MIT Enterprise Forum
January 11, 2006
Dr. Irwin Mark Jacobs
Founded July 1, 1985

No Products at Start
Strategy – Innovation: Digital & Wireless Communications & Applications
Rapid Mobile Growth from 1988

Telephone Main Lines and Mobile Subscribers World Market 1988-2003

Source: ITU World Telecommunication Indicators, 2004
November 1989 – Demonstration BTS & “Mobile Phone”
2005 Cellphone Compares Favorably to 2000 Desktop

Intel Pentium based desktop computer
- Date: February 2000
- Processor: Pentium III
- Speed: 550 MHz
- RAM/Flash: 128 MB
- Drive/Storage: 20 GB
- Network Connection: 56kbps peak (dialup)
- Price: $2,111 with monitor

Samsung SCH-i730 (1xEV-DO)
- Date: June 2005
- Comm’s Processor: QCT MSM6500
- PDA Processor: Intel Bulverde
- Speed: 520 MHz
- RAM/Flash: 128 MB
- Drive/Storage: 64 MB + SD Card – up to 2 GB
- Network Connection: 2.4Mbps peak (mobile)
- Price: $600
<table>
<thead>
<tr>
<th></th>
<th>LGE U880 MSM6250</th>
<th>SAMSUNG SGH-Z510 MSM6250A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td>98.8 x 49 x 18.2</td>
<td>97 x 52 x 14.9</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>99 g (with 840mA Battery)</td>
<td>97 g (with 800mA Battery)</td>
</tr>
<tr>
<td><strong>Camera</strong></td>
<td>1.3Mpixel</td>
<td>1.3Mpixel</td>
</tr>
<tr>
<td><strong>LCD</strong></td>
<td>Main 2.0 inch / 176 x 220 (262K) &lt;br&gt; Sub 1.2 inch / 96 x 96 (65K)</td>
<td>Main 2.2 inch / 176 x 220 (262K) &lt;br&gt; Sub 1.2 inch / 80 X 64 (65K)</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>BT / External T-Flash / MP3</td>
<td>BT / External T-Flash / MP3</td>
</tr>
</tbody>
</table>
Enabled by Moore’s Law:
From Just a Modem Supporting Phone Calls to Much More

Size Comparison (scaled to 90nm)
# QCT Platforms Enabling Mobile Wireless Solutions

<table>
<thead>
<tr>
<th></th>
<th>Value Platform</th>
<th>Multimedia Platform</th>
<th>Enhanced Platform</th>
<th>Convergence Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Surround Sound</td>
<td>Surround &amp; Positional Sound</td>
<td>Surround &amp; Positional Sound</td>
</tr>
<tr>
<td><strong>3D Graphics</strong></td>
<td></td>
<td>50k poly/sec,</td>
<td>100k tri/sec,</td>
<td>4M Tri/sec,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400 pix/sec</td>
<td>7M pix/sec</td>
<td>133M 3D pix/sec</td>
</tr>
<tr>
<td><strong>CAMERA</strong></td>
<td>1.3Mpixel</td>
<td>3Mpixel</td>
<td>5MPixel¹</td>
<td>8 MPixel</td>
</tr>
<tr>
<td><strong>VIDEO</strong></td>
<td></td>
<td>15 fps QCIF</td>
<td>Rec: 15 fps QVGA</td>
<td>30 fps VGA</td>
</tr>
<tr>
<td><strong>LOCATION (LBS)</strong></td>
<td>A-GPS</td>
<td>A-GPS Mode</td>
<td>A-GPS Mode</td>
<td>A-GPS Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standalone Mode</td>
<td>Standalone Mode</td>
<td>Standalone Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Car Navigation</td>
<td>Car Navigation</td>
<td>Car Navigation</td>
</tr>
<tr>
<td><strong>MEDIACAST &amp; comp wireless</strong></td>
<td></td>
<td>Bluetooth</td>
<td>Bluetooth, WLAN Mediacast</td>
<td>Bluetooth, WLAN Mediacast</td>
</tr>
<tr>
<td><strong>DISPLAY</strong></td>
<td>sQCIF [128 x 96]</td>
<td>QCIF [176 x 144]</td>
<td>QVGA [320 x 240]</td>
<td>VGA [640 x 480]</td>
</tr>
<tr>
<td><strong>uPROCESSOR</strong></td>
<td>up to 100MHz</td>
<td>up to 180MHz</td>
<td>270 MHz</td>
<td>Dual CPUs 400MHz - 1GHz *</td>
</tr>
</tbody>
</table>

