



Technology Roadmaps

November 2009



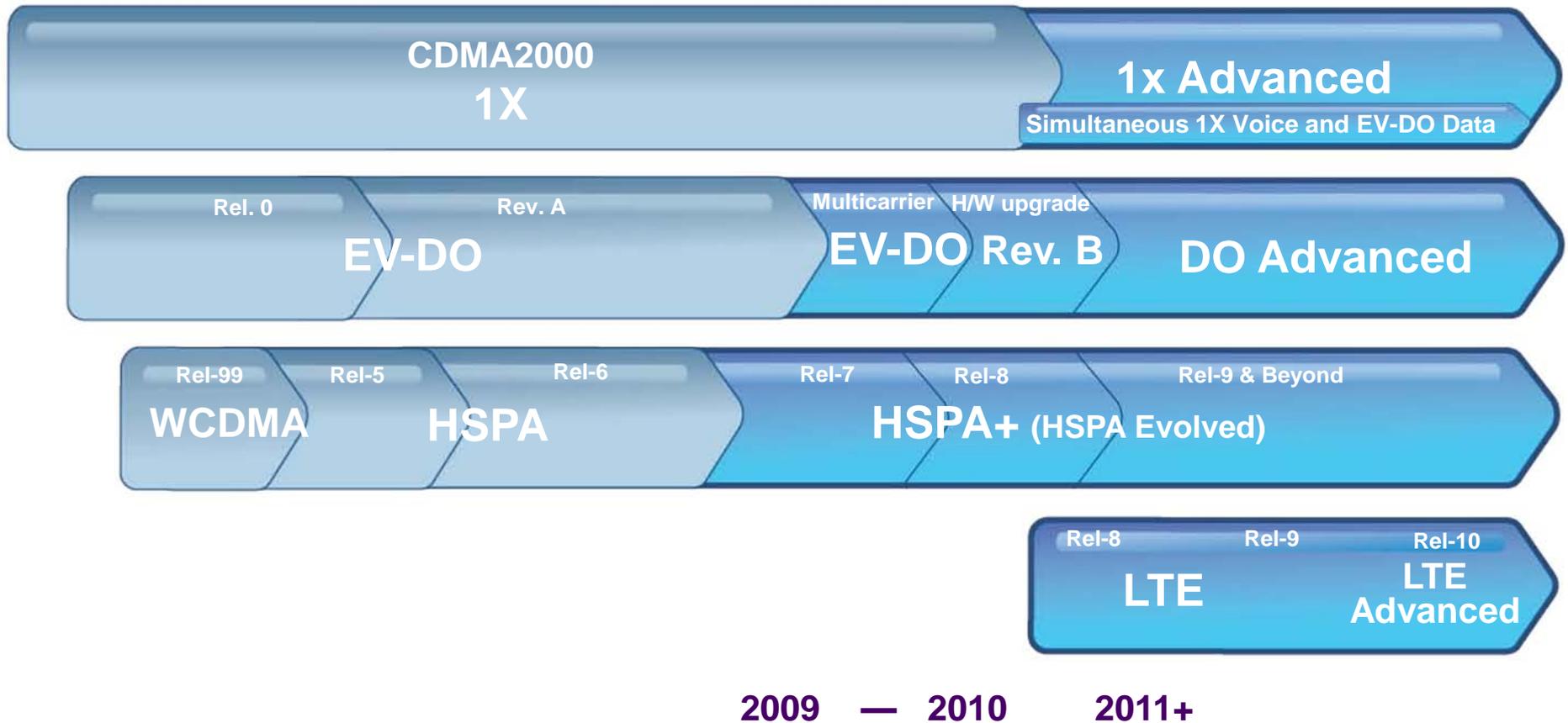
3G Has a Strong Evolution Path LTE is on a Parallel Evolution Path

