Wireless Broadband Evolution

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Mobile Services Are Becoming the Center of Life

Mobile Communication

Mobile Entertainment

Mobile Enterprise

Developing Markets

Location Based Services

Mobile Education

Mobile Healthcare

Mobile Retail

Wireless Broadband Evolution

Network Evolution	Mobile Device Evolution	Service Evolution
• *All-IP Network For Fixed-Mobile Convergence (VoIP & data)*	• *Convergence of Communication, Computing & CE Platforms*	• *User Behaviors Trend from Wired to Wireless*
• *Co-existence of Different Access Networks for Various Needs* – *Coverage, Mobility, Capacity, QoS, Data Rates …*	• *Multi-mode Devices Connect to Various Access Networks* – *Service Requirements, Availability, Cost …*	• *Same Rich IP Apps and Services in all Environments* – *Ubiquitous & Consistent Experience Desired*

Evolution of Wireless Technologies

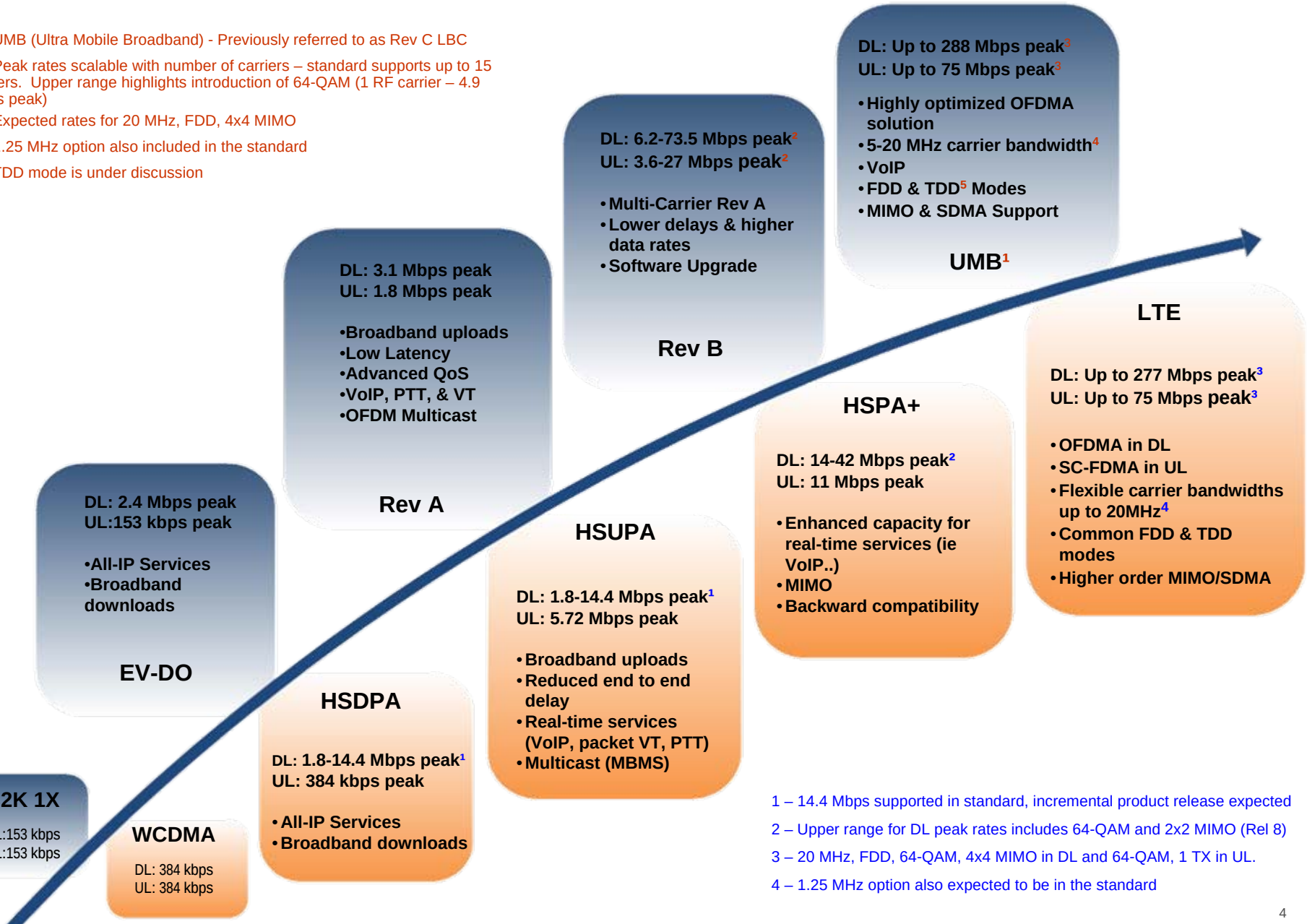
1 – UMB (Ultra Mobile Broadband) - Previously referred to as Rev C LBC

