NTT DoCoMo WCDMA Commercial Service

- Finally Oct. 1, 2001
- Sold 4000 terminals the 1st day in Tokyo
- $400 standard
- $566 video
- $233 laptop PC card
- Game just started
We are Uniquely Positioned as a 3G Technology Enabler

- Partnership Alliance
  - Microsoft, AMD, ZTE, Capitel, Mobilecom, …

- Hold patents future (3G) wireless systems

- Development focus on WCDMA Terminal Chipsets
## Wiscom Major Milestones

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>5</td>
<td>Established in New Jersey, US.</td>
</tr>
<tr>
<td>2000</td>
<td>6</td>
<td>First round funding closed.</td>
</tr>
<tr>
<td>2001</td>
<td>3</td>
<td>Voice call and file transfer demo, 7 patents submitted</td>
</tr>
<tr>
<td>2001</td>
<td>4</td>
<td>Wiscom China Established in Beijing.</td>
</tr>
<tr>
<td>2001</td>
<td>5</td>
<td>Signed MOI with Mobicom for WCDMA mobile co-development.</td>
</tr>
<tr>
<td>2001</td>
<td>7</td>
<td>Signed MOI with Capitel for WCDMA L2/L3 co-development.</td>
</tr>
<tr>
<td>2001</td>
<td>8</td>
<td>Signed MOU with ZTE for WCDMA mobile development &amp; interop. test</td>
</tr>
<tr>
<td>2001</td>
<td>8</td>
<td>Signed MOU with AMD for WCDMA mobile develop. &amp; chip/stacked memory</td>
</tr>
<tr>
<td>2001</td>
<td>10</td>
<td>Signed LOI with Microsoft for 3G applications on platform &amp; standard collaboration</td>
</tr>
<tr>
<td>2001</td>
<td>10</td>
<td>True 3G high bandwidth demo over the air: Video conf, Streaming Video &amp; Web browsing on WCDMA platform</td>
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</tbody>
</table>
Where Are We Today?

- Analog networks have migrated to digital
- Handset volume growth outstrips PCs almost 4:1
- Subscriber base has grown to almost 700 million
- Connectivity is a major part of emerging devices—Including handsets
  - *Always connected-internet everywhere*
- Still a voice-centric network operation today, but data capabilities are emerging
  - 2.5G interim evolution: GSM (GPRS), CDMA (IS-95B, 1x), TDMA (IS-136+)
  - 3G revolution will occur in multiple stages
- **We are just at the starting line**
Mobile Devices Market Segmentation

Modules -
Embedded Apps
Telematics /
Telemetry

Add-On
Devices

Data Devices
w/ Integral
Wireless

Business /
Smart
Phones

Basic
Phones

Nokia 3330
Add-On
Devices -
Embedded Apps
Telematics /
Telemetry

PDQ
Smart Phone

Ericsson
R380

Blackberry

Palm

HandSpring Visor,
Spring Board Modules

Data Devices
w/ Integral
Wireless

Greater Multi-Media Capability
Larger Displays / Touch-Screens
and Keyboards

Multi Wireless Modes
& Generally Higher Data Rates

Wiscom Technologies
3G Mobile Multimedia Devices

Portable Electronics Devices + Cellular Terminal = Mobile Multimedia Devices

- Pocket calculator
- Game player
- GPS terminal
- Notebook PC
- Palm top PC
- PDA
- FM/AM Radio (DAB)
- Voice recorder
- TV (DVB)
- MD player
- CD player
- MP3 player
- Digital Camera
- Camcorder
- DVD player
Inflection Points – Bandwidth

- Rare Internet use, only in text modes (9.6 kbps)
- First useful speed for graphics (28.8 kbps)
- Web more accessible, full web pages, some file downloads (56 kbps)
- Speed enables large downloads and multimedia (128 kbps)
- Close to office LAN experience; almost full network transparency (384 kbps)
Mobile Data Drives ARPU higher in Europe & US

“Killer Cocktail” emerging (3000+ applications – SMS/Email/Fax/Voice Mail, Banking/Payments, Location Based Internet Access/Info. Services Mobile Office, Telemetry/Telematics, Interactive Gaming)

Source: Qualcomm Estimates

4/25/2003

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Wireless Applications

Mail 33%
Others (eg banking) 8%
Personal homepages 6%
Gourmet/recipes 6%
Travel 6%
Ticketing/living 6%
Town information 7%
News 12%
Entertainment 16%

