options available to NMT 450 operators to evolve their systems from analogue to digital, and has recommended both GSM 400 and cdma450 solutions

To date, several NMT operators have announced trials and/or deployment of cdma450 systems:

- In Romania, Telemobil is in the process of upgrading its NMT 450 network to cdma450, and has announced plans to offer commercial services by the end of 2001
- In Russia, Moscow Cellular (MCC) is in the process of conducting a trial of cdma450 equipment on its NMT 450 network
- Operators in numerous other Central and Eastern European countries are in discussions with equipment providers to digitize their networks using cdma450 equipment
- These cdma450 trials and deployments are being supported by CDMA equipment vendors Lucent Technologies and Curitel (formerly Hyundai)

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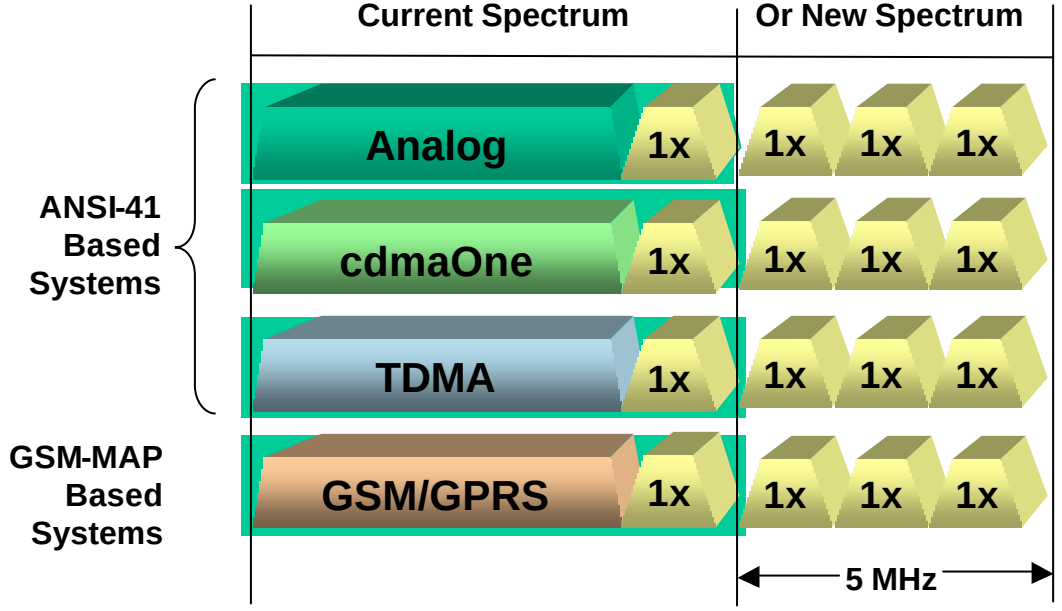
Spectrum flexibility is a key consideration for any technology...

CDMA2000 3G services operate in a small amount of spectrum

- Effective use of spectrum, significant to ALL operators
- Effective both in overlay or greenfield deployments

CDMA2000 is not constrained to only the IMT-2000 band. Defined to operate in existing and IMT spectrum:

- 450 MHz
- 700 MHz
- 800 MHz
- 900 MHz
- 1700 MHz
- 1800 MHz
- 1900 MHz
- 2100 MHz



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The CDMA2000 evolution path is flexible and future-proof

- **Voice**
- **Data up to 14.4 kbps**

- **Voice**
- **Data up to 115 kbps**

- **2x increases in voice capacity**
- **Up to 307 kbps packet data on a single (1.25 MHz) carrier**
- **First 3G system for any technology worldwide**

- **Optimized, very high-speed data (Phase 1)**
- **Up to 2.4 Mbps packet data on a single (1.25 MHz) carrier**
- **Integrated voice and data (Phase 2); up to 4.8 Mbps**

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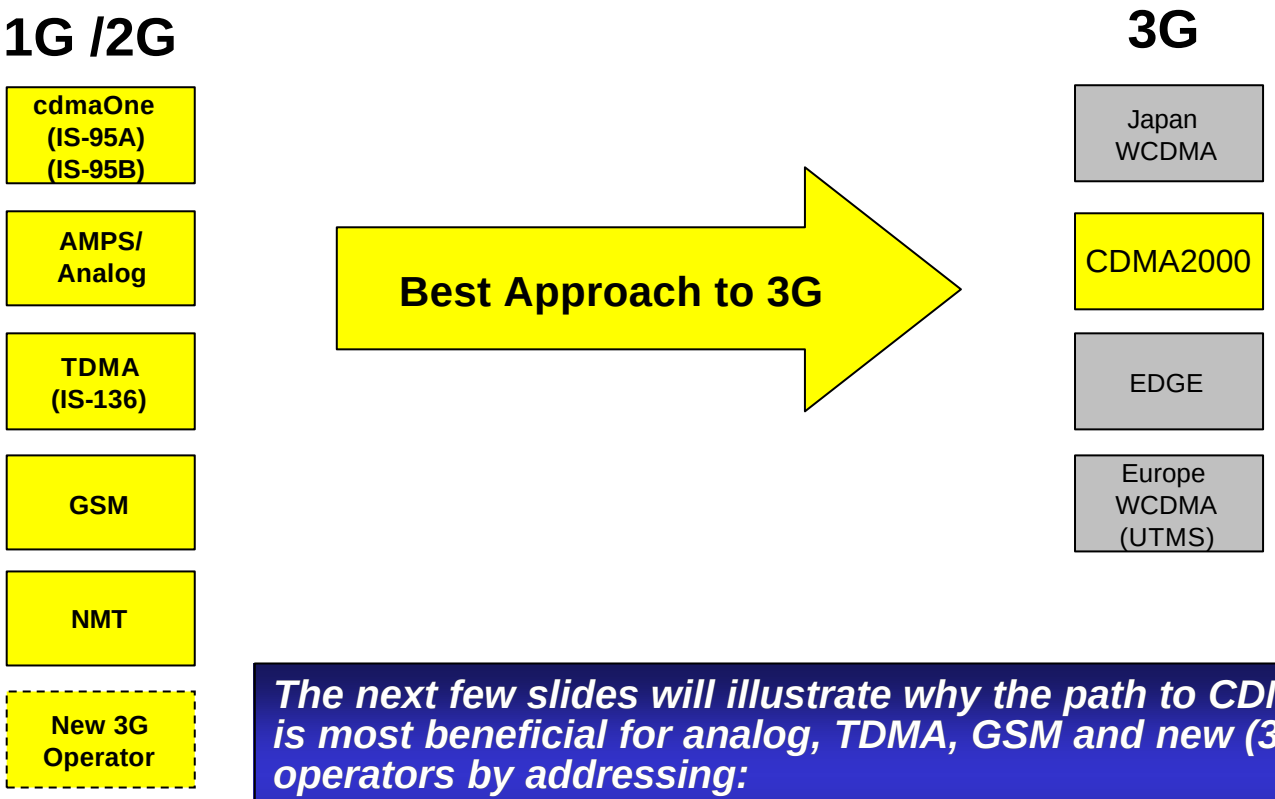
Operators are faced with a few migration alternatives to 3G



The next few slides will illustrate why the path to CDMA2000 is most beneficial for analog, TDMA, GSM and new (3G) operators by addressing:

- ***Basic network architecture***
- ***Ease of migration***

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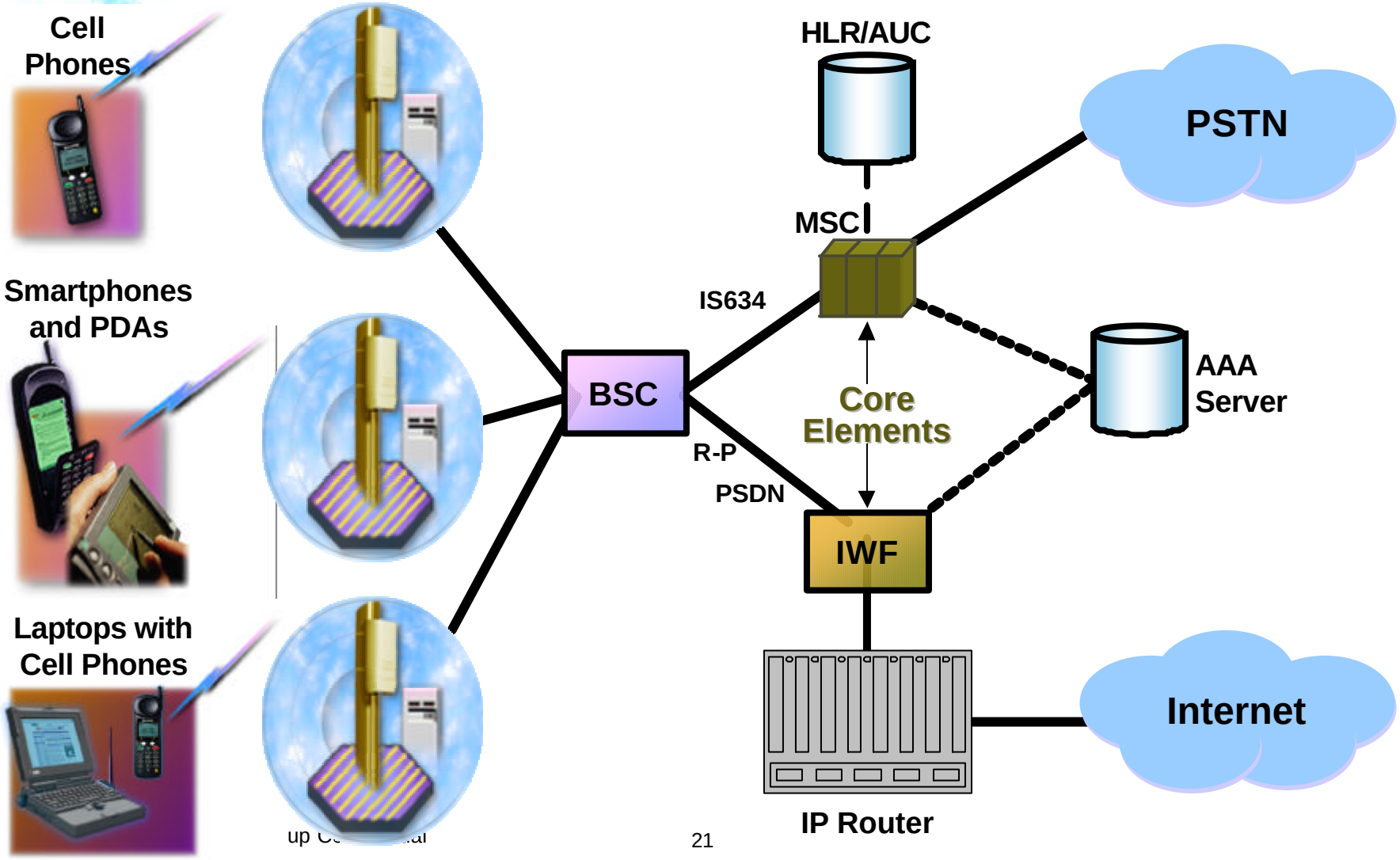
The architecture for CDMA2000 is quite clean



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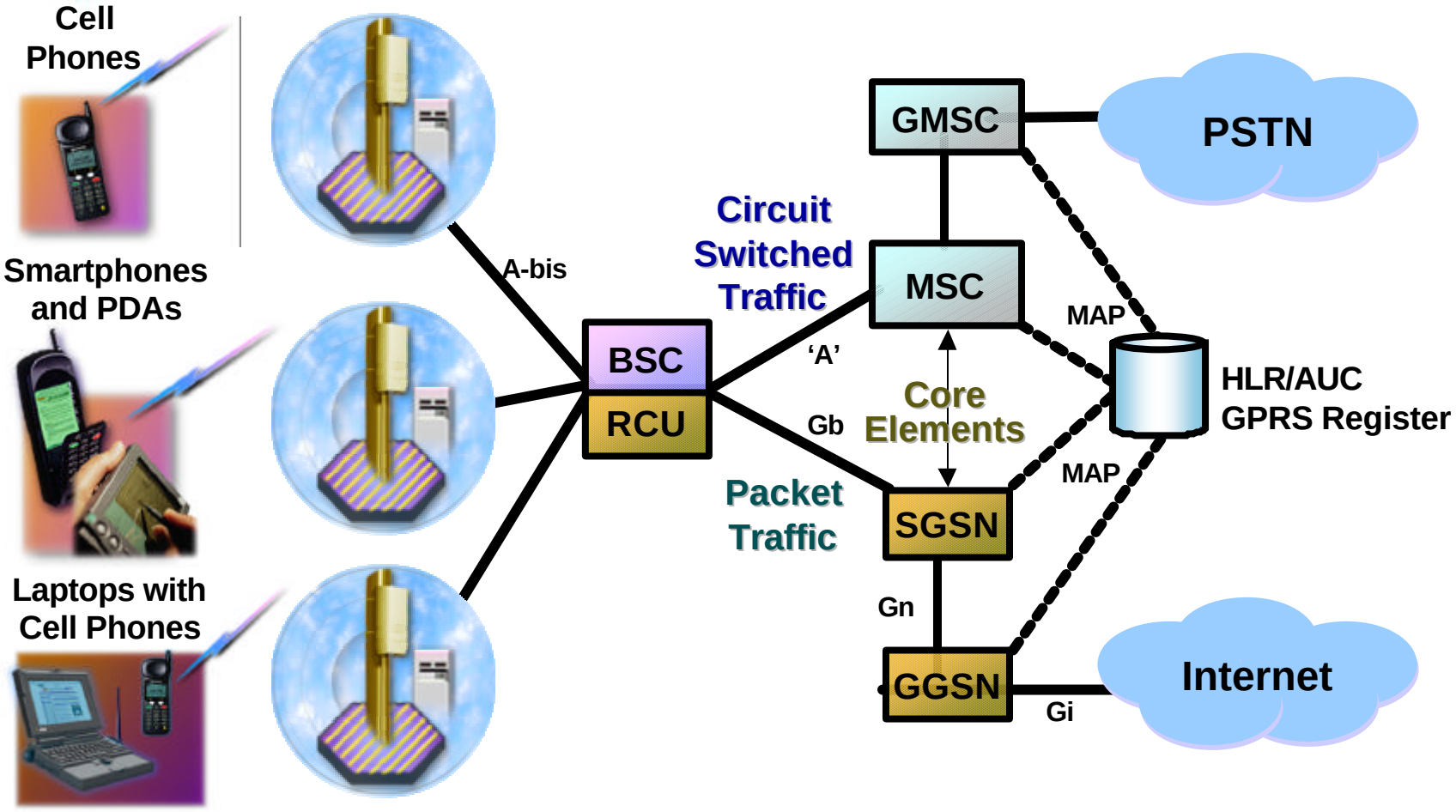
Whereas that for GSM/GPRS/EDGE/WCDMA requires a parallel network of service nodes