2 – Peak rates scalable with number of carriers – standard supports up to 15 carriers. Upper range highlights introduction of 64-QAM (1 RF carrier – 4.9 Mbps peak)

3 – Expected rates for 20 MHz, FDD, 4x4 MIMO

4 – 1.25 MHz option also included in the standard

5 – TDD mode is under discussion



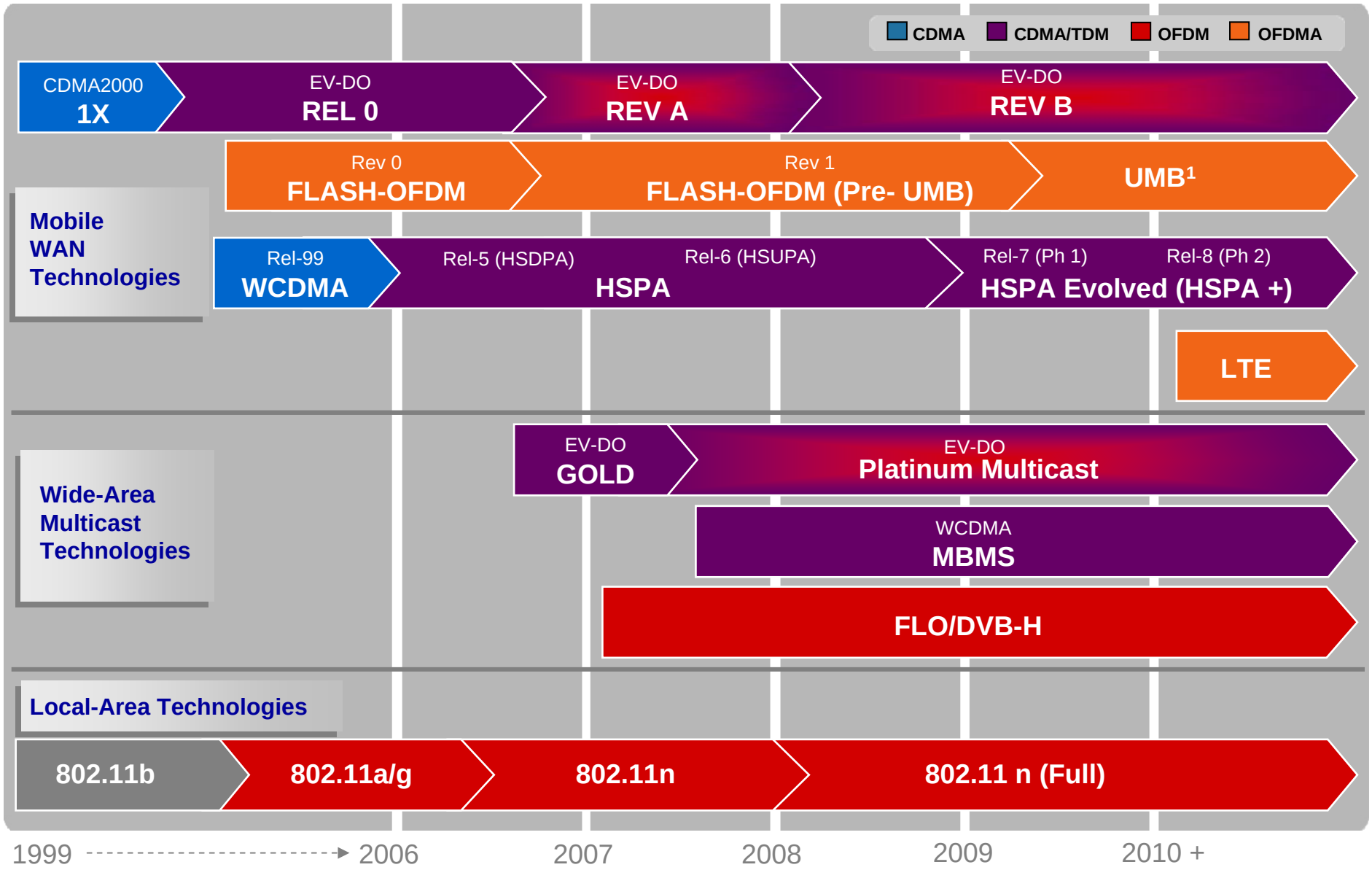
1 – 14.4 Mbps supported in standard, incremental product release expected

