CDMA2000 1xEV-DO: Affordable Wireless High Speed Data Today

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CDMA2000 1xEV-DO Wireless Broadband Expanding Rapidly Over 10 Million Subscribers on 13 Networks

Additional Launches Coming Shortly

Subscribers ( Millions)

<table>
<thead>
<tr>
<th>Oct'03</th>
<th>Oct'04</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4M</td>
<td>&gt;10M</td>
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Networks Launched

<table>
<thead>
<tr>
<th>Oct'03</th>
<th>Nov'04</th>
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<tbody>
<tr>
<td>3</td>
<td>14</td>
</tr>
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</table>
1xEV-DO Commercialization by CDMA Operators

**Operators representing over 85% of the CDMA base have launched, trialed or plan to launch**

### cdmaOne / CDMA2000 Market: 212 Million Subscribers*

- **Verizon**
  - Launched Oct 2003
  - 18.2%
- **SKT**
  - Launched Jan 2002
  - 8.8%
- **KDDI**
  - Launched Nov 2003
  - 8.3%
- **KTF**
  - Launched May 2002
  - 5.6%
- **Alltel**
  - Planned Launch Q4 '04 / Q1 '05
  - 7.3%
- **Vivo**
  - Planned Launch Q4 2004
  - 9.3%
- **Pelephone, Telstra & TNZ**
  - Planned Launches
  - 24.3%
- **Other**
  - 13.0%
- **Trialing and/or plan Launches, Not Announced**
  - 3.5%
- **Announced Planned Launches**
  - 1.7%

*Source: CDG, EMC June 2004 and Operator Estimates*
66+ commercial 1xEV-DO devices have been introduced from 11 vendors
CDMA2000 1xEV-DO Device Trends

Retail prices have dropped 60% in 2 years*:

from $700 in January ’02 to less than $200 in January ’04*

- 100 grams or less a standard
- Higher-resolution LCD’s with tens or hundreds of thousands of colors, new phones incorporate QVGA screens
- Wide majority have cameras, mostly video and new phones have more than a megapixel resolution
- Audio and video players for MPEG4, MP3, AAC downloads, many have streaming capability for real-time content delivery

* Korean retail prices for lowest priced commercial EV-DO handsets
Verizon Wireless Going Nationwide With Flat-Rate EV-DO

- Offered at $79.99 flat rate, all-u-can eat pricing
- 300 to 500 kilobits per second, or about 10 times the average dial-up connection speed...
- 30% of POPs covered by 2004
  - Nationwide by 2005
- Verizon says it will spend $1 billion over the next two years to launch the EV-DO network... the company's nationwide deployment will be marketed to both consumers and enterprises...

Source: Verizon Wireless, January and October 2004
Current BroadbandAccess Coverage

32 Markets Already Launch

- Cities:
  - Atlanta, GA
  - Austin, TX
  - Baltimore, MD
  - Boston, MA
  - Chicago, IL
  - Cincinnati, OH
  - Columbus, OH
  - Dallas/Fort Worth, TX
  - Dayton, OH
  - Hartford, CT
  - Houston, TX
  - Jacksonville, FL
  - Kansas City, MO
  - Las Vegas, NV
  - Los Angeles, CA
  - Madison, WI
  - Miami/Fort Lauderdale, FL
  - Milwaukee, WI
  - New Haven, CT
  - New Orleans, LA
  - New York, NY
  - Newark, NJ
  - Orlando, FL
  - Philadelphia, PA
  - Phoenix, AZ
  - Pittsburgh, PA
  - Providence, RI
  - San Diego, CA
  - St. Petersburg/West Palm Beach, FL
  - Tampa, FL
  - Washington, DC
BroadbandAccess (EV-DO) and NationalAccess (1X) Coverage in San Diego and New York

San Diego

New York City

Source: Verizon Wireless, October 2004
Coming Next Month: VCAST
Consumer Service over EV-DO

• Touted as the nation’s first 3G wireless multimedia service for consumers via EV-DO handsets

• Media services:
  – High-quality video-on-demand
    • current news, weather, sports and entertainment programming
    • music videos and short programs specifically designed for mobile phones
  – Download and play 3D games

• Branded Content:
  – News Corp. and 20th Century Fox
    • “24: Conspiracy,” “Sunset Hotel” and “Love & Hate” – specifically designed for mobile phones.
  – NBC newscasts made exclusively for mobile phones
  – MTV Networks’ VH1, Comedy Central

