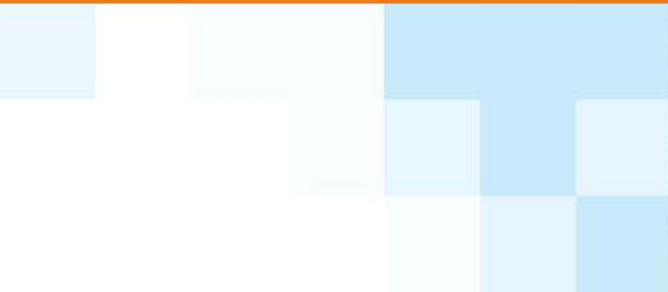


LTE Release 8 and beyond

February 2009



Disclaimer

Nothing in this presentation is an offer to sell any of the parts referenced herein. This presentation may reference and/or show images of parts and/or devices utilizing parts whose manufacture, use, sale, offer for sale, or importation into the United States are subject to certain injunctions against Qualcomm. This presentation is intended solely to provide information for those products and uses of products that are outside the scope of the injunctions. Any device utilizing 1x-EVDO parts must utilize Qualcomm's hybrid mode alternative solution.

LTE: An Optimized OFDMA Solution

L
T
E

Boosts Data Capacity in Dense Urban Areas

Seamless Interoperability with 3G

Leverages New, Wider and TDD Spectrum

Best suited in 10 MHz and beyond

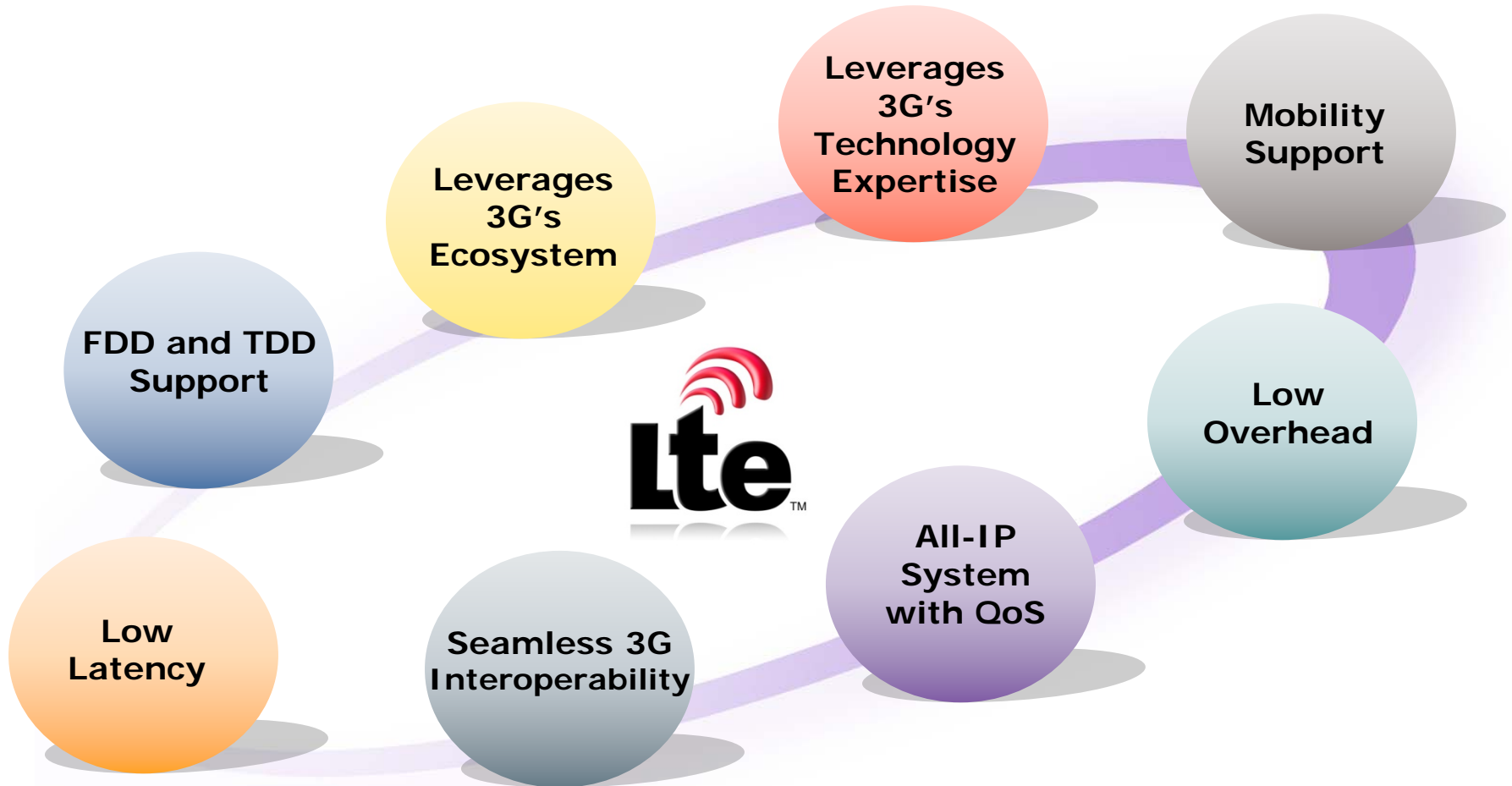
A Parallel Evolution Path to 3G

Similar performance with same bandwidth

Qualcomm: Industry's First LTE/3G Multimode Chipsets

3G multimode required for ubiquitous data coverage and voice services

LTE: An Optimized OFDMA Solution



Continuing 3G's track record of mobility and high spectral efficiency

LTE Boosts Data Capacity in Dense Urban Areas

- LTE boosts data capacity in dense urban areas
- 3G provides ubiquitous data coverage and voice services
- Seamless service continuity with 3G using multimode devices



