

4G Mobile: Hype vs. Reality

Evolution of Next Generation Mobile Networks

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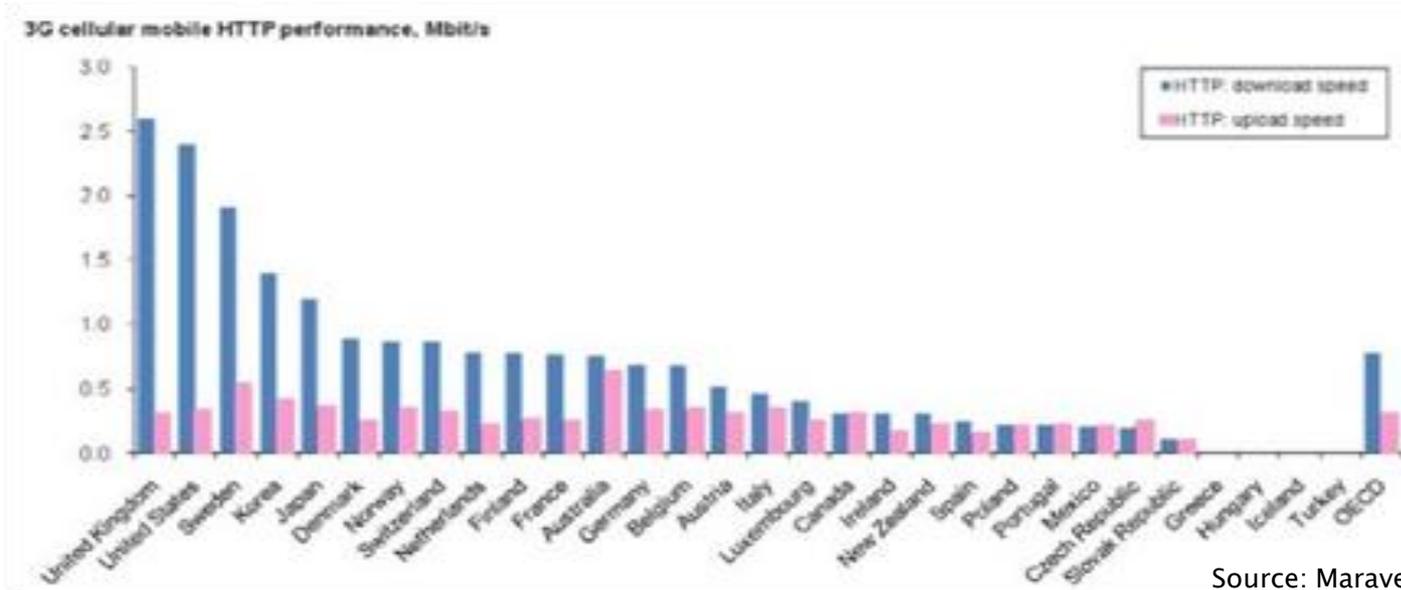
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Mobile Broadband Wireless Landscape

- ▶ Majority of current cellular networks are based on Wideband Code Division Multiple Access (W-CDMA) 3G technology
- ▶ Many of these networks are being updated to handle higher downlink and uplink data rates by incorporating High Speed Packet Access (HSPA) and HSPA Evolution (HSPA+)
- ▶ Competing Code Division Multiple Access Evolution Data Only (CDMA EV-DO) networks improve data throughput on earlier CDMA networks
- ▶ Growing worldwide demand for higher throughput for mobile broadband services has spawned two next generation (4G) network architectures
 - Worldwide Interoperability for Microwave Access (WiMAX)
 - Long Term Evolution (LTE)

How will the evolution of these networks play out?

What is Driving Network Expansion?



- ▶ Only five countries can deliver >1 Mbps data downloads over existing 3G networks, and uplink data rates discourage user-generated content
- ▶ Although voice is still the cash cow, data services represent a growing percentage of monthly average revenue per user (ARPU)
- ▶ Proliferation of laptops, netbooks, and smartphones are creating demand for richer mobile user applications
- ▶ Two-way services (e.g., MySpace, YouTube) are driving need for increased uplink rates