* Scorpion – 2100 DMIPS, 240 mWatts superscalar ARM v7 compliant CPU

Footnote 1: Depends on MSM
New “Scorpion” Mobile Microprocessor Core

- Scorpion – low power, high performance superscalar CPU developed by QCT
  - 1GHz CPU for battery powered wireless applications
  - Low power, low leakage, 65-nm process
  - Specifically designed and optimized for MSM solutions
  - ARM v7 compliant, dynamic voltage & clock scaling
- VeNum – low power, high performance multimedia coprocessor
  - Up to 2X performance boost for multimedia applications
  - ARM NEON™ technology - 8 billion operations per second

How Scorpion stacks up

<table>
<thead>
<tr>
<th>Feature</th>
<th>Cortex-A8</th>
<th>Scorpion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>&gt;600MHz</td>
<td>1GHz</td>
</tr>
<tr>
<td>Performance</td>
<td>1200 DMIPS</td>
<td>2100 DMIPS</td>
</tr>
<tr>
<td>Power @ 1200 DMIPS</td>
<td>300 mWatts</td>
<td>240 mWatts</td>
</tr>
</tbody>
</table>

NOTE: in low-power 65nm technologies. Uses Dhrystone 2.1 (DMIPS)
**Wireless Roadmap - Applications Drive Technology Choice**

**Wide Area Multiple Access Technologies**

*for cdmaOne/CDMA2000 operators*

- CDMA2000 1X
- CDMA2000 1xEV-DO
- EV-DO Rev A
- EV-DO Rev B*  

*for WCDMA/GSM/GPRS operators*

- Rel-99 WCDMA
- Rel-5 HSDPA
- Rel-6 HSUPA*

**Wide Area Multicast Technologies**

*In-band 3G multicast for CDMA2000 operators*

- EV-DO Gold
- EV-DO Platinum Multicast*

*In-band 3G multicast for WCDMA operators*

- WCDMA MBMS*

*Dedicated multicast network for 3G operators*

- FLO (Forward Link Only)

**Local Area Technologies**

*for home, enterprise, campus and hotspot access*

- 802.11b
- 802.11a/g
- 802.11n*

*These technologies are in process of standardization*
### Wireless Roadmap - Applications Drive Technology Choice

#### Wide Area Multiple Access Technologies

*For cdmaOne/CDMA2000 operators*

<table>
<thead>
<tr>
<th>Technology</th>
<th>CDMA</th>
<th>CDMA/TDM</th>
<th>OFDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDMA2000 1X</td>
<td>CDMA2000 1xEV-DO</td>
<td>EV-DO Rev A</td>
<td>EV-DO Rev B*</td>
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*For WCDMA/GSM/GPRS operators*

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<td>Rel-5 HSDPA</td>
<td>Rel-6 HSUPA*</td>
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#### Wide Area Multicast Technologies

*In-band 3G multicast for CDMA2000 operators*

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<tr>
<td>EV-DO Gold</td>
<td>EV-DO Platinum Multicast*</td>
<td>WCDMA MBMS*</td>
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*In-band 3G multicast for WCDMA operators*

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*Dedicated multicast network for 3G operators*

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#### Local Area Technologies

*For home, enterprise, campus and hotspot access*

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<td>802.11a/g</td>
<td>802.11n*</td>
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*These technologies are in process of standardization*
Trend: Global Wireless Handset Shipments

3G (CDMA2000 & WCDMA) will make up 60% of total shipments by 2009

Worldwide Wireless Handset Shipments

* Includes Analog, cdmaOne, TDMA, PDC, GSM, GPRS and EDGE

Source: Average of Strategy Analytics (August 2005) and Yankee Group (October 2005) handset forecasts
Trend: Demand for Mobile Data Is Rapidly Growing

*More and more enterprises and consumers are relying on mobile data services*

The demand for additional spectrum, spectral efficiency and network capacity is increasing

