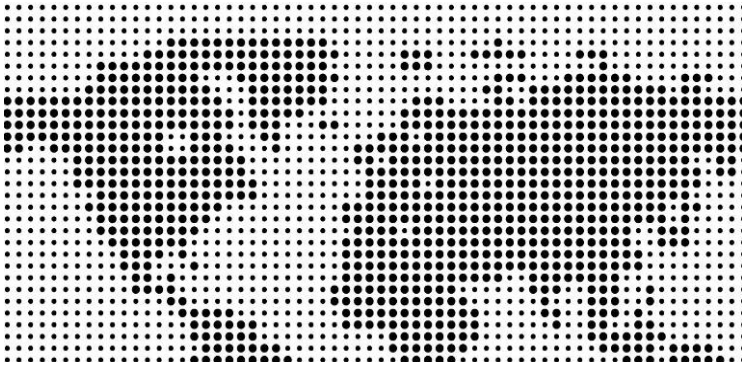
3G in Emerging Markets



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[1] Executive Summary

Telephone and Internet services are vital to economic and social growth everywhere but not readily available in emerging markets[1]. Fully aware of this, governments, businesses and public agencies focus a large amount of resources on improving communications in these regions. Wireless systems, with their broad coverage, low deployment cost, and usability for fixed, portable and mobile applications are excellent alternatives. Further, 3G wireless systems have become very prevalent due to their unsurpassed economies for delivering voice and data services, capacity to support rapidly growing subscriber bases, and ability to support advanced revenue generating services. This paper discusses why and how 3G wireless systems have become viable communications solutions in emerging markets, and why their evolutions will likely continue similarly.

[2] Emerging Markets and Value of Improving Infrastructures

Developed and emerging nations often differ substantially in their telephone and Internet penetrations. Countries in regions like Southeast Asia, Latin America, the Middle East and Africa have lower tele-densities and Internet penetrations than more developed regions like South Korea, Japan, Western Europe and the U.S. Various factors give rise to this limited penetration, including that developing markets generally have lower GDPs, smaller tax bases, and less existing infrastructure. Consequently, consumers and businesses in these regions are often underserved by communications providers or completely without service.

[1] For this discussion, Emerging Markets are defined per The Economist magazine which cites 27 countries based on various socio-economic criteria. The case studies cited are from this list.

It is also well known, however, that improving telephone and Internet penetrations in any region is an important economic stimulus. As shown in Figure 1, improvements in either mobile phone density or Internet density are strongly correlated with significant improvements to GDP. Consequently, improving telecommunications and data communications infrastructures is a primary goal of most governments in developing countries, as well as of the World Bank, the ITU, and many charitable organizations. Toward this end, governments often establish universal access service funds and policies to secure monies to build these infrastructures. Further, they often reduce licensing fees on spectrum and reduce duties and taxes on infrastructure and devices to encourage investment. They may also adopt various policies like Calling Party Pays and reduced basic service charges to lessen the financial burden on lower income subscribers and boost adoption.

