

CDMA2000 for Developing Markets

How CDMA2000 1X, EV-DO Rev. A and VoIP
will satisfy the demand for affordable telecommunications

January 2007

Prepared by: CDMA Development Group





Executive Summary

Most emerging markets have one thing in common—their citizens and businesses have limited access to basic telephone services, and those that are available often are prohibitively expensive. This creates opportunities for telecom service providers, particularly greenfield operators, that are willing to use innovative technologies and strategies to bring affordable voice and broadband data services to these underserved markets.

Enabling universal access to basic telephony and Internet services is also a key initiative for governments worldwide, particularly those in emerging markets. Numerous studies have clearly established that there is a close relationship between a country's teledensity and Internet penetration and its level of economic power as measured by per-capita gross domestic product (GDP). By spurring economic development, affordable, widely available voice and data services help improve conditions for both businesses and the general population. Universal access also benefits remotely located schools and health care facilities, by enabling them to connect to essential resources in urban areas and the rest of the world.

Regardless of whether the goal is universal access or to capitalize on the business opportunity of underserved markets, wireless has become the favored means of providing voice and data services in emerging markets. Compared to wireline telephony and DSL, wireless is significantly more cost-effective, easier and faster to deploy, and more scalable. These benefits apply in both densely populated urban locations and sparsely populated rural areas. Over the long term, wireless is also better-equipped to accommodate growth in voice and data usage in emerging markets, just as it already does in developed countries.

Third generation wireless technologies such as CDMA2000® 1X and 1xEV-DO Rev. A are particularly well-suited for developing markets, especially greenfield deployments. CDMA2000 1X offers high-quality and high-capacity circuit-switched voice communications, so operators can provide basic telephony services at an affordable price. CDMA2000 1xEV-DO Rev. A, with its enhanced all-IP functionality, is the most advanced mobile broadband technology commercially available today—it provides faster than DSL access to Internet-based services and will enable operators to offer VoIP and next-generation converged communication services in the future.

This white paper examines why emerging markets are a major, long-term business opportunity for both greenfield and incumbent service providers – if they can be served cost-effectively. It outlines the key requirements for telecom technologies to meet the requirements of these markets, and it describes the benefits of CDMA2000 1X and 1xEV-DO Rev. A for addressing these market opportunities.



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Opportunities in Developing Markets

A key difference between developed and emerging markets is teledensity and Internet penetration. Many countries in regions such as Africa, Central Asia, Latin America and the Middle East have significantly lower teledensity and Internet penetration than, for example, Japan, South Korea, the United States and Western Europe. Two factors help explain this difference: Developing markets typically have lower GDPs; and they typically have large, sparsely populated rural areas. Both factors create difficult, and often impossible, market conditions for wireline technologies such as twisted pair and DSL. As a result, citizens and businesses in these regions are frequently underserved by telecom providers – or not served at all.

Table 1 provides an overview of these differences, based on International Telecommunication Union (ITU) data. For example, Chad has a low teledensity of 1.54 telephone subscribers per 100 inhabitants and a sparse population density of approximately eight persons per square kilometer. By comparison, Japan has a high teledensity of nearly 120 telephone subscribers per 100 inhabitants and a high population density of approximately 339 persons per square kilometer. On a regional basis, only 16 out of 100 people in Africa have access to a telephone, compared to Europe, where telephony penetration is above 120 percent.

Table 1: Teledensity, Internet Usage in Selected Emerging and Developed Markets

Regional	Population		GDP	Telephone	Internet
	Total (M)	Density (per km ²)	per capita (US\$)	Subscribers per 100 inhabitants	Users per 100 inhabitants
	2005	2005	2004	2005	2005
Africa	899.82	30	800	15.93	3.72
Americas	890.94	22	15,435	80.26	31.55
Asia	3,849.79	125	2,506	38.07	9.78
Europe	800.05	31	17,077	124.24	33.71
Oceania	32.89	4	18,974	133.33	52.03
World	6,473.48	48	6,065	52.14	15.17



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Table 1: Teledensity, Internet Usage in Selected Emerging and Developed Markets (cont.)

Selected Countries					
	Population		GDP	Telephone	Internet
	Total (M)	Density (per km ²)	per capita (US\$)	Subscribers per 100 inhabitants	Users per 100 inhabitants
	2005	2005	2004	2005	2005
Angola	15.94	13	715	7.45	1.22
Afghanistan	29.86	47	...	4.35	0.1
Cambodia	14.07	78	337	3.78	0.28
Cameroon	16.32	34	670	10.04	1.02
Canada	32.27	3	23,213	108.08	62.36
Chad	9.75	8	445	1.54	0.4
China	1,315.84	137	1,268	56.53	8.44
Egypt	74.03	74	1,118	32.45	6.75
Ethiopia	77.43	63	...	0.77	0.16
Finland	5.25	14	35,442	140.05	63
Germany	82.69	232	33,156	162.35	45.35
Honduras	7.2	64	1,075	24.65	3.18
India	1,103.37	348	634	11.31	5.44
Indonesia	222.78	116	1,156	26.79	7.18
Japan	128.08	339	31,324	119.86	50.2
Korea (Rep.)	48.29	491	14,136	128.56	68.35
Niger	13.96	12	244	1.39	0.19
Pakistan	153.96	192	614	11.72	6.82
Peru	27.97	22	2,476	28.01	16.45
South Africa	47.43	40	2,239	46.21	10.75
Sir Lanka	20.74	316	1,031	22.2	1.44
Thailand	64.23	125	2,567	36.11	11.03
United Kingdom	59.67	244	26,369	158.51	62.88
United States	298.21	32	36,273	122.71	63
Yemen	20.98	110	563	9.02	0.87

Source: ITU Market, Economics and Finance Unit Indicator Website: <http://www.itu.int/ITU-D/icteye/Indicators/Indicators.aspx>

Reducing and eventually eliminating the digital divide is a key initiative for most governments of developing countries, as well as global organizations such as the ITU and the World Bank. A major reason for these initiatives is economic – many governments view universal access as an important economic development tool, especially in regions where a few countries have significantly higher teledensity than most of their neighbors.

A prime example is Africa. Northern Africa has approximately 12 million of the continent's fixed-line phones, while South Africa has another 4.9 million, leaving only 5.8 million fixed lines in the rest of Africa. As a result, North and South African businesses have a significant competitive edge simply because they have access to telecom services.

The same issue applies within a single country. When most businesses in an area have limited access to basic telecom services, they're at a disadvantage when competing against companies elsewhere in that country that do have access to telephone and Internet services.

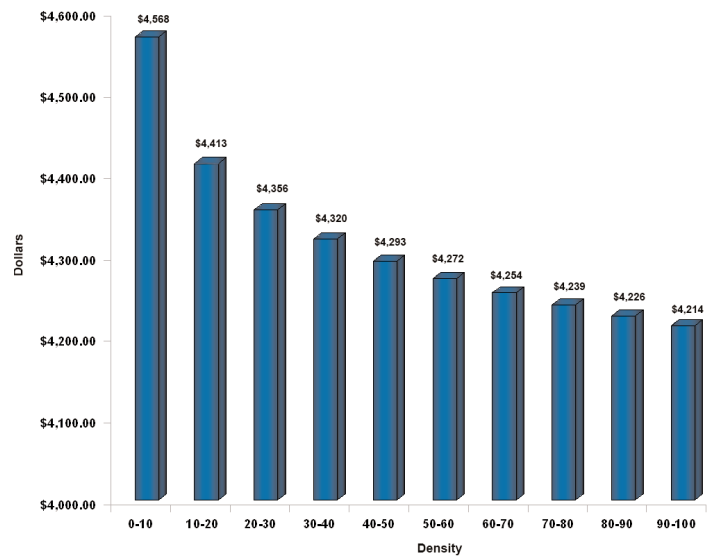
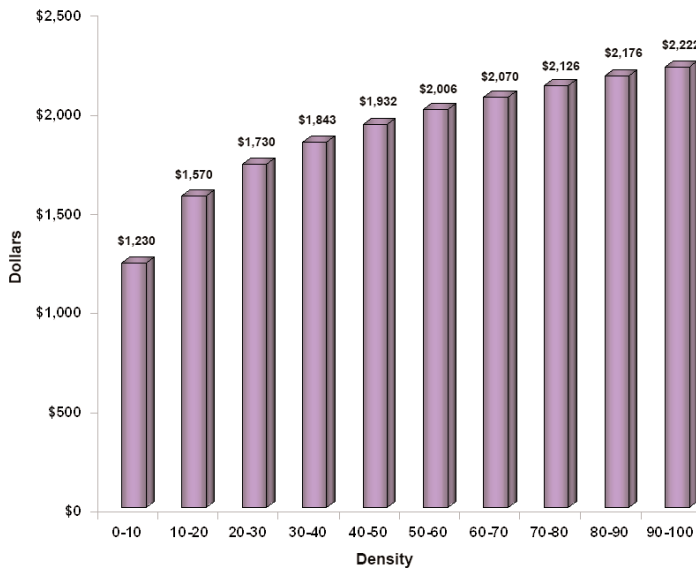


Figure 1 illustrates a close relationship between teledensity and Internet penetration with a country's level of economic power as measured by per-capita GDP.

