

3G: Key advantages and challenges

Technology watch, May 17, 2010

3G, which brings together the rapidly growing mobile and internet sectors, has witnessed increased adoption in developed markets over the past few years. While the technology has existed since 2001, it was initially plagued with issues such as huge spectrum licensing fees and large capex requirements for network build-outs.

However, operators across the globe have gradually migrated to 3G networks and are now expanding their coverage to capitalise on the opportunity that the technology offers in terms of revenue generation and service capability. Moreover, with the two most populated countries in the world, India and China, just entering the 3G segment, the growth potential for this technology is clearly huge.

There are different 3G technology standards. Globally, the most prevalent standard is the universal mobile telecommunications system (UMTS), which is based on WCDMA (WCDMA and UMTS are often used interchangeably). UMTS is the 3G technology of choice for most carriers using GSM as their 2G technology.

The other major standard is CDMA-2000, which is a 3G variant of CDMA 2G technology. There are several types of CDMA2000, offering different data rates and levels of compatibility with 2G CDMA. Today, EV-DO Rev. A is the most common CDMA 2000 technology.

Since 2007, a series of enhancements to UMTS including high speed downlink packet access (HSDPA), high speed uplink packet access and high speed packet access (HSPA), have been developed. These upgrades increase throughput and capacity, improve coverage and decrease system delays. HSPA is the leading 3G technology used by the majority of wireless operators and subscribers worldwide.

These technologies, with their higher bit rate capabilities, have spurred the development of many bandwidth-intensive applications that would not have been conceived of otherwise and are now ready for the next consumer wave.

3G advantage

3G technology has several advantages. 3G-enabled systems, capable of providing a minimum

3G: Key advantages and challenges

Technology watch, May 17, 2010

speed of 144 kbps, are designed to offer increased voice capacity and high speed data rates.

This technology allows mobile operators to address the growing global demand for low-latency broadband services. The existing fixed line networks have not been able to cater to this demand. In addition, 3G, which is backward compatible with legacy networks, provides increased network capacity and other efficiency enhancements that enable operators to deliver more competitive mobile broadband services while ultimately reducing their investments in both capex and opex. The proliferation of 3G devices and the ever expanding industry ecosphere is creating economies of scale that reduce total network ownership costs for operators.

The technology offers faster data speeds while using the mobile phone as a modem, connecting a PC to the internet via the phone. Due to its high bandwidth capabilities, the technology is used for driving applications in a number of industries including health care, education and entertainment.

As 3G is emerging as an alternative or back-up to traditional wireline connectivity options such as dial-up, frame relay and integrated services digital network, enterprises can leverage this technology for network redundancy and business continuity for critical applications. In case of a failure to prioritise mission-critical traffic, the company's information technology department can define which traffic can be permitted over the 3G high speed network.

The enhanced version of the technology, 3G HSPA also provides a number of benefits. It uses a higher order modulation of 16QAM in the downlink, which enables data transmission at a higher rate. This technology provides maximum data rates of 14 Mbps in the downlink.

Another major advantage of HSPA is the introduction of a shortened packet duration or time transmission interval (TTI).

Reducing the minimum TTI in a Release 99 system from 10 milliseconds to 2 milliseconds for HSDPA provides several advantages. It allows Node B to react more quickly to changes in the channel quality experienced by each user. More importantly, it reduces the latency associated with the transmission of each packet. The packet latency represents the delay between the data packet transmission and its successful reception and decode.

For applications such as voice over internet protocol and interactive gaming, excessive packet latency degrades the quality of service. When coupled with hybrid automatic re-transmission request, which allows fast re-transmission of erroneous packets, the reduced latency on the network enables the mobile operator to offer a wider range of services.

For the network operator, 3G HSPA technology reduces the cost per bit carried and increases system capacity. This technology presents an attractive option for operators looking to increase revenues from data transmission, especially with the growth in data traffic. A further advantage of the 3G HSPA technology is that it can be rolled out by incorporating a software update into the system.

Key issues

While 3G has witnessed strong growth in global deployments, the technology has its share of problems as well. Globally, telecom operators need to be armed with a war chest to get a 3G service licence and may, in some cases, have to sustain large amounts of debt. This trend has been observed worldwide and more recently in India where 3G spectrum has been valued at over \$2 billion.

3G is deployed further down the frequency bands compared to 2G, and hence the wavelength of the signal transmitted through this technology reduces. This limits 3G's area of coverage. Therefore, operators need to deploy more base stations to meet coverage and capacity requirements, which increases capex and opex. Accordingly, carriers are now evaluating femtocells as a solution to reduce costs and enhance indoor quality of service for the 3G technology.

The high price of 3G continues to deter its mass deployment. Initially, very few manufacturers supported the launch of the technology, and the first 3G phones were heavy, expensive and had limited battery life. While 3G handset prices have declined over the past few years (Qualcomm recently introduced a 3G handset at below Euro 100), they are still high when compared to 2G or 2.5G devices.

3G: Key advantages and challenges

Technology watch, May 17, 2010

In addition, 3G services are expensive and are yet to generate demand from average users. 2G and 2.5G technologies are adequate for providing mobile communication services to such users as of now. In some countries, 3G services also include internet access which is expensive for normal users.

3G coverage in rural areas continues to be poor. Operators like AT&T and Verizon Wireless in the US as well as O2 and Vodafone in the UK have very poor 3G penetration rates because providing coverage using 2100 MHz would be too expensive, impractical and time-consuming. But there is a very strong business case for deploying UMTS900 (WCDMA-HSPA) systems in the 900 MHz band, which will enable operators to efficiently extend voice, data and mobile broadband services by leveraging the advantages of lower frequencies. Moreover, radio propagation path loss at 900 MHz is much lower compared to the 2100 MHz and higher bands. For the same service offering and coverage, the number of cell sites required using 900 MHz is significantly lower than the same needed for 2100 MHz. The 900 MHz band also offers better indoor coverage.

UMTS900 network operators can provide HSPA mobile broadband services in a very cost-effective way. GSM operators can use their existing network assets including antennas and network management systems for providing the service. UMTS900 delivers the same data rates as UMTS2100 with less than half the number of cell sites. Therefore, UMTS900 can complement 2100 MHz deployments to improve coverage; reduce capex, opex and rollout time; improve quality of service; and enhance user experience.

According to a GSA HSPA Devices survey, 190 UMTS900-HSPA devices were launched in the market by 34 suppliers as on October 4, 2009. UMTS900 is rapidly becoming mandatory for devices to be sold in Europe, the Middle East, Africa and the Asia-Pacific.

The overall radio frequency planning is also more complex in 3G networks as both high and low speed users will be supported on the same network.

For 3G cellular systems to compete in the mobile data market, technologies like Wi-Max, and multi-antenna transmission and reception (MIMO) will be required to achieve high data rates. However, MIMO systems do not operate well with high levels of interference. Since any well-designed cellular system is, by nature, interference limited, this poses a basic problem — increasing the spectral efficiency with MIMO will necessitate a reduction in the interference level, which traditionally requires increased frequency reuse or other spectral

3G: Key advantages and challenges

Technology watch, May 17, 2010

efficiency-reducing measures.

These concerns notwithstanding, there is a compelling business case for 3G networks. Despite the trial and launch of 4G services by some global operators, 3G will continue to be in the spotlight in the future and is likely to coexist with 4G deployments.

[About Us](#)

[We are Hiring](#)

[Contact Us](#)

[Subscribe](#)

[Privacy Policy](#)

[Advertise](#)

[Terms & Conditions](#)

Copyright © 2010, tele.net.in All Rights Reserved

