

# Whitepaper

# 4G LTE Market Update

## Executive Summary

Consumers are increasingly shedding wires for the convenience of anywhere/anytime mobility. More and more users are turning to smart phones and other mobile devices to access their social networks, online games, video, information, and more. The skyrocketing use of mobile devices and applications is fueling an insatiable demand for mobile broadband and bandwidth. As a result, operators are turning to 4G, the next stage in mobile evolution, to meet the needs of today and tomorrow's mobile generation.

**LTE (Long Term Evolution) is the leading 4G technology under consideration** throughout the industry, with **more than 100 operators having announced plans to deploy or evaluate LTE.**<sup>1</sup> This technology offers a bit rate capacity of at least 100 Mbps downlink and 50 Mbps uplink, along with spectral efficiency for a low cost per bit. While some carriers like Verizon and TeliSonera have a head start on their 4G schedule, **industry analysts expect to see the bulk of operators launching with LTE in 2012 and 2013.** The benefits of 4G and LTE are significant, and as 4G CPE equipment becomes more available, 4G mobile broadband will prove to be disruptive technology that changes how we communicate, work, are entertained, and perform day-to-day tasks.

## The Market...a Mobile Broadband Explosion

Armed with smart phones, tablets and other mobile platforms, a new generation of mobile users are looking to perform an increasing number of personal and business applications on the go. Regardless of location, these users expect to access bandwidth-intensive applications and real-time services — such as accessing their social network, watching a viral video or live sporting event, paying bills, making a dinner reservation, checking into a flight, and more.

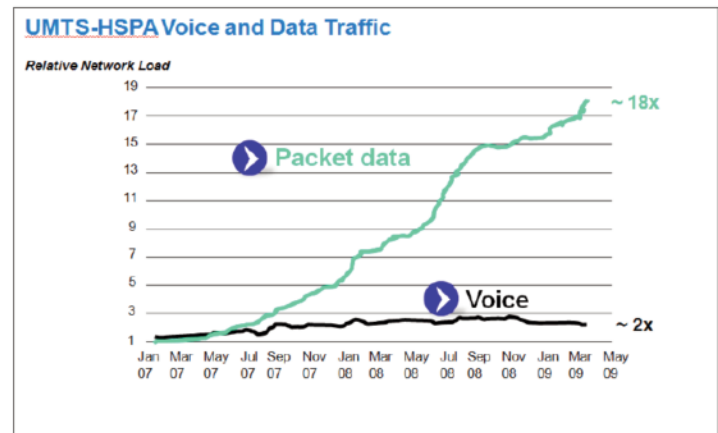


Figure 1: The Rise and Rise of Data<sup>2</sup>

According to a 2009 Pew Internet & American Life survey<sup>3</sup>, 92 percent of all adult Americans have at least one Internet-enabled device (laptop, handheld, etc) and 79 percent have at least two different devices. 32 percent of all adult Americans have gone online with their cell phone or smart phone.

These numbers are expected to climb over the next few years as mobile devices continue to grow in sophistication and power, and as consumers increasingly choose to shed their wires for the convenience of anywhere/anytime accessibility.

## According to PriMetrica Inc., wireless subscribers will outnumber wireline and broadband subscribers 3 to 1 in 2013.

And the Atlantic ACM states, "Total wireless revenues will overtake total wireline revenues by 2014, according to the study, and consumer Internet access growth will continue, adding \$7 billion to the market through 2014."

And while mobility may already seem ubiquitous today among some consumer groups, there is significant room for growth. According to research firm IDC, there are less than 4 billion mobile subscribers today. Tomorrow, over 50 billion devices are expected to connect to high speed broadband.<sup>4</sup> And IDC projects **the U.S. mobile broadband market to more than quadruple by 2014**, estimating that there will be 30.2 million U.S. subscribers in 2014 compared with just 6.5 million subscribers in 2009.

Similarly strong growth is predicted for mobile devices, including both smart phones and tablets. As shown in Figure 2, Parks Associates believes that the number of smartphone users will quadruple, exceeding 1 billion users worldwide by 2014.<sup>5</sup> And according to a forecast from IDC, worldwide media tablet shipments will enjoy a 57.4% CAGR from 2010-2014, hitting more than 46 million units in 2014.<sup>6</sup> For comparison, IDC expects 398 million portable PCs will be shipped in 2014.

