Next-generation CDMA2000 devices and multimedia convergence

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2006 3G CDG Latin America Regional Conference
May 24th 2006
3G Broadband Evolution

Wide-Area Multiple Access Technologies

**CDMA2000 Path**

<table>
<thead>
<tr>
<th>CDMA2000 1X</th>
<th>CDMA2000 1xEV-DO</th>
<th>EV-DO Rev A</th>
<th>EV-DO Rev B</th>
<th>Rev C/Phase II</th>
</tr>
</thead>
</table>

**WCDMA Path**

<table>
<thead>
<tr>
<th>Rel-99 WCDMA</th>
<th>Rel-5 HSDPA</th>
<th>Rel-6 HSUPA</th>
<th>Rel-7 HSPA+ Phase 1</th>
<th>Rel-8 HSPA+ Phase 2</th>
</tr>
</thead>
</table>

Note: timeline depicts initial commercial availability of each technology. Those introduced beyond 2008 are under standardization and are subject to variability

1. EV-DO Rev A and Rev B incorporate OFDM for multicasting; Rev B supports flexible bandwidths (1.25 to 20 MHz)
2. Data rates in a 2 x 20 MHz allocation
3. May have multiple modes, with at least one mode being backwards compatible with EV-DO (all versions); will likely utilize CDMA/OFDM or a combination of OFDMA and CDMA; MIMO/SDMA; leverages EV-DO protocol stack; support flexible bandwidths (1.25 to 20 MHz)
4. Data rates are for a sparsely loaded pedestrian system in a 2 x 20 MHz allocation
5. Release 7 and Release 8 introduce enhancements such as MIMO and VoIP
6. Utilizes OFDMA on the DL and SC-FDMA on the UL; MIMO; supports flexible bandwidths (1.25 to 20 MHz)
Driving Wireless Convergence

The Device that is Always With You
It isn’t just about voice and SMS anymore

Mobile TV
Music on Demand
Themes
Sports
Gaming
Location Based Services
Push-to-talk
Messaging (IM, MMS, Email…)
Business Services
Video Monitoring

Connecting services with simple user experiences

Next Generation CDMA2000 Devices being Driven on 3 Fronts

- Low Cost 1X
- EV DO Rev 0 Mainstream and Next Generation EV DO Rel A
- WorldMode
EV-DO Operation Enables Full Range of Devices & Services

Numerous Terminal Types
- VOD Phone
- Camera Phone
- Smart-Phone
- Music Phone
- Game Phone
- PDA-Phone
- WWAN Laptop
- WWAN Desktop/ Home HD

All IP Apps & Services
- Music DL
- Video On Demand
- Heavy Messaging (Email / MMS)
- Low-Latency Network Gaming
- High-quality VT
- Multimedia Intensive Browsing
- High bandwidth
- CRM, SFA and VPN
- VoIP
- PTC/ PTM
CDMA2000 Product Portfolio - A World of Choices

- **Voice Centric**
  - Mono tone
  - 2.4 Mbps
    - PC Cards
    - Embedded
    - Modems
    - Wi-Fi Routers

- **Data Centric**
  - 2.4 Mbps
    - PC Cards
    - Embedded
    - Modems
    - Wi-Fi Routers

- **Personal Messaging**
  - Camera
  - SMS
  - MMS
  - Ring tones
  - Wallpaper

- **Interactive Multimedia**
  - Camcorder
  - VoD/MOD
  - Games phone
  - 100K pixel

- **WorldMode Roaming**
  - Smartphone
    - Multi-mode
      - GSM/GPRS
      - CDMA2000 1X
      - 1xEV-DO
    - Multi-band
      - 800 MHz
      - 900 MHz
      - 1800 MHz
      - 1900 MHz

- **Digital Convergence**
  - Video telephone
  - Digital TV
  - Wi-Fi
  - Smartphone
  - 300K megapixel CCD
  - Voice recognition
## QCT Path Toward Greater Integration

<table>
<thead>
<tr>
<th>Multimedia</th>
<th>Radio</th>
<th>Components &amp; Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video ASIC</td>
<td>radioOne™</td>
<td>1 RF CMOS</td>
</tr>
<tr>
<td>Ringer Chip</td>
<td>Baseband w/ integrated co-proc.</td>
<td>2 Single Chip</td>
</tr>
<tr>
<td>3D Gaming ASIC</td>
<td>Power Mgmt.</td>
<td>3 Advanced Process Technologies</td>
</tr>
<tr>
<td>Apps Co-proc.</td>
<td>Memory</td>
<td></td>
</tr>
<tr>
<td>Camera Module w/ DSP</td>
<td>RF</td>
<td></td>
</tr>
</tbody>
</table>

*Image of a cell phone and a circuit board with labels for multimedia components and radio components.*
Evolution of Low Tier Handsets
Affordability + Variety + Functionality + Compelling Form Factors

Bar Type
Clam Shell
Other

$BOM, Size, TTM, Performance, Features

Increased Handset Variety (Platform)

Increased Performance, Features

QSC Proven integration => Schedule Reduction

Q1, Q2, Q3, Q4...