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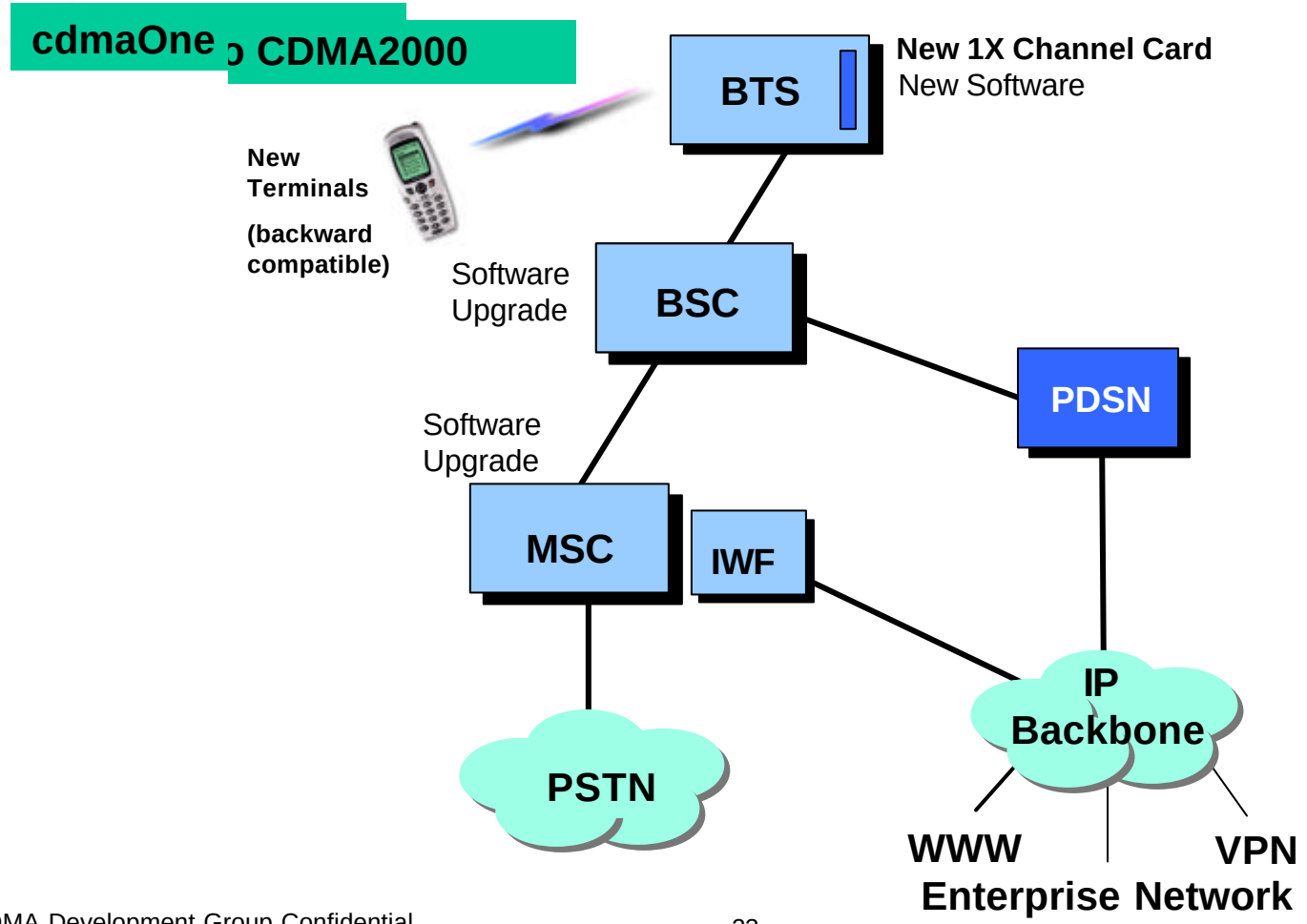
Evolving cdmaOne to CDMA2000 1X is a logical proposition



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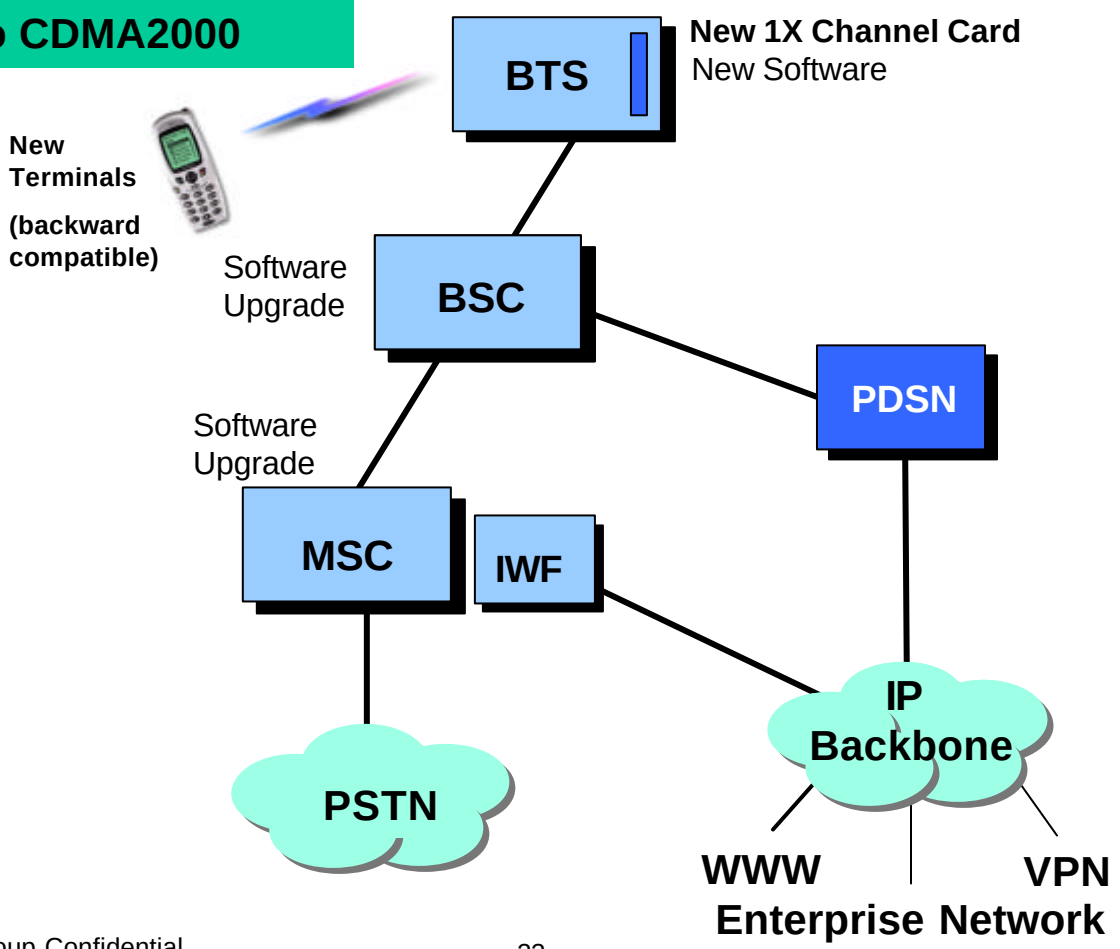
Evolving to CDMA2000