Source: Global Mobile Market Forecast, The Yankee Group, October 2005
New – Laptop 3G CDMA Wide Area Mobile Broadband

Embedded EV-DO and HSDPA modules are an optional feature to access the web or enterprise VPN at high-speeds
Mobile Receive Diversity Improves Performance

- Doubles voice capacity of 1X & EV-DO
- Significantly increases data rates
- Significantly increases sector capacity
- Backwards compatible
- No new standards required

![Commercial 2-Rx Diversity Handsets](image)

![Mobile Receive Diversity Diagram](image)
Base Station Receive Diversity Improves Performance

2 pairs of spatially separated cross-polarized antennas provide 4-branch RX diversity

- Yields much higher sector capacity: even larger than gain from device diversity
- Same network topology and RF plan
- No new standards
- Can be rolled out incrementally as needed
4GV – Fourth Generation Vocoder

Integrating Narrow Band, Wideband and VOIP Speech Codec Solution

[Capacity vs Quality] of EVRC vs 4GV vs AMR @ 1% FER

Continuous Range of COPs

Higher Quality
Lower Capacity

4GV

Lower Quality
Higher Capacity
Pilot Interference Cancellation (PIC)

- For low data rate applications (e.g. VoIP, PTT), where many devices transmit at the same time, a significant portion of BTS received power is from reverse link (RL) pilots.

- Removal of pilot interference increases capacity.

- For example, VoIP experiences ~15-20% reverse link capacity gain.

- No standard changes required.

- Can be rolled out incrementally as needed.
Growing Voice Capacity

Erlangs Per Sector

(2x10MHz)

2% GOS for all calculations
Assumes 100% loading of voice traffic

1. "Further Capacity Improvements in CDMA Cellular Systems", QUALCOMM Inc, Roberto Padovani, Assumes 2-way Rx Div at handset and 4-way Rx Diversity at BTS. 4GV Capacity Operating Point 2
2. QUALCOMM simulation, 4GV Capacity Operating Point 2
Packet-only Carrier Throughput Improvements to Spectral Efficiency
VOIP Supported by DO Rev A (DOrA)

Downlink

EV-DO Rel 0: 850 Kbps
EV-DO Rel 0 + 2-RX Handset Diversity: 1240 Kbps (~45% Increase)
EV-DO Rel 0 + 2-RX Handset Diversity + Equalizer: 1500 Kbps (~20% Increase)

Uplink

EV-DO Rel 0: 350 Kbps
EV-DO Rev A: 600 Kbps (~70% Increase)
EV-DO Rev A 4-RX BTS Diversity: 1200 Kbps (~100% Increase)
Quality of Service, QOS: Packet Based Video Telephony

- Full duplex service with audio, video, and control flows
- More efficient than circuit switched
- More freedom in balancing available bandwidth and video quality
- Easier integration with other packet-based services (e.g., IM)
- Introduces Additional Flexibility in Pricing Plans
Increasing Convergence With Consumer Electronics

- Voice
- Walkie-Talkie
- PDA
- Television
- Camcorder
- Photo Album
- Glucometer
- Wallet
- Bar Scanner
- Pager
- Camera
- FM Radio
- Game Console
- PC
- MP3 Player
- Newspaper
- GPS Device
- Rolodex
Korea’s KTFreetel Diabetes Phone: LGE and Healthpia

Glucometer cell phone & service for managing diabetes remotely

* Providing Customized Healthcare Services for each Patients
* Built-in glucose meter
* Sending Measured Blood Sugar Level
* Receiving Information Required
* Counseling and Advising
* Giving the Alarm for Dosage and Measuring
* Building Personal Profile
* Retreiving Personal Data
* Being Provided Customized HealthPia Service Plan

Physician

Transmitting data
Storing Patient DB

Healthpia Data Center
CardioNet: Cardiac Monitoring Service --
*Enabled by QUALCOMM’s Wireless Network Management Services*
BREW Applications

- Games and Entertainment
- Information and News
- LBS
- Productivity
- Communication
- mCommerce
- Enterprise
KDDI EZ Navi Walk

Currently positioning...