Q1, Q2, Q3,........

45% direct IC area reduction

Reduced Cost

Reduced Size

Reduced TTM

IC integration
Logistics
Manufacture, Test
...

Camera (1.3 MP)
Music (AAC/AAC+)
Video (MP4, decode)

6xxx
PM610
RFR6122

Reduced Cost
Reduced Cost

Reduced Size
Reduced Size

Reduced T
Reduced T

QSC
San Diego, CA, USA

QSC
San Diego, CA, USA

1.3 MP
AAC/AAC+
MP4, decode

Bar
Clam Shell
Other

QSC

Q1, Q2, Q3, Q4...

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Q1, Q2, Q3,........

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Reduced Cost
CDMA2000 1X Next Generation Low Cost Products

QSC Solution

- 800 MHz RF
- 4GV: voice capacity
- Improved Standby/Talk times

QSC 6030
- 153 kbps data
- MP3/AAC/AAC+
- ARM9
- MPEG4 decode
- Integrated 1.3 MP camera
- ARM9

QSC 6020
- 14.4 kbps data, BREW support
- Voice, SMS Centric
- ARM9

QSC 6010
- 800, 1900/2100 MHz RF
- SGPS, Secure boot
- 4GV, QLIC

QSC 6055
- 1x data (153.6 kbps)
- Stereo MP3/AAC/AAC+
- Up to 1.3 MP Camera
- BREW/Java support

QSC 6065
- Up to QCIF+ Video/Camcorder
- eAAC+
- Up to 3.0 MP Camera

RFT6122
- 4GV: voice capacity
- Improved Standby/Talk times

MSM6000/25
- 4GV, QLIC

PM6610
- 800, 1900/2100 MHz RF
- SGPS, Secure boot
- 4GV, QLIC

45% direct chipset area reduction

Single-Chip Architecture

Traditional PCB Area

QUALCOMM PUBLIC
Global Demand for Multimedia Services is Driving EV-DO Growth

- EV-DO Rev0 Handset models launched globally
  - 170+
  - 50+
  - 6500
  - 6550
- Wireless broadband type services are in mainstream mass markets
- PDA’s, datacards, and embedded modules in laptops are all growth drivers
- High-quality audio and video, Download and play 3D games

**First Product by Year End CY’06**
- EV-DO Rev A + Dual Processor
- First Product by Year End CY’07
- 1.8 Mbps Uplink
- 3.2 Mbps Downlink
- 4.9 Mbps 1.25 MHz
- 14.7 Mbps 3 Channels

**First Product by Year End CY’05**
- DO Rev A + Dual Processor
- On-time sampling June 2005

- SK Telecom
- Sprint
- Verizon Wireless
- KTF
- KDDI
- Vivo
- LG VX9800
- LG SB120
- Samsung SB300
- LG TeleCam
- Kyocera Passport
- Sanyo W32SA
- LG VX8100
- Motorola RAZR V3C
- Motorola RAZR V3
- Motorola RAZR V3c
- Motorola RAZR V3m
- LG Razzle
More than **140** CDMA2000 1xEV-DO Devices have been Commercialized by **18** Vendors

Samsung SCH-V7900
3GB Hard Disk Drive
2 MP/Camcorder

Samsung SCH-i730
Windows Mobile 2003, 802.11b

Toshiba W41T
4GB Hard Disk Drive, 3.2 MP Camcorder

Maxon MiniMax
MM-5500U USB Modem

Sanyo W32SA
14mm thin, 1.3MP Camera

LG VX9800
Megapixel Camera, V-Cast – Streaming Video

LG VX8100
OTA Music Downloads Video, 3DGames

Toshiba W41T
4GB Hard Disk Drive, 3.2 MP Camcorder

Samsung SPH-V7900
3GB Hard Disk Drive 2 MP/Camcorder

LG VX8100
OTA Music Downloads Video, 3DGames

Maxon MiniMax
MM-5500U USB Modem

Samsung a900

*Source: www.3Gtoday.com"
QUALCOMM Chips Support Consumer Electronics on a Mobile Handset

• MSM7XXX features
  • Up to 8.0 megapixel camera
  • 30 fps VGA video
  • MP3, AAC+, 3-D sound
  • Advanced 3D graphics (with ATI), TV-out
  • Third party operating systems

41% Area Savings

The first Smartphones featuring chipsets supporting Windows Mobile are expected as early as the first half of 2007