Industry's first LTE/3G multimode solutions



LTE

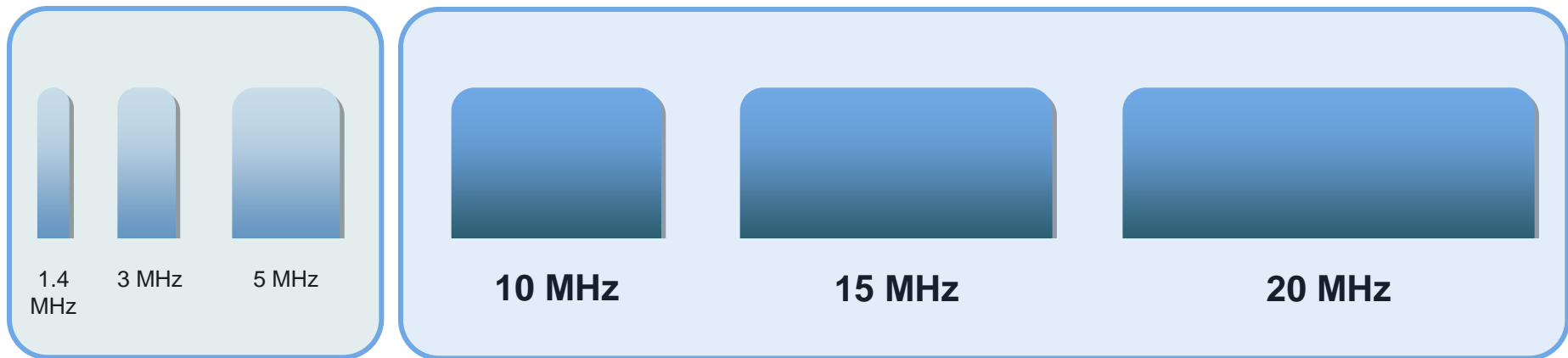
3G Coverage

Evolved 3G ensures similar user experience outside the LTE coverage

LTE Leverages New and Wider Spectrum

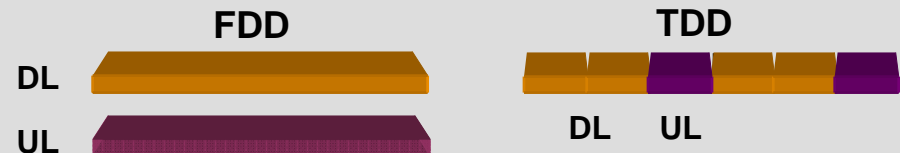
Available in smaller bandwidths

Best suited to leverage new and wider bandwidths



LTE relative performance decreases with bandwidth due to higher overhead; 40% overhead in 1.4 MHz vs. 25% in 20 MHz results in 25% better relative performance in 20 MHz vs. 1.4 MHz.

