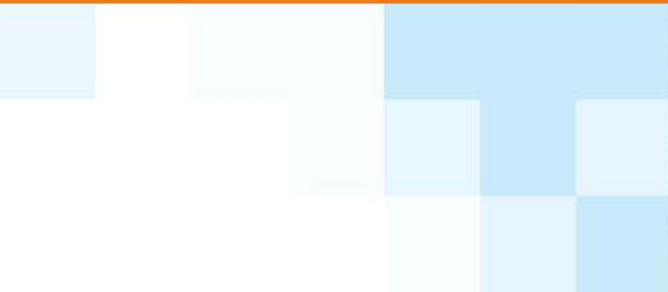


HSPA+ R8

February 2009



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Expands HSPA+ to 10 MHz

42 Mbps Peak Data Rates

Evolution to 84 Mbps and beyond in R9+

Multicarrier Enhances Broadband Experience

R8 Doubles data rates and lowers latency for all users

Multicarrier Increases Bursty Appl. Capacity

Multicarrier can double capacity for partially loaded carriers

Standardized Support for Femtocells

Topology provides gains beyond technology

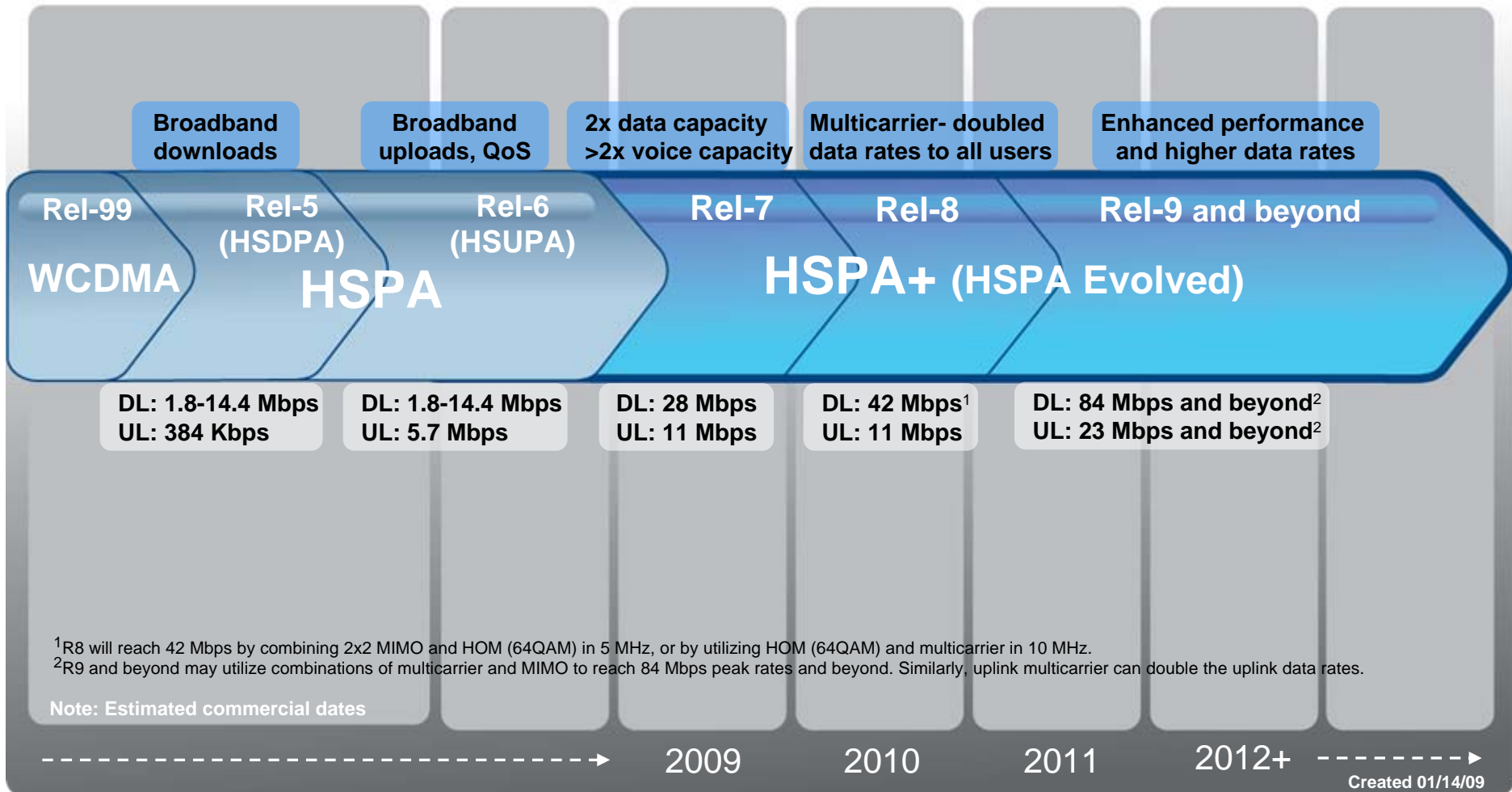
The Natural Evolution at a Lower Cost

Incremental and cost-effective upgrade that leverages existing assets

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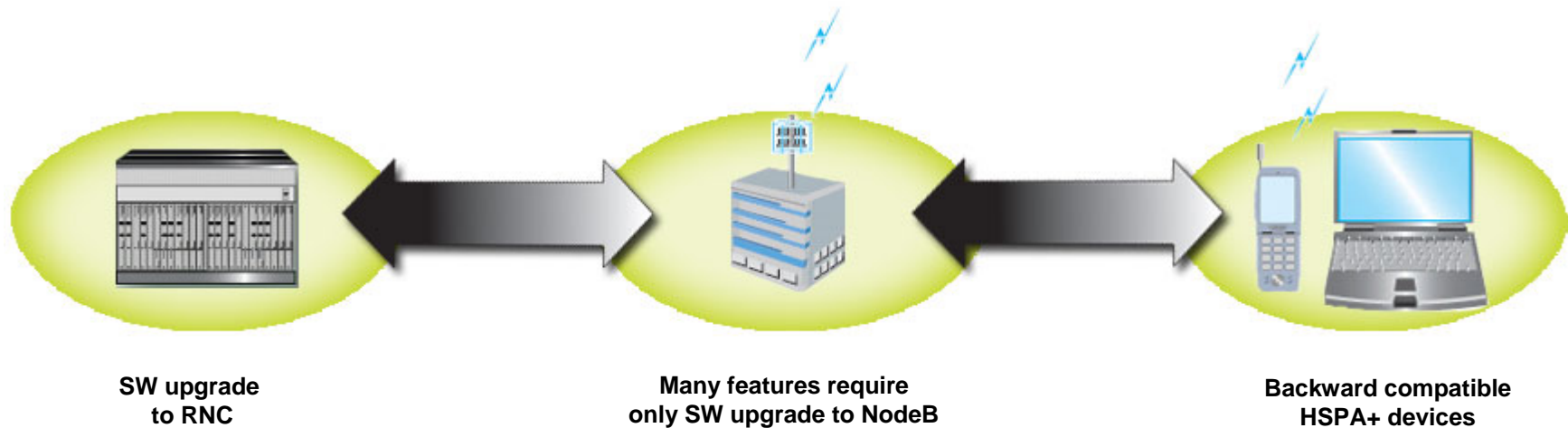
R8

HSPA+ R7 is Commercial in Q1 2009, HSPA+ R8 is Commercial in 2010



HSPA+ R8: up to 42 Mbps peak data rates