Smartphones Units Shipped

QUALCOMM & Microsoft Revolutionize Smartphones with BENEFITS to OEM Manufactures, Carriers and Subscribers

• Collaborating to enable Windows Mobile to run on 7XXX Convergence Platform chipsets

• Enable slimmer, power efficient, affordable devices

• Provide consumers with familiar operating environment with titles such as Outlook Mobile, Media Player Mobile

QUALCOMM PUBLIC
CDMA2000 Global Roaming

CDMA2000 ↔ GSM/GPRS

• Introducing new low end chips with dual mode capability
• Focus on mass markets in US, Latin America & Asia
• Extended Chipset Sampling in third quarter of calendar 2006
• Future support for CDMA2000/EDGE/WCDMA

Samsung SCH-i830 (includes EV-DO)
Samsung SCH-W379
Amoi CMA8301/
LGE KW-9200 (includes EV-DO)
QUALCOMM is increasing global roaming capabilities

- Extension of WorldMode capabilities to mainstream chipsets in multiple tiers
  - MSM-6125, MSM-6500, MSM-6550
- Development of dual-band CDMA2000/quad-band GSM/GPRS RF integrated solution

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Chipset</th>
<th>Bands</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing products</td>
<td>MSM6300+RTR6300</td>
<td>CDMA2000: 800/1900MHz</td>
<td>ZIF Tx/Rx, GPS, 1x/EVDO r0</td>
</tr>
<tr>
<td></td>
<td>MSM6500+RFL/RFR6000+</td>
<td>GSM/GPRS: 900/1800MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RTR6300</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>PM6050</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upcoming products</td>
<td>MSM6125/6500/6550</td>
<td>CDMA2000: 800/1900MHz</td>
<td>ZIF Tx/Rx, SGPS, MRD, 1x/EV-DO r0</td>
</tr>
<tr>
<td>(CS 3Q’06)</td>
<td>+RTR6350+RFR6500+</td>
<td>GSM/GPRS: 850/900/1800/1900MHz</td>
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</tr>
<tr>
<td></td>
<td>PM6640</td>
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</tr>
</tbody>
</table>

- MSM7600 Chipsets: Scale Economy Enabled through Moore’s Law
  - UMTS-HSDPA/EV-DO rA/1X/GSM-GPRS
  - Feature sizes on chip are going down
  - Application processors are taking up more of silicon
  - There is a sweet spot for chip size implies additional radios come at ever lower cost over time
WorldMode Devices
Global roaming enabled with CDMA2000/GSM/GPRS multi-mode/multi-band devices
## Segmentation Strategy
*Integration Yields Cost-effective Solutions at All Tiers*

<table>
<thead>
<tr>
<th>Value Platform</th>
<th>Multimedia Platform</th>
<th>Enhanced Platform</th>
<th>Convergence Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Gaming &amp; 3D GUI</td>
<td>50k Triangles/sec</td>
<td>225k Triangles/sec</td>
<td>4M Triangles/sec</td>
</tr>
<tr>
<td></td>
<td>400k 3D pixels/sec</td>
<td>7M 3D pixels/sec</td>
<td>133M 3D pixels/sec</td>
</tr>
<tr>
<td>CAMERA</td>
<td>2Mpixel</td>
<td>3Mpixel</td>
<td>5MPixel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8MPixel</td>
<td></td>
</tr>
<tr>
<td>VIDEO</td>
<td>15 fps @ QCIF</td>
<td>Record: 15 fps @ QCIF</td>
<td>Record: 15 fps @ QVGA</td>
</tr>
<tr>
<td></td>
<td>Record: 15 fps @ QCIF</td>
<td>Playback: 30 fps @ QVGA</td>
<td></td>
</tr>
<tr>
<td>LOCATION (LBS)</td>
<td>A-GPS Mode Standalone Mode Enhanced Navigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hybrid, MS-Assisted, MS-Based, Standalone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDIACAST &amp; PERIPHERALS</td>
<td>Bluetooth 1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISPLAY</td>
<td>QCIF [176 x 144]</td>
<td>QCIF+ [176 x 220]</td>
<td>QVGA [320 x 240]</td>
</tr>
<tr>
<td></td>
<td>225k Triangles/sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7M 3D pixels/sec</td>
<td>4M Triangles/sec</td>
<td>133M 3D pixels/sec</td>
</tr>
<tr>
<td>uPROCESSOR / QDSP</td>
<td>CPU – 50-180MHz QCDS-75MHz</td>
<td>CPU – 150-225MHz QCDS-75MHz</td>
<td>CPU – 225-300MHz QCDS-90MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dual CPUs 400MHz - 1GHz QCDS-250MHz</td>
<td></td>
</tr>
</tbody>
</table>