Figure 1: GDP per Capita Resulting from Telephone and Internet Penetration

Each 10 point increase in mobile density boosts per capita income by the following amount:

Each 10 point increase in Internet density boosts per capita income by the following amount:



Source: TMG, Inc. based on 75 countries, May 2006

Wireless Usage in Developing Markets

Many countries worldwide have universal service projects underway, and many more are under development. At the same time, many incumbent and greenfield operators in those and other countries are looking for ways to deliver voice and Internet services to underserved markets. Although each operator has different objectives and requirements, one common denominator is that all of these groups prefer technologies that can enable lower tariffs. They also want the network technology to be flexible enough to be quickly and widely deployed in both densely populated urban areas and sparsely populated rural areas. Thus, the income from urban areas can be used to subsidize the cost of providing coverage in rural villages.

Wireline technologies have several major drawbacks. For example, in urban areas, stringing or burying cables is time-consuming, disruptive and expensive, making it difficult to price the services affordably for most citizens and businesses. In sparsely populated areas, wireline technologies are rarely cost-effective because the enormous expense of extending infrastructure to a few people can't be recouped by monthly service fees.

Over the past decade, second-generation (2G) wireless technologies, such as GSM and cdmaOne™, began the process of bridging the telephony "digital divide." Table 2 provides a summary of wireless usage in several countries and shows dramatic increases in teledensity over short periods of time. For example, in 2000, Algeria had 6,000 wireless users. Five years later, it had more than 13 million. At the same time, wireless became the technology of choice for the vast majority of telephone subscribers in Algeria. These figures highlight how quickly wireless can be deployed to reach large segments of the population and how its cost structure makes it affordable to more users and businesses, even in sparsely populated areas, where citizens have below-average purchasing power.



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Table 2: Wireless Usage or Penetration in Selected Emerging and Developed Markets

Regional				
	Cellular Mobile Subscribers			
	(k)	CAGR%	per 100 inhabitants	As % of total telephone subscribers
	2005	2000 - 2005	2005	2005
Africa	135,014.5	53.9	15.03	83.2
Americas	458,881.0	20.3	51.86	60.7
Asia	875,731.8	29.5	23.22	59.4
Europe	676,274.0	18.3	84.53	67.3
Oceania	22,532.4	17	68.51	
World	2,168,433.6	24	33.95	63.2
Selected Countries				
	Cellular Mobile Subscribers			
	(k)	CAGR%	per 100 inhabitants	As % of total telephone subscribers
	2005	2000 - 2005	2005	2005
Angola	1,094.1	111.6	6.86	92.1
Afghanistan	1,200.0	...	4.02	92.3
Cambodia	1,062.0	52.1	7.55	...
Cameroon	103.3	85.3	13.84	...
Canada	16,600.0	13.7	51.44	47.6
Chad	210	107.2	2.15	...
China	393,428.0	35.8	29.9	52.9
Egypt	13,629.6	58.6	18.41	56.7
Ethiopia	410.6	87.4	0.53	40.2
Finland	5,231.0	7	99.66	71.2
Germany	79,200.0	10.4	95.78	59
Honduras	1,281.5	52.5	17.79	72.2
India	90,000.0	90.6	8.16	64.4
Indonesia	46,910.0	66.5	21.06	78.6
Japan	94,745.0	7.2	73.97	61.7
Korea (Rep.)	38,342.3	7.4	79.39	61.8
Niger	299.9	170.9	2.15	92.6
Pakistan	12,771.2	110.8	8.3	70.8
Peru	5,583.4	34.4	19.96	71.3
South Africa	33,960.0	32.4	71.6	87.8
Sri Lanka	3,361.8	50.9	16.21	73
Thailand	27,378.7	73	42.98	...
United Kingdom	61,091.0	8.9	102.16	64.4
United States	201,650.0	13	67.62	...
Yemen	2,000.0	128.7	9.54	

Source: ITU Market, Economics and Finance Unit Indicator Website: <http://www.itu.int/ITU-D/icteye/Indicators/Indicators.aspx>

In most cases, wireless technologies are more economical than wireline both for providing universal access and for operator-initiated efforts to expand service to underserved areas. The World Bank has estimated that the capital cost of providing mobile coverage to an individual is one-tenth of the cost of installing a fixed-line connection.

These conditions create ample market opportunities for wireless service providers, particularly for greenfield deployments, which benefit from the fact that there are typically few incumbent operators willing or able to serve these



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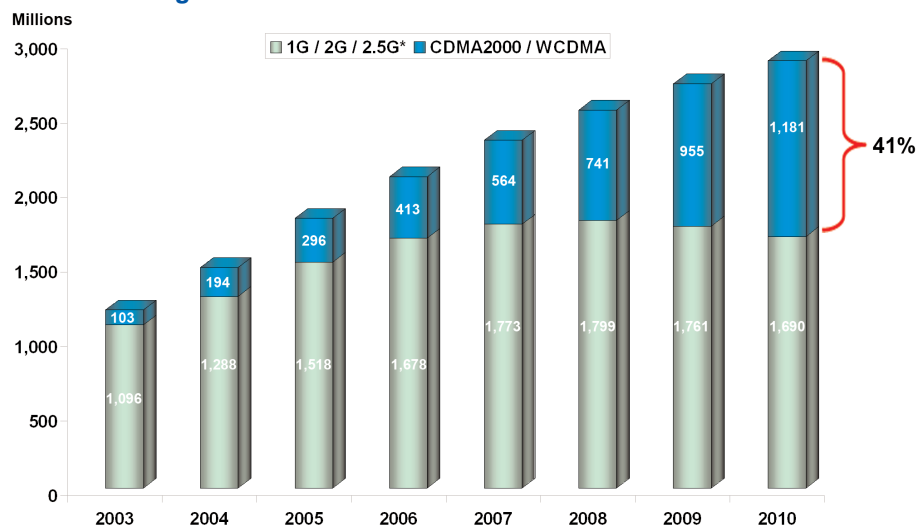
markets. One major reason for this lack of interest and initiative among incumbents is that they in most cases use older wireless technologies, which have limited capacity and little or no data capabilities to supplement their voice revenues. Another reason is that incumbents primarily focus on urban areas because these markets offer a larger pool of potential customers than sparsely populated rural areas.

Although there are a wide variety of wireless technologies available, operators and governments increasingly are choosing 3G (CDMA2000 and WCDMA) over 2G (GSM). That's because 3G technologies are the most spectrally efficient and can provide voice and true broadband access much more economically.

This preference also reflects the fact that the worldwide wireless industry is steadily migrating to 3G because advanced technologies are better suited for serving the needs of both developed and emerging markets. As of November 2006, more than 220 operators had deployed 3G networks, serving more than 400 million users, or 15% of all wireless subscribers worldwide. These 3G networks are adding approximately 30 million customers every quarter.

In some developed markets, such as Japan, South Korea and North America, there are already more 3G than 2G subscribers. Analysts forecast that the number of 2G subscribers will begin to decline in 2008, and by 2010 3G will account for 41% of total users worldwide. The result of this rapid evolution is that 2G systems will quickly become obsolete, and as volumes of 3G infrastructure and user devices grow, their costs will steadily decrease, making 3G even more affordable. Figure 2 illustrates these trends.