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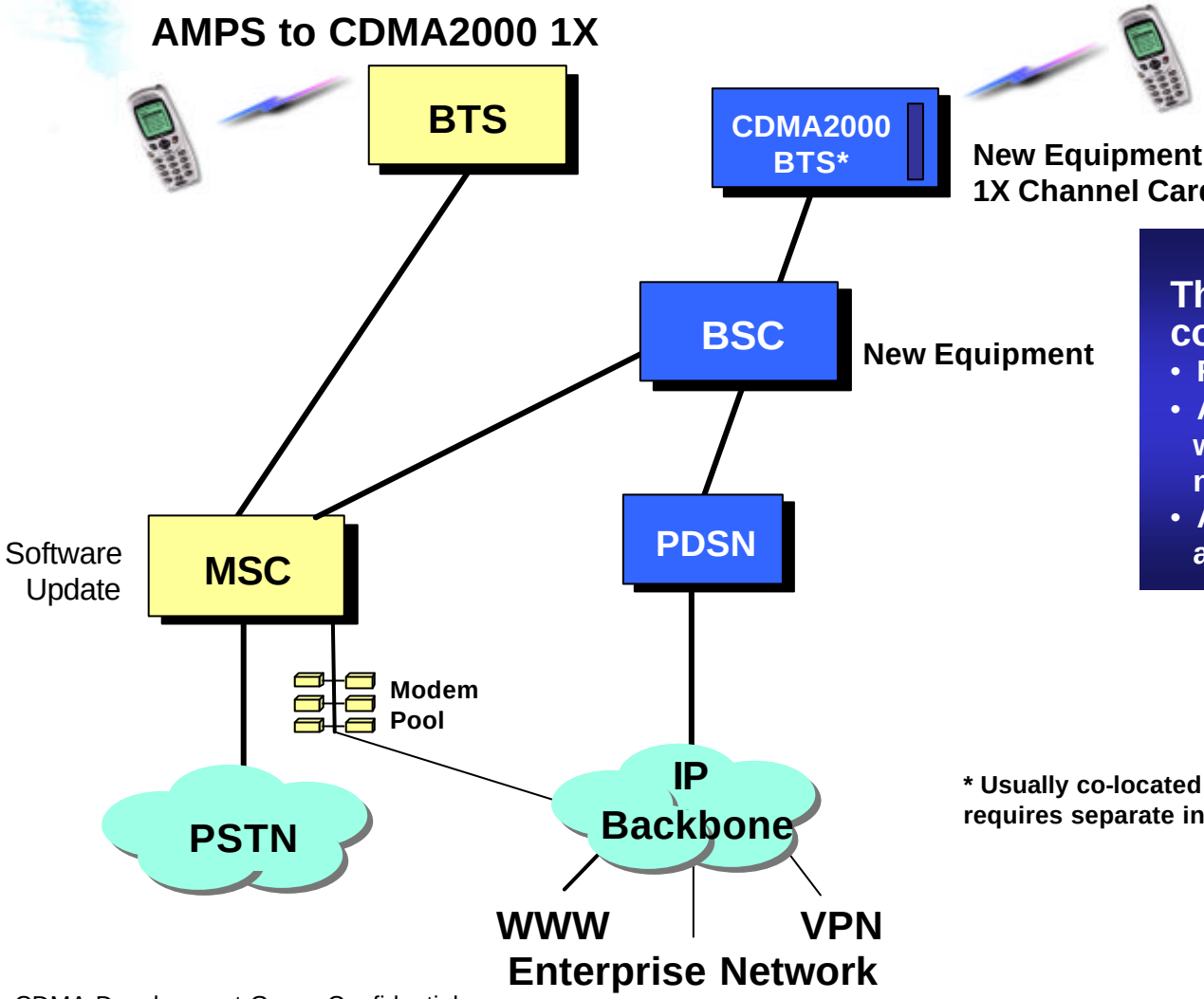
AMPS and TDMA to 3G: Practical solution to CDMA2000

AMPS to CDMA2000 1X



This path is particularly compelling due to:

- Re-use of the core network
- Ability to deploy 3G in-band, without the cost of buying new spectrum
- Ability to deploy 3G in only a small amount of spectrum

*** Usually co-located with AMPS equipment, requires separate interface protocols**

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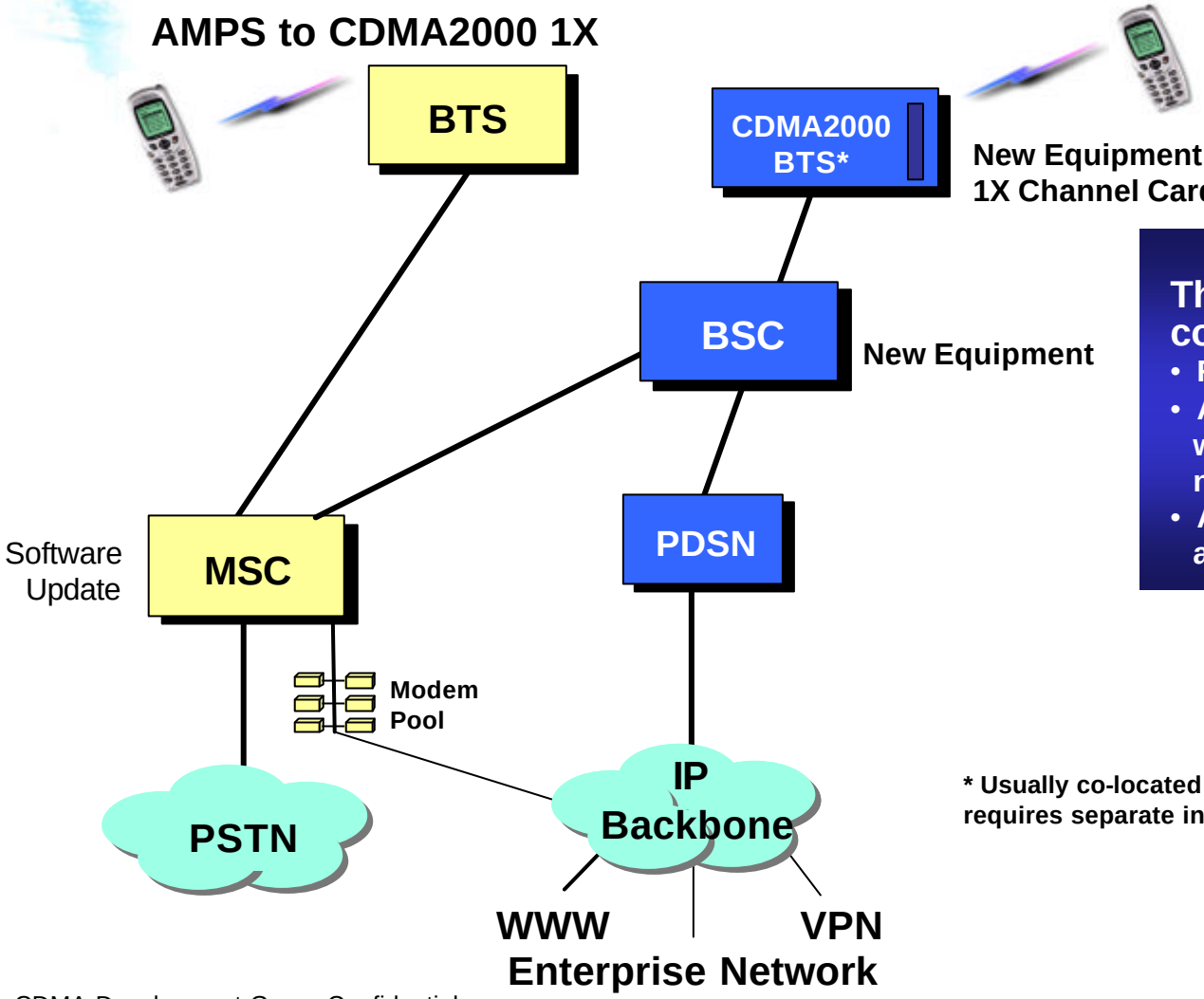