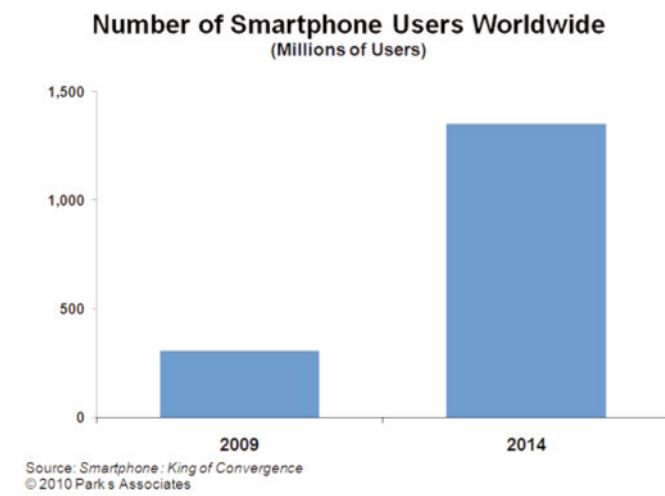


Figure 2: Strong growth projected in the smartphone market

**"Mobile broadband is growing in importance for both consumers adopting the service and the operators offering connectivity," said IDC Mobility Service Program Manager Carrie MacGillivray.**

"Diversity in pricing plans, new computing devices capable of mobile broadband connections, and the promise of a 4G world with faster speeds are a tempting proposition for customers looking to be ubiquitously connected regardless of location, anytime."

## The Technology

### What is 4G?

At the most basic level, 4G is what comes after 3G. It refers to the fourth generation of cellular wireless standards. It's a next generation technology poised to redefine mobile broadband, delivering a superior end user experience for new classes of bandwidth-hungry mobile applications and real-time services.

Today's wireless broadband networks are powered by third generation (3G) technology — including HSDPA/UMTS and CDMA EVDO radio technologies in the U.S. Defined by the 3GPP2, 3G technologies support multi-media applications, spread spectrum transmission, and at least 200 kbps.

The same standards body is working to standardize the requirements for 4G technology. While standards are not yet finalized, fourth generation wireless networks are to be IP-based, mobile ultra-broadband (gigabit) access, and multi-carrier transmission. 4G networks must meet the International Mobile Telecommunications (IMT) Advanced criteria, including:

- Flexible channel bandwidth, between 5 and 20 MHz, optionally up to 40 MHz
- Target peak data rates of up to 100 Mbps for high mobility (i.e. mobile access) and 1 Gbps for low mobility (i.e. local wireless access)
- Worldwide roaming capability, and user equipment suitable for worldwide use
- Compatibility of services within IMT and with fixed networks
- Capability of interworking with other radio access systems
- High quality mobile services for next generation multimedia support (real time audio, high speed data, HDTV video content, mobile TV, etc.)
- User friendly applications, services and equipment

In addition to the above guidelines, 4G replaces the CDMA spread spectrum radio technology used in 3G networks with frequency-domain equalization schemes, such as OFDM (Orthogonal Frequency Division Multiplexing). OFDM offers high spectral efficiency, and is able to pack data more efficiently on today's expensive air waves. Another technique employed in 4G systems is MIMO (Multiple Input Multiple Output) antenna technology. By deploying multiple antennas at the transmitter and at the receiver, MIMO helps 4G systems achieve higher rates, higher reliability and longer range communications.

## 4G Technology Players and Predecessors

### LTE (Long Term Evolution)



Using both OFDM and MIMO technologies, LTE has a theoretical bit rate capacity of at least 100 Mbps downlink and 50 Mbps uplink (when a 20 MHz channel is used). LTE offers up to 5 times greater spectral efficiency than most 3G networks, to reduce the cost per bit for better cost efficiency for operators. LTE Advanced is a candidate for the IMT Advanced standard (submitted to ITU-T by the 3GPP organization in fall 2009, with expected release in 2012). The

target of LTE Advanced exceeds the IMT Advanced criteria, and will be compatible with first generation LTE equipment.

TeliaSonera deployed the first commercial LTE service in Scandinavia in December 2009. At the end of 2009, more than 100 operators have announced their intentions to deploy 4G branded services based on LTE, including Verizon, Telefonica, Vodafone, China Mobile, AT&T, MTS, and Telenor.

### WiMAX (IEEE 802.16e-2005)

WiMAX delivers wireless, high speed fixed broadband and mobile services to large areas, with significantly less infrastructure than required today. The standard currently offers peak data rates of 128 Mbps downlink and 56 Mbps uplink over 20 MHz wide channels. A new standard (802.16m) is underway to improve the speeds to meet the 1Gbps stationary/100 Mbps mobile requirements of the IMT Advanced criteria. KT announced the first commercial mobile WiMAX service in South Korea in 2006. Additionally, Sprint Nextel is using WiMAX for their 4G network.



## The Benefits of LTE

### ...LTE offers the lowest cost per bit and spectrum flexibility

The ever increasing sophistication of mobile applications will fuel an insatiable demand for mobile bandwidth, and the use of smart phone/tablet services and applications will shift from a luxury to an essential part of day to day life. As a result, **operators will be under intense pressure to deliver mobile broadband as cost efficiently as possible**, both for their own bottom line and to keep service pricing low. Cost per bit will be an even more critical factor for carriers in the coming years.