*Specifics vary per chipset*
LAUNCHPAD™

The technology engines that drive rich applications on the MSM

<table>
<thead>
<tr>
<th>Multimedia</th>
<th>Connectivity</th>
<th>Position location</th>
<th>User Interface</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>• CMX™ Compact Media Extension</td>
<td>• BREW™ Integration Support</td>
<td>• gpsOne™ AGPS technology</td>
<td>• UI One</td>
<td>• MMC</td>
</tr>
<tr>
<td>• Qcamera™</td>
<td>• USB</td>
<td>• Hybrid AGPS/network solution</td>
<td>• SIM/UIM Card interface</td>
<td>• SD-Card</td>
</tr>
<tr>
<td>• Qtv™</td>
<td>• Bluetooth</td>
<td>• Mobile-Assisted Mode</td>
<td>• CMOS/CCD image sensor interface</td>
<td>• Blue Tooth</td>
</tr>
<tr>
<td>• Qcamcorder™</td>
<td>• PureVoice Mail™</td>
<td>• Mobile-Based Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Qvideophone™</td>
<td>• IP Protocol stack</td>
<td>• Stand Alone Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Q3Dimensions</td>
<td>• WAP Browser</td>
<td>• 3GPP/3GPP2 compatible</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• MMS Client</td>
<td>• Control Plane support</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Secure MSM</td>
<td>• User Plane support</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• JAVA J2ME</td>
<td>• Digital compass interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 802.11</td>
<td></td>
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</tr>
</tbody>
</table>

- UI One
- SIM/UIM Card interface
- CMOS/CCD image sensor interface

- MMC
- SD-Card
- Blue Tooth
Camera Solutions

• **Qcamera**
  
  - delivers high-quality imaging and flexible image manipulation
  - Digital still camera for multiple cameraphone user segments
  - Combine QCamera with other popular Launchpad features to include sounds for movies and slideshows, position location for photos, 3D effects for screensavers and wallpaper

Camera:

- Up to 8MP Support
- VGA Viewfinder @ 30fps
- Enhanced ISP (Image Signal Processing) for better Tuning
- Enhanced Post Processing Features:
  - Hand Jitter Reduction
  - Red Eye Removal
  - Low Light Modes

With Hand Jitter Reduction
## Mobile Video Solutions

**Qtv** video decode to stream, download and play back multimedia content

**Qcamcorder** encoding solution to record video and audio simultaneously

**Qvideophone** 2-way video conferencing application tailored to 3G networks such as EV-DO and UMTS

### Enhanced Multimedia for 6K & 7K Series

#### Video:
- Single Chip Broadcast Support for (DVBH, ISDBT & SDMB)
- H.264 & AAC Encoding for high quality movie recording
- Introduction of Rev A based IP videotelephony

#### Camera:
- **Post Processing Enhancements:**
  - Hand Jitter Reduction
  - Red Eye Removal
  - Low Light Modes

#### Audio:
- AMR-WB/+ (decoder and speech)
- QConcert (Surround Sound)
- QAUDIOFX (Positional Audio)
- Improved Echo Cancellation
- SVG (Scalable Vector Graphics)

### Video:
- Support VGA Decoding and Encoding @ 30fps
- Multiple Decoder Support
- Single Chip Broadcast Support for (DVBH, ISDBT & SDMB, TDBM)
- MBMS Support
- Integrated and Optimized for Windows Mobile 5

### Audio:
- Dual Microphone Support
- Noise Cancellation
3G Graphics Enabling Mobile Advanced Gaming Market

QDimension

• 2D/3D graphics to provide the same high degree of performance as many of today’s sophisticated handheld gaming devices

• Efficient, flexible and fast solution for publishers and developers to create 2D & 3D games
QUALCOMM’s gpsOne Technology Addresses Key Requirements for LBS Success

Operator Needs and Subscriber Needs fulfilled by gpsOne

- Gain market share
- Generate revenue
- Differentiation
- Easy to deploy, grow

- Reasonable price
- Fast, accurate, reliable
- Variety of applications
- Easy to use, anywhere

- Lowest cost solution
- Fast, accurate, reliable
- Supports App variety
- Use anywhere

AGPS accuracy is critical to maximizing user value….
Cell-ID is simply not good enough.
Multimedia Multicasting

- **1xEV-DO RevA Multicast Technology**
- **FLO™ (Forward Link Only) Multicast Technology**

### Unicast (Directed to One)
- Video / Audio
- Gamecasting
- Data Channels / RSS

### Multicast (Directed to Many)
- Video / Audio
- Gamecasting
- Data Channels / RSS
- MediaFLO
  - Video Quality: QVGA, 30fps
  - Channel Switching Time: ~1.5 seconds
  - Power Consumption: similar to a Voice Device

- Weather
- Stock Ticker
- Traffic
Making Multimedia Mainstream: Next Generation Devices

The Portable Wireless Media Center
Thank you!