Maximizing Capacity, Coverage & Performance With CDMA2000

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CDMA2000 Evolution
Maximizing Capacity, Coverage, Performance

3G NOW!

- CDMA2000 1X
  - Up to 153.6 kbps Voice & Data

- CDMA2000 1xEV-DO
  - 2.45 Mbps Data

- CDMA2000 1xEV-DV
  - 3 Mbps Voice & Data

3G NOW!..Differentiate and capture subscribers
- Double voice capacity
- Deploy ‘low risk’ data
- ‘Always On’ user experience
- Spectrally efficient
- Seamless evolution

Superior data user experience
- High speed mobile data
- Triple data sub capacity
- Grab high ARPU data users

High speed data and voice on single carrier
- Most spectrally efficient voice and data solution
- Added efficiencies for spectrum constrained & low density markets
- Still in Standards work

Delivering 3G With Investment Protection
CDMA2000 1X: Should You Deploy?

Can You Afford Not To Deploy?

- Double voice capacity - gains in voice services alone support migration to 1x
- Capitalize on Revenue-Generating 3G Capabilities
- Spectrally efficient – voice & data on same carrier
- Protects IS-95 investment - Spectrum & infrastructure
- Superior power control features
- Delivers profitable packet data
- Supports packet data up to 307 kbps
- Low cost terminals available
Capacity, Coverage, Performance Advantages Lower Costs

- 2x increase in voice capacity lowers overall cost per subscriber
- Up to 22% increase in coverage reduces cell sites required in Rural areas
- Radio Resource Management (RRM) algorithm optimizes voice and data capacity in network
- Active / Dormant MAC states optimizes mobile battery usage and spectrum
- Quick Paging Channel Extends mobile battery life by approximately 40% over IS-95 in idle state and facilitates ‘Always On’
- Superior features enhance network performance and reduce costs
  - Superior Power Control, Traffic Steering, MCTA, coherent detection

Increased Capacity

Increased Coverage Area
CDMA2000 1X - Increased Voice Capacity

**Benefits**
- CDMA2000 1X delivers up to 2x voice capacity of IS-95
  - 35 users per sector (EVRC): billable in mobility environment
- More users/call traffic supported in the same spectrum increases revenue opportunity per RF infrastructure

**Description**
- CDMA2000 1X Standard defines the ability to increase capacity
  - Fast Forward Power Control (FFPC)
    - Lowers power required per user, reducing overall noise
    - Faster Power Control (800 Hz sampling vs 50 Hz)
  - Reverse Pilot:
    - Power Control Synchronization - initiated by mobile

Live Network trial tests have shown actual RF power savings enabled by CDMA2000 1X
Coverage Comparison at 800 MHz

- The Radius of a Cell is proportional to Spreading Gain
- Spreading Gain = (Spreading Rate / Data Rate)
- CDMA2000 1X Spreading Rate is constant
- Cell coverage for data dependent on data rate

<table>
<thead>
<tr>
<th>Data Rate</th>
<th>TDMA Voice</th>
<th>IS-95 Voice</th>
<th>CDMA2000 1X Voice</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.6 kbps</td>
<td>19.2 kbps</td>
<td>38.4 kbps</td>
<td>76.8 kbps</td>
</tr>
</tbody>
</table>
Revenue Generating Capabilities

- Simultaneous support for IS-95, 1X voice, 1X high-speed data and 1xEV on the same BTS
- Mobile & Simple IP
  - Mobile IP enables “push” services
- Voice while dormant
  - “Always on” data capability
- Rich set of IP services and industry leading intelligent capabilities
  - Secured wireless VPN extends the reach to corporate intranets and B2B communications
  - Personal Content Portal enables unlimited applications such as self-provisioning and customized push services
  - Web Steering enables subscription services such as content filtering and virus scanning
  - Per-subscriber stateful Firewall, anti-spoofing and encryption offer subscriber protection from attacks
  - QoS allows differentiated treatment of sessions in the core
CDMA2000: Enabling “Always On”

**Three Levels of Mobility**

**Air Interface**
- Cell to cell handoffs including soft and hard handoffs
- Intra-RN handoffs
  - *Radio Network handoffs used at this level*

**Link Level**
- PPP link across R-P interface
- RN changes, PDSN remains the same
- Mobile may be actively transmitting or dormant
  - *R-P interface mobility used at this level*

**Network Level**
- PDSN to PDSN handoff
  - *Mobile IP used at this level*
3G NOW! … CDMA2000 1X
Backwards Compatibility With IS-95