• Accessed through the Get It Now® virtual store

• $15.00 per month
  – unlimited access to more than 300 daily updated videos

• Launching Feb. 1, 2005
3G Evolution: EV-DO Enhancements & Rev. A
CDMA2000 1xEV-DO Roadmap

**VoIP**
1X-like spectral efficiency/voice capacity/quality

**Low Latency**
30ms

**Rev A – Higher Data Rates**
3.1 Mbps DL
1.8 Mbps UL
Avg 600-1300 Kbps DL

**Quality of Service (QoS)**
Multiple QoS concurrent flows
Selected by user or application

**Release 0**
2.4 Mbps DL
153Kbps UL
Avg 300-600 Kbps DL

**Video Telephony**
Packet voice and video

**Push To Talk**
Instant Messaging
Instant Multi-media
Audio and video
<750ms PTT

**Gold Multicast**
Platinum Multicast
High rate media delivery

**Equalizer**
Interference Cancellation
Voice/data capacity gains
QoS: Ability to Offer Tiered Services to Users

- **Inter-user QoS** (differentiate users):
  - Enables system to treat various users with different levels of priority
  - Tiered pricing plans for different classes of users (Gold, Silver, Bronze)
  - On a per session basis, check user’s profile in AAA server and match it to a level of service
  - Assign priority level to the scheduler and RL MAC for the user
  - No device impact
QoS: Support Apps With Various Delay Requirements

• **Intra-user QoS** (differentiate applications):
  – Applications can be treated with different priority based on the delay requirements
  – Delay sensitive traffic can have higher priority
  – Optimal user experience for various types of applications
  – Applicable to one user’s traffic as well as across all users
1xEV-DO Gold Multicast

- Multiple channels of content can be distributed to many users at the same time (One to Many)
- Capacity efficient method to distribute content in a cellular environment
- Users may choose various content based on pricing plans
EV-DO Gold Multicast

- Each channel may be transmitted at different rates and different BTS’ may transmit multiple channels
- No physical layer changes to EV-DO Rev 0
- Software upgrade only, channel cards not affected
- Flexibility in allocating portions of the forward link to EV-DO unicast services vs. Multicast
- Information delivered encrypted over the air
- Standard mechanism leveraged for the device to request specific services and be authenticated
# CDMA2000 Chipset Roadmap

<table>
<thead>
<tr>
<th>CONVERGENCE PLATFORM</th>
<th>CDMA2000</th>
<th>CDMA2000 + GSM-GPRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual CPU On-Chip</td>
<td>1X</td>
<td>1xEV-DO (Rel. 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1xEV-DO (Rev. A)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ UMTS/ EDGE/HSDPA</td>
</tr>
<tr>
<td>ENHANCED PLATFORM</td>
<td></td>
<td>7500</td>
</tr>
<tr>
<td>Enhanced Multimedia &amp; Graphics</td>
<td>2Q '05</td>
<td>7600</td>
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<tr>
<td></td>
<td></td>
<td>1Q '05</td>
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<tr>
<td>MULTIMEDIA PLATFORM</td>
<td>6150</td>
<td>6550</td>
</tr>
<tr>
<td>Multimedia &amp; 2D-3D Graphics</td>
<td>2Q '04</td>
<td>6800</td>
</tr>
<tr>
<td></td>
<td>6100</td>
<td>6300</td>
</tr>
<tr>
<td></td>
<td>3Q '02</td>
<td>5Q '04</td>
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<tr>
<td>VALUE PLATFORM</td>
<td>6050</td>
<td>6500</td>
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<tr>
<td>Integrated gpsOne Voice &amp; Data Voice</td>
<td>2Q '03</td>
<td>1Q '06</td>
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<tr>
<td></td>
<td>6025</td>
<td>1Q '02</td>
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<tr>
<td></td>
<td>3Q '03</td>
<td>Integrated:</td>
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<td>• MSM</td>
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<td>• RTR</td>
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<td>• PMIC</td>
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<tr>
<td></td>
<td>6000</td>
<td>1Q '02</td>
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# UMTS Chipset Roadmap