Figure 2: Worldwide 2G and 3G Subscriber Trends

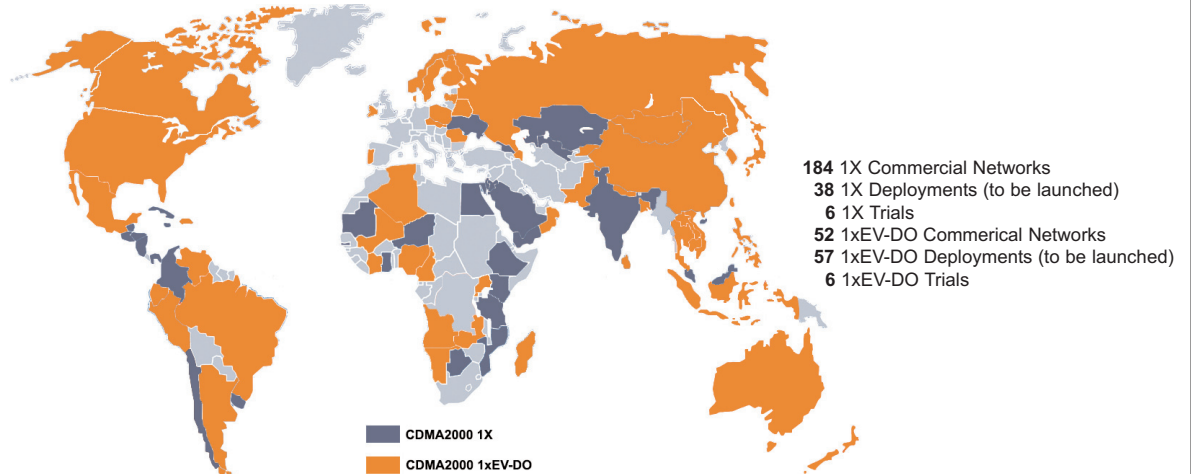


Includes AMPS, cdmaOne, GSM/GPRS/EDGE, iDEN, PDC, PHS, and TDMA
Source: Strategy Analytics, Worldwide Cellular User Forecasts, 2005-2010, January 2006

CDMA2000 is leading this rapid migration to affordable 3G services. As of November 2006, 185 operators in 80 countries have deployed or are deploying CDMA2000 technologies. There are more than 302 million CDMA2000 customers, which is approximately 75% of the 3G market today.

CDMA2000 is by far more widely deployed in developing markets than WCDMA. In fact, more than 121 of the 185 CDMA2000 operators are in developing markets. These markets already account for 44 percent of CDMA2000 users worldwide, and their share will continue to increase. Appendix A lists examples of CDMA2000 deployments in developing countries. See excel spreadsheet.

Table 3: CDMA2000 Deployments and Trials Worldwide



Source: CDMA Development Group, January 2007

In emerging markets where CDMA2000 has been deployed, government and service provider feedback has been overwhelmingly positive. Following are some testimonials:

- “We are impressed with the consistent performance of CDMA and the value proposition that it delivers. Apart from being able to offer ubiquitous broadband data access, the reliability of the CDMA connection and its voice clarity are the two major benefits that we are delivering to our customers.” – *Artem Orange, CEO of Dialog, a foreign investor in Pakistan with licenses to operate in five telecom regions, covering more than 40 million of the country’s population, October 9, 2006*
- “CDMA2000 is an enabler to provide affordable telephone and Internet connectivity for the masses. This shall lead to increasing teledensity, Internet penetration and a better economy. Furthermore, CDMA broadband services with EV-DO open more opportunity for various public services such as distance learning, telemedicine, e-government and public safety applications.” – *Anindya N. Bakrie, chief executive officer of PT Bakrie Telecom Tbk, August 21, 2006*
- “Sri Lanka Telecom’s CDMA service, I believe, will be an important enabler in eliminating the digital divide in the country.” – *Shuheh Anan, CEO of Sri Lanka Telecom, October 16, 2005*
- “Fixed Wireless Technology (CDMA) or ‘Jamano’ will go a long way in bridging the digital divide ... between Gambia and developed countries and between our rural and urban areas, yet avoid the high costs inherent in developing fixed line infrastructure.” – *Yahya A.J.J. Jammeh, President of Gambia, March 27, 2005*
- “Wireless signals travel further at lower frequencies; thus a cell site at 800 MHz covers more geography than a GSM 1800 or 1900 MHz site; for example using CDMA2000 deployed by MTN, a single site has a radius of up to 29.4 km at 800 MHz and 13.3 km at the GSM 1900 MHz frequency. The implication of this is fewer cell sites deployed to cover an area, hence lower deployment and maintenance costs; this advantage is passed on to our valued customers in the form of reduced costs.” – *MTN Uganda*



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- “CDMA2000 Wireless Local Loop (WLL) technology, for example, which is well suited to Algeria’s rough, mountainous terrain, can be provided by Chinese firms for as little as \$10 a connection.”
– *Oxford Business Group, May 15, 2006*

Key Wireless Requirements

Although wireless is ideal for providing voice and data services in emerging markets, not all wireless technologies provide the same benefits. When selecting a wireless technology, operators and governments should take a long-term view of how their market’s telecommunication needs will evolve, and evaluate key commercial and technical aspects, including:

- **Voice:** Reliable, clear and ubiquitous access to a carrier-grade telephony service is the most essential element of any wireless technology.
- **Broadband data:** High-speed Internet access, large file transfers, multimedia, broadcast video and Web cams are increasingly important tools for supporting business, health, education and safety within emerging markets.
- **Coverage, capacity and scalability:** In sparsely populated areas, each base station should have a range of tens of kilometers in order to reduce the number of cell sites and backhaul connection. This network efficiency means that the network can serve as many people as possible at the lowest possible cost. In densely populated urban areas, the wireless technology should be highly scalable so that capacity can be easily and cost-effectively added to accommodate growth in voice and data usage.
- **Flexibility:** The technology should support a wide variety of environments and installations, such as fixed wireless, wireless local loop (WLL) and full mobility in dense urban and rural areas.
- **Economics:** Reducing the Total Cost of Ownership (TCO), which includes infrastructure investments (capex), operating costs (opex) and handset prices is of great importance to developing markets. This requirement is due to the fact that the Average Revenue Per User (ARPU) is significantly lower than in developed markets and because there are limited financial resources available in these markets for building and operating networks. Therefore, technologies with higher capacity, network efficiencies and a global cost structure have a favorable TCO for these markets.
- **Device selection:** A wide selection of affordable devices is necessary to address the entire emerging market segment. The range of devices should cater to different user needs and support a broad range of applications, ranging from entry-level phones for price-sensitive markets to PC cards for broadband connectivity.
- **Clear evolution path:** A clearly defined, long-term technology roadmap with backward compatibility protects the investments of the service providers and their investors. This requirement highlights a key difference between 3G and 2G, which is rapidly approaching obsolescence and thus will have to be replaced by 3G systems over the next few years.
- **Multiple spectrum options:** Wireless spectrum allocations vary from country to country. In order to offer a global cost structure, the wireless technology should be available at a variety of frequencies. Spectral flexibility is also key when building networks for sparsely populated areas. For example, the 450 MHz and 800 MHz bands are ideal for covering large geographic areas because signals travel farther than at higher frequencies, such as 2100 MHz.



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- **Proven technology:** A wireless technology is considered proven or mature once there are more than 10 million subscribers using it in hundreds of commercial deployments worldwide. This adoption ensures that the technology is capable of providing the reliability that businesses, schools and government agencies expect and require. That's why 3G technologies such as CDMA2000 have a significant advantage compared to other broadband wireless access solutions – such as mobile WiMAX – that are still being developed and which have yet to be proven in the marketplace.

CDMA2000 for Emerging Markets

CDMA2000 technologies commercially available today include CDMA2000 1X, 1xEV-DO Rel 0 and Rev. A.

CDMA2000 1X is a digital voice and data technology capable of supporting up to 168 voice subscribers per sector and data transmissions up to 153.8 kilobits per second. 1X networks are used to provide voice and value-added data services, as well as Internet connectivity. 1X is the most widely 3G technology deployed today with 220 commercial and pre-commercial networks and 300 million users across all continents.

CDMA2000 1xEV-DO Release 0 (Rel. 0) is an evolutionary technology that is optimized to support peak download speeds of up to 2.4 Mbps and upload speeds as high as 153 kbps. It is widely used to provide enhanced data services, including video, multimedia and broadband Internet access. Nearly 110 operators have deployed or are deploying Rel. 0 and serve 45 million users.