2 – Upper range for DL peak rates includes 64-QAM and 2x2 MIMO (Rel 8)

3 – 20 MHz, FDD, 64-QAM, 4x4 MIMO in DL and 64-QAM, 1 TX in UL.

4 – 1.25 MHz option also expected to be in the standard

Wireless Evolution:
The Right Technology for the Right Application



1-UMB (Ultra Mobile Broadband), previously referred to as Rev C LBC

EV-DO : From Rev A to Rev B

Rev A

- ***Key Improvements***
  - Designed for symmetric traffic
  - Reduced latency and optimized QoS
- ***Increased capacity***
  - 1.2 times Rel 0 forward link sector capacity
  - 3.4 times Rel 0 reverse link sector capacity
- ***Higher data rates***
  - 3.1 Mbps peak data rate on forward link
  - 1.8 Mbps peak data rate on reverse link
- ***QoS***
  - User based and flow based prioritization
  - Enables different grades of services based on subscription level to expand the addressable market
- ***Enhanced services and applications***
  - Improves user experience UL intensive apps (sending files, picture/video messaging)
  - Target mass market for applications such as mobile social networking
  - DO Platinum Multicast
- ***Backward compatibility***
  - Continued support for existing Rel 0 devices

Rev B

- ***Key Improvements***
  - Aggregates multiple carriers for higher performance
- ***Increased capacity***
  - Bigger pipe to address more users & encourage longer usage
- ***Higher data rates***
  - Proportional to number of carriers aggregated
  - Flexible frequency re-use configurations
- ***QoS***
  - Reduced delays from with delivery from a bigger pipe
- ***Enhanced services and applications***
  - Significantly enhanced user experience for existing applications throughout cell coverage
  - Faster Download of Higher Quality, Longer Video and Music
- ***Backward compatibility***
  - Software upgrade to existing DOrA channel cards
  - Continued support for existing Rev A devices

UMB (Ultra Mobile Broadband)

- ***Highly optimized Mobile OFDMA solution with higher performance than competing technologies***
  - Advanced antenna techniques, superior interference management, optimized reverse link
- ***Scalable IP network architecture and advanced QoS mechanisms enable leading-edge performance***
  - Support for real time services and seamless handoffs
- ***Enhanced user experience with higher data rates (peak, avg, cell edge), lower latency, and seamless mobility***
- ***More flexible and affordable services with higher capacity & robust QoS capabilities***
- ***Support for all applications ranging across all types of devices***