Optimal Technology for Unpaired TDD spectrum

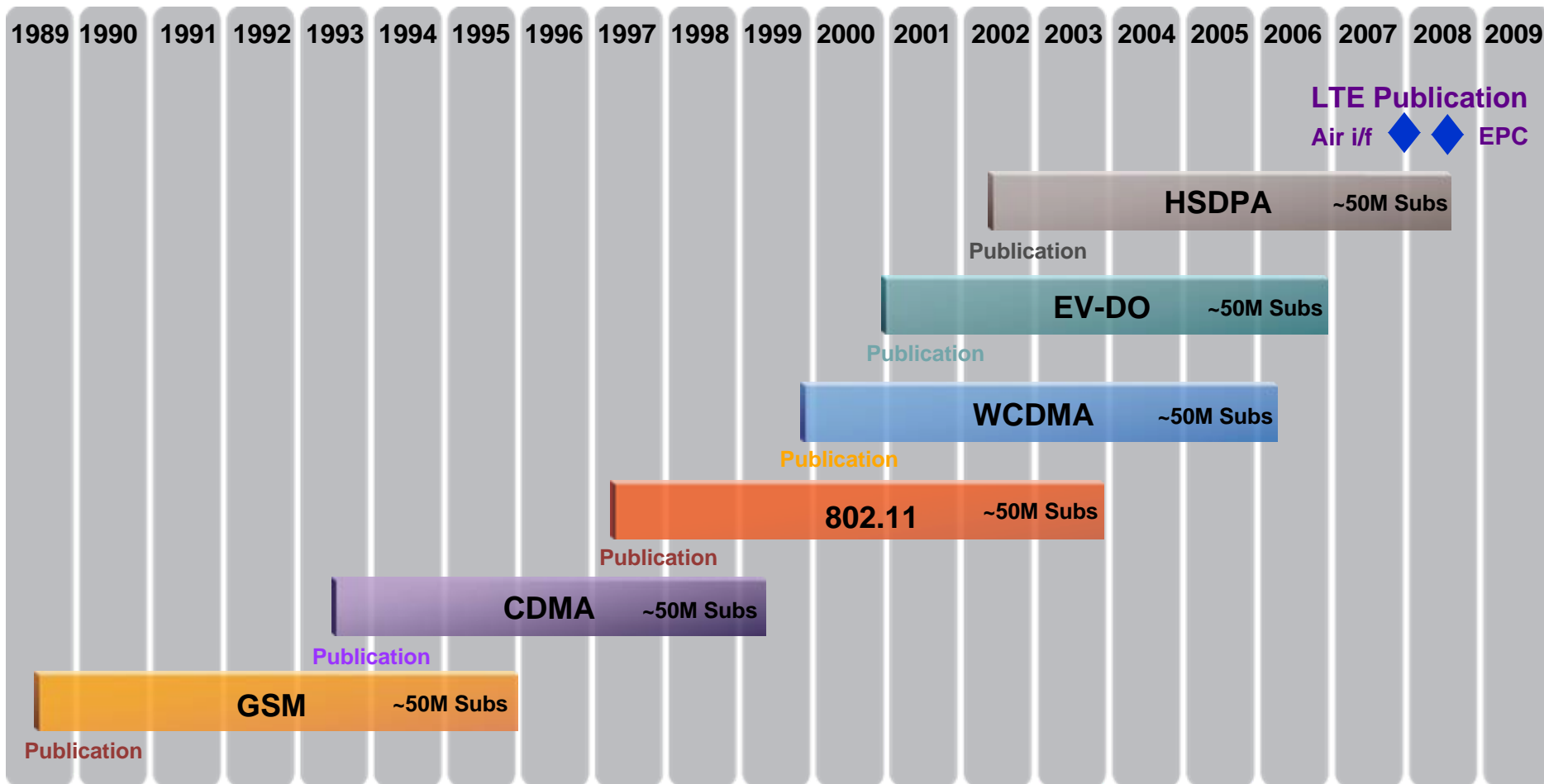


3G Supports Entire Range of IP Services



