CDMA2000 v.s. WCDMA

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2004/3/9
Introduction of APBW

❖ Establishment
  ▪ November, 2001
  ▪ Obtained CDMA2000 license E in February, 2002
  ▪ Commercial Launched on 07/29/2003

❖ Vision
  ▪ First 3G operator in Taiwan
  ▪ Most valuable mobile service provider
  ▪ Innovation, Quality, Efficiency

❖ Objectives
  ▪ Integrate voice, data, video and media content
  ▪ Form strategic alliance with global renown telecoms to gain regional competitive advantage
  ▪ Become the most efficient broadband service provider delivering fix line, cable, internet and mobile communications

Customer’s 1st Choice
Asia Pacific Telecom Group

Operations Support Systems with Synergy of Networks, Multiple Technologies, Discipline, and Human Resources

- Voice Services
- Data Services
- Lease Line

- Broadband Internet Access
- IDC
- Value-Added Applications and Services
- Integrated Enterprise Networks

- Broadband Wireless
  - Basic Services
  - Value-added Services
Advanced Technology—Evolution of CDMA Network Standard

- WAP/9.6K
- PHS/32-64K
- GPRS/64K
- CDMA2000 1xEV 2.4Mbps
- CDMA2000 1X 聲音、數據傳輸 153Kbps
- cdmaOne(IS-95B) 聲音、數據傳輸 64Kbps
- cdmaOne(IS-95A) 聲音、數據傳輸 14.4Kbps

- Competition for Mobile Network Transmission Rate

East Broadband Telecom
Asia Pacific Broadband Wireless Communications
Asia Pacific Online
3G Impact to Live Style

Enlarge mobile broadband applications much beyond 2G’s capability

<table>
<thead>
<tr>
<th>Rich Content</th>
<th>High Data Rate</th>
<th>User Friendly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice Services</td>
<td>Multimedia Entertainment</td>
<td>Information Services</td>
</tr>
<tr>
<td>Internet Access</td>
<td>On-Demand News and Information</td>
<td>Remote Location/Navigation Services</td>
</tr>
<tr>
<td>Teleworking</td>
<td>Transactions</td>
<td>On-Line Scheduler</td>
</tr>
<tr>
<td>Extended Roaming</td>
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</tr>
</tbody>
</table>

- Rich Content
- High Data Rate
- User Friendly
Integrated Product—Various 3G Handsets

- The specification of CDMA handsets includes High-resolution, passive Matrix Color Display, multi Polyphonic ringing tones, external or integrated digital camera, Caller ID in one or even double screen. Besides, you can capture the moment with the integrated camera and then send your best shots via MMS.
- Handsets that support GPS can provide accurate location information.
- The manufacturers for CDMA handsets are a lot, e.g. Benq, Samsung, MOTO, LG, Sanyo, Sony, Casio…etc. Consumers can get what they need in the market.
APBW Services

Quality Multimedia Access

Are You Cute Today?
Worldwide Mobile Status
Successful Story in Asia
Technical Aspect
Worldwide Mobile Status as of Jan, 2004

- GSM → 987.3 million
- CDMA2000 1x → 82.1 million
- CDMA2000 EV-DO → 5.53 million
- WCDMA/UMTS → 3.01 million

Source:
- GSM MoU http://www.gsmworld.com
- 3G today http://www.3gtoday.com
Worldwide 3G Market Status as of Jan, 2004

- **CDMA 2000**: 87.6 million
- **W-CDMA**: 3.01 million

**Graph Details**

- CDMA 2000 1X Reported Subscribers: 82.1 million
- CDMA 2000 1xEV-DO Reported Subscribers: 5.53 million
- WCDMA/UMTS Reported Subscribers: 3.01 million
Worldwide Mobile Status
Successful Story in Asia
Technical Aspect
CDMA2000 is currently continuously spreading out

There are about 18 commercial 3G CDMA2000 networks today
CDMA2000 Success Story in Korea as of Nov, 2003

