CDMA2000
Network Path to LTE

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Network Growth

2007: 253
2009: 291

12 more networks being launched in 2009

Source: CDG, August 2009

Subscriber Growth

2008: 455 Million
2013: 597 Million

Over ½ billion subscribers as of June 2009


Data Revenue Growth

2007: $20 Billion
2008: $27 Billion

35 percent growth from top 3 CDMA carriers*

Source: Chetan Sharma, 2009

* Top 3 CDMA carriers in terms of data revenue: Verizon, KDDI and Sprint

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CDMA Operators with Announced LTE plans

The following CDMA2000 operators have announced their plans to deploy LTE

Most other CDMA2000 operators do not have the requisite demand, spectrum or capital to deploy LTE
CDMA2000 Manufacturers Working on LTE

The following CDG members are developing LTE devices and equipment

Infrastructure Vendors

- Alcatel-Lucent
- LG
- Huawei
- Motorola
- Nortel Networks
- ZTE

Chipset and Device Vendors

- LG
- Nokia
- Samsung
- Qualcomm

Test Vendors

- Anritsu
- SGS
- Spirent Communications

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What do operators want?

• Meet the growing demand for voice and data
• Offer an unsurpassed user experience
• Reduce the cost of delivering services
• Maximize the return on existing investments
CDMA2000 and OFDM-Based Solutions

**CDMA2000** is complemented with several **OFDM-based solutions**

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**CDMA2000 Evolution Path**

1. **CDMA2000 1X**
2. **1xEV-DO Rel. 0**
3. **1xEV-DO Rev. A**
4. **H/W Upgrade**
5. **EV-DO Rev. B**
6. **DO Advanced**

**OFDMA-based Technologies**

- **LTE**
- **Mobile WiMAX**

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**LTE is part of the CDMA2000 technology roadmap**

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CDMA and OFDM-based Technologies

CDMA and OFDM are complementary technologies.

- OFDM-based broadband networks will complement 3G CDMA

- Backhaul:
  - WiMAX 802.16d

- Broadcast:
  - DVB-H
  - ISDB-T
  - MFLO
  - S-DMB
  - T-DMB
  - CMMB

- Additional Broadband Capacity:
  - LTE
  - Mobile WiMAX
  - Wi-Fi
CDMA vs. OFDMA

CDMA and OFDMA are different technologies with different capabilities.

CDMA2000 1X and EV-DO are more efficient in bandwidths up to 5 MHz.

OFDMA-based solutions offer a simpler implementation in bandwidths greater than 10 MHz.
Lessons Learned: Migration from 1G to 2G to 3G

- Takes longer, and is never as simple as it may seem
- Graceful evolutionary change is preferred
- Coverage is king
- Multimode devices are essential
- Economies of scale matters
- A mature ecosystem is desired

To sustain its exponential growth, the global mobile industry should continue strengthening and expanding its existing ecosystem, while it embraces and assimilates newer technologies and players within its fold.

Source: IDC
LTE Interoperability: CDG Areas of Focus

Current CDG initiatives

**Seamless Mobility:**
- To ensure service continuity, inter-standard hand-offs between LTE and CDMA2000 networks is essential

**System Determination:**
- To maximize revenue, the appropriate system determination algorithms must exist in every CDMA2000/LTE device

**Device Certification:**
- To ensure full compliance, device certification from an independent third-party is sanctioned

**Inter-Standard Global Roaming:**
- To enable global roaming, inter-standard roaming between LTE and CDMA2000 networks is essential
CDMA: Efficient and Flexible Spectrum Utilization

CDMA2000’s 1.25 MHz bandwidth facilitates subscriber traffic management

Minimizes “stranded” spectrum assets required to support embedded user equipment while moving between technologies

CDMA offers greater flexibility to implement LTE. Several vendors support LTE in existing CDMA2000 base stations, with common radios and antennas.
OFDMA Broadband Overlay Timeline

OFDM-based solutions will be built-out over time as demand grows and spectrum becomes available

Today

3G CDMA WAN Coverage

Next 10 years (Coexistence)

OFDM Urban-zone 3G CDMA OFDM Urban-zone 3G CDMA OFDM Urban-zone

Beyond 10 years (Migration)

OFDMA WAN Coverage

3G CDMA WAN networks will coexist with OFDM-based solutions until next generation broadband networks are fully capable of delivering:

1) Ubiquitous coverage
2) Carrier-grade VoIP
3) Low-cost devices *
4) Global roaming *

* Harmonization of spectrum for OFDM-based solutions will be necessary to build economies of scale and enable global roaming

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What about LTE voice communications

Most CDMA2000 operators will rely on their CDMA2000 1X network to deliver voice

LTE only for voice and data?
Or, LTE for data and 1X for traditional voice?

Factors to consider:
How important is simultaneous voice & data?
How important is an all-IP service model?
Should voice capacity be maximized?
CAPEX spending priorities?
Handset complexity?
Roaming Partners?
Timing?

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3G/4G multimode device availability will drive the commercialization of LTE
EV-DO Evolution Periods

- Ubiquitous EV-DO Service
- Additional Capacity Femtocells VoIP
- Mature VoIP; Concurrent VoIP/Data; High-Definition Multimedia; Integration w/LTE
- Seamless LTE Handoff

% of Addressable Market

- EV-DO Rev. A
- EV-DO Rev. B Advanced
- Mature EV-DO

Today 2010-2011 2012 2015 2017

- LTE Regional Deployments
- LTE First Full Scale Deployments
- LTE First Small Volumes
- LTE First Volume Devices

Source: Airvana
CDMA2000 WorldMode™ Devices

More than 200 WorldMode devices from more than 57 vendors

CDMA2000 1X + GSM + GPRS
- Nokia 2865

CDMA2000 1X + EV-DO Rev. A + GSM + GPRS
- RIM Blackberry 8830

EV-DO Rev. A + HSPA
- Dell Precision Series

CDMA2000 1X + EV-DO Rev. A + HSPA
- LG SH-100

What Comes Next?
- CDMA2000 1X + EV-DO Rev. A/B + LTE
- Coming!

Samples shown, LTE WorldMode is concept only
World’s First 3G/4G WorldMode™ Device

Enables Mobile WiMAX devices to roam onto EV-DO Rev. A networks

EV-DO Rev. A + Mobile WiMAX

Franklin U300

Several CDMA2000/LTE multimode and multiband devices are being developed
Next Generation Multimode Devices

Next generation mobile broadband devices will leverage the learning curve of CDMA2000 WorldMode™ devices

Radio Frequency Links:

- LTE
- WiMAX*
- EV-DO Rev. B
- EV-DO Rev. A
- EV-DO Rel. 0
- GPS
- 1X

Radio frequency selection is carrier-dependent

* WiMAX is enabled using a separate chipset
** MDM 9800 and MDM 9600 chipsets will support FDD and TDD duplex modes and different carrier bandwidths.
Initial WorldMode LTE Device Availability

CDMA industry is developing CDMA2000 / LTE multimode/multiband devices

Multimode LTE
Commercial Device Availability

Modes:
• LTE
• CDMA2000 1X
• EV-DO Rev. A
• EV-DO Rev. B
• UMTS
• HSPA+

LTE Peak Data Rates (20 MHz):
DL: 50 Mbps
UL: 25 Mbps

PC Card
Handset

2009
Q4 2010
Q2 2011
Migration Timeline

With an increasing number of subscribers the migration process is lengthening.

Migration of Subscribers

2G subs exceed 1G subs – Roughly 15 years after inception of industry.

Putting things into perspective.
The generational migration process will take many years.
Voice will remain the Killer Application.