CDMA2000 1xEV-DO Revision A (Rev. A) is an enhanced version of Rel. 0 and is the most advanced 3G technology commercially available today. It incorporates Orthogonal Frequency Division Multiplexing (OFDM) to enable multicasting (one-to-many) multimedia content delivery. With its ability to support higher data rates (3.1 Mbps on the downlink and 1.8 Mbps on the uplink), Quality of Service (QoS) and low latency (below 50 milliseconds) on an IP radio network, Rev. A enables operators to extend IP throughout the radio access and core network and to offer time sensitive applications, such as Voice over IP (VoIP) on the same packet network.

Rev. A was commercially deployed in October 2006 by Sprint-Nextel in the United States. At least seven additional operators, including KDDI (Japan), LG (South Korea), Sky Link (Russia), SkyTel (Mongolia), Telecom New Zealand, and Verizon Wireless (United States) are in various phases of deployment. Many other operators are currently evaluating and will be deploying Rev. A.

CDMA2000's Advantages for Developing Markets

CDMA2000 is ideal for developing countries because it can provide voice and advanced data services in both dense urban and vast rural territories very economically and leapfrog other technologies in migration to next-generation all-IP capabilities to offer converged next-generation services in the future.

By deploying CDMA2000 1X, an operator can take advantage of the high-voice capacity and broad range of low-cost devices to deliver affordable, high-quality voice services even to the most price sensitive consumers. By complementing 1X with CDMA2000 1xEV-DO Rev. A, it can offer broadband Internet, advanced multimedia and customized data applications. As ultra low-cost VoIP-enabled Rev. A devices become widely available in 2009, the operator will be able to migrate from 1X circuit switch voice to more robust and cost efficient all-IP delivery of voice and data and next-generation converged broadcast, telecommunication and broadband services.

1X and Rev. A can co-exist in the same network by running them over separate channels. This approach is efficient, and it gives the operator more flexibility when migrating from 1X to Rev. A.



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CDMA2000 1X/Rev. A advantages include:

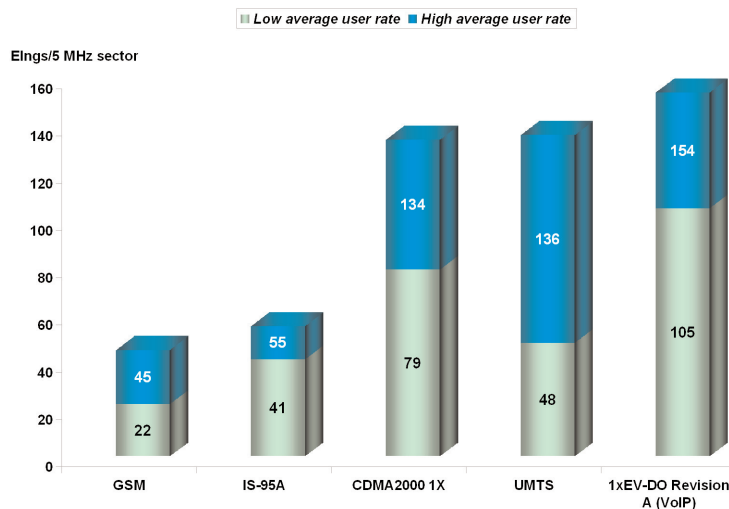
Superior Voice Capacity

The CDMA2000 family of technologies provides the most voice capacity of any commercially available 3G technologies. Figure 3 illustrates this advantage.

CDMA2000 1X supports between 33 and 40 voice calls per single 1.25 MHz channel. A new codec, 4GV, for CDMA2000 1X will increase voice capacity by 40%.

Rev. A continues this leadership by providing 10% to 30% more capacity than CDMA2000 1X. Rev. A VoIP supports between 40 and 66 simultaneous voice calls within a single 1.25 MHz carrier, depending upon the enabled features and network load, and up to 154 users per 5 MHz sector. That's four times more than GSM.

Figure 3: Voice Capacity per Sector



Source: Various and Signals Research Group, LLC¹

Network high capacity is key because if a voice service quickly becomes enormously popular with users – as is often the case when telephony becomes widely available in underserved markets – the operator has ample capacity to accommodate that growth. Also, the higher network capacity, the higher quality and less network resources (base stations) required to serve a given number of users, directly impacts capex. In fact, studies have demonstrated that because of the CDMA2000 capacity advantage, costs of deploying and maintaining CDMA2000 networks in high-growth markets is up to 23% lower than for GSM/EDGE³.

Advanced Broadband and Multimedia Applications

With enhanced broadband speeds, low latency and advanced quality of service, Rev. A enables advanced multimedia applications and delivers experience comparable to or better than DSL and cable. These advanced capabilities make Rev. A ideal for broadband access to the Internet and bandwidth-intensive applications such as streaming multimedia, videoconferencing, distance learning and telemedicine. For example, the fast upload speeds easily support large file transfers, such as a rural health clinic sending a patient's X-rays to a major urban hospital for consultation.

¹ Signals Research, "Ca-ching or Ker-plunk, The Dollars and Sense of 3G," August 2006



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Rev. A also expands group communications applications by enriching voice-centric push-to-talk (PTT) with multimedia content. Examples include push-to-multimedia (PTM) services where everyone in a group call receives audio, video, text and pictures from one or multiple users. PTM has many applications in enterprise, as well as in public service environments.

The enhanced QoS of Rev. A also permits greater control of network resources by allowing operators to manage various users and applications with different levels of priority, making it ideal for public safety uses and tiered services for different types of applications and services.

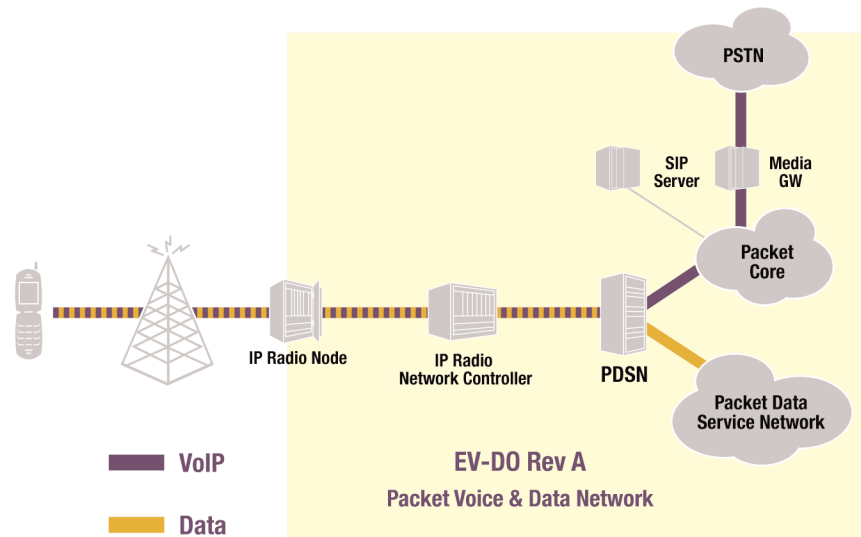
VoIP

For service operators, the three primary drivers for deploying VoIP are network efficiency, spectral efficiency and the ability to enhance service portfolios. Moving to VoIP enables wireless operators to fundamentally transform their networks from circuit-switched architecture to packet-switched. Packet networks based on IP technology cost less to build, operate and evolve. Also, operators will be able to quickly provision their networks to introduce new services faster than their competitors, and at a lower cost.

VoIP requires high-speed data both on the down and uplink, low latencies and QoS. Rev. A is the first 3G technology to support these three network capabilities to offer a best-in-class VoIP solution. GSM, GPRS, EDGE and WCDMA operators cannot move to an All-IP configured network until they incorporate a standard IP interface between the radio access network and core network, SIP call control and IP Multimedia Subsystem (IMS) servers and applications. Even WCDMA networks that are upgraded to High Speed Downlink Packet Access (HSDPA) are unable to support VoIP, because HSDPA's uplink capacity and latency is not sufficient to provide VoIP capacity comparable to what is offered by circuit-switched WCDMA.

With the implementation of VoIP, an operator can migrate to a single core network to support voice and data, and eliminate highly redundant network elements, such as base station radios and controllers, and use lower cost network elements such as a media gateway or softswitch instead of a mobile switching center. The all-IP core network provides greater efficiencies and lowers transport cost up to 50%.