Using OFDM and MIMO technology, LTE is able to more efficiently pack data onto the air waves, offering a lower cost per bit for carriers. This will enable carriers to meet the needs of the mobile market, while providing lower costs to consumers. In addition to cost per bit, LTE offers the advantage of a flexible spectrum. The technology can operate in different spectrums from 1.4 MHz to 20MHz, giving carriers the flexibility to deploy based on licensing and availability.

## The Future of the 4G Landscape

### LTE vs WiMAX

With sky rocketing demand for mobile broadband and multiple operator types across the world, no single technology will win the mobile broadband battle — at least in the near term. The mobile broadband landscape will be composed of a mix of technologies, and not dominated by one.

According to Godfrey Chua, Research Manager Wireless and Mobile Infrastructure at IDC, “Widespread and ubiquitous broadband connectivity will be enabled, not by a single wireless technology, but rather a confluence of technologies that will co-exist as well as compete with each other.”

Yet while multiple technologies will be involved in the 4G landscape, LTE is expected to play the leading role. The LTE market is accelerating, and is forecast to top \$11 billion by 2019, according to Infonetics Research. Ovum projects LTE deployments to be twice the size of WiMax by 2014, and gain even more market share in the following years. The research firm is estimating approximately 109 million LTE connections and only 55 million WiMAX connections worldwide by 2014.<sup>7</sup>

### 4G Mobile Broadband in the U.S.

**According to IDC, the U.S. mobile broadband market will grow from 6.5 million in 2009 to 30.2 million in 2014.<sup>8</sup>**

Highlights of 4G deployments, trials, and schedules in the U.S. include:

#### *Verizon Wireless*

Verizon Wireless is pursuing an aggressive LTE roadmap, with announced plans to deploy its LTE network in 25 to 30 markets (covering approximately 100 million people) by the end of 2010. The carrier pledges to double that number in 2012, and then cover its entire 3G footprint with LTE by the end of 2013. Verizon is building the network with the valuable 700 MHz spectrum it bought in the 2008 FCC auction.



In a video, Verizon announced better than expected results of its LTE trials in Boston. Reported speeds were 5-12 Mbps downlink and 2-5 Mbps uplink, a significant improvement over typical 3G speeds of 1.5 Mbps downlink and 0.5 Mbps uplink.

#### **AT&T**

AT&T announced that it will conduct LTE field trials in 2010, and commercially deploy the service in 2011. In an interview with CNBC, AT&T CEO Randall Stephenson said that the company will invest \$19 billion this year, "more than any company in the U.S.," to expand its mobile broadband network. The carrier will first focus on upgrading its existing 3G network with HSPA+ to increase speeds, and then begin its technical trials of LTE. AT&T's schedule is behind that of Verizon, but the carrier is making a substantial investment in its network.



#### **Others**

T-Mobile is expected to trial LTE starting in 2011. Clearwire's WiMAX network currently covers 27 markets and 34 million people, and the company expects to expand its network to cover 120 million people by the end of 2010. Sprint has been aggressively pursuing a 4G expansion based on WiMAX, currently covering 43 million people in 33 markets, with plans to have up to 120 million people covered by the end of 2010.

### **The Global Mobile Broadband Market**

According to Infonetics, LTE subscribers should exceed 153 million by 2014, with most of them split between Asia Pacific and Europe, the Middle East and Africa (EMEA).<sup>9</sup> The world's first commercial LTE deployment was in the Scandinavian capitals of Oslo and Stockholm in December 2009 (carrier: TeliaSonera). LTE deployments will get a major boost in 2012-2013 when Chinese operators, including China Mobile and China Telecom, begin a massive LTE rollout.

## 4G and Rural Broadband

With speeds reaching 100 Mbps (high mobility) and 1 Gbps (low mobility), 4G offers a promising solution for bridging the broadband divide facing rural areas.

### Broadband service providers can turn to 4G to deliver high quality and high speed broadband to customers where it simply isn't feasible or cost-effective to deploy fiber or copper-based broadband.

In 2009, the National Telecommunications Cooperative Association (NTCA) conducted a survey of U.S. small and rural carriers and found significant interest in entering the wireless marketplace.<sup>10</sup> More than three quarters (76%) of the respondents are providing wireless services to their customers, with 61% providing fixed broadband and 54% offering mobile voice. 88% of the respondents who offer wireless today said they have plans to deploy next generation technology:

- 55% of those with plans to deploy next generation technology said they would deploy LTE
- 15% said they would deploy WiMAX 802.16e



Rural carriers that have the resources to invest in mobile broadband architecture are encouraged to do so, in order to stay competitive in an increasingly mobile market. Other options are available where a full network rollout and investment are not feasible. For example, **Verizon is looking to "collaboratively build and operate" 4G LTE networks in rural areas with local carriers.** In this partnership, the rural carrier will provide the towers and backhaul lines while Verizon brings in the core LTE equipment and the regional 700 MHz licenses, which they purchased in the 2008 FCC auction.