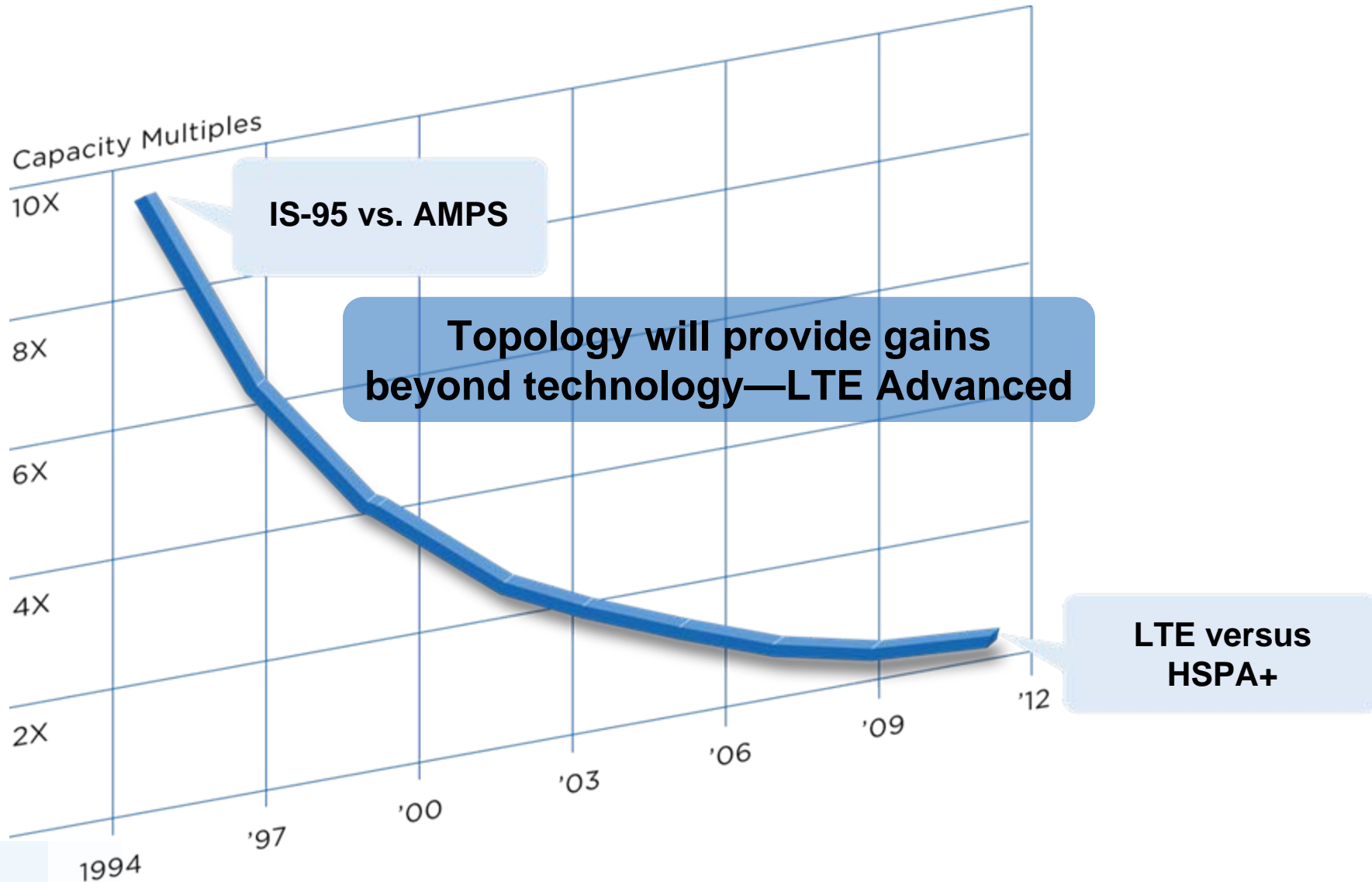
Initial LTE will focus on data while leveraging 3G for voice