Figure 4: Rev. A Packet Voice and Data Network



Source: Airvana, Mobile VoIP Over 1xEV-DO, July 2006



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In addition, an all-IP core network means that 1xEV-DO Rev. A base stations can be easily integrated with Ethernet-based backhaul services, which have lower costs than ATM- and TDM-based backhaul.

The introduction of VoIP services over a Rev. A network offers the following additional benefits:

- **Network convergence and interoperability:** Instead of being restricted to a single access network, VoIP applications enable operators to deliver interoperable services over multiple access networks: EV-DO, wireline, cable, DSL, and Wi-Fi.
- **Network Efficiency:** Improved network performance is achieved by using existing resources more efficiently and by consolidating multiple networks, systems, and support organizations. Converging the network onto one common, packet-based infrastructure dramatically reduces the number of systems, employees and facilities required.
- **Spectrum Efficiency:** Operating parallel voice and data networks that transmit voice and data on separate radio channels prohibits load balancing between the two services, and reduces overall trunking efficiency. As in the case of wireline networks, a transition to VoIP enables wireless carriers to converge all uses, voice and data and other multimedia, onto the same spectrum, eliminating the need for redundant channels, increasing trunking efficiency, and making better overall use of the spectrum.
- **Faster Creation of Advanced Services:** VoIP enables the rapid creation of advanced services. With VoIP, an operator can create new services much easier and faster than with the MSC-centric architecture of legacy cellular networks.

End-to-End Security

Unlike technologies, such as analog cellular and 802.11 Wi-Fi, the coding for the CDMA2000 air interface offers operators the most secure access to voice communications and the Internet, making it impossible to penetrate the network from inside or outside. CDMA2000 addresses security risks from end-to-end using a closed loop security solution. SSL 3.0 with 128-bit key encryption and support for digital signatures through public key infrastructure also ensures complete network security integrity. As a result, eavesdropping, blocking and hacking are impossible, making CDMA2000 ideal for sensitive applications for business and government communications.

For additional security, Rev. A is easily paired with tools such as virtual private networks (VPNs). The technology's low latency is key to providing superior VPN performance and reducing computer and application crashes. Avoiding these problems is particularly important for small businesses, which typically don't have an IT staff to help employees troubleshoot mobile VPNs.

Network Design Flexibility

CDMA2000 systems can be used for both mobile and fixed services – inside and outside of buildings – using wideband or narrowband bandwidths – with or without other complementary air links – with ubiquitous or non-contiguous coverage.

CDMA2000 network can be designed with a centralized or distributed architecture, or with a mix of the two. This flexibility gives operators more options and helps reduce costs. For example, a local exchange can be omitted from the design.

As UTStarcom, a telecom and networking supplier pointed out, "IP CDMA infrastructure is a cost-effective means of providing basic as well as advanced forms of mobile communications. Operators can distribute the network elements in an all-IP network, thereby enabling local calls to remain in the local domain. Instead of all traffic being backhauled to a



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central point-of-presence, local traffic is directed to the nearest local gateway. This results in reduced transmission costs and significant operational cost savings compared to traditional voice networks.” UTStarcom has been working with operators and governments in developing markets such as Angola, Bangladesh and India on utilizing IP CDMA systems in rural areas.

CDMA2000 is designed to use a variety of backhaul technologies, which connect base stations to the core network. For example, in sparsely populated areas, service providers may choose satellite for backhaul because it’s faster to deploy and less expensive than installing wired backhaul technologies such as copper or fiber. This flexibility is key because when an operator has multiple backhaul options, it can choose the most cost-effective one in order to be better able to price its services at a point that more citizens and businesses can afford.

Spectrum Options and Coverage Considerations

Currently, CDMA2000 network infrastructure and user devices are available for use in a wide range of bands, including 450 MHz, 800 MHz, 1700 MHz, 1900 MHz and 2100 MHz. Furthermore, CDMA2000 systems operate in 2x1.25 MHz channels, compared to other 3G technologies, which require 2x5 MHz of spectrum. Additional 1.25 MHz channels can be added over time as the demand for the services grows and more bandwidth is needed.

This spectral flexibility improves the chances that regulators in most countries have one or more bands that can be used for CDMA2000. It also improves the chances that CDMA2000 can be deployed quickly instead of waiting for a band to be cleared.

Lower frequencies, such as 450 MHz and 800 MHz, are especially well-suited for covering sparsely populated rural areas because signals in these bands travel farther. As a result, fewer base stations and less investment are required to serve a large area.

Table 3 illustrates these benefits. For example, it shows that a 450 MHz CDMA2000 base station covers an area three times larger than a GSM base station in the 900 MHz band and thirteen times larger than UMTS in the 2100 MHz frequency band.

Table 3: How Frequency Affects Coverage

Frequency (MHz)	Cell Radius (km)	Cell Area (km ²)	Normalized Cell Count
450	48.9	7521	1
850	29.4	2712	2.8
950	26.9	2269	3.3
1800	14.9	618	12.2
1900	13.3	553	13.6
2500	10	312	24.1

Sources: ANATEL, Lucent Technologies

It is important to note that CDMA2000 systems can easily cover sparsely populated areas and a variety of terrains, such as plains, coastal areas, deserts, mountains and forests. Many infrastructure vendors also offer base station and antenna solutions designed for the unique requirements of a particular environment.



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Economics

For operators and regulators in developed and, especially, developing markets, capital and operating expenses are key considerations. When comparing the TCO for different 2G and 3G technology options, CDMA2000 is very compelling for developing markets.

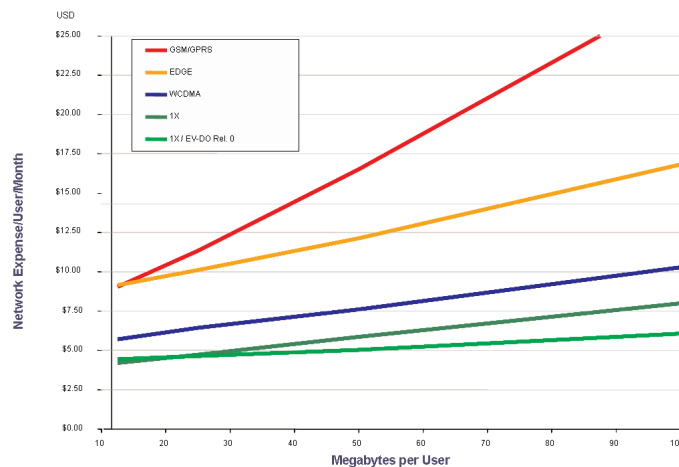
A Signals Research study showed that 3G is more economical than 2G for developing markets in the long run and that CDMA2000 @ 800 MHz has a competitive advantage over WCDMA. The key findings of the study demonstrate that CDMA2000 offers:

- A **26% cost savings** over GSM/UMTS/HSDPA @ 2100 MHz in moderate growth and usage markets
- A **12% cost savings** over GSM/UMTS @ 900 MHz in moderate growth and usage markets
- A **18-23% cost savings** over GSM/GPRS/EDGE @ 900 MHz in high growth and usage markets

This advantage is mainly due to the higher voice capacity and sector data throughput, lower frequencies and backwards compatibility.

Figure 5 illustrates how CDMA2000 provides the lowest cost for voice and data per user.

Figure 5: Combined Voice and Data Network Expense (500 Minutes of Use)



Assumptions:

On demand Traffic:

- a) 15% of traffic demand occurs at the busy hour,
- b) 7,600 kbps / sq km at busy hour,
- c) 5 MHz

Multicast Traffic:

- a) 2,000 subscribers / cell,
- b) 30 live streaming minutes / day at 128 kbps data rate,
- c) 1.25 MHz

Source: The Economics of Wireless Data,

<http://www.qualcomm.com/main/whitepapers/WirelessMobileData.pdf>

There are nearly 1,500 models of CDMA2000 handsets on the market today, offered by 86 manufacturers. The huge economies of scale and competition have driven prices of CDMA2000 devices down to nearly 2G levels. Entry-level CDMA2000 1X handsets are now available in the sub \$50 USD range in many markets.

Figure 6 provides a real example in India, where the price gap between 2G GSM low-end handsets and 3G CDMA2000 handsets has narrowed to only \$4 USD. In fact, if one evaluates the entire product portfolio for both technologies offered, the 3G CDMA2000 devices have a notably lower Average Selling Price (ASP) than 2G GSM devices (see Figure 7).