Navigation begins

Going Home

In line with your walking speed, the map scrolls automatically

70 meters ahead, to the right
Sprint Nextel Customizes Handsets with BREW uiOne Themes

• ‘Skins' (user interfaces) for standby screen, main menu and favorites and link to other Theme-related multimedia and online content, (ringers, screensavers and other premium content)

• Customize by changing outside color accent plate
The Third Screen is Here and Always With You

Movie Screen  ➔  TV Screen  ➔  Phone Screen
MEMS-based iMOD Lowers Display Power Consumption

Strengths vs. LCDs

- Much simpler technology
- Near zero power for static images
- Lower power for moving images
- Lower cost for similar quantities
- High contrast and visibility
- High response speed
- Operates over greater temperature range

Power advantages range between 50% and 300% depending on lighting requirements and viewing mode
High Reflectivity of iMoD

- LCD TFT transflective and reflective
- QUALCOMM iMoD reflective
Interest in Video Outstrips Other Cell Phone Features

- Video functionality second only to voice
  - 1.5 to 1 preference for video services over camera phone
  - 2.3 to 1 preference for video services over push-to-talk

Source: Consumer Preference Index Video vs. Alternate Features; Primary research results conducted by Spear & Associates, sample of 2,800 cell phone and cable users & nationwide focus groups
MediaFLO
MediaFLO “now playing” interface
MediaFLO

- Forward Link Only (FLO™) Technology: a new OFDM air interface
- Media Distribution System (MDS)
- MediaFLO USA Inc network operator & service provider

Verizon to be 1st U.S. operator to launch MediaFLO

<table>
<thead>
<tr>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>Q1</td>
</tr>
<tr>
<td>Q2</td>
<td>Q2</td>
</tr>
<tr>
<td>Q3</td>
<td>Q3</td>
</tr>
<tr>
<td>Q4</td>
<td>Q4</td>
</tr>
</tbody>
</table>

- On-going Technology Development
- Technical Trials
- Commercial Trials
- Commercial Launch
Integrated Service Across Multiple Networks

Content Providers (Shared Content) -> MediaFLO MDS -> FLO Network

MediaFLO MDS (Managed by FLO Operator)

Content Providers (Unique Content) -> MediaFLO MDS -> 3G Network

3G Network (Managed by Wireless Operator)

SAME SUBSCRIBER

UHF Channel 55

Cellular Carrier

MediaFLO Client
Platinum Multicast – Time Slot with OFDM Modulation

- Flexible design
- Percent of bandwidth can be changed dynamically
- Backwards compatible
Layered Modulation

Supports transmission of base and enhancement layers with different levels of robustness

- Used in conjunction with layered source coding to extend coverage area
- Provides a more graceful degradation of reception, as compared to a single grade of service

Transmission Tower

Enhancement Layer
30 frames/second (maximum)

Base Layer:
15 frames/second (minimum)

Subscriber A
(receives base layer and enhancement layer signals)

Subscriber B
(receives base layer signal)
MediaFLO Handset

- Additional receive chain for FLO services
  - MBD1000 + RBR1000
- Existing modem ASIC for H.264 decode
- MediaFLO Client Software
- CDMA2000 and WCDMA
Diverse Content Distribution Possibilities

Video / Audio

Gamecasting

Data Channels / RSS

Weather

Stock Ticker

Traffic
Wireless Connectivity in Developing Nations

Rajasthan, India

Andaman and Nicobar Islands

Brazil

Nigeria

Sri Lanka

Ecuador

Placilla, Chile

Huawei Technologies

Sunitel
Impact of Telephony and Internet Connectivity

It’s not just about voice… It’s about voice & data (Differentiated Services)

For each 1% increase in telephony penetration, GDP per capita goes up by **US$240**

For each 1% increase in Internet penetration, GDP per capita goes up by **US$593**

Offering differentiated services (voice, Internet access, multimedia, etc.) via advanced wireless networks will boost India’s economic growth

Broadband access business models benefit from leveraging voice revenues

Tata Indicom – Non-Stop Mobile Unlimited Incoming Calls

- Receive unlimited incoming calls without recharging
- No commitment to recharge every month
- Recharge with any voucher, anytime, and get 100% talktime