South Korea Subscribers as of Nov, 2003

<table>
<thead>
<tr>
<th>Type</th>
<th>Sub. (m)</th>
<th>SKT</th>
<th>KTF</th>
<th>LGT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mobile</td>
<td>33.4</td>
<td>18.2</td>
<td>10.4</td>
<td>4.8</td>
</tr>
<tr>
<td>CDMA2000 1X</td>
<td>24.2</td>
<td>14.0</td>
<td>7.2</td>
<td>3.0</td>
</tr>
<tr>
<td>CDMA2000 1X (%)</td>
<td>72.5%</td>
<td>77.5%</td>
<td>68%</td>
<td>62%</td>
</tr>
</tbody>
</table>

- SKT: CDMA2000 1X, ARPU = US$48 is double to 2G
- SKT: ARPU CAGR = 7%, Data growth rate = 50%
CDMA2000 Success Story in Japan as of Nov, 2003

- Total 3G sub. in Japan in Nov, 2003 = 12.9M
- KDDI (CDMA2000 1X) 3G user = 11.2M,
  DoCoMo (WCDMA) user = 1.3M
- KDDI 3G ARPU is more than 25% to 2G, Data ARPU is 2 to 3 times than 2G

- Remark: China Unicom CDMA user = 15.8M
  China Unicom GSM ARPU=RMB 67
  CDMA ARPU=RMB 172
Worldwide Mobile Status
Successful Story in Asia
Technical Aspect
IMT-2000 standards

CDMA
- IMT-DS Direct Spread
  - W-CDMA
  - HSDPA
- IMT-MC Multi Carrier
  - 1xRTT
  - 1xEV-DO
  - 1xEV-DV
  - cdma2000

TDMA
- IMT-TC Time Code
  - UTRA-TDD
  - TD-SCDMA
  - HSDPA
- IMT-SC Single Carrier
  - EDGE
  - GERAN

FDMA
- IMT-FT Frequency Time
  - DECT

Source: ITU
3G Evolution paths

- cdma2000
  - IS-95
  - PDC
  - TDMA
  - TD-(S)CDMA
- cdma2000
  - GPRS
  - W-CDMA
  - EDGE
- UMTS
  - HSDPA
- 3G
  - 1xRTT
  - 1xEV-DO
  - 1xEV-DV
## System performance comparison

### Differences between W-CDMA and cdma2000

<table>
<thead>
<tr>
<th></th>
<th>W-CDMA</th>
<th>cdma2000 (1x / 1xEV-DO)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bandwidth</strong></td>
<td>5 MHz</td>
<td>1.25 MHz</td>
</tr>
<tr>
<td><strong>Chip rate</strong></td>
<td>3.84 Mcps</td>
<td>1.2288 Mcps</td>
</tr>
<tr>
<td><strong>Power control</strong></td>
<td>1500 Hz up/down</td>
<td>1xRTT: 800 Hz up/down</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1xEV-DO: no DL PC</td>
</tr>
<tr>
<td><strong>Base station</strong></td>
<td>Not needed</td>
<td>Yes, via GPS</td>
</tr>
<tr>
<td><strong>synchronization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cell search</strong></td>
<td>3-step approach via primary, secondary search code and CPICH</td>
<td>Sync through time-shifted short code correlation</td>
</tr>
<tr>
<td><strong>Downlink Pilot</strong></td>
<td>CDM common (CPICH) TDM dedicated (bits in DPCH)</td>
<td>1xRTT: CDM common 1xEV-DO: TDM common</td>
</tr>
<tr>
<td><strong>User separation</strong></td>
<td>CDM / TDM (shared channel)</td>
<td>1xRTT: CDM 1xEV-DO: TDM (scheduler)</td>
</tr>
<tr>
<td><strong>2G interoperability</strong></td>
<td>GSM-UMTS handover (Multi-mode terminals)</td>
<td>1xRTT backward compatible (1xEV-DO not)</td>
</tr>
</tbody>
</table>
3G Coverage in Taiwan

- CDMA2000 works in 800MHz and UMTS(WCDMA) works in 2.1GHz
- CDMA2000 BTS covers larger area
- CDMA2000 BTS quantity can be less than UMTS(WCDMA) with same quality

- Data Rate
  - CDMA 2000 1x EV-DO is up to 2.4Mbps by E2004
  - WCDMA is only 384Kbps by E2004
Issues

- Standard
- Chipset
- Terminal Development
- Applications
- Inter-operability
- Roaming