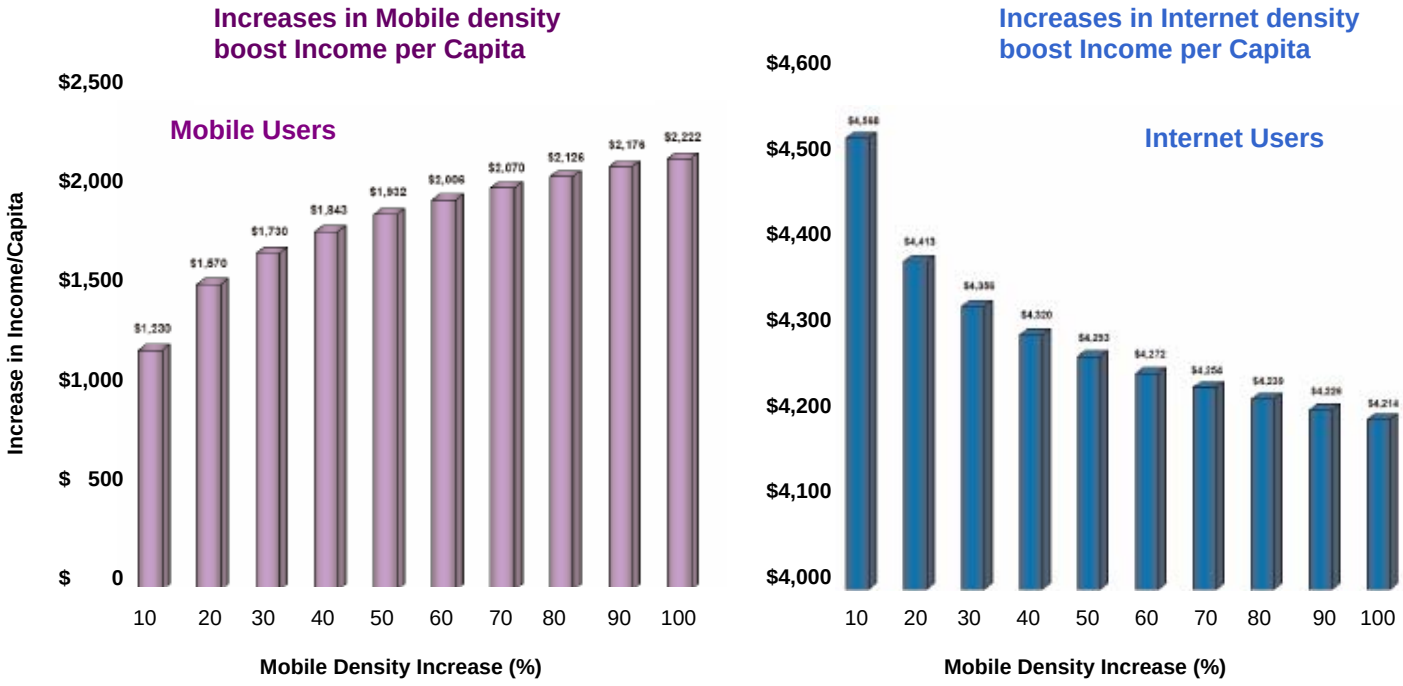

Figure 1. GDP per Capita from Telephone and Internet Penetration

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

[3] Communications Solutions for Emerging Markets

In selecting communications solutions for developing markets, wireless infrastructure is usually a clear choice for operators. With greatly reduced needs for cable installation and maintenance, wireless infrastructure is typically cheaper and faster to deploy. It is estimated that the capital cost of providing mobile coverage to an individual is about 1/10th the cost of installing a fixed-line connection[2]. Wireless infrastructure is also less susceptible to theft or vandalism as is often the case with copper lines in developing countries. Wireless also has the added benefit of being usable for portable and mobile applications as well as fixed ones. Further, governments like rapid installation which can both quickly improve available infrastructure and quickly introduce competition with wireline incumbents to drive down service prices.

Wireless deployments in developing regions often begin with fixed implementations. This is because insufficient wireline infrastructure usually exists and basic services have to be put in place. While urban areas are often underserved, rural ones are typically unserved altogether. In both settings, businesses and consumers benefit greatly from basic voice services as well as basic Internet connectivity – at whatever speed they can achieve. The key enabler is basic wireless access with as large population coverage as possible. In addition to wireless access, users typically need fundamental productivity applications like messaging (email and/or SMS), Internet browsing, and the ability to host web sites. Many other applications both business and consumer oriented, garner interest in emerging markets especially when enabled by 3G networks. Some examples are given in the case studies that follow.

[2] *World Bank, World Development Indicators, 2006*

Beyond fixed communications services, users yearn for mobility. Mobility allows businessmen, who are otherwise location bound, the freedom to conduct activities in multiple venues at once. Similarly, it allows family members the flexibility to venture out and engage in other activities while remaining ”on call” for family needs. In each case, mobility allows people to stay connected and be productive both at their destination and in transit.

With this in mind, it is clear that wireless communications are greatly preferred to wireline ones in developing nations, and that mobile deployments are inevitable.

“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 Diallog, investor in a Pakistan operator covering over 40M people[a].

“CDMA2000 Wireless Local Loop 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

[a] CDMA Development Group 01/07

[4] 3G is a Preferred Wireless Solution in Emerging Markets

As of October 2007, there were more than 442 CDMA2000® deployments[3] worldwide of which a majority was in emerging markets. There were also more than 268 WCDMA/HSPA deployments[4] worldwide of which a majority was in emerging markets. Popularized not only by their much greater voice/data capacities and airlink economies, 3G wireless technologies like EV-DO Rel. 0, EV-DO Rev. A, UMTS and HSPA have also become preferred solutions given their excellent coverage, outstanding mobility attributes (the end game for most wireless WAN deployments), availability in numerous spectrum bands (such as 450 MHz, 800 MHz, 900 MHz, 1.8 GHz, 1.9 GHz, 2.1 GHz, 2.5 GHz, etc.) and interoperability with prior and future network evolutions. Also central to their popularity in many regions is that they enable wireless broadband data service for the first time with multi-megabit speeds and they are upgradeable. In the next section, we offer some case studies which illustrate the value that 3G networks (both WCDMA and CDMA2000 based) have brought to emerging markets[5].