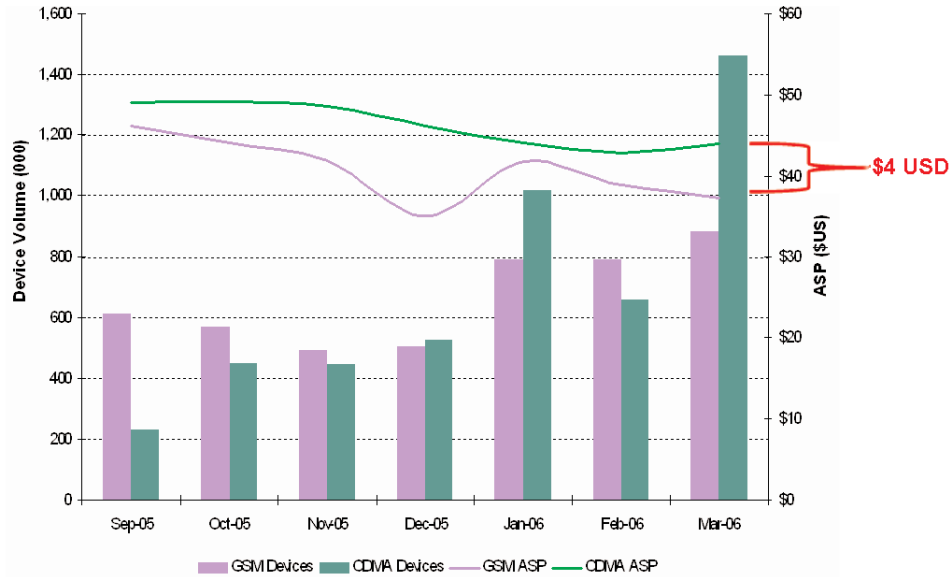


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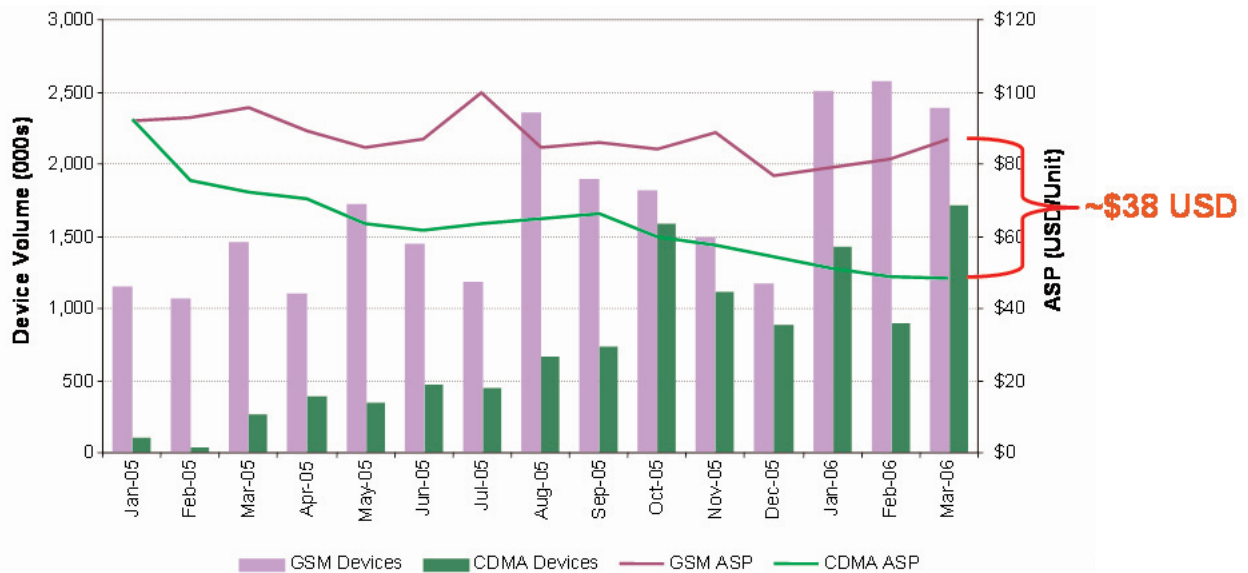
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Figure 6: Sub-\$50 USD Handset Shipments in India and Average Selling Price (Wholesale)



Source: Yankee Group, June 10, 2006

Figure 7: Total Handset Shipments in India and Average Selling Price (Wholesale)



Source: The Yankee Group, June 2006

Korean manufacturers announced recently that \$30 CDMA2000 handsets will become available in 1Q 2007 and that the price will go further down to \$20s by 2008.

Rev. A devices are already available on the market and they include air cards and PC modems. Rev. A handsets support advanced features such as BroadCast MultiCast Services (BCMCS), video telephony, high-resolution 3D graphics and mobile commerce services.

Initially, VoIP-enabled Rev. A devices will not be able to compete in price with 1X devices, but as more Rev. A networks are deployed and VoIP-enabled Rev. A devices become commercially available and prevalent, the prices should fall rapidly and become affordable for the developing markets.

Figure 8 illustrates several examples of Rev. A devices



Source: CDMA Development Group, January 2007

Conclusion

Over the past several years, wireless has emerged as the favored means of providing universal access to voice and data services in emerging markets. Wireless is also the preferred choice for incumbent and greenfield operators that are expanding service to underserved areas. Compared to circuit-switched telephony and DSL, wireless is significantly more cost-effective, easier and faster to deploy, and more scalable. These benefits apply in both urban locations and sparsely populated areas.

Of all the wireless technologies currently available and scheduled for release within the next two years, CDMA2000 is superior for delivering voice and broadband data in emerging markets. The technology's benefits include affordable voice and true broadband speeds, ample device selection and significant investment and operating cost savings. Those features and advantages give both greenfield and established operators the ability to offer affordable yet powerful voice and data services today to businesses and the public, as well as hospitals, schools, government offices and other facilities, even in remote areas and to build a platform on which to evolve to the next-generation services for the future.



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Appendix A: Examples of CDMA2000 systems in developing markets

Region	Country	Operator	Technology	Operating Frequency
Africa - Middle East	Algeria	Algerie Telecom	1X (Commercial) EV-DO (To Launch)	1900 MHz
Africa - Middle East	Algeria	Consortium Algerian de Telecommunications (CAT)	1X (Commercial) EV-DO (To Launch)	1900 MHz
Africa - Middle East	Angola	Movicel Telecomunicações Lda.	1X (Commercial) EV-DO (To Launch)	800 MHz
Africa - Middle East	Angola	Mundo Startel	1X (To Launch) EV-DO (To Launch)	1900 MHz
Africa - Middle East	Botswana	Botswana Telecommunications Corp (BTC)	1X (Trial)	1900 MHz
Africa - Middle East	Cameroon	CAMTEL	1X (Commercial) EV-DO (To Launch)	450/800 MHz
Africa - Middle East	Cote d'Ivoire	Arobase Telecom S.A.	1X (Commercial) EV-DO (Commercial)	800 MHz
Africa - Middle East	Egypt	Telecom Egypt	1X (To Launch)	800 MHz
Africa - Middle East	Ethiopia	Ethiopian Telecommunications Corporation	1X (To Launch)	450/800 MHz
Africa - Middle East	Gambia	Gambia Telecommunications Company Limited (Gamtel)	1X (Commercial) EV-DO (To Launch)	450 MHz
Africa - Middle East	Ghana	Kasapa Telecom Limited	1X (Commercial)	800 MHz
Africa - Middle East	Israel	Pelephone Communications Ltd.	1X (Commercial) EV-DO (Commercial)	800 MHz
Africa - Middle East	Kenya	E.M. Communications Ltd.	1X (Commercial)	1900 MHz
Africa - Middle East	Kenya	Flashcom LTD	1X (Commercial)	1900 MHz
Africa - Middle East	Kenya	Telkom Kenya Limited	1X (Commercial)	450 MHz
Africa - Middle East	Kuwait	Ministry of Communications, Kuwait	1X (Commercial)	800 MHz
Africa - Middle East	Madagascar	Telecom Malagasy S.A.	1X (Commercial) EV-DO (To Launch)	450 MHz
Africa - Middle East	Mali	Sotelma	1X (Commercial) EV-DO (Commercial)	450 MHz
Africa - Middle East	Mauritania	Mauritel	1X (Commercial)	450 MHz
Africa - Middle East	Morocco	Maroc Connect	1X (To Launch) EV-DO (To Launch)	800 MHz
Africa - Middle East	Mozambique	Telecomunicações de Mozambique (TDM)	1X (Commercial)	450 MHz
Africa - Middle East	Nambia	Telecom Nambia	1X (To Launch) EV-DO (To Launch)	450/800 MHz
Africa - Middle East	Niger	Sonitel	1X (Commercial)	800 MHz
Africa - Middle East	Nigeria	Bourdex Telecom	1X (Commercial) EV-DO (To Launch)	800 MHz
Africa - Middle East	Nigeria	Cell Communications Ltd.	1X (Commercial)	800 MHz
Africa - Middle East	Nigeria	Independent Telephone Network Ltd.	1X (Commercial)	800 MHz
Africa - Middle East	Nigeria	Intercellular Nigeria Ltd.	1X (Commercial)	800 MHz