~6-7 Years from Standards Publication to ~50M Subs for Successful Wireless Standards



Sources: CDG, Qualcomm, Ericsson, IEEE, 3GPP2 and GSMA. The “first reference publication” date **used is the earliest** publication date where Qualcomm feels that a set of reasonably complete **and** consistent specifications were available. Note that the LTE air interface publication date **shown is** 12/2007, but the core network (EPC) was published mid 2008. A stable ASN.1 code is required for commercial implementation of the standard (LTE R8 ASN.1 freeze expected 1H 2009).

Radio Link Improvement is Slowing, What Is Next?



Add Pico and User Deployed Femtocells for Increased Capacity and Coverage



Interference

Scalability

Fairness

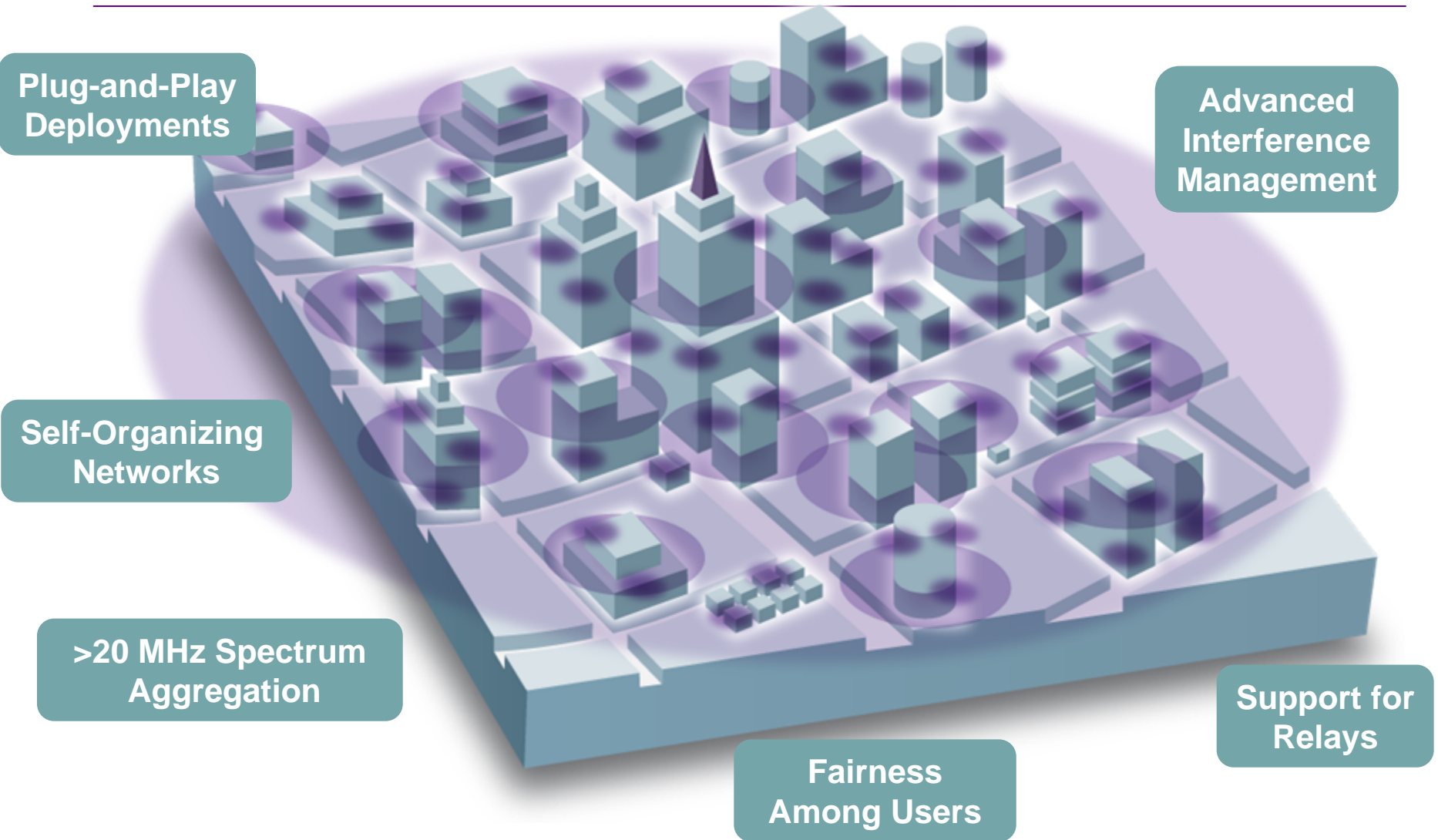
Operation & Management

Restricted Femto Access

User-Deployed Nodes

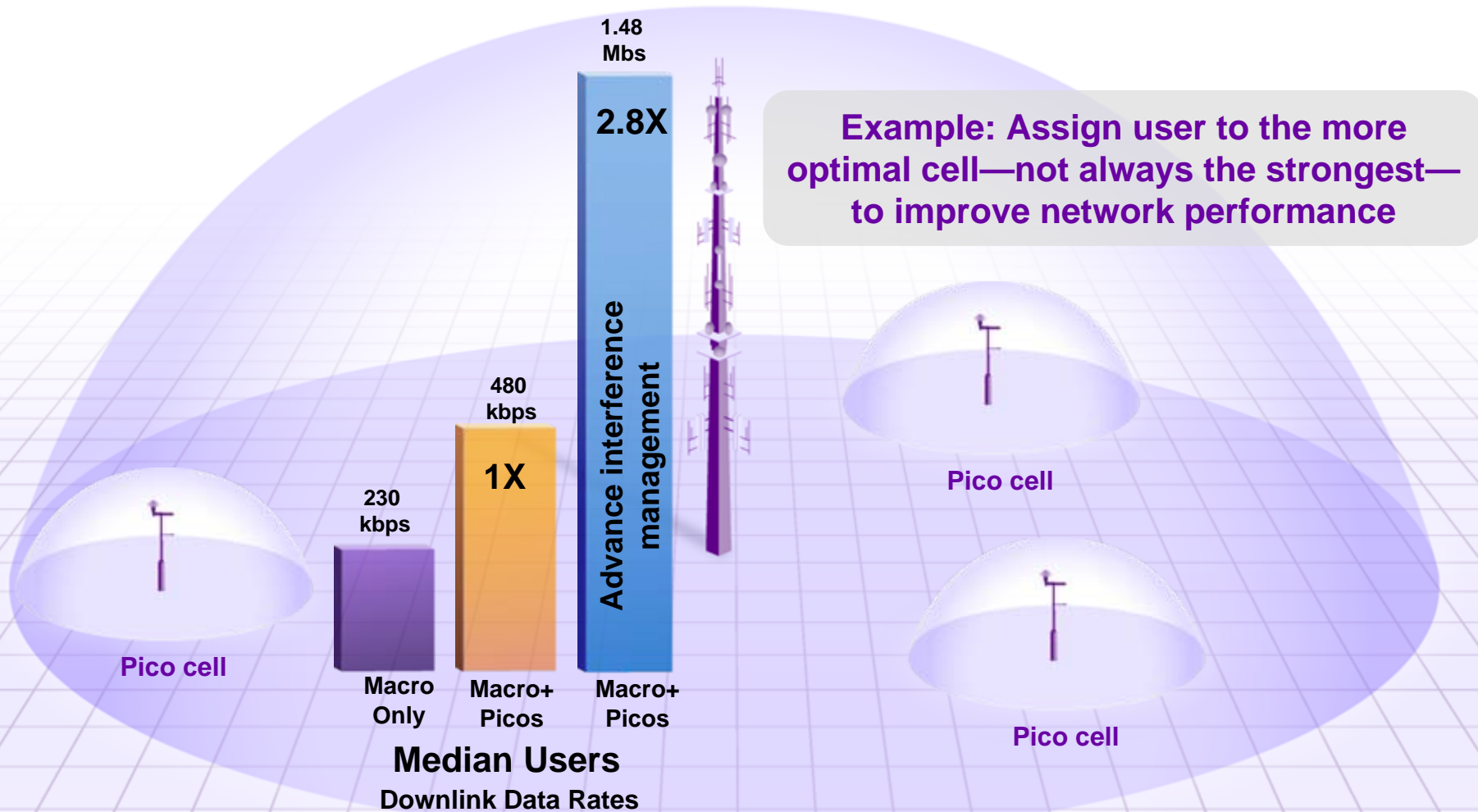
Mixed Networks
Impose Challenges

Improved Performance for Advanced Topology Networks with LTE Advanced



Note: Most topology enhancement features considered for LTE Rel-10 (LTE Advanced), but some may be introduced in earlier releases e.g., some SON functions in Rel-9.

LTE Advanced Improves Advanced Topology Networks



Qualcomm: Mobile OFDM/A Leadership

- A Leading contributor to the LTE standards
- A Leading contributor to OFDM/A based standards and solutions
 - Flash-OFDM, Platinum Multicasting and MediaFLO
- More than 1,000 OFDM/A patents
 - Announced standalone OFDM/A licensing agreements