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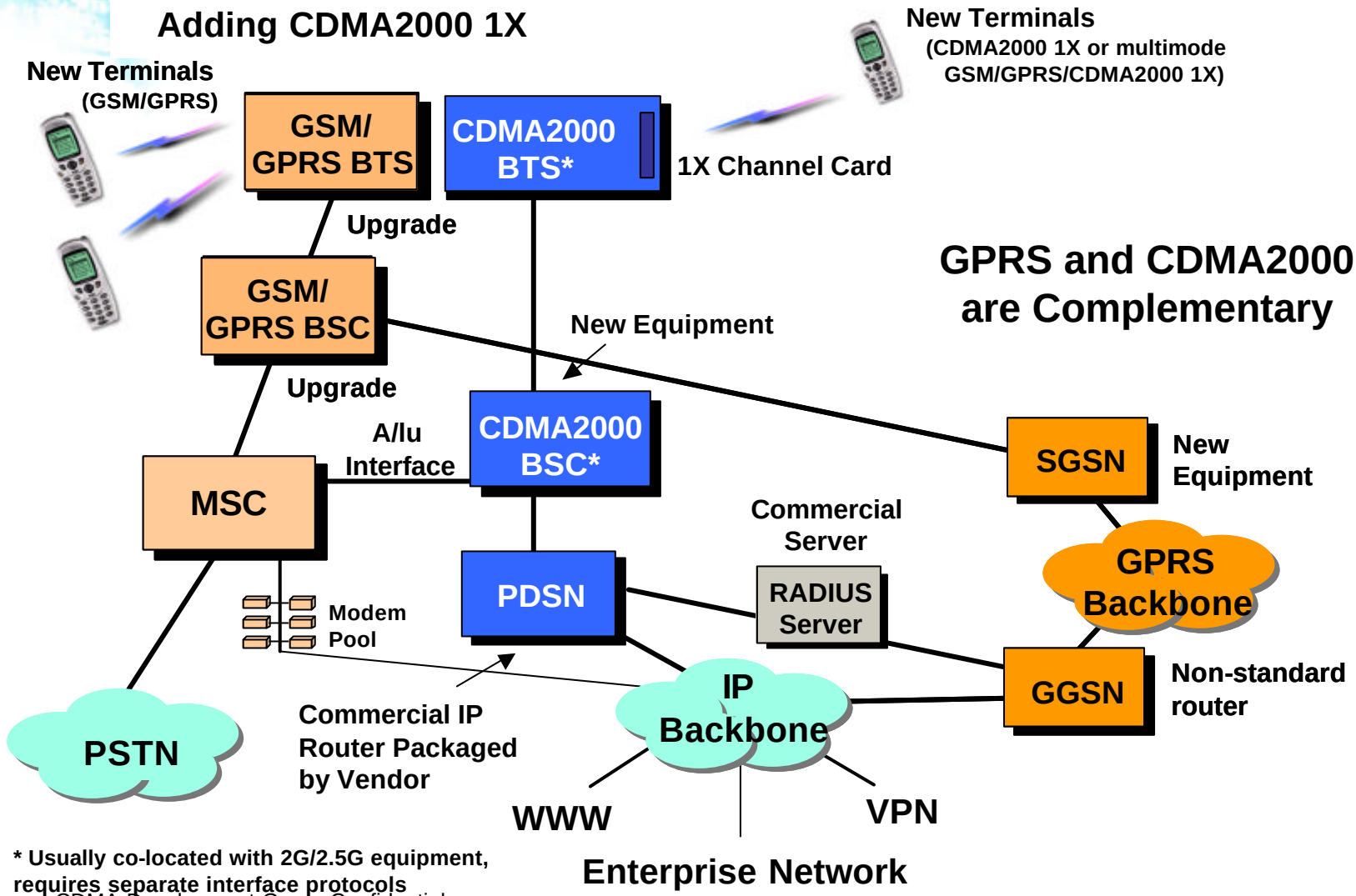
GSM to 3G: Practical solution to CDMA2000



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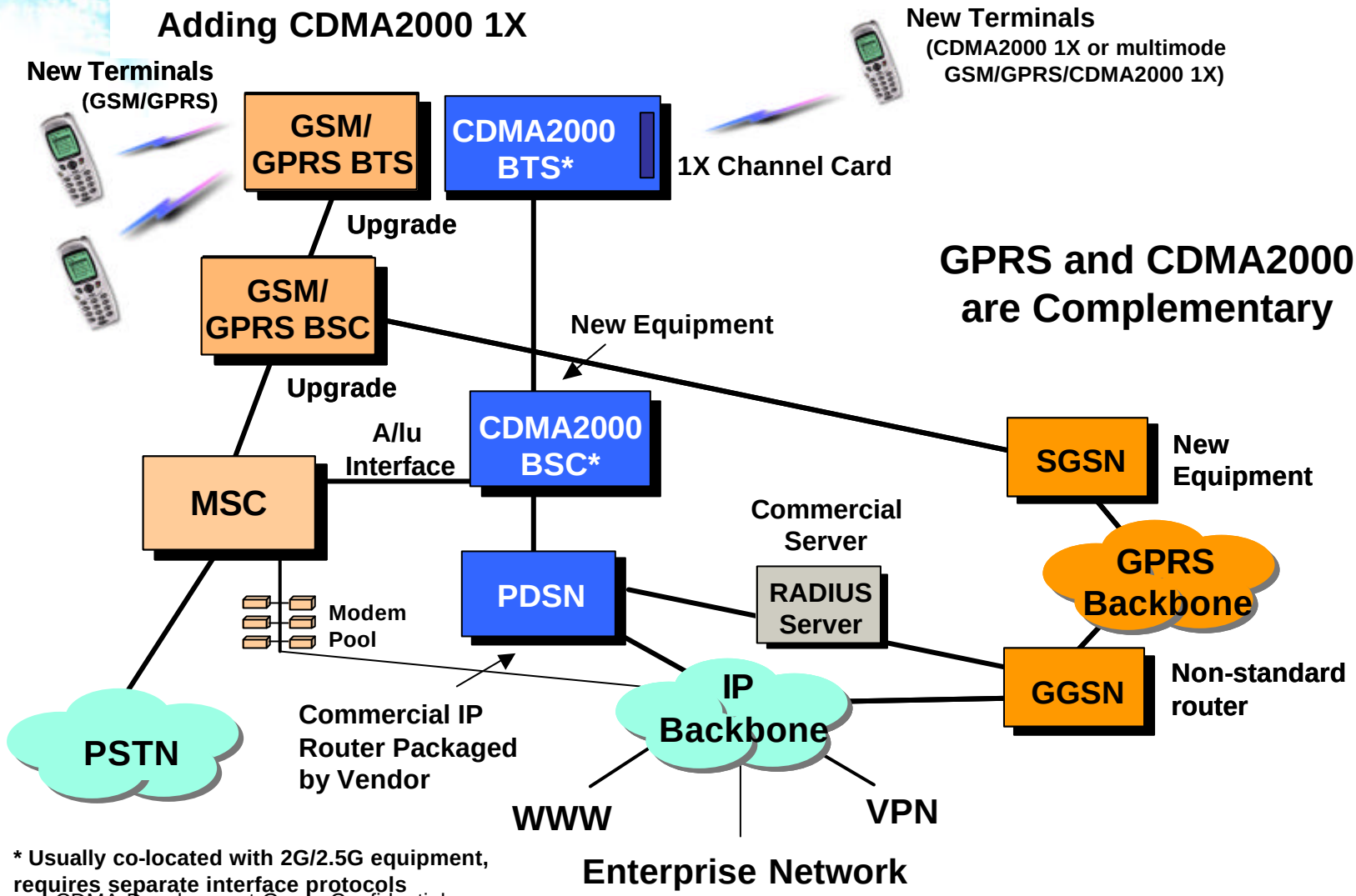

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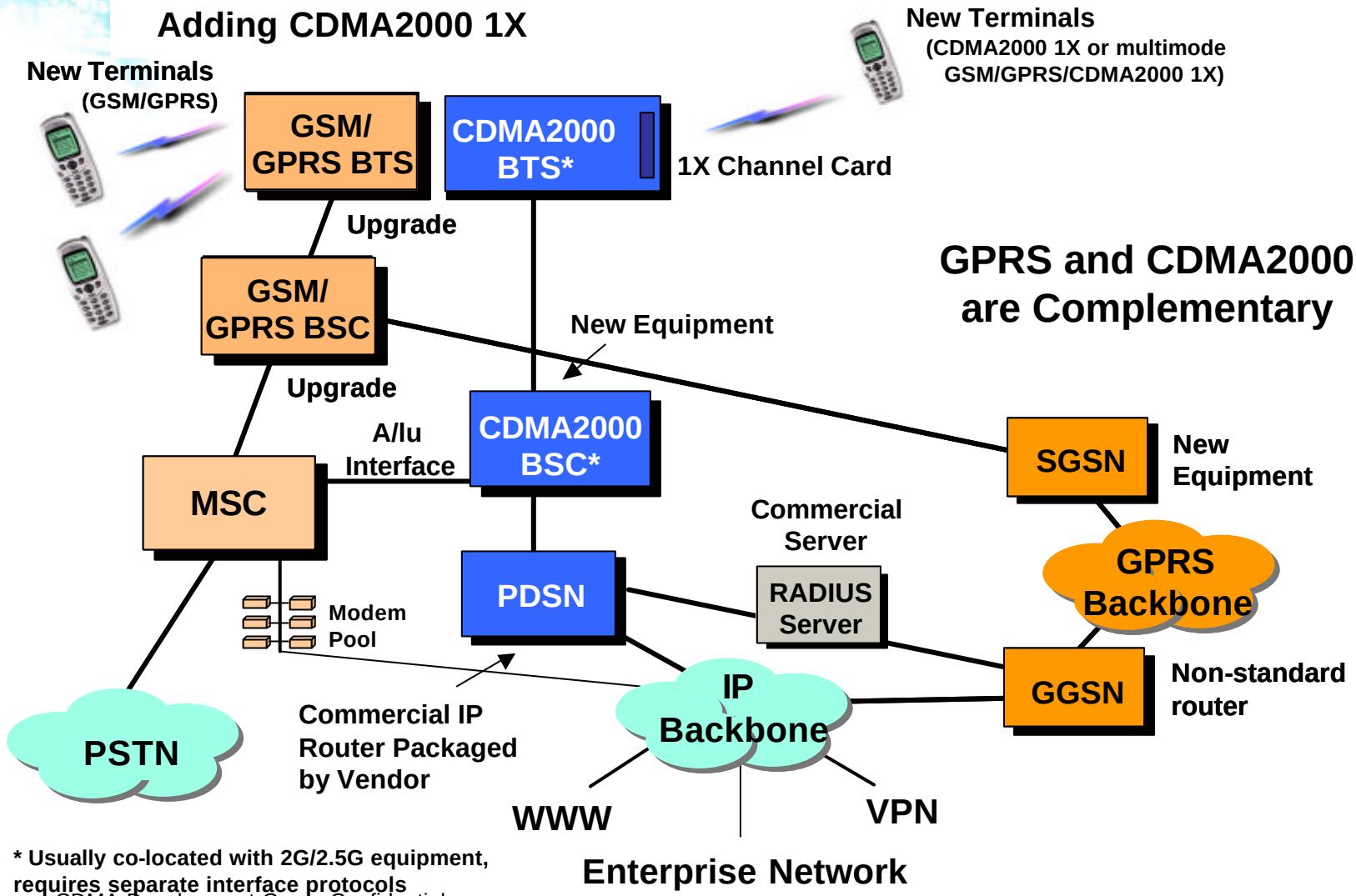