[3] CDG, 10/07: http://www.cdg.org/technology/cdma_technology/cdma_stats.asp
[4] GSA,10/07: http://www.gsacom.com/downloads/wcdma/HSDPA_Operator_Commitments
[5] Emerging Markets are defined per The Economist magazine which cites 27 countries based on various socio-economic criteria. The case studies cited are from this list.

Region	Country	Operator	Technology
Latin America	Venezuela	Movistar	EV-DO
Africa	Nigeria	MTS	EV-DO
Asia	China	China Unicom	EV-DO
Middle East	Iraq	Kalimat Telecom	EV-DO
Latin America	Peru	Claro	HSDPA
Asia	Nepal	Nepal Telecom	HSDPA
Africa	Tanzania	Vodacom Tanzania	HSDPA
Middle East	Egypt	Egypt Telecom	HSDPA
E. Europe	Croatia	VIP Net	HSDPA
Latin America	Colombia	Comcel	UMTSR99
Asia	Indonesia	3 Indonesia	UMTSR99
Africa	S. Africa	3C Telecom	UMTSR99
Middle East	Libya	Libyana	UMTSR99
E. Europe	Croatia	T-Mobile	UMTSR99

Figure 2: Sample of 3G Deployments in Emerging Markets

4.1 MTN, South Africa[6]

With 47 million people and the largest economy in Africa, South Africa has only about 350,000 broadband connections. Its broadband penetration is just 0.7% compared to the average of 15.5% for peer countries in the Organization For Economic Cooperation and Development. However this difference is now shrinking due to mobile broadband. Compared to Western Europe, South Africa has low suburban and rural population densities. People are concentrated in towns and villages that are widely separated. Connecting these towns with no existing infrastructure is best achieved with wireless rather than wireline networks.

In late 2005, MTN was the first operator to launch HSDPA in South Africa, and the eleventh worldwide. Initially, it supplied urban areas but soon expanded to rural ones. It sold HSDPA as a mobile broadband service in direct competition with fixed-line services, and other wireless alternatives where available. In doing so, it emphasized HSDPA's advantages of being faster, cheaper and easier to deploy. MTN provided connectivity via PC cards for laptops and USB modems for desktop computers.

In the course of its rollout, MTN SA founded a community payphone Kiosk concept, called MTN@ccess. It is part of a nationwide initiative to bring computing and broadband access to low-income townships in order to enhance their commerce, education and healthcare. In the program, MTN partnered with local entrepreneurs to construct small service establishments that provided wireless voice and multiple computers with HSDPA for a high-speed Internet connection. To date, Kiosk owners have found that customers tend to use the broadband connections especially for job searches, educational applications, email and procuring news/sports updates. They have been particularly helpful in aiding people looking for work in nearby towns. Some of the kiosks have been so popular as to reach profit within a couple months of opening, and have caused their owners to expand the kiosks and open new ones. It has also caused many other residents to approach MTN with requests to open their own kiosks.

[6] Sources for this case study include the GSM Association (2007) and MTN SA (2007)

Since MTN launched its 3G data services and its rival Vodacom followed suit, wireless Internet connections now account for over 55% of South Africa's broadband connections. Further, MTN has seen over 4500% growth in its data traffic.

In the course of its success, MTN South Africa cemented its understanding that: (i) HSPA resolves the last-mile problem in developing nations quickly, economically and reliably. Even when fixed-line options are available, HSPA can offer easier deployment, improved provisioning, and in some regions, better performance. (ii) Data connectivity is only part of the solution. Developing regions also need applications like web-based community portals to help people and businesses interconnect. (iii) Even low-income consumers in rural areas can give rise to sizeable, profitable business – with an appropriate service model and technology.