Excellent Mobile Broadband Today

Voice and Full Range of IP Services

Enhanced User Experience

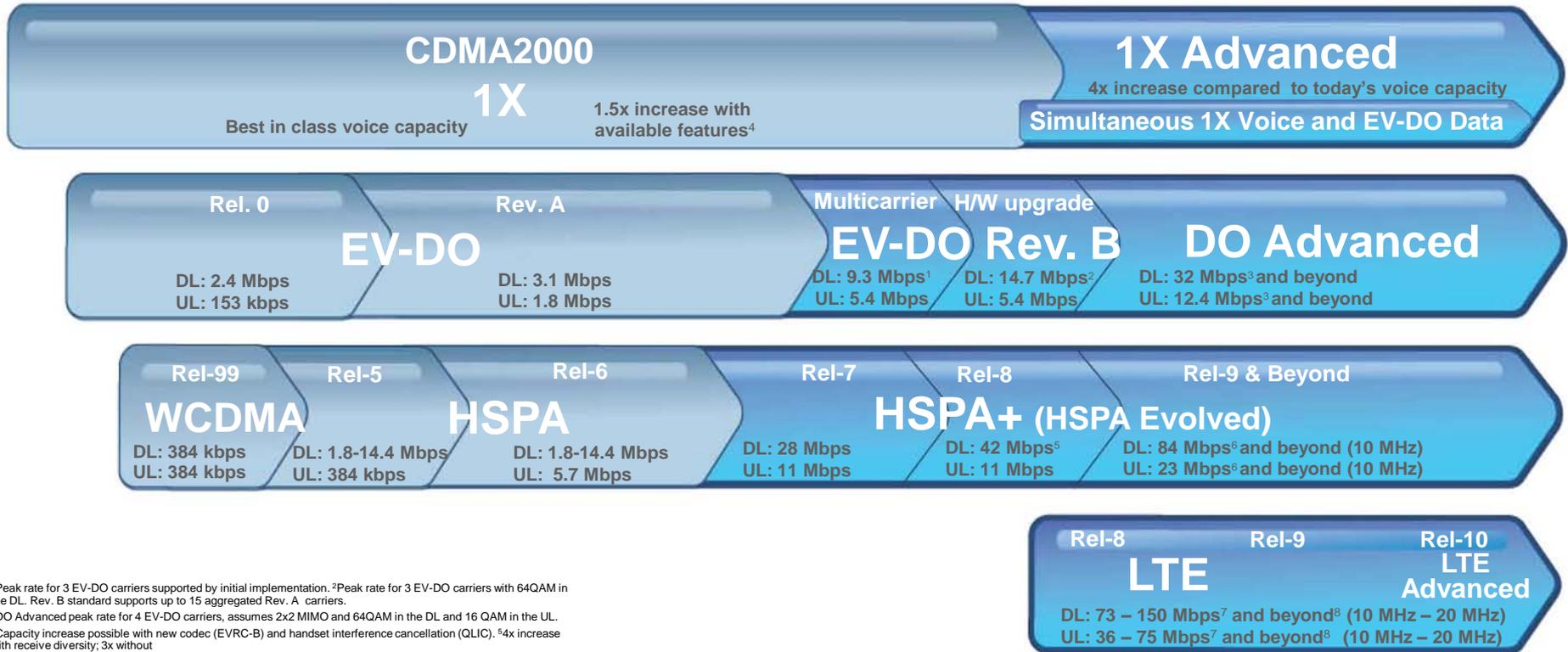
Improved voice and data capacity



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Excellent Mobile Broadband Today
Voice and Full Range of IP Services

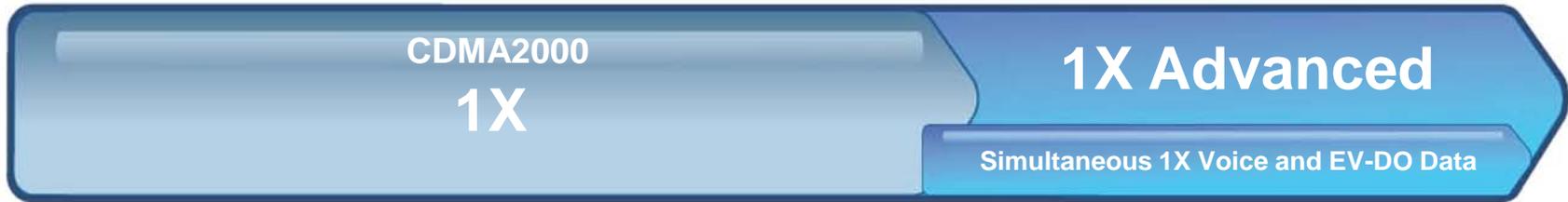
Enhanced User Experience
Improved voice and data capacity



2009 — 2010 2011+

¹Peak rate for 3 EV-DO carriers supported by initial implementation. ²Peak rate for 3 EV-DO carriers with 64QAM in the DL. Rev. B standard supports up to 15 aggregated Rev. A carriers.
³DO Advanced peak rate for 4 EV-DO carriers, assumes 2x2 MIMO and 64QAM in the DL and 16 QAM in the UL.
⁴Capacity increase possible with new codec (EVRC-B) and handset interference cancellation (QLIC). ⁵4x increase with receive diversity; 3x without
⁶R8 will reach 42 Mbps by combining 2x2 MIMO and 64QAM in 5MHz, or by utilizing 64QAM and multicarrier in 10 MHz. ⁷R9 and will utilize combinations of multicarrier and MIMO to reach 84 Mbps peak rates and beyond. Similarly, uplink multicarrier can double the uplink data rates.
⁸Peak rates for 10 and 20 MHz FDD using 2x2 MIMO; standard supports 4x4 MIMO enabling peak rates of 300 Mbps. TDD rates are a function of up/downlink asymmetry.
⁹Peak rates can reach or exceed 300 Mbps by aggregating multiple 20 MHz carriers as considered for LTE Advanced (LTE Rel-10)..