Peak Data Rates
10 MHz, FDD

	1 X 2	2 X 2	4 X 4
FL	37 Mbps	70 Mbps	140 Mbps

	1 X 2	1X4
RL*	34 Mbps	34 Mbps

Peak Data Rates
20 MHz, FDD

	1 X 2	2 X 2	4 X 4
FL	74 Mbps	140 Mbps	280 Mbps

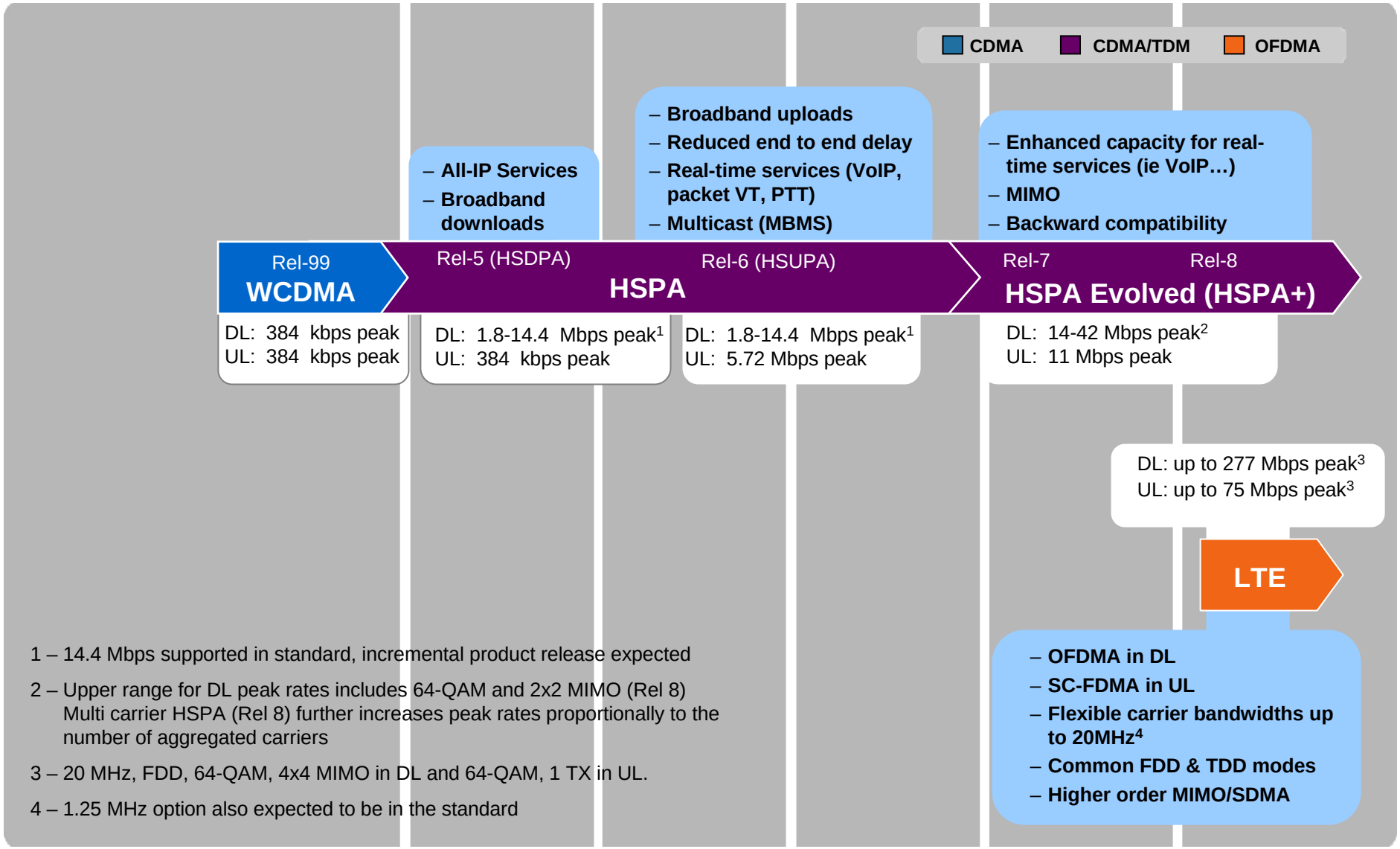
	1 X 2	1X4
RL*	68 Mbps	68 Mbps

* RL SIMO 1XN: 1 tx antenna at terminal, N rx at AP

3GPP2 Evolution Offers Industry Leading Mobile Broadband Capabilities

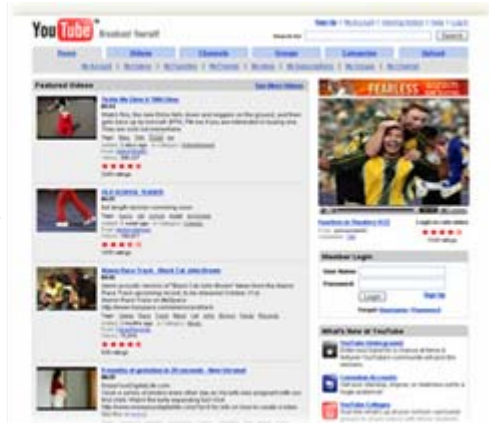
- ***EV-DO was built to support all-IP services***
- ***EV-DO Rev A supports higher data rates, increased capacity***
- ***QoS support in Rev A enables support for delay sensitive packet Applications (e.g., VoIP, Push to Media, Video Telephony)***
- ***Rev B provides a natural evolution in existing spectrum via software upgrade as operators add more voice and data capacity with additional Rev A cards***
- ***Rev B provides superior user experience with consistently higher data rates and lower delays***
- ***UMB is a highly optimized OFDMA system for wider bandwidths in new or vacant spectrum and will coexist with Rev B***
- ***UMB's scalable IP network architecture and advanced QoS mechanisms enable leading-edge performance***
- ***Flash is a field proven technology that provides early time to market for an OFDMA deployment***