Access Network

BTS

BSC

1X card

1X card

MSC

PSTN

Core Network

Circuit Voice

Packet Data

Software upgrade

Private Packet Data
IP Network

Internet

Intranet

Policy Services

AAA, DNS, DHCP Servers

PDSN

CDMA2000 1X delivered by software and hardware modular upgrades to existing IS-95 infrastructure.
Ongoing Reduction in Operator Expenses

Investment Protection

- Modular upgrades and continued footprint reduction enable lower cost evolution
- Maximum reuse of network components protects investment
  - 100% BSC hardware is reused for CDMA2000 1X voice
  - 90% of BSC hardware reused for CDMA2000 1X data
  - 100% reuse of current Metro Cell hardware - modular addition for 1X voice and data support
  - 100% reuse of MTX switch – software upgrade to support 1X
- Pay as you grow offering minimizes up-front costs
- Capacity provisioning via remote software downloads minimizes site visits
- Ongoing footprint reduction
- Positioned for evolution to 1xEV and packet switched voice
CDMA2000 1xEV-DO
Delivering A Superior Data User Experience

- Broadband mobility - up to 2.4 Mbps peak data rate
- Up to 3 times data capacity of 1X
  - 1.25 MHz spectrum
- First mover advantage to high bandwidth applications
- Dedicated data-optimized carrier, complimentary to 1X
  - Data and voice resources don’t compete
- 1X/IS-95 spectrum and infrastructure investment protection
  - Card upgrades to Metro Cell -> lower cost, smaller footprint
  - Centralized architecture with all-IP network to BTS
  - Share Antenna and RF chain with 1X
- 1X and 1xEV-DO functionality comparable to UMTS
  - Utilizes much less spectrum
1X and 1xEV-DO Dual Mode Network

How is 1xEv-DO added to a 1X network?

Access Network

Core Network

Nortel Networks 1xEV-DO network: Elegant upgrade to the 1X Access network.
3G Applications Are Here!
“Making Communication Easier”

Valuable 3G Applications already exist! CDMA2000 1xEV-DO delivers these applications at the level of QoS subscribers are expecting.

How does 3G 1xEV-DO impact our lives?

- >384 Kbps
- 128 - 384 Kbps
- 64 - 128 Kbps
- <64 Kbps

Focusing on Subscriber Behavior

Source: Ovum 2001
### 1xEV-DO Strategic Fit

<table>
<thead>
<tr>
<th></th>
<th>CDMA2000 1X</th>
<th>1xEV-DO</th>
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</thead>
<tbody>
<tr>
<td>Data Subscriber Penetration</td>
<td>0 – 15%</td>
<td>7% - 30+%</td>
</tr>
<tr>
<td>Download Rates (Peak)</td>
<td>9.6 – 153.6 kbps</td>
<td>38.4 – 2450 kbps</td>
</tr>
<tr>
<td>Subscriber Usage</td>
<td>Wireless Internet</td>
<td>Wireless Internet plus Streaming Audio and Video</td>
</tr>
<tr>
<td>Data Subscriber Capacity</td>
<td>Introduces Packet Data (Aggregate Throughput 270 kbps)</td>
<td>3 – 6 times 1X (Aggregate Throughput 970 kbps)</td>
</tr>
<tr>
<td>Value Proposition Base</td>
<td>Optimized, Cost Reduced Voice Business + the intro of packet data services</td>
<td>optimized packet data transportation solution delivering high data download speeds + capacity</td>
</tr>
</tbody>
</table>

- 1xEV-DO delivers higher throughputs & data speeds
- As 1X data penetration and data usage increases, economics favor 1xEV-DO as a technology choice for data
- 1xEV-DO is more cost efficient once data traffic volumes are elevated beyond 1 CDMA carrier dedicated for data
CDMA2000 1X: Delivering “Always On”

Reliable & Always With me

Radio Resource Management

Combined voice and data

Embedded & Easy to Use

Timely & Convenient

3G NOW!
CDMA2000 1X
Available Today

Low cost 1X terminals

Data rates 10X previously available

Ubiquitous Coverage

Shipping Now

Ready When You Are

Mobile IP

Low cost 1X terminals

Longer Battery life

Data rates 10X previously available

IP Services

Ubiquitous Coverage

Up to 2 times Voice capacity

Timely & Convenient

Awareness (Presence and Availability)

Nortel Networks

Longer Battery life

Shipping Now

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IP Services

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Ready When You Are