1X and EV-DO Have Strong Evolution Paths



Best in class voice capacity

1.5x increase with available features⁴

4x increase compared to today's voice capacity⁵

**Broadband Up & Downloads
Low Latency, QoS and VoIP**

Multicarrier—3x Higher capacity and data rates

Higher network capacity and improved user experience



**DL: 3.1 Mbps
UL: 1.8 Mbps**

**DL: 9.3 Mbps¹
UL: 5.4 Mbps**

**DL: 14.7 Mbps²
UL: 5.4 Mbps**

**DL: 32 Mbps³
UL: 12.4 Mbps³**

2009

2010

2011

2012+

Note: Estimated commercial dates

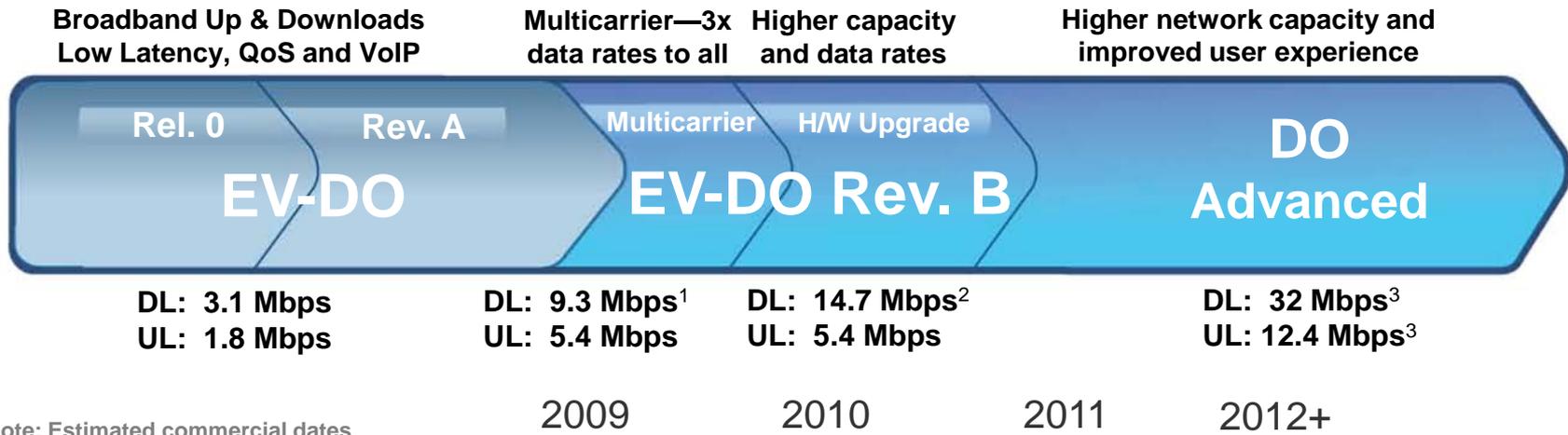
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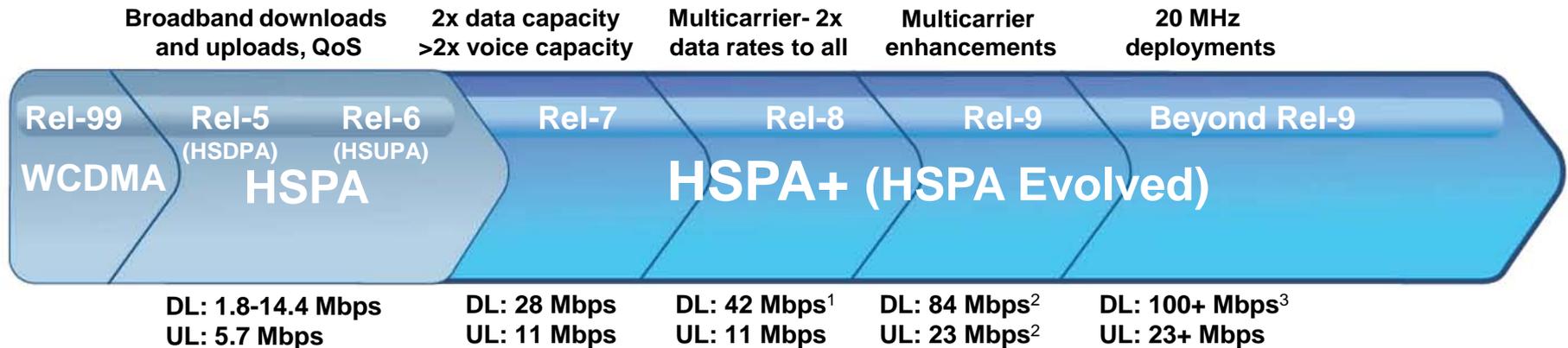
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HSPA+ Has A Strong Evolution Path