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Multiple CDMA2000 terminal products are already available in the market

Samsung SCH-X100

Samsung SCH-X120

Samsung SCH-X110

LG Electronics Cyber ezx1

Samsung SPH-X1000

SK TeleTech IM-2300

Samsung SCH-X130

Samsung SCH-X200

Hyundai Curitel DD-101

Hyundai Curitel DD-X10

LG Electronics Cyber ex2

LG Electronics CX-300L

Samsung SPH-X2500

SK TeleTech IM-2400

Hyundai Curitel PD-1000

Hyundai Curitel PD-X100

Motorola V671C

Samsung SCH-X2000

Samsung SCH-X210

LG Electronics Cyber X-1

Samsung SPH-X1200

SK TeleTech IM-3100

GTRAN DotSurfer 1X

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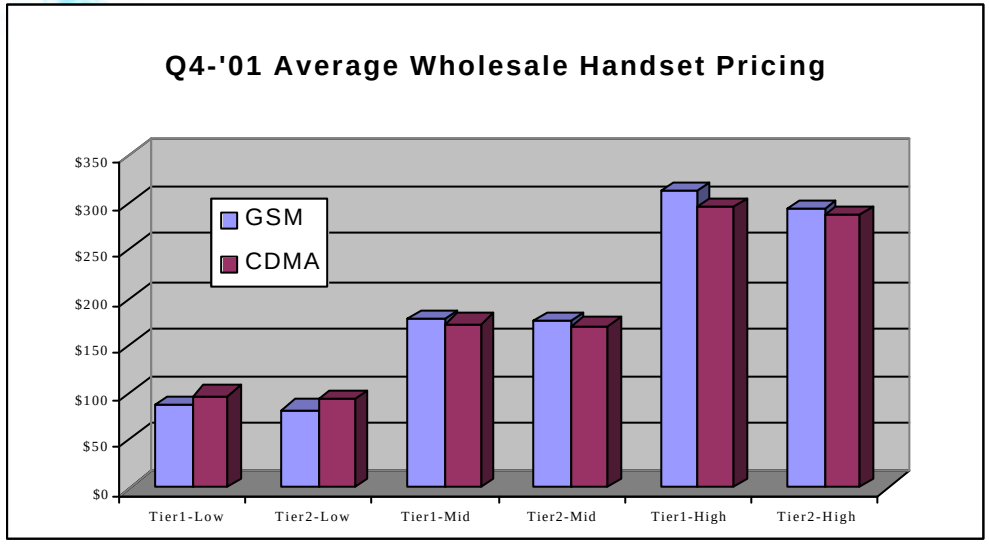
CDMA terminals are reaching price parity with GSM



Source: Gartner Group, April 2001

In a recent study comparing phones from the top tier vendors, CDMA is reaching price parity with GSM and achieving lower prices in some price tiers

Sub-$100 phones are available for cdmaOne and GSM

cdmaOne cost curves and economies of scale directly benefit CDMA2000

Comparison of average unsubsidized wholesale terminal prices from Tier One and Tier Two manufacturers. Grouped by product tier.

	Average*	High-End Smartphone
GSM	$186	Nokia 9210 $1407**
CDMA	$188	Kyocera QCP-6035 $499***

Tier 1 vendors: Perceived by the market as supplying the best overall quality for a specified product at a particular price point. The most important characteristic of a Tier 1 vendor is market share. Since Tier 1 vendors normally have a strong brand, they are typically able to levy a premium for their products.

Tier 2 vendors: Regarded as providing average quality for a specified product at a particular price point. Tier 2 vendors do not obtain a premium for their products and will sell them for a price less than that charged by a Tier 1 vendor, even if product specification were similar.

Source: Wholesale Price Analysis of Wireless Devices Report, Gartner Group, April 2001
**Average Price - Source: Nokia*

***Retail Price - Source: Orange:* *http://www.the order.co.uk/orange_contract/Orange_nokia_9210_contract.asp*

****Retail Price - Source: Verizon Wireless*

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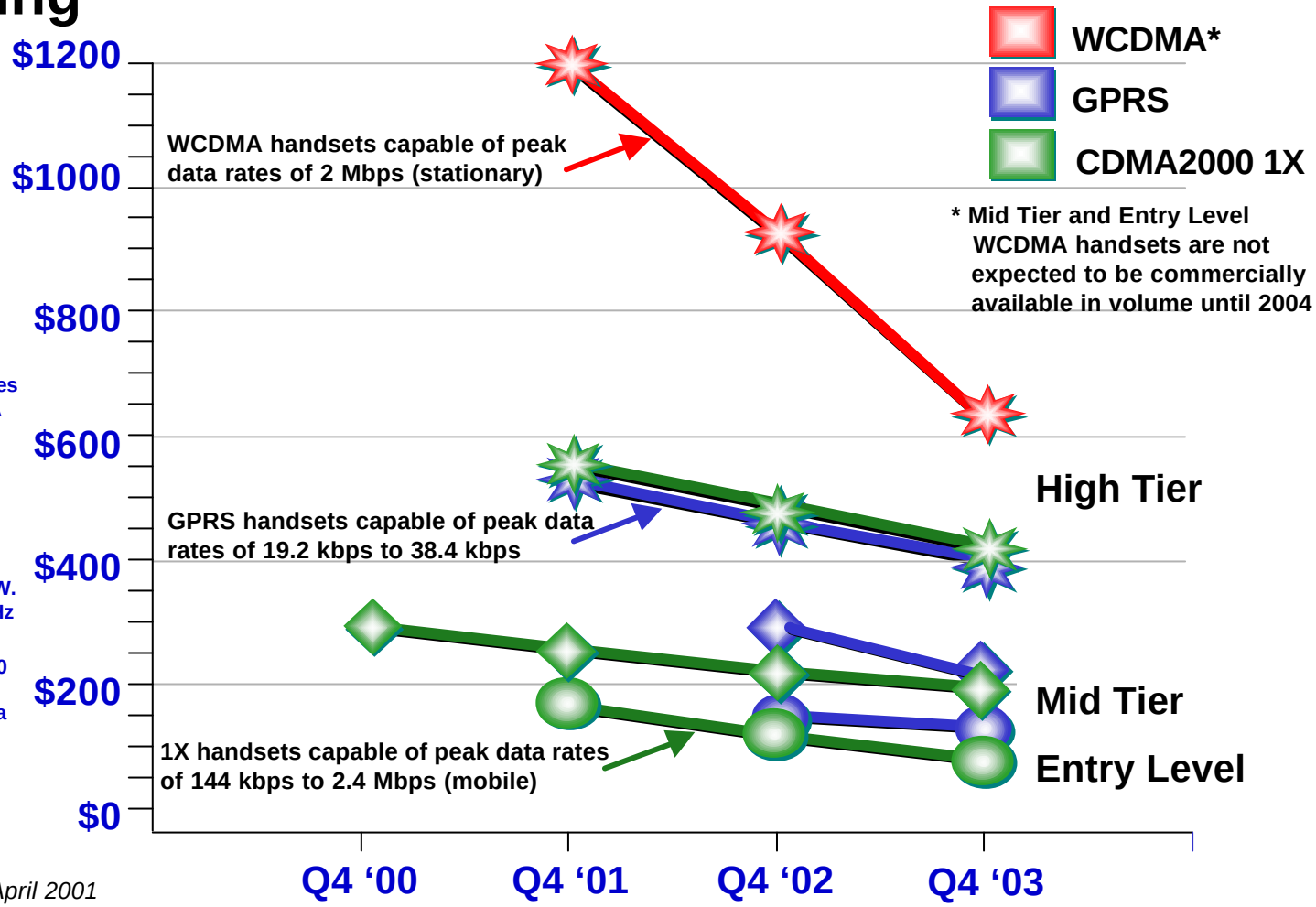
CDMA2000 terminals have a time-to-market advantage that will translate to better economies and pricing