- First in wireless net additions (23% Net Adds share)
- 5th place in overall Indian Wireless Market
Voice and Data Becoming Ubiquitous

Mobile Web surfing via CDMA2000 1X data cards on Reliance network in India
3G for Wireless Broadband Access
CDMA2000 1xEV-DO at 450 MHz: Pilot Project in Brazil

Partnership between Lucent and Anatel (Brazilian telecom regulator) to demonstrate CDMA2000 1xEV-DO broadband data capabilities and coverage at lower frequencies for universal broadband access
High Tech High Charter School – San Diego, CA

Innovation in Public Education

• Launched in September 2000 by an industry and educator coalition
• Small, diverse learning community
• Admission by Lottery
• Founded on three design principles:
  • personalization, adult-world connection, and a common intellectual mission
HTH Schools San Diego-- a Snapshot in 2004-05

- 3 schools operational (2 high schools and 1 middle)
- 1040 students, 90 employees
- All schools have API base scores above 800
- 100% of graduates headed off to college
- $22 million in real estate holdings
- All schools operate as LEAs for purposes of special education
- 12 teachers enrolled in HTH teacher certification program
QUALCOMM Continues to Innovate

Cumulative U.S. Patents (Issued Patents & Filed Applications)  
(Excludes non-U.S. filed applications and granted patents)
Financial Highlights – Fiscal 2005

- Record revenues
  - $5.67 Billion, up 16% YOY

- Record net income
  - $2.14 Billion, up 25% YOY
  - $1.97 Billion, up 9% YOY (Pro forma*)

- Record EPS
  - $1.26 GAAP, up 22% YOY
  - $1.16 Pro forma*, up 8% YOY

- Record operating cash flow
  - $2.7 Billion operating cash flow**

*Pro forma results exclude the QSI segment and one-time tax benefits recorded in Q2’05 and Q3’05 and are presented as if the New Method of recording royalties was in use during FY2004. FY2004 results have also been adjusted to conform to new segment presentation for the reorganization of MediaFLO into the QSI segment during Q1’05

**Defined as net cash provided by operating activities
Strong Balance Sheet

- Liquidity for Significant Opportunities Ahead
- Returning Value to Shareholders Through Dividends and Buybacks

<table>
<thead>
<tr>
<th>($Billions)</th>
<th>Sep 2004</th>
<th>Sep 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash &amp; Marketable Securities</td>
<td>$7.6</td>
<td>$8.7</td>
</tr>
<tr>
<td>Receivables, Inventory</td>
<td>$0.7</td>
<td>$0.7</td>
</tr>
<tr>
<td>Fixed Assets &amp; Goodwill</td>
<td>$1.0</td>
<td>$1.6</td>
</tr>
<tr>
<td>Deferred Tax Assets &amp; Other</td>
<td>$1.5</td>
<td>$1.5</td>
</tr>
<tr>
<td>Total Assets</td>
<td>$10.8</td>
<td>$12.5</td>
</tr>
<tr>
<td>Total Liabilities</td>
<td>$1.1</td>
<td>$1.4</td>
</tr>
<tr>
<td>Stockholder Equity</td>
<td>$9.7</td>
<td>$11.1</td>
</tr>
<tr>
<td>Total Liabilities &amp; Stockholder Equity</td>
<td>$10.8</td>
<td>$12.5</td>
</tr>
</tbody>
</table>
Impact of Execution - Recognition

8th Consecutive Year

FORTUNE 100 BEST COMPANIES TO WORK FOR 2005

S&P 500

Forbes 2004 THE PLATINUM LIST

68th World’s biggest public companies, FT Global 500

BestBig Companies IN‘AMERICA

7 years on Forbes list

NASDAQ

THE WALL STREET JOURNAL.

The 2005 FORTUNE 500

100 BEST Corporate Citizens

4th Consecutive Year
Best Financially Managed Company

FSA

IW LEADERSHIP IN MANUFACTURING

COMPUTERWORLD 100 BEST PLACES TO WORK IN IT 2004

San Diego Society For Human Resource Management

Workplace Excellence

EDD Employment Development Department State of California

MIT Enterprise Forum
January 11, 2006
What does the future Hold?

It’s up to your imagination!
Thank you