3GPP: A Well Established Mobile Broadband Evolution Path



HSPA

- ***HSDPA Key improvements on downlink***
  - Shared channel transmission – time, codes and power
  - Higher order modulation – 16 QAM
- ***HSUPA Extends benefits of HSDPA to Uplink***
- ***HSPA significantly increases capacity***
  - 3x gain in DL sector capacity over R99
  - 2x gain in UL sector capacity over R99
- ***Higher data rates***
  - DL peak data rates up to 7.2 Mbps (14.4 Mbps per standard)
  - UL peak data rates of up to 5.76 Mbps
- ***QoS***
  - Enables different grades of services
- ***Enhanced services and applications***
  - Improves end-user experience for existing applications
  - Support for delay sensitive services and low latency networked gami
  - Enables efficient multicast transmission (MBMS)
- ***Backward compatibility***
  - Continued support for Rel 99 and Rel 5 HSDPA handsets



Social Networking

Video On-Demand

HSPA+

- ***HSPA+ enhances R6 HSPA to significantly increase performance in a 5MHz carrier bandwidth***
- ***Doubled data capacity over HSPA****
- ***Almost 3x Voice capacity through VoIP***
  - Using VoIP frees up significant data capacity
- ***Higher data rates***
  - DL: 14-21 Mbps peak (no MIMO)**
  - DL: 28-42 Mbps peak (2x2 MIMO)**
  - UL: 11 Mbps peak
- ***Enhanced services and applications***
  - Enhances system capacity for VoIP and other low-throughput delay sensitive applications
  - Reduced set-up times, enhanced support for real time services (Packet VT, VoIP and enriched V+D applications)
- ***Backward compatible***
  - Continued support for Rel. 99 and HSPA terminals

Packet Video Telephony

Push to Talk Push to Media

* Numbers based on advanced receivers at node B and UE

** Upper range for DL peak rates includes 64 QAM. 28 Mbps is supported in R7

Long Term Evolution (LTE)

- ***Optimized Mobile OFDM solution suitable for wider bandwidth deployments (up to 20 MHz)***
  - OFDMA in DL and SC-FDMA in UL
  - Same principles as HSPA+ : Link Adaptation, HARQ, MIMO, etc.
- ***Flexible bandwidth usage for TDD and FDD Modes***
  - Variable bandwidths up to 20MHz supported
- ***High peak data rates***
  - 277 Mbps DL / 75 Mbps UL in 20MHz*
- ***Increased cell edge coverage and data rates by use of Frequency Reuse techniques***
- ***High capacity fully integrated Single Frequency Network (SFN) broadcast and multicast support***
- ***Interoperable with existing 3GPP technologies and multi-mode devices will provide seamless user mobility***

* 64-QAM, 4x4 MIMO in DL and 64 QAM 1 TX stream in UL

HSPA+ And LTE Are Complementary

HSPA+ – Deployments optimized for 5 MHz Carriers (1 - 4)

- The natural and most economical upgrade from HSPA
- Increased peak, average & cell edge rates
- Enhanced capacity for real-time services (VoIP, VT, PTT)
- Backward compatible
- MIMO support

LTE – Deployments optimized for wider bandwidths up to 20MHz

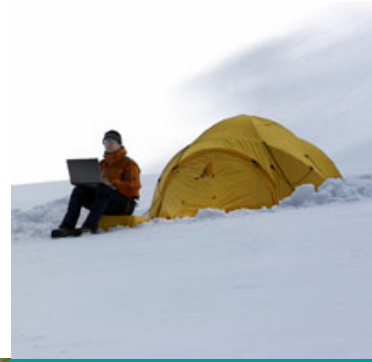
- Optimized mobile OFDMA solution for new and unused spectrum
- Flexible bandwidth usage with FDD and TDD modes
- Higher capacity and higher peak rates through wider bandwidths, higher order MIMO and SDMA support
- Interoperable with existing 3GPP networks