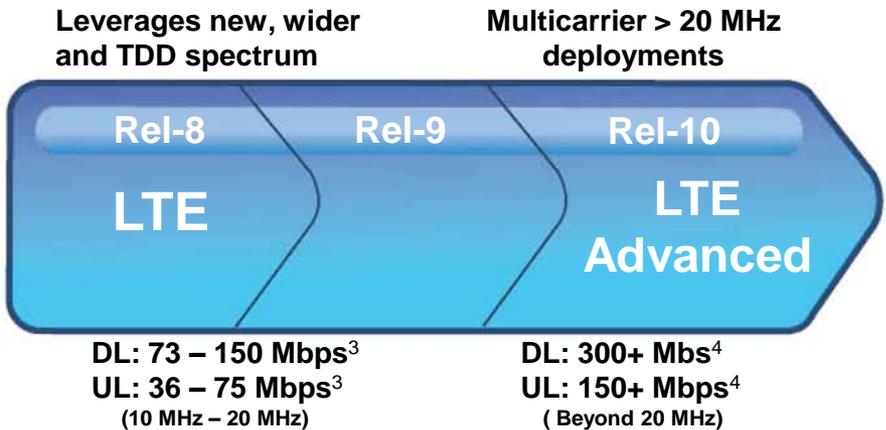
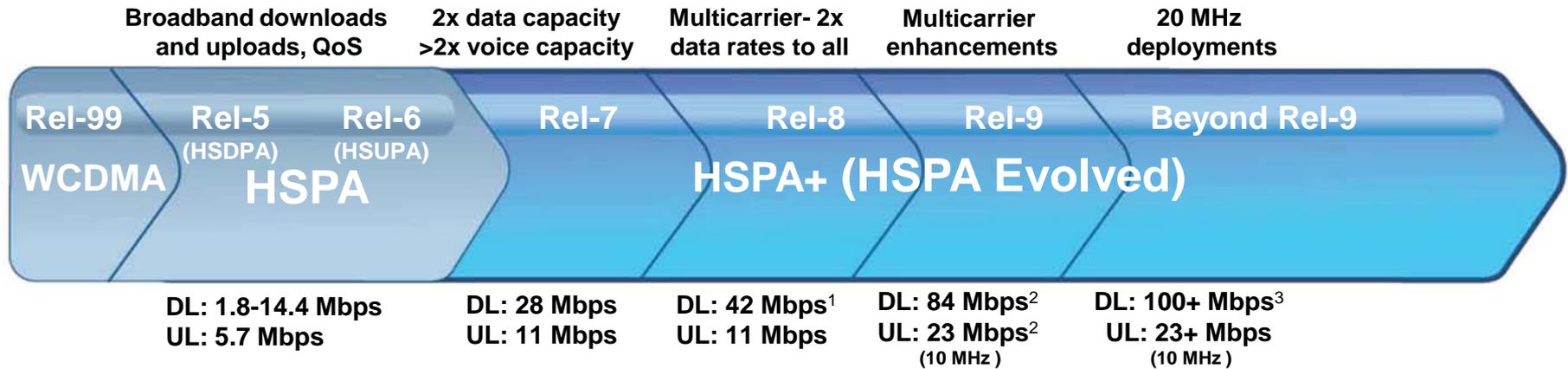
¹R8 will reach 42 Mbps by combining 2x2 MIMO and HOM (64QAM) in 5 MHz, or by utilizing HOM (64QAM) and multicarrier in 10 MHz.

²R9 combines multicarrier and MIMO in 10 MHz to reach 84 Mbps peak rates. Uplink multicarrier double the uplink peak data rate to 23 Mbps.

³Releases beyond R9 may expand multicarrier to 20 MHz and utilize combinations of multicarrier and MIMO to reach data rates exceeding 100 Mbps.

Note: Estimated commercial dates

LTE: A Parallel Evolution Path to HSPA+



¹ R8 will reach 42 Mbps by combining 2x2 MIMO and HOM (64QAM) in 5MHz, or by utilizing HOM (64QAM) and multi carrier in 10 MHz.

² R9 and beyond may utilize combinations of multi carrier and MIMO to reach 84 Mbps peak rates. Similarly, uplink multi carrier can double the uplink data rates.

³ Peak rates for 10 and 20 MHz FDD using 2x2 MIMO, standard supports 4x4 MIMO enabling peak rates of 300 Mbps. TDD rates are a function of up/downlink asymmetry

⁴ Peak rates can reach or exceed 300 Mbps by aggregating multiple 20 MHz carriers as considered for LTE Advanced (LTE Rel-10).

Note: Estimated commercial dates