4.2 Maxis, Malaysia[7]

Malaysia's economy has a GDP of more than US $135 billion and is one of the strongest in Asia. Also, its mobile market is about 78% penetrated and is one of the fastest growing in the region. However, the total broadband penetration stands at 15%. Maxis is the second largest telecom company in Malaysia. Together with its subsidiaries and associated companies, Maxis delivers fixed-line, mobile, data, satellite, cable TV, multimedia and Internet services. It is also the largest mobile operator in Malaysia with a 40% share and covers over 92% of the country. In July 2005, it launched WCDMA services in much of its network and a year later, upgraded it to HSDPA. 3G provides Maxis with an efficient, high-performance platform to launch not only basic wireless broadband services, but also numerous compelling data-centric applications like video on demand, full track music downloads, and video telephony. To support these services, it offers a range of consumer-oriented 3G handsets, as well as other devices like PC data cards and USB terminals, many of which are targeted toward the enterprise market.

[7] Sources for this case study include the GSM Association (2007) and Maxis (2007)

What is most noteworthy about Maxis, however, is its strategy to use 3G to win business from fixed broadband access services like ADSL, and open up both the residential and business markets. Its core wireless offerings include fixed and portable access based on HSDPA. With data speeds similar to ADSL, Maxis provides extra value through the portability of its services and device, a compact unit with battery backup, and the ability to conduct both voice calls and broadband data sessions. For the first time, residential and business consumers can obtain both services from a single provider, and do so at an attractive bundled price. In fact, its current service offering is so popular that Maxis signs up hundreds of users per day and aims to reach 100,000 by year end. With its wireless and fixed offerings combined, Maxis plans to acquire 25-30% of the broadband access market within five years.

Leveraging its success in Malaysia, Maxis is extending the model to other countries. In 2006, it acquired Indian operator Aircel with more than 4 million mobile subscribers. While India has yet to issue 3G licenses, Maxis made this acquisition with plans to bring economical voice and broadband data services to the market via HSPA. According to Dr. Nikolai Dobberstein, Head of Product and New Businesses at Maxis, “when we started planning our HSDPA strategy for Malaysia in late 2005, the prevalent industry opinion was that HSDPA is a premium mobile service and should be used for mobile phones and data cards. Maxis has changed the industry thinking and spearheaded the development of a lower cost residential modem to launch HSDPA broadband as a residential service. It will ensure the economic viability of the overall 3G rollout.”

4.3 Telefonica O2, Czech Republic[8]

Although the Czech Republic had over 98% mobile voice adoption in mid- 2006 and a sizeable population with advanced socio-economic profiles, it had less than 3% Internet adoption. This posed an opportunity for a service provider who could offer the right combination of speed, economy and coverage. With more than 4.7 million customers in June 2006, Telefonica 02 Czech Republic was and remains the largest provider of

[8] Sources for this case study include Nortel (2006) and Telefonica (2007).

wireless voice and data services in the Czech Republic. The company's networks cover 99% of the Czech Republic's more than 10 million residents. Operating under the name "Eurotel" until recently, it first entered the wireless market with voice-only NMT technology in 1981. It later moved to a GSM/GPRS solution, and in recent years, used that technology to trial an aggressive flat rate Internet service. Internet users soon overwhelmed the network, however, and O2 realized that a higher capacity wireless solution was needed. It also needed one that would provide cost-effective countrywide coverage. Based on the results of a two-month trial with Nortel, 02 realized that the excellent coverage of CDMA 450, combined with the high data capacity and throughput characteristics of 1xEV-DO, made it the ideal solution for their needs. O2 then enlisted Nortel to build the network which soon covered 80% of the Czech population with just 224 base stations.

In August 2004, O2 launched its CDMA 450 1xEV-DO network, and within five months of launch, it had acquired more than 30,000 subscribers representing over 20% of the Czech Republic's broadband connections. As of May 2006, that number was about 90,000 subscribers and has continued to grow rapidly. A true convenience, O2's service can be purchased at local retail outlets, where one can obtain an access terminal that configures quickly for both fixed and portable use. Naturally, O2 now offers EV-DO data cards as well. It also offers solutions that enable business customers to connect to corporate VPNs and work efficiently with large files and email attachments while out of the office. With the huge success of its EV-DO service, Telefonica 02 Czech Republic has been able to sustain its market leading position despite rapidly rising competition in this developing region.

[5] Evolution of 3G in Emerging Markets

A common theme of these examples and many others in emerging markets is operators' desires to cover as much of their populations as possible and do it very economically. This is usually their first and foremost need. By using a cost-effective wireless solution, they often penetrate largely untapped markets of voice and data users and enjoy rapid subscriber uptake.

