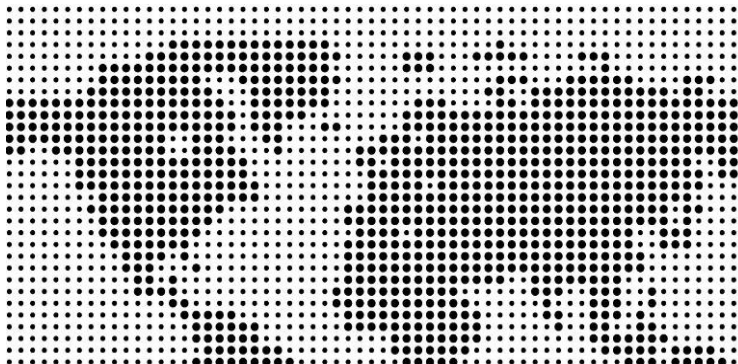




3G Case Studies



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Table of Contents

[1] Introduction 1

[2] Case Studies..... 2

 2.1 AT&T..... 2

 2.2 KDDI 4

 2.3 Maxis 6

 2.4 Verizon Wireless..... 8

[3] Conclusion 10

[4] Bibliography 11

[1] Introduction

The wireless telecommunications market is rapidly expanding, fueled by convergence in the consumer segment, and increased wireless integration in the enterprise segment. At the same time, conventional voice services are being commoditized, resulting in stable or declining voice ARPU (average revenue per user) for most operators, especially in developed markets. Thus, operators are looking to advanced and rich data services to help spur revenue growth.

To support such data services, operators are fast realizing that they must look beyond their 2G/2.5G networks for long-term, cost-effective and proven solutions.

3G technologies and their broadband capabilities provide a viable solution with the key characteristics that operators are looking for:

- A well-established roadmap that ensures investment protection
- Excellent performance and a large ecosystem that provides cost efficiency
- Support for rich applications and services
- Seamless backward compatibility for ubiquitous coverage

Many small and large operators, serving both developed and emerging markets, are already reaping the benefits of 3G technologies. As of January 2008, there were 435 3G operators worldwide, with more than 560 million subscribers in 143 countries. Among these subscribers, more than 100 million have either EV-DO (Evolution – Data Optimized) or HSPA (High-Speed Packet Access) services.

This paper presents success stories from some of the world's leading 3G operators, notably Verizon Wireless, AT&T, KDDI and Maxis, whose services span markets in the U.S., Japan and Malaysia. Verizon and KDDI offer CDMA2000[®]-based 3G services, including CDMA2000 1xEV-DO and CDMA2000 1xEV-DO Revision A enhancements. AT&T and Maxis provide WCDMA-based 3G services, including HSPA. This paper focuses on the successes associated with EV-DO and HSPA. These stories are a very small sample of many such successful operators across the world.



[2] Case Studies

2.1 AT&T

AT&T is the largest mobile operator in the U.S., with 71.4 million customers. AT&T also boasts the largest digital voice and data coverage in the U.S.



In 2005, AT&T launched the first commercial large-scale HSDPA (High-Speed Downlink Packet Access) deployment in the world. HSDPA, with a theoretical maximum data rate of 14.4 Mbps, provides an excellent mobile broadband experience and also lowers the cost of data delivery. AT&T's rollout focused primarily on major metropolitan areas, though subsequent deployments will include suburban areas. Currently, its 3G service covers most of the urban markets in the U.S. It plans to expand the 3G service to reach nearly 350 top U.S. markets by the end of 2008.

AT&T has a mix of 1900 MHz and 850 MHz spectrum. 3G at 850 MHz is a perfect mix of superior performance and excellent coverage, and this combination will prove extremely cost effective for AT&T as it expands the 3G network into rural areas, where population is sparse and ARPU is lower. To provide ubiquity and seamless service, AT&T has ensured that its 3G network and devices support both spectrum bands.