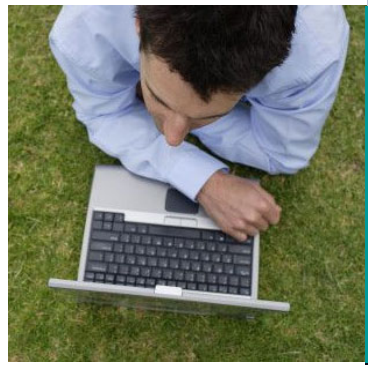
3GPP Evolution Offers Industry Leading Mobile Broadband Capabilities

- ***HSDPA provides broadband downloads and significant increase in DL capacity***
- ***HSUPA provides broadband uploads and significant increase in UL capacity***
- ***QoS support in HUSPA enables support for delay sensitive packet applications (e.g., VoIP, Push to Media, Video Telephony)***
- ***HSPA+ enhances R6 HSPA to significantly increase performance in a 5MHz carrier bandwidth***
- ***HSPA+ further enhances capacity for delay sensitive applications***
- ***LTE is an optimized OFDMA system for wider bandwidths in new or vacant spectrum and will coexist HSPA+***

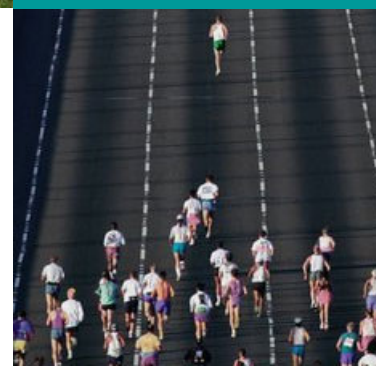
Challenging Steps to Select a Mobile Notebook

- *Today's Process: Limited by Mono-Mode Technology*
  - Complicated technology/carrier decision process for end-user
  - No freedom of technology choice after purchase
  - Restricted global mobility
  - Forces notebook OEM to create variety of SKUs
  - Delays time to market
  - Inhibits cost reduction
  - Limits economies of scale
  - Results in low volume
    - ~1% of 100M notebook units per year