Notes:

1. Average Q4 wholesale pricing for CDMA2000 is based on 300,000 unit shipments.
2. WCDMA pricing is based on smaller volume shipments since Gartner does not expect volume order for WCDMA until after 2003.
3. WCDMA pricing represents single mode 2.1 GHz and multimode dual band terminals for W. Europe and Asia.
4. GSM/GPRS pricing represents 900 MHz and 900/800 MHz terminals for W. Europe and Asia, plus GSM 1900 MHz terminals for N. America.
5. CDMA2000 1X pricing represents 800 MHz and 1.9 GHz, single mode, dual mode and tri-mode handsets for Asia and N. America.

Source: Gartner Group, April 2001

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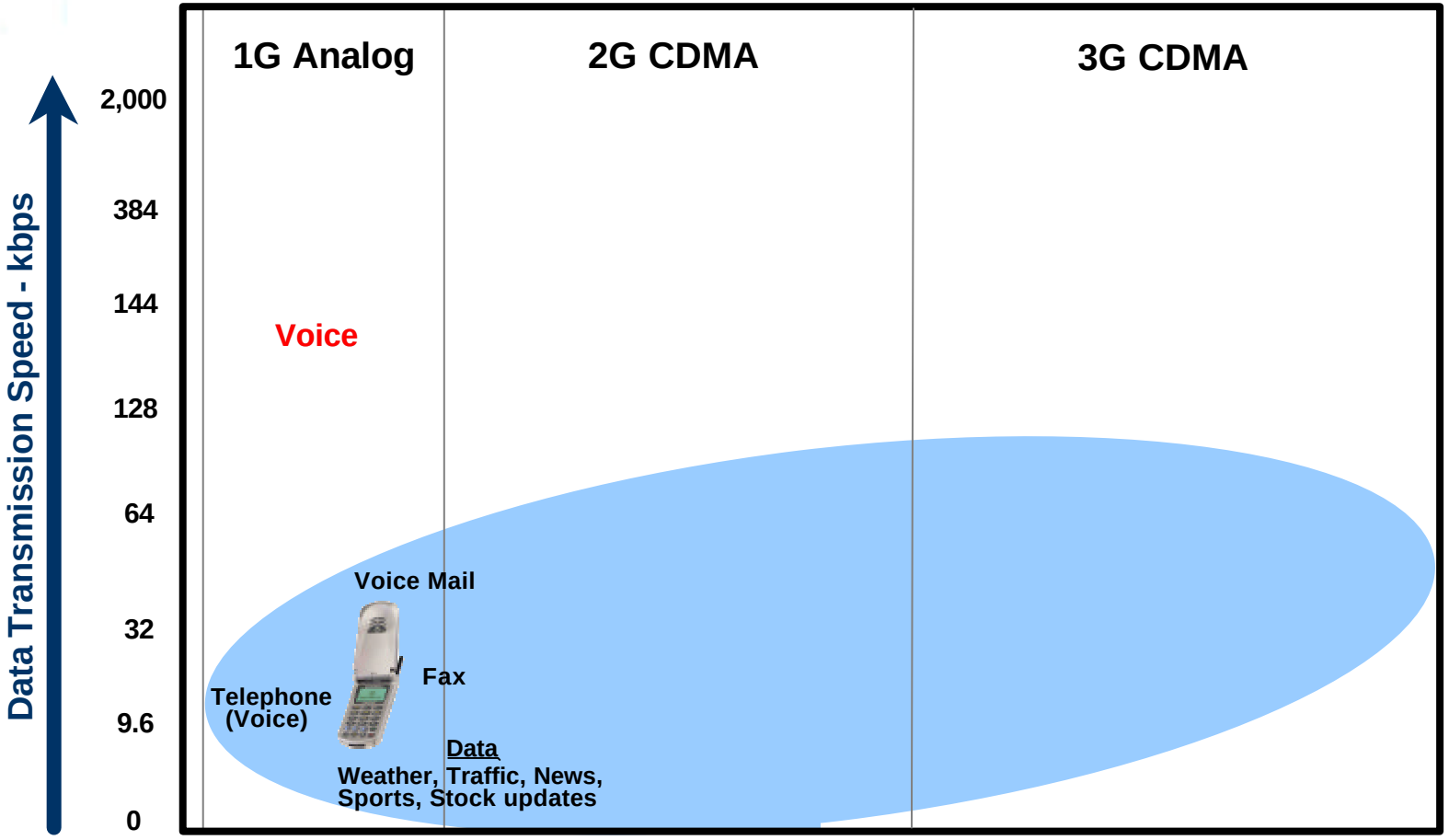
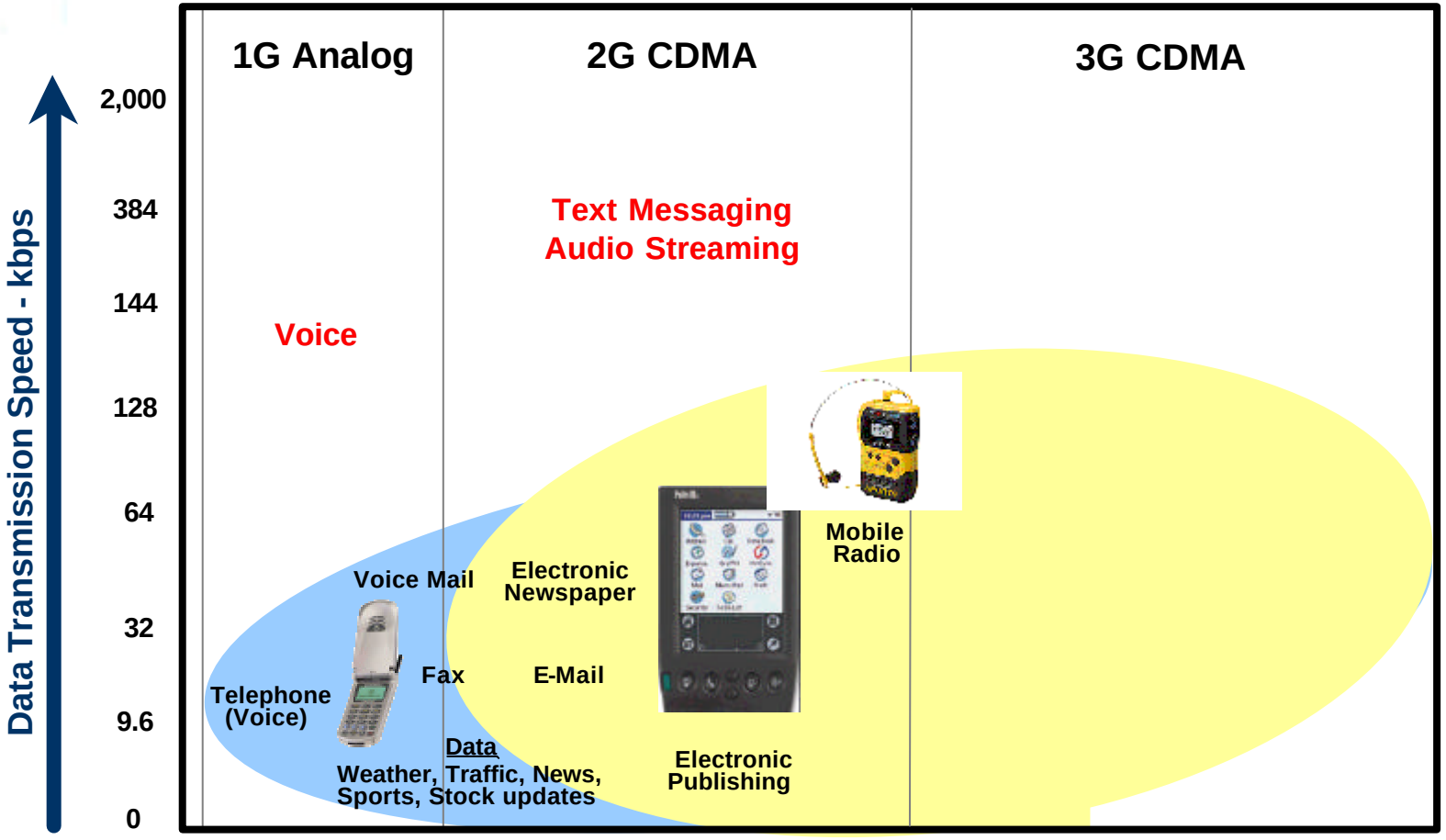
CDMA enables the kind of capabilities needed to realize significant advancements in services...