Like other operators in the U.S., AT&T initially targeted the enterprise market with PC cards and USB modems, then rapidly expanded the offering to include PDAs, handsets and embedded laptops.

AT&T offers an impressive range of applications and services, including full-length video and audio download, games, and improved 2G/2.5G services such as text and picture messaging. Mobile video downloads in particular are reported to be popular with AT&T data customers. Fast downloads and high-speed video streaming for TV channels such as HBO®, MTV, ESPN, and CNN provide an excellent viewing experience. This combination of a compelling range of content and prices with the enhanced user experience offered by HSDPA has helped AT&T become one of the most successful mobile video providers. AT&T's flagship MEdia™ Net unlimited data plan, bundled with voice, messaging and other services allows unlimited Internet access on handsets including surfing, streaming and downloads. AT&T also provides premium packages for additional fees.

AT&T launched its live Video Share service—first of its kind in the U.S.—in July 2006. This HSDPA-based service allows users to send a live video stream during a standard voice call. Such services are only possible with high-speed 3G networks such as HSDPA and the packet-based core network that AT&T has employed to enable its future services. AT&T continues to add new and innovative services to its portfolio. The most anticipated addition is the Mobile TV service based on Qualcomm’s MediaFLO™ technology. The commercial launch of this service is expected in May 2008.

3G has spurred rapid growth in data ARPU and increased customer loyalty for AT&T. Data ARPU increased by 57.5% year over year in the fourth quarter of 2007. The data revenues currently stand at \$2 billion, about 20% of the total wireless service revenue. Churn continues to fall; it was 1.2% in the fourth quarter, compared with 1.5% a year ago.

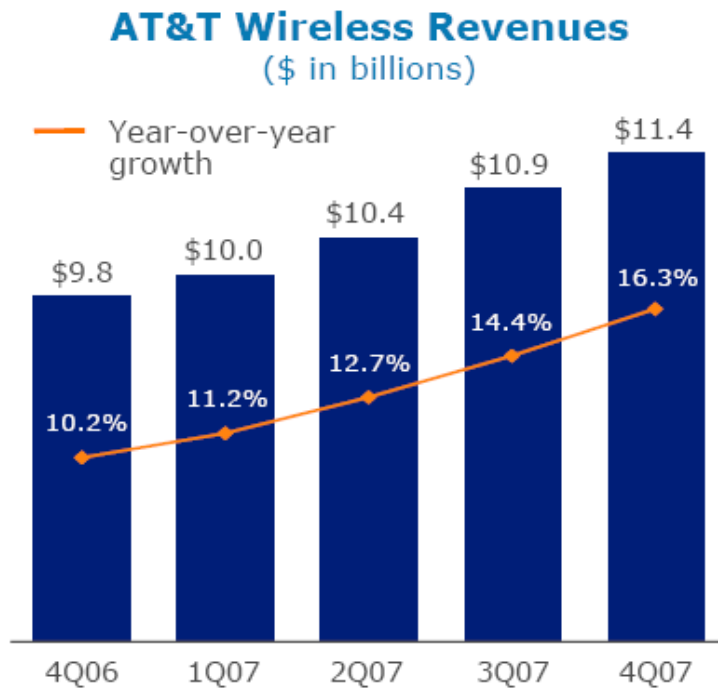


Figure 1. AT&T Wireless Data Revenues

Source: AT&T Quarterly Reports

AT&T recently unveiled its plan to finish upgrading the network to HSUPA (High-Speed Uplink Packet Access) technology by mid 2008. HSUPA is a natural next step in 3G evolution. It significantly boosts uplink data rates,

as well as enables latency-sensitive applications like Voice over IP (VoIP), and Interactive gaming.

AT&T reaffirmed its commitment to a 3G roadmap by recently announcing its intention to evolve the 3G network to HSPA+ and LTE (Long Term Evolution) technologies in the future.

2.2 KDDI

Japan is a highly competitive wireless market and is arguably the world's most advanced data market. In such an aggressively competitive environment, operators are even more compelled to bring innovation to the market and provide differentiated service. KDDI has successfully employed such a strategy. CDMA2000 and EV-DO have helped KDDI introduce innovative services while leveraging time-to-market advantage.