Source: DoCoMo survey
The Promise of 3G

- Higher bandwidth capability
  - 144-384 Kbps at mobile speeds
  - 2 Mbps at fixed locations (ITU spec)
  - 10-20 Mbps using HSDPA (3.5G)
- Future broadband applications/services
  - Internet browsing (WML, HTML)
  - Audio/video streaming multimedia (MP3, MPEG, H.3XX)
  - Location based services (GPS), e-commerce, push software technologies (ASP), and much more...
- Migration path from 2G and 2.5G technologies
- Voice/data convergence will shake up the market as wireless world merges with IP and computing world
- Worldwide coverage eventually
- 4G will be for 100 Mbps after 2010
2G to 3G Evolution Path

- TDMA (IS-136)
- GSM
- PDC
- CDMA (IS-95A)
- CDMA (IS-95B)
- GPRS
- CDMA2000-1X
- cdma2000-1X
- AT&T Wireless switch to GSM/GPRS
- Original Plan
- Current View

- EDGE
- WCDMA HSDPA
- TDD-CDMA
- Cdma2000 1X-EV
- cdma2000-3X
Global Telecom Market

By 2003, Wireless Voice and Internet will surpass Wired Voice and Internet.

Source: Salomon Smith Barney Estimates.
Wireless Expansion

Wireless explosion continues – Global subscribers to double between 2001 and 2005

Subscribers by Market (millions)

Source: EMC World Cellular Database; June 2001 forecast based on actual figures to end March 2001
Wireless Expansion

Western markets approaching saturation. Opportunities in emerging markets remain high.

Penetration by Market (%)

Source: EMC World Cellular Database; June 2001 forecast based on actual figures to end March 2001
Handset Sales

Global Handset Sales (K units)

Source: The Strategis Group, Gartner/Dataquest, Morgan Stanley, UBS, Alcatel, Nokia
China Market

China on track to becoming the world’s largest mobile market

Source: the Yankee Group
Market Drivers for 3G

- 2G mobile systems are reaching capacity limit
- Revenue per user for voice is declining
- New value-added services need high speed, packet data

Source: EMC statistics for 2000
**Market Drivers - key decision Criteria**

» Price, Price, Price. (data rates are an enabler, not a value!)

- **Affordable Service**: 38%
- **Affordable Equipment**: 29%
- **Better Coverage**: 9%
- **Ease of Use**: 9%
- **Network Reliability**: 9%
- **Content Services**: 4%
- **Other**: 2%

Source: Yankee Group
Market Share by Technologies

- TDMA and PDS will phase out
- IS95/cdma2000 market may have slow growth
- GSM/GPRS market will reach peak during 2004 - 2005
- WCDMA will gain more than 40% of market share by 2007

Global Mobile Sales (Million)

Source: Wiscom Estimate
Chip Vendor Success Factors

- Balanced solution: low power, high performance, low cost, targeted at several consumer form factors
- Tier-1 OEMs still drive the market, but tier-2/3 and start-up OEMs building momentum
- Drive Standardization:
  - Offer interoperability with other offload chips (GPS, Bluetooth, etc.) and multimedia application processors
  - Offer feature-rich and easy-to-use software development environment and tools
  - Offer several packages to different OEMs
- Partnerships and collaboration critical to success
- Branding activities become common
WCDMA dominates in IMT-2000 (3G)

- **WCDMA**
  - Pushed by Japanese players and GSM players
  - Will dominate based on GSM current footprint (~65%)

- **Cdma2000**
  - A natural path for IS-95 CDMA players
  - Limited growth due to current limited IS-95 footprint (~12%)

- **TD-SCDMA**
  - One option of TDD mode (1.28Mcps)
  - “home-grown” and with strong political support in China
  - less interest outside China

- **EDGE**
  - Original GSM interim step, barely meets 3G need, viewed as 2.5G
  - Diminishing support from TDMA (IS-136) players (~ 8%)
Major PHY Differences between WCDMA and cdma2000

- **Synchronization Between Base Stations**
  - WCDMA uses asynch BTS → need cell search for initial synch and soft handover

- **Operating Bandwidth and Chip Rate**
  - WCDMA operates at 3.84Mcps over 5MHz

- **Channel Structure and Rate Flexibility**
  - WCDMA introduces TrCH concept for varieties of rate and QoS flexibilities
  - WCDMA rate information can be obtained via TFCI

- **High Speed Packet Data**
Thank You!

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