Summary

L
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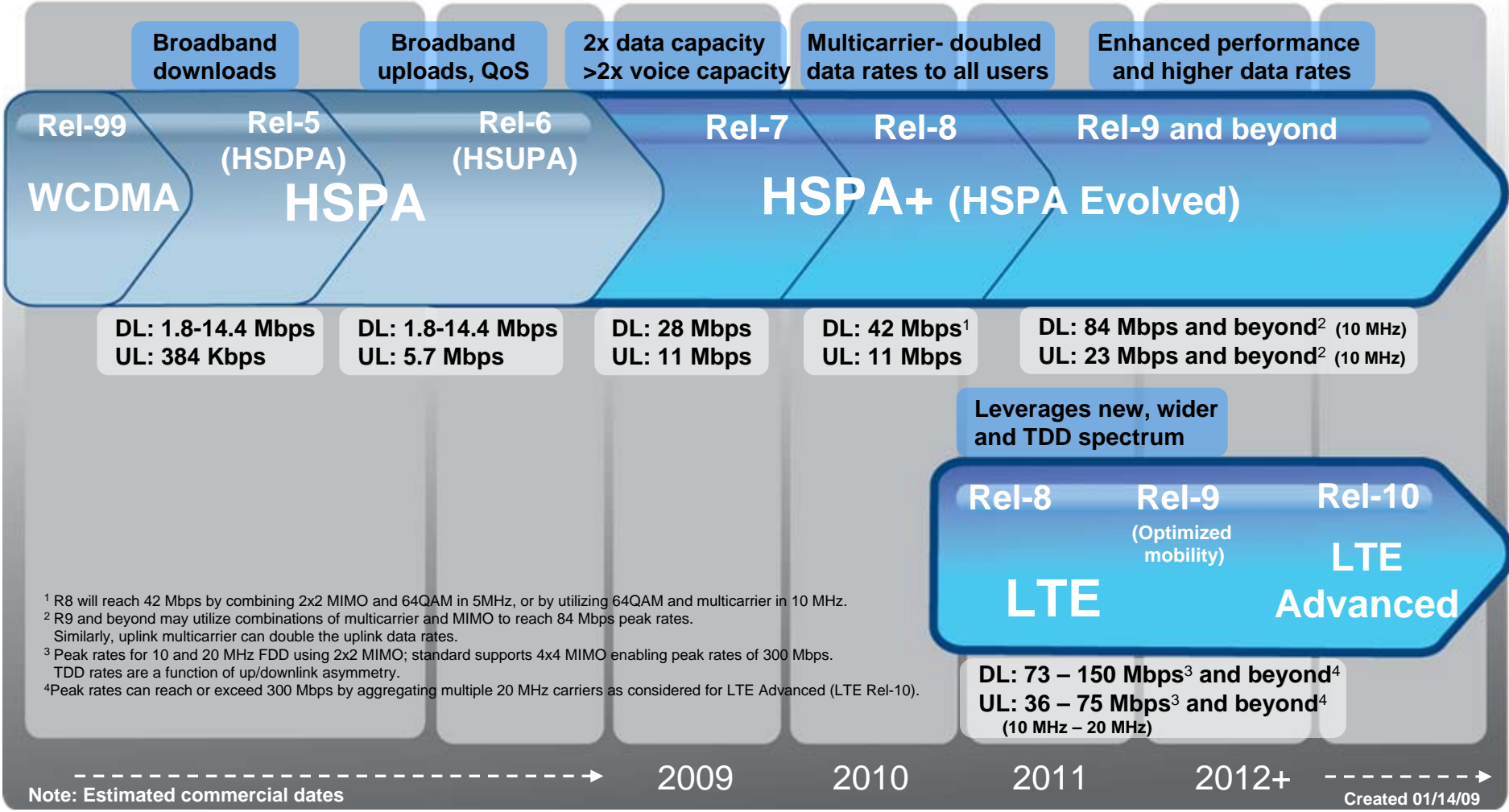
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LTE and HSPA+ are on Parallel Evolution Paths



¹ R8 will reach 42 Mbps by combining 2x2 MIMO and 64QAM in 5MHz, or by utilizing 64QAM and multicarrier in 10 MHz.
² R9 and beyond may utilize combinations of multicarrier and MIMO to reach 84 Mbps peak rates. Similarly, uplink multicarrier 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).

Achievable & Supported Peak Data Rates

Achievable LTE Peak Data Rates

Accounts for overhead at different bandwidths & antenna configurations

Bandwidth	DL		UL
	2x2	4x4	1x2
5 MHz	37 Mbps	72 Mbps	18 Mbps
10 MHz	73 Mbps	147 Mbps	36 Mbps
20 MHz	150 Mbps	300 Mbps	75 Mbps

- Peak data rates scale with the bandwidth
 - 2x2 MIMO supported for initial LTE deployments

UE Supported Peak Data Rates (Mbps)

Based on FDD UE categories defined in 3GPP standard

LTE UE Category	1	2	3	4	5
DL	10	50	100	150	300
UL	5	25	50	50	75

- Similar peak data rates defined for FDD & TDD



➤ Thank You