	Solutions that are globally recognized and meet adopted, international standards
	Solutions that work, enable quick time -to- market and meet industry expectations
	Spectrum flexibility, efficiency and cost
	Capacity to meet future demand
	Seamless and cost effective migration from today's systems
	Broad range of competitively -priced devices for end users (consumers, enterprises)
✓	Broad range of applications for end users

CDMA enables the kind of capabilities needed to realize significant advancements in services (cont.)



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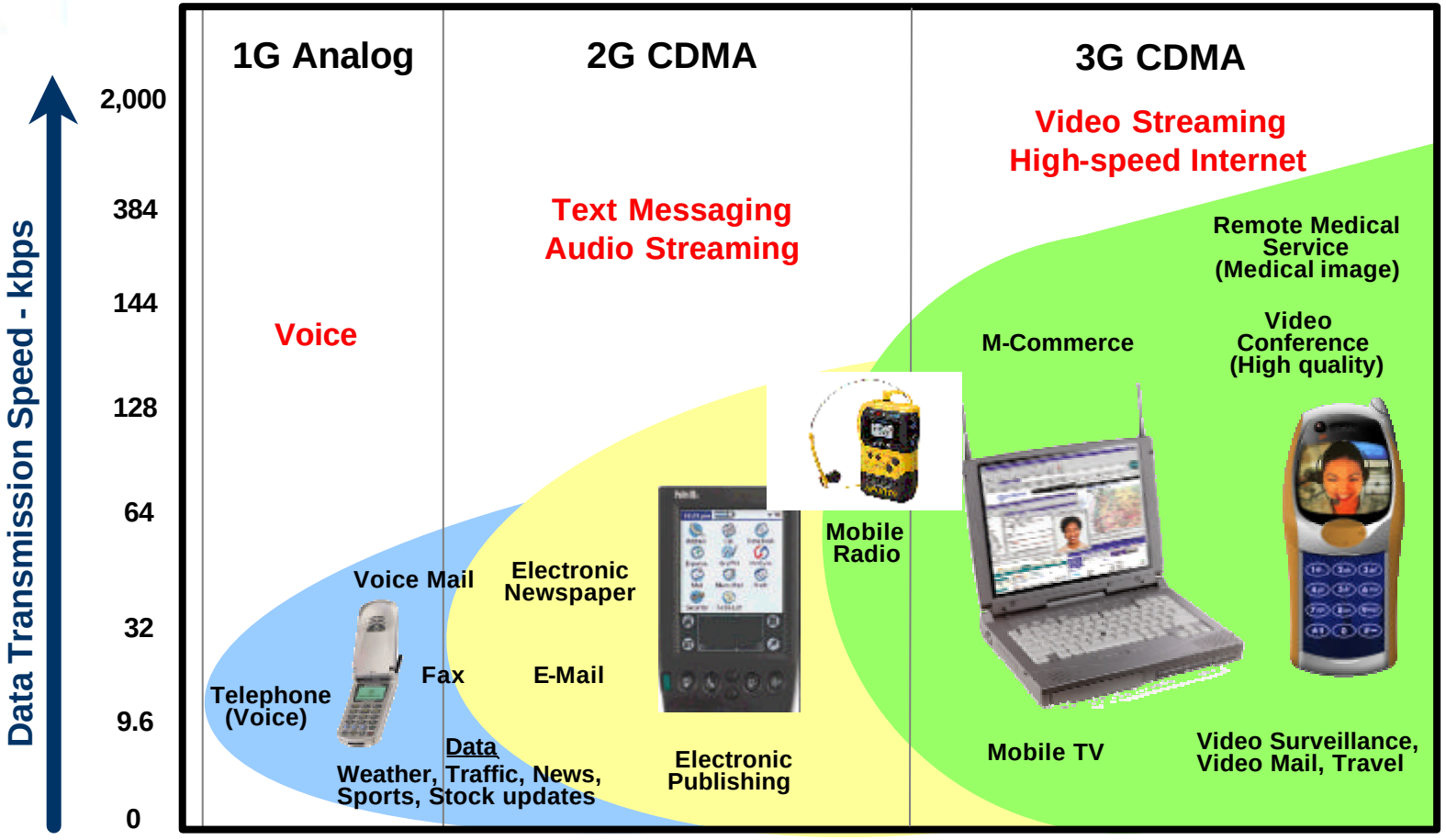

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…and significantly enhances the user's wireless experience

Approximate transfer times for a 3 minute MP3 song file

Tx Standard	Data Rate	Download Time	Commercial
GSM	9.6 kbps	2466 (41 minutes)	Commercial
cdmaOne (IS-95A)	14.4 kbps	1852 (31 minutes)	Commercial
GPRS	45 kbps	526 (8.8 minutes)	Commercial
cdmaOne (IS-95B)	56 kbps	417 (7 minutes)	Commercial
WCDMA phase 1	56 kbps	417 (7 minutes)	??
CDMA2000 1X	307 kbps	77 (1.3 minutes)	Commercial
WCDMA phase 2	306 kbps	77 (1.3 minutes)	2004+
CDMA2000 1xEV	2-5 Mbps	13-6 (0.2-0.1 minutes)	2002

Summary

CDMA2000 delivers on 3G now

Commercial for one year

Over 1 million subscribers, 75% of handset sales

Handsets are available in large quantities. Color display drive sales.

Thousands of personalized services including information, entertainment, m-banking and multimedia services such as video downloads, advertisement, MP3 file transfer

Average data rates 120Kbps

Capacity increase 1.5 to 1.7 times

Handset standby time increase by 2 times

175% higher data ARPU

Video at 130 Kbps

Summary

The wireless industry is on the verge of enabling applications and services never before imagined

Operators are faced with different alternatives for enabling these capabilities with 3G systems

In the end, certain factors are critical to determining which alternative is most beneficial, including:

- Global recognition of the technology
- Viability of the technology, and ability to deliver
- Flexibility in solutions
- Cost competitive solutions
- Broad range of products and applications

CDMA2000 is delivering on 3G, and addresses these factors