After satisfying their fixed connectivity need, users soon yearn for mobility—to be able to leave their homes or businesses so they can pursue useful activities yet remain reachable both en route and at each destination. In addition to mobility, these users show a keen desire for increased data speeds just as they do in developed markets. Greater speeds save time, increase productivity, and often come hand in hand with price reductions on existing services which yield greater uptake. Further, the combination of greater speed and lower costs enables new kinds of data services, many of which have already proven popular in developing markets. Some of these include the ability to host web sites that permit residents of different towns to share news and events, advertise goods and services, and contact one another. Other services include the ability to multicast educational material to many users at once, to conduct telemedicine and basic infotainment like streaming newscasts, music and eventually TV.

We have seen from the case study discussions already that 3G wireless standards like EV-DO and HSPA support all of these services today. They are the highest performing WAN radio technologies available, and provide comparable spectral efficiencies (cost of delivery over the air). While EV-DO Rev. A enables peak data rates up to 3.1 Mbps downlink and 1.8 Mbps uplink in 1.25 MHz, HSPA provides up to 14.4 Mbps downlink and 5.76 Mbps uplink in 5 Mhz. They also both incorporate mechanisms on the downlink for efficiently downloading and streaming rich media to many users at once. Furthermore, they are both fully IP-based so they support all Internet applications and enable use of low-cost IP-based network components.

The evolutions of these radio network technologies improve capacity and performance on multiple dimensions. These in turn translate into the ability to support more users, provide better user experiences, lower prices and/or improve profit. The natural evolution of an EV-DO Rev. A network is EV-DO Rev. B. Rev. B bonds multiple Rev. A carriers together via a software upgrade to provide higher capacity and spectral efficiency. It also enables higher data rates (up to 73.5 Mbps downlink and 27 Mbps uplink in 20 MHz FDD), lower delays, and better edge performance to permit wireline-like performance across the entire coverage area. Similarly, HSPA+, the evolution of HSPA, introduces MIMO, higher order modulation, various forms of interference cancellation, and other techniques to improve capacity and performance. As a result, it doubles HSPA's data capacity and increases its voice capacity three-fold. HSPA+ further enhances user experience through higher peak rates (up to 42 Mbps downlink and 11 Mbps uplink in 10 MHz FDD), lowers latencies, and extends device talk times to enable an "always-on" experience. Both Rev. B and HSPA+ are backward compatible with existing devices and are expected to be commercially available in 2008 and 2009 respectively.

As the load on these networks grows and as operators secure new, larger blocks of spectrum, the evolutions of these technologies become compelling. UMB (Ultra Mobile Broadband) is the evolution of 3GPP2 and supports bandwidths up to 20 MHz as well as both FDD and TDD modes. It is a highly optimized OFDMA solution with a scalable IP network architecture, advanced QoS mechanisms, and support for advanced antenna techniques like MIMO, SDMA and Beamforming. It also incorporates various other enhancements while remaining interoperable with Rev. A and Rev. B. As a result, UMB will supply peak data rates up to 288 Mbps downlink and 75 Mbps uplink in 20 MHz FDD, as well as packet latencies less than 16ms. Together, Rev. B and UMB will extend EV-DO Rev. A's industry-leading mobile broadband performance.

Similarly, LTE (Long Term Evolution) is the evolution of HSPA+. Like UMB, it is an optimized OFDMA solution that supports wider bandwidths up to 20 MHz and both FDD and TDD operation. It too offers an IP-based architecture, higher order MIMO and SDMA techniques, and a range of other design enhancements. Together, these enhancements provide an evolution path for 3GPP with peak data rates up to 277 Mbps downlink and 75 Mbps uplink in 20 MHz FDD.

[6] Conclusion

To date, 3G technologies have spearheaded economical wireless broadband communications in both developed and emerging markets. These technologies are being rapidly deployed for fixed, portable and mobile uses. While emerging market residents have received tremendous value from fixed 3G broadband deployments, they are eager for and are beginning to reap the value of mobility. Today's 3G technologies like EV-DO Rev. A and HSPA provide outstanding capabilities which have made them the preeminent choices. Their evolutions further improve capacity and performance to support future market needs. They will also provide solutions for new, wider spectrum opportunities and for emerging high-demand regions like urban hotspots. 3G and its evolutions will continue to stimulate significant social and economic gains.