KDDI introduced EV-DO Release 0 in 2003 under the WIN brand name. Since Japan has a lower laptop penetration rate than other developed markets, it offers a different set of market dynamics and brings the focus on handsets rather than on PCs. Hence, KDDI not only had to enable phones with broadband capabilities, it also had to be an early innovator of mobile-based applications and services. Naturally, the consumer segment was KDDI's prime target.

KDDI's wide range of service offerings caters to its diverse customer base. A service named EZMovie allows users to access a variety of video content, including movies, music, animation and sports. EZ Chaku-uta service offers ring tones and EZ Chaku-uta Full extends it to provide full-track music downloads. EZFM and EZTV offer radio and TV channels, respectively. EZNavi is a real-time location-based service that provides vehicle and pedestrian directions.

KDDI's game portal offers a very large bouquet of online games that suits players of all kinds. KDDI also offers broadband service, providing fast and ubiquitous Internet access at data speeds of up to 3.1 Mbps.

KDDI is the pioneer in employing a 3G feature called BCMCS (broadcast multicast service). BCMCS offers two benefits to operators: the ability to offer multicast multimedia services using cellular infrastructure, and the ability to monetize network idle time through cache casting. KDDI's EZ News Flash and EZChannelPlus services use BCMCS. EZ News Flash



provides hourly news and weather updates throughout the day, and EZChannelPlus is a unique and cost-effective content broadcast service. The EZChannelPlus provides the preview of popular content such as music, audio and video clips along with ranking and other related information. The subscribers can preview the clips free of cost, and download the full versions by paying a nominal fee.

Thanks to BCMCS, EZChannelPlus is cost effective to KDDI, as it uses network capacity efficiently, and cost effective to subscribers, as this service costs less than accessing the same content through unicast.

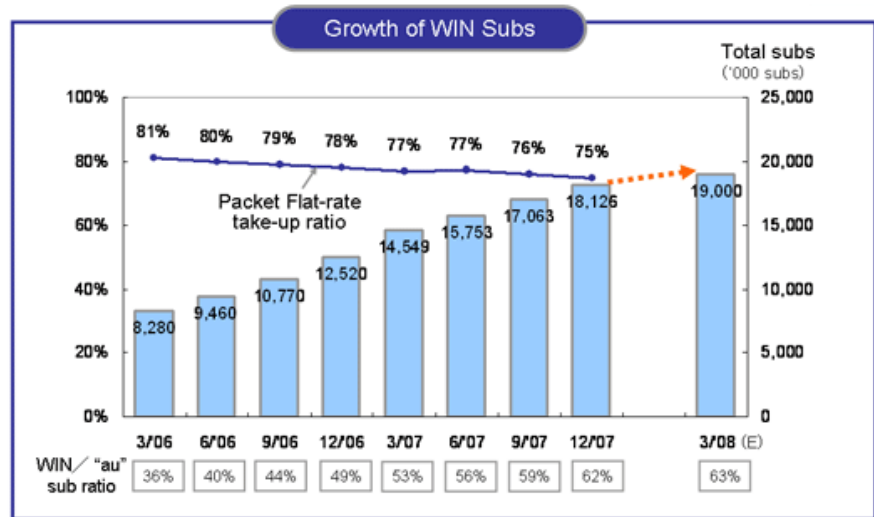


Figure 2. Growth for WIN Subs

Source: KDDI Quarterly/Annual Reports

KDDI has successfully employed a tiered flat-rate pricing strategy. It currently offers multiple tiers based on traffic volumes to suit subscribers of all profiles.

KDDI's WIN uptake and ARPU performance tell a compelling story. Total ARPU for WIN users is 30-40% higher than for all other users on the network, and data ARPU for WIN users is almost double that of all other users. The data portion of total ARPU for WIN customers is 35-40%.