According to Verizon:

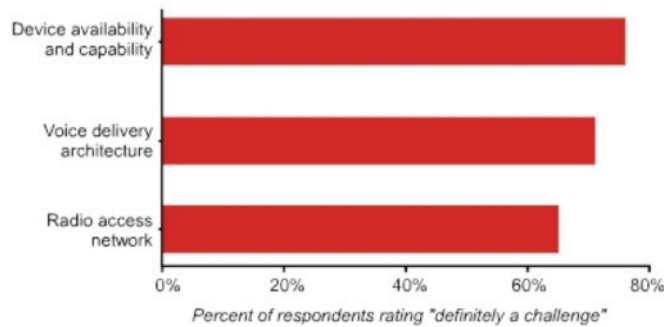
"Verizon Wireless may work with rural companies that have towers and backhaul capabilities, even if those companies are not currently wireless operators. Together, we will plan and coordinate a local LTE deployment schedule that makes sense for both Verizon Wireless and the rural company that we are collaborating with."

## Current Challenges Facing 4G Deployments

While the telecom and mobile industry understands the importance of upgrading their networks to the faster speeds and spectral efficiency of 4G, several factors can hamper real-world deployment and field trials. The availability of 4G devices is one such challenge.

Market research firm Infonetics Research surveyed service providers in EMEA, North America, Asia Pacific, and Central and Latin America regarding their 4G network build-out plans and deployment strategies.<sup>11</sup> As shown in Figure 2, 'device availability and capability' was the leading challenge to upgrading to 4G.

Figure 2: Top 3 service provider challenges to upgrading to 4G



© Infonetics Research, 4G Strategies: Global Service Provider Survey, April 2010

4G-capable routers are available today, which force users to purchase a separate 4G modem and subscribe to 4G service separately. Future 4G routers will integrate the 4G radio directly inside the box. As a result, broadband service providers can directly control the 4G radio — giving them the ability to deploy 4G service as an integrated part of their service portfolio, as well as provide support and management of the device and service.

## Conclusion

As the use of sophisticated mobile devices skyrockets, so does demand for mobile broadband. As the next evolution in mobile technology, 4G promises to deliver a superior user experience, with blazing fast speeds (approximately 100 Mbps downlink/50 Mbps uplink) to support mobile multimedia, mobile social networking, mobile enterprise and more. LTE (Long Term Evolution) is the leading 4G technology under consideration by carriers, with more than 100 operators having announced plans to deploy or evaluate LTE. While some carriers like Verizon and TeliaSonera have a head start on their 4G schedule, industry analysts expect to see the bulk of operators launching with LTE in 2012 and 2013. The benefits of 4G and LTE are significant, and as 4G CPE equipment becomes more available, 4G mobile broadband will prove to be disruptive technology that changes how we communicate, work, are entertained, and perform day-to-day tasks.

## About Actiontec

Actiontec Electronics develops broadband connectivity and broadband-powered solutions that simplify and enrich the digital life – delivering a unified experience that encompasses communications, entertainment, home management, and more. Actiontec offerings range from the market's broadest selection of IPTV-capable broadband home gateways for bringing IP-based video services into the home, to DSL modems, wireless networking devices, routers and digital entertainment devices. The company's carrier-class products are easy to install, manage, and use, and are sold through retail channels and broadband service providers. The company is committed to protecting the environment through energy efficient products and other green-friendly practices. Founded in 1993, Actiontec is headquartered in Sunnyvale, CA, and maintains branch offices in Colorado Springs, CO; Shanghai, China; and Taipei, Taiwan.

## Appendix 1: Upcoming 4G Events

4G Wireless Evolution Conference in Los Angeles: Oct 4-6, 2010

4G World in Chicago: Oct 18-21, 2010

CTIA Wireless 2011 in Orlando: Mar 22-24, 2011

## Sources

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<sup>3</sup> Pew Internet & American Life Survey. Pew Internet. March 25-April 19, 2009.

<sup>4</sup> IDC Directions 2010

<sup>5</sup> Parks Associates, Smartphone: King of Convergence. March 2010

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<sup>7</sup> 3GPP Mobile Broadband Innovation Path to 4G by 3G Americas.org

<sup>8</sup> "30 Million Mobile Broadband Users by 2014." Wireless Week. June 2010.  
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<sup>9</sup> LTE Infrastructure Market Highlights. Infonetics Research.  
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<sup>11</sup> 4G Strategies: Global Service Provider Survey. Infonetics Research. April 2010.