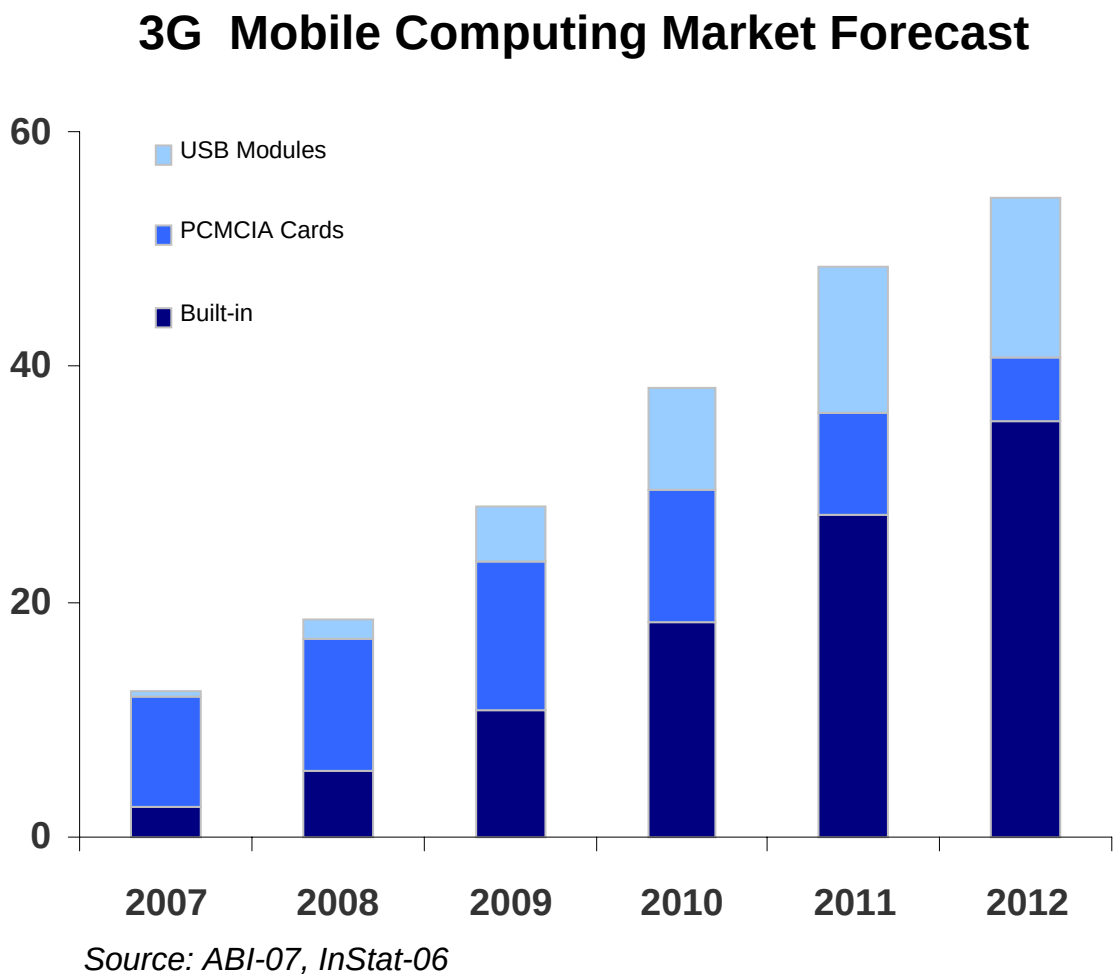




Searching for network…



Demand for Built-in Mobile Internet is Growing



Source: ABI-07, InStat-06

- ***Notebook models***
  - Notebooks with Mobile Internet built in will be the majority by 2010
- ***Subscriptions***
  - 12M subs per year now - growing >20M next year

Delivering Global Mobile Internet – Today!

Highly Integrated

Reliable Connectivity

Optimized Performance

- *Gobi technology includes*
  - Multi-mode chipset for global connectivity
  - Software stack and API for streamlined network certification
  - Module reference design for reduced costs and time to market
- *Benefits to wireless ecosystem*
  - Brings global connectivity that is popular in PDAs to notebook computers
  - Enables global connectivity for the end-user
  - Improves the user connectivity experience
  - Streamlines inventory and supply chain logistics aimed to reduce costs
  - Provides greater functionality
  - Enables LBS services, asset tracking, anti-theft with built-in GPS functionality

Global Mobile Internet – Today!

- *Qualcomm's Gobi Technology*
  - Delivers wireless communication technology to make mobile internet enabled notebooks mainstream
  - Provides transparent global connectivity for end-users
  - End-user confidence in purchase decision – no complexities, no compromise
  - World coverage - unifies wireless high-speed networks
    - CDMA2000® 1X, EV-DO, EV-DO Rev. A
    - GSM, GPRS, EDGE, HSDPA, HSUPA
  - Streamlines notebook manufacturer supply logistics aimed to reduce costs
  - Internet, email, VPN, mobile TV, music downloads and more
  - Provides popular mobile GPS functionality on notebooks

Gobi You. Wherever You Are

WIRELESS REACH: A NEW QUALCOMM INITIATIVE

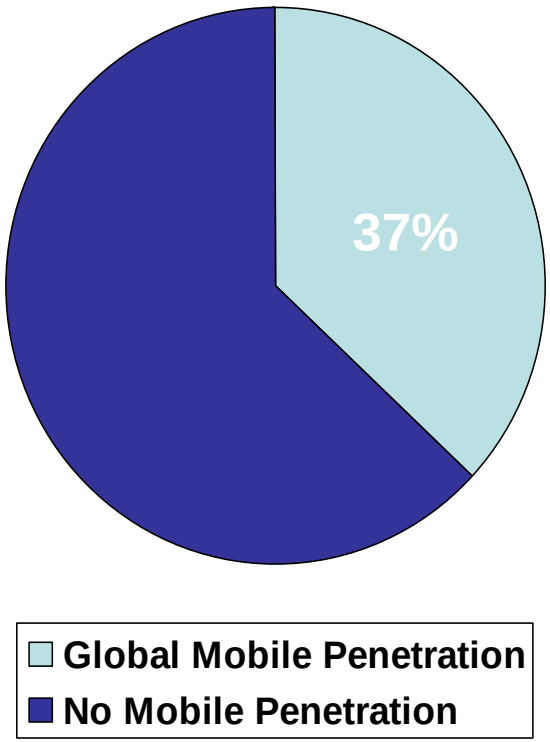
QUALCOMM believes access to advanced wireless voice and data services improves people's lives.