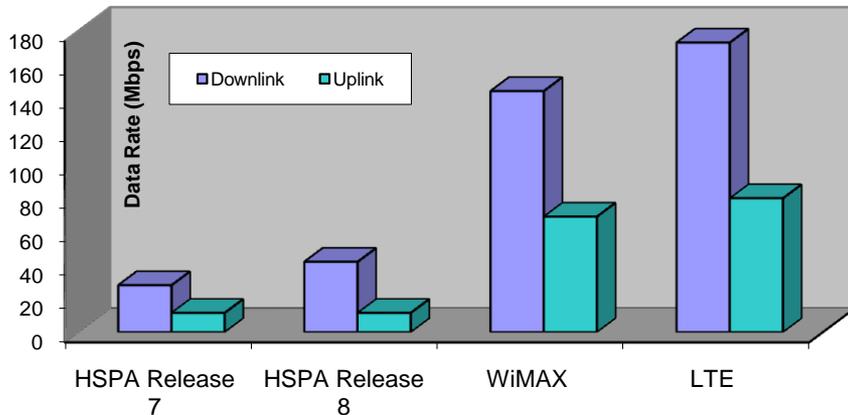
Anticipated Network Usage

Service	HSPA	WiMAX	LTE
VoIP	No	Likely	TBD
Multimedia (mobile TV, video telephony, MP3, e-books)	Yes	Yes	Yes
Wireless displacement for DSL/cable broadband Internet services	No	Yes	Unlikely
Wireless connectivity for Wi-Fi hotspots	No	Yes	No
User-generated content (e.g., YouTube, MySpace, Dailymotion)	Limited	Yes	Tiered pricing
Mobile payment/banking	Limited	TBD	Yes
High bandwidth downloads (e.g., Slingbox, BitTorrent, Hulu)	No	Yes	Tiered pricing
Interactive gaming	No	Yes	Tiered pricing

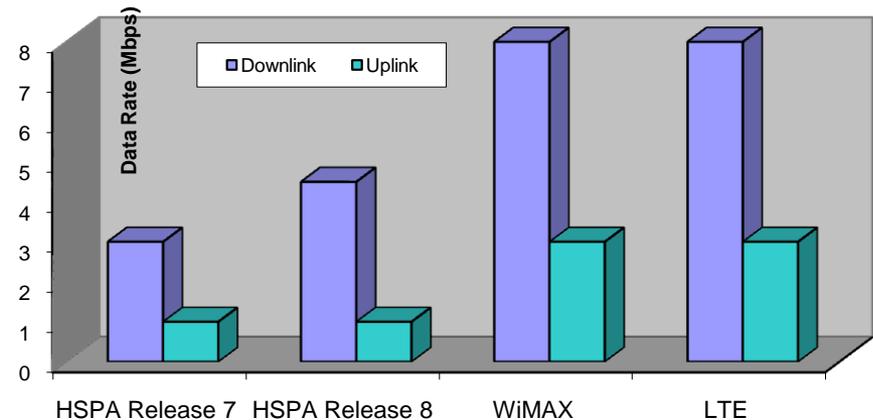
WiMAX operators will focus on data revenues and encourage higher bandwidth applications; cellular operators will need to conserve bandwidth for voice and will dole out bandwidth to users based on a tiered pricing structure to prevent overloading network

Network Data Performance Comparison

Anticipated Peak Data Rates



Estimated Typical Data Rates



Although WiMAX and LTE Networks offer significantly higher peak data rates, typical downlink and uplink data rates in actual usage may only be 2X and 3X, respectively compared to HSPA Evolution Networks

Note: Real world data rates can vary greatly depending on many factors including distance from base station, operational frequency, size of bandwidth and modulation scheme, physical blockage, and indoor penetration capability

Where are the Real 4G Battlegrounds?

- ▶ Current 3G GSM operators will likely upgrade to HSPA and eventually migrate to LTE because they can leverage some of the existing 3G network
- ▶ Current CDMA operators can go either way, but may lean toward WiMAX
 - Verizon opted for early deployment of LTE to maximize commonality with Vodafone and for economy of scale reasons
- ▶ Fixed line operators seeking mobile capability (e.g., Comcast, Time Warner Cable) will migrate to WiMAX
- ▶ Real battleground will be current 2G operators in developing countries who will want to leapfrog to 4G in the next few years as customer service demands necessitate more bandwidth
 - WiMAX will be maturing with a significant number of devices available for their networks
 - LTE will just be starting significant deployments, but with an advantage of economies of scale based on the number of 3G operators who will be deploying LTE
- ▶ Rural areas represent another battleground
 - Green field deployments will allow WiMAX to go head-to-head against LTE
 - Backhaul expenses will be a challenge for either network

Femtocells: Early Enabler for 4G Deployment



Benefits:

- ▶ Provides good indoor coverage for voice and low speed data currently
- ▶ Supports multiple cellular devices simultaneously from one base station
- ▶ Minimizes operator's base station backhaul expenses by using customers' DSL/cable line
- ▶ Permits tailored build out of 4G connections based on broadband demand
- ▶ Weans customers off wireline voice and DSL/cable service by offering wireless substitute