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Appendix A: Examples of CDMA2000 systems in developing markets

Region	Country	Operator	Technology	Operating Frequency
Africa - Middle East	Nigeria	MTS First Wireless Ltd.	1X (Commercial) Rev A (To Launch)	1900 MHz
Africa - Middle East	Nigeria	Multi-Links Telecommunications Ltd.	1X (Commercial)	1900 MHz
Africa - Middle East	Nigeria	Nigerian Telecommunications Limited (Nitel)	1X (Commercial) EV-DO (Trial)	1900 MHz
Africa - Middle East	Nigeria	Rainbownet Limited	1X (Commercial)	800 MHz
Africa - Middle East	Nigeria	Reliance Telecommunications Limited	1X (Commercial)	1900 MHz
Africa - Middle East	Nigeria	Starcomms Limited	1X (Commercial) EV-DO (Commercial)	1900 MHz
Africa - Middle East	Oman	Oman Telecommunications Company	1X (To Launch) EV-DO (To Launch)	450 MHz
Africa - Middle East	Rwanda	Terracom	1X (Commercial) EV-DO (Commercial)	800 MHz
Africa - Middle East	Saudi Arabia	Saudi Telecom Company	1X (To Launch) EV-DO (To Launch)	450 MHz
Africa - Middle East	Tanzania	My Cell Company Ltd.	1X (To Launch) Rev A (To Launch)	800 MHz
Africa - Middle East	Tanzania	Zantel	1X (Commercial)	800 MHz
Africa - Middle East	Uganda	MTN Uganda Ltd.	1X (Commercial) EV-DO (To Launch)	800 MHz
Africa - Middle East	Uganda	Uganda Telecom	1X (To Launch) EV-DO (To Launch)	450 MHz
Africa - Middle East	Yemen	Yemen Telecom	1X (Commercial)	800 MHz
Africa - Middle East	Zambia	ZAMTEL	1X (To Launch) EV-DO (To Launch)	450 MHz
Asia - Pacific	Afghanistan	Afghan Telecom	1X (Commercial)	800 MHz
Asia - Pacific	Azerbaijan	Aztrank LLC	1X (Commercial) EV-DO (To Launch)	450 MHz
Asia - Pacific	Azerbaijan	Caspian American Telecom LLC	1X (Commercial)	800 MHz
Asia - Pacific	Bangladesh	Dhaka Telephone Company Ltd.	1X (Commercial)	800 MHz
Asia - Pacific	Bangladesh	Jalalabad Telecom Limited	1X (Commercial)	800 MHz
Asia - Pacific	Bangladesh	National TeleCom Ltd (NTC)	1X (To Launch) EV-DO (To Launch)	450/1900 MHz
Asia - Pacific	Bangladesh	Onetel Communications Limited	1X (Commercial)	800 MHz
Asia - Pacific	Bangladesh	Pacific Bangladesh Telecom Limited	1X (Commercial) EV-DO (To Launch)	800 MHz
Asia - Pacific	Bangladesh	RanksTel	1X (Commercial)	800 MHz
Asia - Pacific	Bangladesh	Tele Barta Limited	1X (Commercial) EV-DO (To Launch)	1900 MHz
Asia - Pacific	Cambodia	AZ COM	1X (To Launch) EV-DO (To Launch)	800 MHz



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Appendix A: Examples of CDMA2000 systems in developing markets

Region	Country	Operator	Technology	Operating Frequency
Asia - Pacific	Cambodia	Cambodia Shinawatra Co. Ltd.	1X (Commercial)	450 MHz
Asia - Pacific	China	China Telecom	1X (Commercial)	450 MHz
Asia - Pacific	China	China Unicom	1X (Commercial) EV-DO(Trial)	800 MHz 2100 MHz
Asia - Pacific	Fiji	Telecom Fiji Limited	1X (Commercial) EV-DO(To Launch)	800 MHz
Asia - Pacific	Georgia	Iberiatel	1X (Commercial)	450 MHz
Asia - Pacific	Guam	Guamcell	1X (Commercial)	800 MHz
Asia - Pacific	Guam	IT&E Overseas, Inc.	1X (Commercial) EV-DO(To Launch)	1900 MHz
Asia - Pacific	India	Bharat Sanchar Nigam Limited (BSNL)	1X (Commercial)	800 MHz
Asia - Pacific	India	HFCL Infotel Limited	1X (Commercial)	800 MHz
Asia - Pacific	India	Mahangar Telephone Nigam Ltd. (MTNL)	1X (Commercial)	800 MHz
Asia - Pacific	India	Reliance Infocomm Limited	1X (Commercial)	800 MHz
Asia - Pacific	India	Shyam Telelink	1X (Commercial)	800 MHz
Asia - Pacific	India	Tata Teleservices	1X (Commercial)	800 MHz
Asia - Pacific	Indonesia	PT Bakrie Telecom	1X (Commercial) EV-DO (Commercial)	800 MHz
Asia - Pacific	Indonesia	PT Indosat	1X (Commercial) EV-DO (To Launch)	800/1900 MHz
Asia - Pacific	Indonesia	PT Mobile-8 Telecom	1X (Commercial) EV-DO (Commercial)	800 MHz
Asia - Pacific	Indonesia	PT Sampoerna Telekomunikasi Indonesia	1X (Commercial)	450 MHz
Asia - Pacific	Indonesia	PT TELKOM Indonesia	1X (Commercial)	800 MHz
Asia - Pacific	Kazakhstan	JSC ALTEL	1X (Commercial)	800 MHz
Asia - Pacific	Kyrgyzstan	AkTel LLC	1X (Commercial) EV-DO (To Launch)	800 MHz
Asia - Pacific	Kyrgyzstan	WinLine	1X (Commercial)	450 MHz
Asia - Pacific	Laos	Lao Telecommunications (LTC)	1X (Commercial) EV-DO (To Launch)	450 MHz
Asia - Pacific	Macau	China Unicom Macau	1X (Commercial) EV-DO (To Launch)	800 MHz
Asia - Pacific	Malaysia	Telekom Malaysia	1X (To Launch)	800 MHz
Asia - Pacific	Mongolia	SkyTel	1X (Commercial) EV-DO (To Launch)	800 MHz



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Appendix A: Examples of CDMA2000 systems in developing markets