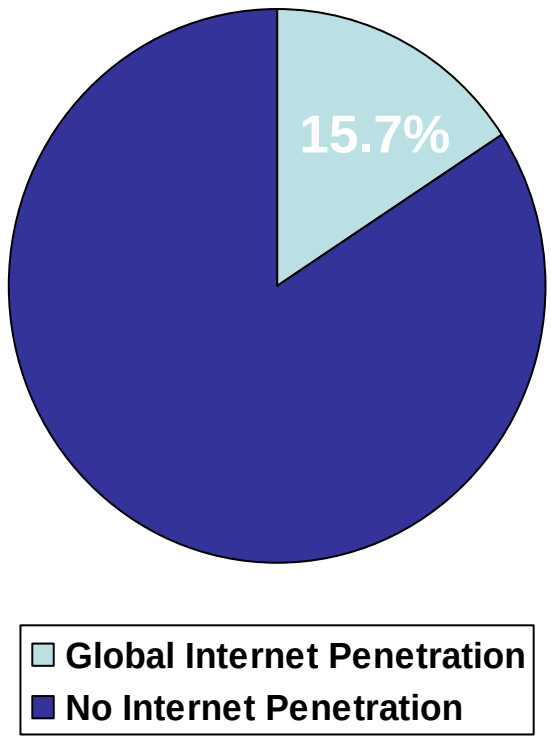
Worldwide partnerships use advanced wireless technology solutions to provide new ways for people to communicate, learn, access healthcare and reach global markets for economic development.

A Global Wireless Initiative

A Global Wireless Initiative

Current State of the World: A Digital Divide Exists





For every 100 people worldwide, less than 40 have a mobile phone. Even fewer have Internet access

Peru: Remote Mountain Surgery

Partner: ***Kausay Wasi Health Clinic, FACES Foundation***

Execute: ***Laptops, datacards, printers, webcams***

Innovate: ***Critical medical care for >12,000***

HEALTHCARE

China: Rural Innovation & Business

Partner: ***PlaNet Finance, China Unicom***

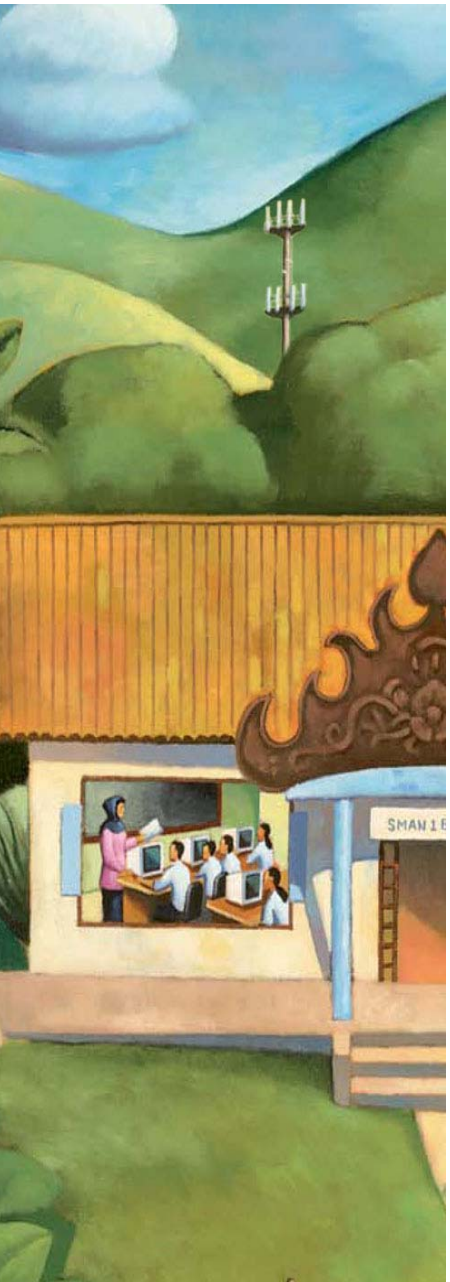
Execute: ***Mobile phones and service***

Innovate: ***More efficient small businesses***



"(SMS) allows me to know when is the best time to buy, when I should buy more and when I should buy only what I need until the price drops." —Yanchi County farmer, Ningxia province

ENTREPRENEURSHIP



Why Wireless Connectivity Matters

"A 1 point increase in mobile penetration is correlated with an increase in GDP per capita of USD $322."

"A 1 point increase in Internet penetration is correlated with an increase in GDP per capita of USD $551."

Source: TMG Telecom and ITU World Telecommunications Database Statistics; 2004

THANK YOU