Femtocell:

- ▶ Low power mobile phone base station that improves indoor connectivity
- ▶ Voice or data backhaul is handled via customer's standard broadband DSL or cable network

Challenges:

- ▶ Requires consumers to invest in yet another network appliance in addition to Wi-Fi router and broadband modem
- ▶ Possible interference between femtocell and cellular base station frequencies
- ▶ Dual cellular/Wi-Fi handset achieves same functionality without need for femtocell
- ▶ Currently unable to support high data rates at an affordable femtocell price

Possible 4G Business Models

WiMAX

- ▶ Encourage open network and third party applications to maximize service offering
- ▶ Focus on laptop and netbook market first with high data rate applications (e.g., Slingbox, Hulu)
- ▶ Offer youth-oriented services for smart phones as soon as practical
- ▶ Offer highly competitive pricing for data packages to capture early market share
- ▶ Replace DSL/cable broadband use with wireless solution, and offer seamless mobility to permit wireline to wireless handoff
- ▶ Utilize femtocells to help capture DSL/cable users, facilitate seamless mobility, and minimize backhaul expenses
- ▶ Offer mobile VoIP capability to enhance data services

LTE

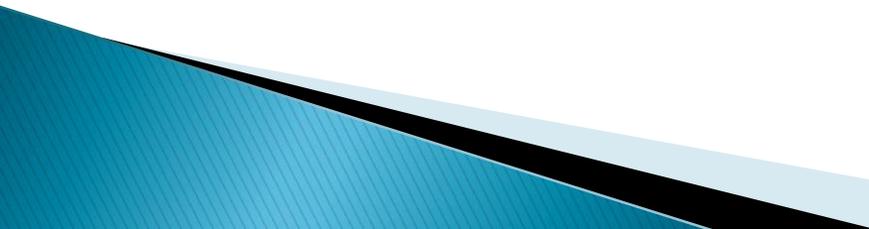
- ▶ Retain existing customer base by exploiting HSPA as long as possible
- ▶ Tailor LTE rollout to those markets demonstrating greatest need for broadband services
- ▶ Offer free access to Wi-Fi hotspots and dual cellular/Wi-Fi handsets to compensate for limited data rates of HSPA network
- ▶ Selectively deploy femtocells to minimize initial LTE network equipment expenses
- ▶ Move away from “Walled Garden” approach and allow more third party applications on LTE networks
- ▶ Foster new LTE businesses involving ad-supported mobile applications and machine-to-machine communications for health care and utility applications
- ▶ Use extensive backend billing and bundling capabilities to offer attractive voice/data/video packages

Outlook for Mobile Network Transition

- ▶ **HSPA/HSPA+ will reign until at least 2014**
 - Already deployed on >250 networks in 114 countries
 - Releases 7 and 8 provide downlink data rates up to 42 Mbps (with modifications to the Radio Access Network) and uplink data rate improvements
 - Requires no new spectrum allocation
 - HSPA/HSPA+ could handle as much as 75% of all broadband connections as late as 2014
- ▶ **LTE deployments will gradually increase with big spurt expected in 2013–2015**
 - Offers practical data rates at least twice HSPA+
 - Economies of scale and increasing volume of LTE-compatible devices will encourage transition to LTE
 - Data revenues will start to overtake voice revenues in about 2014 and become the driver in network configuration decisions
- ▶ **Mobile WiMAX will likely see success in developing countries, in rural areas, and as a replacement for DSL landline service**
 - HSPA will discourage existing mobile carriers from moving to WiMAX
 - WiMAX emphasis on broadband data services could capture youth market
 - WiMAX must quickly penetrate developing counties to exploit its “first-to-market” position and capture users before LTE economies of scale create price pressures

How Will This All Play Out?

RevGen Group can provide important insights on these key questions:

- ▶ Can WiMAX be profitable, and how does it differentiate itself from HSPA and LTE?
 - ▶ What factors will prod 3G operators to move from HSPA to LTE?
 - ▶ Can the 4G networks really fulfill all of the promises? What services will be the killer apps for 4G?
 - ▶ Who will profit from femtocells, if anybody?
 - ▶ Are the mobile carriers giving up on voice too soon? Can WiMAX fill a void in this area?
 - ▶ What strategy should component suppliers pursue in addressing the uncertainties of 4G buildout?
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[Email Mort Cohen](#) for more insights and analyses on the transition to Broadband Wireless

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