As with other leading EV-DO providers, KDDI upgraded the network to EV-DO Revision A (Rev. A) in 2007. This upgrade allowed KDDI to expand its services portfolio to include packet-switched video telephony, another first in the market. Rev. A provides support for low-latency services such as multiplayer gaming and instant multimedia, and uplink-

centric services

such as social networking. Rev. A also supports Platinum Multicast, which triples the capacity of the current BCMCS Gold Multicast solution.

2.3 Maxis

3G success is not limited to developed countries. In fact, 3G is proving to be an important technology in emerging markets, especially for improving broadband penetration in countries such as Malaysia and Indonesia.

Maxis, the biggest operator in Malaysia, is one of the phenomenal 3G success stories in Southeast Asia.



Touted as one of the “Asian Tigers,” Malaysia has one of the strongest economies in the region, with a GDP of more than \$135 billion in USD. Malaysia’s mobile market, with a penetration rate of over 75%, is also one of the fastest growing in the region. But the total broadband penetration stands at a mere 15%.

Maxis, with a 41.5% share of the mobile market, covers over 92% of the country. It launched WCDMA services in July 2005, and introduced HSDPA in September 2006. 3G has equipped Maxis with an efficient and high-performance platform to launch a number of data-centric applications, such as video on demand, full-track music downloads and video telephony. It offers a range of 3G-enabled devices including PC data cards and USB terminals targeting the enterprise market. As of April 2008, Maxis reported 1.3 million active 3G users, an impressive three-fold year-over-year increase.

But what is remarkable about Maxis is its strategy to use 3G to provide fixed and nomadic broadband access as an alternative to ADSL and other wireline broadband services. This HSDPA-based service targets the residential broadband market, and has been a phenomenal success. With Malaysia’s broadband penetration teetering at only 15%, there is also a significant growth potential.

Maxis offers a specialized modem that has both data connectivity through USB/RJ45 and voice connectivity through a RJ11 socket. The modem also has a backup battery, providing both portability and uninterrupted service during power outages. The service is priced to compete with ADSL and other wireline broadband services, and Maxis has worked with its vendors to keep the modem cost low. Thus, Maxis can offer consumers a complete

wireless package that is more attractive than any alternative. This service offers a compelling value proposition: data speeds similar to DSL; portability unparalleled by DSL; converged service with both voice and data connectivity; and a single, cost-effective bundled price. For Maxis, this service has opened new revenue streams and is accelerating the return on 3G investments.



Figure 3. Maxis Specialized Modem

Maxis plans to keep up the momentum by expanding the 3G network to cover up to 80% of the country's prime economic areas. Maxis is targeting a market share of 25-30% of the country's total broadband market in the next five years.

Maxis is also exploring mobile TV options. It has publicly announced trials of both MediaFLO™ and DVB-H technologies.

The key takeaway from Maxis' roaring success is this: to ensure the economic viability of investments in 3G, operators should target both mobile and fixed use, especially in countries where the wireline broadband penetration is minimal. Maxis has demonstrated a compelling model for 3G's success in emerging markets.

2.4 Verizon Wireless

Verizon pioneered the concept of a ubiquitous wireless data service in the U.S. by launching its EV-DO Release 0 network in 2003.

Its service, branded BroadbandAccess, initially targeted the enterprise market. The devices offered were PC cards that supported data rates of 2 Mbps peak and 400 Kbps average per subscriber. This service appealed to road warriors who were accessing email and company networks on the limited data speeds of 2G/2.5G, and limited availability of Wi-Fi hotspots. BroadbandAccess, providing both ubiquitous coverage and high-speed connectivity, fundamentally changed the way professionals and consumers accessed corporate networks and browsed the Internet.