Region	Country	Operator	Technology	Operating Frequency
Asia - Pacific	Nepal	Nepal Telecom	1X (Commercial) EV-DO (To Launch)	800 MHz
Asia - Pacific	Nepal	United Telecom Limited (UTL)	1X (Commercial)	1900 MHz
Asia - Pacific	Pakistan	DVCOM	1X (To Launch) EV-DO (To Launch)	450/1900 MHz
Asia - Pacific	Pakistan	Great Bear International Services (Pvt) Ltd	1X (Commercial) EV-DO (To Launch)	450 MHz
Asia - Pacific	Pakistan	Pakistan Telecom Company Limited (PTCL)	1X (Commercial) EV-DO (To Launch)	450/1900 MHz
Asia - Pacific	Pakistan	TeleCard Limited	1X (Commercial)	1900 MHz
Asia - Pacific	Pakistan	Worldcall	1X (Commercial)	1900 MHz
Asia - Pacific	Philippines	Bayan Telecommunications, Inc.	1X (Commercial)	1900 MHz
Asia - Pacific	Philippines	Broadband Everywhere	1X (Commercial) Rev A (To Launch)	450 MHz
Asia - Pacific	Philippines	Digital Telecommunications Phils., Inc (Digitel)	1X (Commercial) EV-DO (Commercial)	1900 MHz
Asia - Pacific	Philippines	Multi-Media Telephony (Broadband Philippines)	1X (Commercial) EV-DO (Commercial)	1900 MHz
Asia - Pacific	Saipan	Saipancell	1X (Commercial)	800 MHz
Asia - Pacific	Sri Lanka	Lanka Bell	1X (Commercial)	1900 MHz
Asia - Pacific	Sri Lanka	Sri Lanka Telecom Limited	1X (Commercial)	800 MHz
Asia - Pacific	Sri Lanka	Suntel	1X (Commercial) EV-DO (Trial)	800 MHz
Asia - Pacific	Sri Lanka	Tritel Services Private Limited	1X (To Launch)	450 MHz
Asia - Pacific	Taiwan	APBW	1X (Commercial) EV-DO (To Launch)	800 MHz
Asia - Pacific	Tajikistan	JSC Tajiktelecom	1X (Commercial)	450 MHz
Asia - Pacific	Thailand	CAT Telecom	1X (Commercial) EV-DO (Commercial)	800 MHz
Asia - Pacific	Thailand	Hutchison CAT	1X (Commercial) EV-DO (To Launch)	800 MHz
Asia - Pacific	Uzbekistan	JSC Uzbektelecom	1X (Commercial)	450 MHz
Asia - Pacific	Uzbekistan	Perfectum Mobile	1X (Commercial)	800 MHz
Asia - Pacific	Uzbekistan	Telekom Mobile Inc	1X (Commercial)	450 MHz
Asia - Pacific	Vietnam	EVN Telecom	1X (Commercial) EV-DO (Commercial)	450 MHz
Asia - Pacific	Vietnam	S Telecom	1X (Commercial) EV-DO (Commercial)	800 MHz
Caribbean - Latin America	Argentina	CoTeCal	1X (Commercial)	450 MHz



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Appendix A: Examples of CDMA2000 systems in developing markets

Region	Country	Operator	Technology	Operating Frequency
Caribbean - Latin America	Argentina	Movistar Argentina	1X (Commercial)	1900 MHz
Caribbean - Latin America	Aruba	Digicel Caribbean Aruba	1X (To Launch) EV-DO (To Launch)	1900 MHz
Caribbean - Latin America	Aruba	Setar	1X (To Launch)	800 MHz
Caribbean - Latin America	Bahamas	Bahamas Telecommunications Company	1X (To Launch) EV-DO (To Launch)	800 MHz
Caribbean - Latin America	Barbados	Digicel Caribbean Barbados	1X (To Launch) EV-DO (To Launch)	1900 MHz
Caribbean - Latin America	Barbados	Sunbeach Communications, Inc.	1X (To Launch) EV-DO (To Launch)	800/1900 MHz
Caribbean - Latin America	Belize	Speednet Communications	1X (Commercial) EV-DO (To Launch)	850 MHz
Caribbean - Latin America	Bermuda	Bermuda Digital Communications	1X (Commercial) EV-DO (Commercial)	800 MHz
Caribbean - Latin America	Bermuda	Digicel Caribbean Bermuda	1X (To Launch) EV-DO (To Launch)	1900 MHz
Caribbean - Latin America	Brazil	Embratel	EV-DO (Commercial)	1900 MHz
Caribbean - Latin America	Brazil	TMais Telecom	1X (Commercial)	1900 MHz
Caribbean - Latin America	Brazil	Unicel Telecomunicações	1X (Trial)	450 MHz
Caribbean - Latin America	Brazil	VIVO	1X (Commercial) EV-DO (Commercial)	800 MHz
Caribbean - Latin America	British Virgin Islands	Caribbean Cellular Telephone (CCT)	1X (Commercial)	800 MHz
Caribbean - Latin America	Cayman Islands	Blue Sky Wireless	1X (To Launch) EV-DO (To Launch)	1900 MHz
Caribbean - Latin America	Cayman Islands	Digicel Caribbean Cayman Islands	1X (To Launch) EV-DO (To Launch)	800 MHz
Caribbean - Latin America	Cayman Islands	E-Technologies Cayman Islands Ltd.	1X (To Launch) EV-DO (To Launch)	1900 MHz
Caribbean - Latin America	Chile	Movistar Chile	1X (Commercial)	1900 MHz
Caribbean - Latin America	Chile	SmartCom PCS	1X (Commercial)	1900 MHz
Caribbean - Latin America	Colombia	EPM-Bogota	1X (Commercial)	1900 MHz
Caribbean - Latin America	Colombia	Movistar Colombia	1X (Commercial)	800 MHz



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Appendix A: Examples of CDMA2000 systems in developing markets

Region	Country	Operator	Technology	Operating Frequency
Caribbean - Latin America	Dominican Republic	Centennial Dominicana	1X (Commercial)	1900 MHz
Caribbean - Latin America	Dominican Republic	Verizon Dominicana	1X (Commercial) EV-DO (Trial)	1900 MHz
Caribbean - Latin America	Ecuador	Alegro PCS	1X (Commercial) EV-DO (Commercial)	1900 MHz
Caribbean - Latin America	Ecuador	Movistar Ecuador	1X (Commercial)	800 MHz
Caribbean - Latin America	El Salvador	Oceanic Digital El Salvador	EV-DO (To Launch)	1900 MHz
Caribbean - Latin America	Guatemala	Movistar Guatemala	1X (Commercial) EV-DO (Commercial)	1900 MHz
Caribbean - Latin America	Guatemala	SERCOM	1X (Commercial)	1900 MHz
Caribbean - Latin America	Haiti	HaiTel S.A.	1X (To Launch) EV-DO (Commercial)	1900 MHz
Caribbean - Latin America	Honduras	Comunitel S.A.	1X (To Launch)	800 MHz
Caribbean - Latin America	Jamaica	Digicel Caribbean Jamaica	1X (To Launch) EV-DO (To Launch)	1900 MHz
Caribbean - Latin America	Jamaica	Oceanic Digital Jamaica	1X (Commercial) EV-DO (To Launch)	800 MHz
Caribbean - Latin America	Mexico	IUSACELL	1X (Commercial) EV-DO (Commercial)	800 MHz
Caribbean - Latin America	Mexico	UNEFON	1X (Commercial)	1900 MHz
Caribbean - Latin America	Netherlands Antilles	EOCG Wireless NV	1X (Commercial) EV-DO (Commercial)	850/1900 MHz
Caribbean - Latin America	Nicaragua	Movistar Nicaragua	1X (Commercial)	800 MHz
Caribbean - Latin America	Panama	Movistar Panama	1X (Commercial)	800 MHz
Caribbean - Latin America	Peru	Movistar Peru	1X (Commercial) EV-DO (To Launch)	800 MHz
Caribbean - Latin America	Peru	Valtron	1X (Commercial)	450 MHz
Caribbean - Latin America	Puerto Rico	Centennial de Puerto Rico	1X (Commercial) EV-DO (Commercial)	1900 MHz
Caribbean - Latin America	Puerto Rico	Movistar Puerto Rico	1X (Commercial)	1900 MHz
Caribbean - Latin America	Puerto Rico	Sprint Puerto Rico	1X (Commercial) EV-DO (Commercial)	1900 MHz



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Region	Country	Operator	Technology	Operating Frequency
Caribbean - Latin America	Puerto Rico	Verizon Wireless Puerto Rico	1X (Commercial) EV-DO (Commercial)	1900 MHz
Caribbean - Latin America	Trinidad & Tobago	LaqTel Limited	1X (To Launch) EV-DO (To Launch)	800/1900 MHz
Caribbean - Latin America	Trinidad & Tobago	TSTT	1X (Commercial) EV-DO (Commercial)	850 MHz
Caribbean - Latin America	Uruguay	Movistar Uruguay	1X (Commercial)	1900 MHz
Caribbean - Latin America	U.S. Virgin Islands	Centennial Virgin Islands	1X (Commercial)	1900 MHz
Caribbean - Latin America	U.S. Virgin Islands	Sprint U.S. Virgin Islands	1X (Commercial) EV-DO (Commercial)	1900 MHz
Caribbean - Latin America	Venezuela	Movilnet	1X (Commercial) EV-DO (Commercial)	850 MHz
Caribbean - Latin America	Venezuela	Movistar Venezuela	1X (Commercial) EV-DO (Commercial)	800 MHz