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<td>Multimedia &amp; 2D-3D Graphics</td>
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<td>VALUE PLATFORM</td>
<td>Voice &amp; Data Voice</td>
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<tr>
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<th>GSM/GPRS</th>
<th>EDGE</th>
<th>HSDPA</th>
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</thead>
<tbody>
<tr>
<td>CONVERGENCE PLATFORM</td>
<td></td>
<td></td>
<td>7200 4Q '05</td>
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<tr>
<td>ENHANCED PLATFORM</td>
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<td>6280 2H '05</td>
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<tr>
<td>MULTIMEDIA PLATFORM</td>
<td>6250 2Q '03</td>
<td>6255 2H '05</td>
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<tr>
<td>VALUE PLATFORM</td>
<td>6200 2Q '02</td>
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## QUALCOMM’s Integrated Launchpad™ Multimedia Roadmap

![Qualcomm Integrated Launchpad](image)

<table>
<thead>
<tr>
<th>Audio</th>
<th>Graphics</th>
<th>Camera</th>
<th>Video</th>
<th>Processor</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;MP3/Ringtone</td>
<td>NA</td>
<td>NA</td>
<td>Sub - QCIF</td>
<td>ARM 7 - 50MHz</td>
</tr>
<tr>
<td>MP3/AAC</td>
<td>50k Triangles</td>
<td>1-2 MPixel</td>
<td>15 fps QCIF</td>
<td>ARM 9 - 150MHz</td>
</tr>
<tr>
<td>MP3/AAC/AAC+</td>
<td>100k Triangles</td>
<td>2-4 MPixel</td>
<td>30 fps CIF</td>
<td>ARM 9 - 225 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 fps VGA</td>
<td>Dual CPU incl. ARM 11 - 400MHz - 1GHz</td>
</tr>
</tbody>
</table>

### Key Features
- **120+ Design Wins**
- **Sampled in 06/04**

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**Notes:**
- QUALCOMM's Integrated Launchpad™ Multimedia Roadmap
- '02 - '03
- '03 - '04
- '04 - '05
- '05 - '06
- '02 - '03
- '02 - '03
- 120+ Design Wins
Backup
3G Peak and Average End User Data Rates

- **1X**: Peak Rate 153 Kbps, Typical End User Rate (implemented) 384 Kbps
- **WCDMA (Rel. 99)**: Peak Rate 384 Kbps, Typical End User Rate (implemented) 384 Kbps
- **1xEV-DO**: Peak Rate 2.4 Mbps, Typical End User Rate (implemented) 2.4 Mbps, Typical End User Rate (estimated) 3.1 Mbps
- **1xEV-DO Rev. A**: Peak Rate 3.1 Mbps, Typical End User Rate (estimated) 3.1 Mbps
- **HSDPA (WCDMA)**: Peak Rate 14.4 Mbps, Typical End User Rate (estimated) 14.4 Mbps

All these 3G technologies have been standardized – future enhancements to these paths are ongoing.

*Peak and typical average end-user forward link data rates.*

*Note: 1X, 1xEV-DO and 1xEV-DO Rev. A rates are achieved in a 1.25 MHz carrier bandwidth, WCDMA and HSDPA rates are achieved in a 5 MHz carrier.*
CDMA2000 1xEV-DO Rev A and OFDMA

- OFDMA data rates similar to 1xEV-DO Rev A
- 1xEV-DO is commercial today, many devices, many manufacturers, 1X coverage
- 1xEV-DO uses standard Internet interconnects

<table>
<thead>
<tr>
<th></th>
<th>Peak Rates</th>
<th>Uplink Average Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>1xEV-DO Rel 0</td>
<td>Uplink: 153 kbps</td>
<td>~ 300 kbps</td>
</tr>
<tr>
<td>Dual Receive Rx</td>
<td>Downlink: 2.4 Mbps</td>
<td></td>
</tr>
<tr>
<td>1xEV-DO Rev A</td>
<td>Uplink: 1.8 Mbps</td>
<td>~ 600 kbps</td>
</tr>
<tr>
<td>Dual Receive Rx</td>
<td>Downlink: 3.1Mbps</td>
<td></td>
</tr>
<tr>
<td>1xEV-DO Rev A</td>
<td>Uplink: 1.8</td>
<td>~ 900 kbps</td>
</tr>
<tr>
<td>Quad Receive Rx</td>
<td>Downlink: 3.1Mbps</td>
<td></td>
</tr>
</tbody>
</table>

- **6800 Series Improved Downlink**
  - Dual Receive Diversity
  - Equalizers
  - Hybrid Free Operation

- **Advantages of EV-DO Family**
  - Time To Market
  - Backward Compatible
  - Pin-Compatible Chip Solutions
  - Standardized in ITU
  - Standardized in 3GPP2
  - Over 40 handset models available today