In 2005, Verizon extended the benefits of EV-DO to consumers by launching the first multimedia wireless service in the U.S., V CAST™, and one year later it introduced a comprehensive mobile music service called V CAST Music. Since then, Verizon has been actively expanding its applications and services portfolio. With the help of 3G, Verizon was the first to bring many services to the market, among them being real-time mobile navigation and mobile TV. Verizon currently offers a variety of data-enabled services including multimedia messaging, multiplayer and 3D gaming. The latest remarkable addition to the services line up is mobile TV offering based in Qualcomm's MediaFLO™ technology. Currently, Verizon offers this service in some of the top U.S. markets.

Verizon has an extensive range of EV-DO devices. Its line up includes phones of various form factors, features, and price points; PDAs; PC cards; USB data devices; and embedded laptops.

3G has enabled Verizon to provide an enhanced user experience through a high-performance network; innovative applications and services; and tailored product and service offerings. That, in turn, has helped Verizon maintain market leadership in data ARPU, ARPU growth, and low churn. Verizon has the highest data-to-total-ARPU ratio among all major operators in the U.S.

Verizon's performance during the last quarter of 2007 speaks volumes about its success:

- 2 million total net customer additions, 1.9 million net retail customer additions; 65.7 million total customers, 63.7 million retail



(non-wholesale) customers; 6.9 million retail net adds in 2007—the most of any carrier.

- 1.20 percent total churn, 0.94 percent retail post-paid churn—industry-leading customer loyalty.
- 13.3 percent increase in total revenues; data revenues up 53 percent; service ARPU up for quarter and full year; highest-ever data ARPU in the quarter; 43.6 percent EBITDA margin on service revenues (non-GAAP).

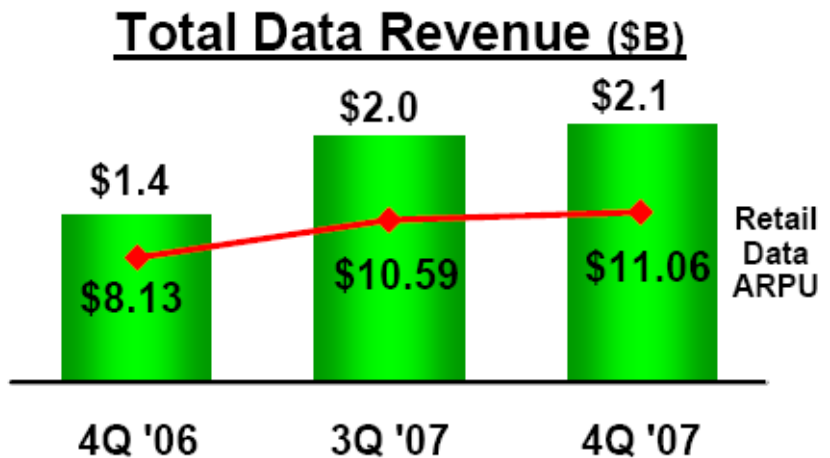


Figure 4. Verizon Wireless Total Data Revenue (\$B)

Source: Verizon quarterly reports

During early 2007, Verizon took another leap forward by upgrading its network to EV-DO Rev. A, which introduced two major features: increased data rates (3.1 Mbps downlink/1.8 Mbps uplink) and robust quality of service (QoS) support. With symmetrical high-speed links, Verizon is providing an enhanced broadband experience to its customers. With QoS support, Verizon is well equipped to provide rich services such as packet video telephony, instant multimedia, low-latency interactive gaming, and rich voice services such as VoIP. QoS also enables Verizon to provide solutions for emergency personnel such as first responders by allowing priority access. All these services will further enhance the user experience, open new revenue streams, and further consolidate Verizon's market position.



[3] Conclusion

3G has helped many operators across the world offer profitable, rich voice and data services that significantly enhance the user experience. 3G technologies have proven to be suitable for both developed and emerging markets. Furthermore, the phenomenal growth of 3G in terms of subscribers, infrastructure, devices and service revenues underscores the strong market leadership position of 3G operators.

The numerous success stories across the world have emphatically proven that 3G is an ideal solution for the global wireless market. 3G's vast ecosystem and its advanced wireless broadband capabilities continue to offer competitive advantages in the rapidly growing wireless market.

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