Incremental and Cost-Effective Upgrade



- An evolution path that leverages existing investments
 - Leverages existing cell sites, RAN, core network and spectrum
- Backward compatibility enables smooth introduction
 - WCDMA, HSPA and HSPA+ devices operate on the same network

HSPA+: The natural evolution at a lower cost

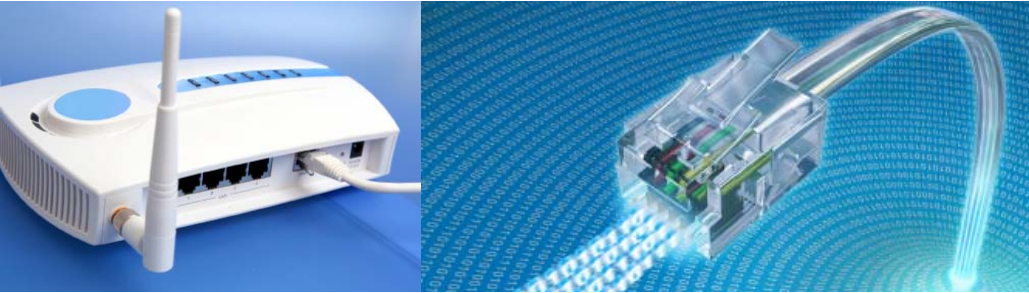
HSPA Supports Entire Range of IP Services



With simultaneous voice and high-speed data services

HSPA/HSPA+: Mobile Broadband for All Market and Device Segments

All Market Segments



Enterprise

- ***Ethernet-Class Performance***

Consumer

- ***Cable/DSL-Class Performance***

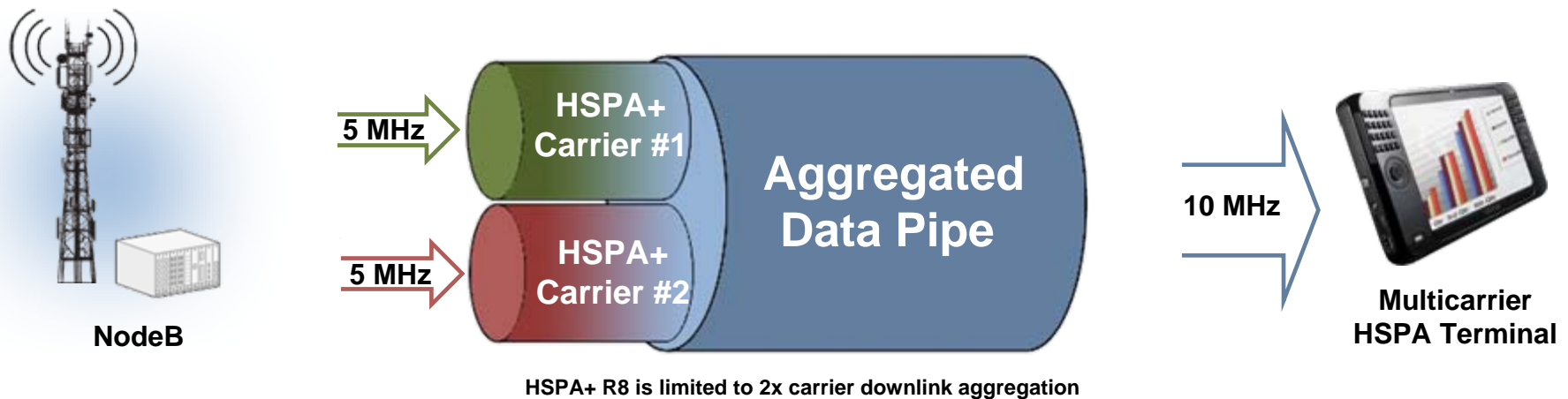
Mobile/Fixed/Nomadic

- *Handsets and PC cards*
- *Consumer Electronics*
- *Ultra Mobile Devices*
- *Embedded Laptops*
- *Desktops*

All Device Segments



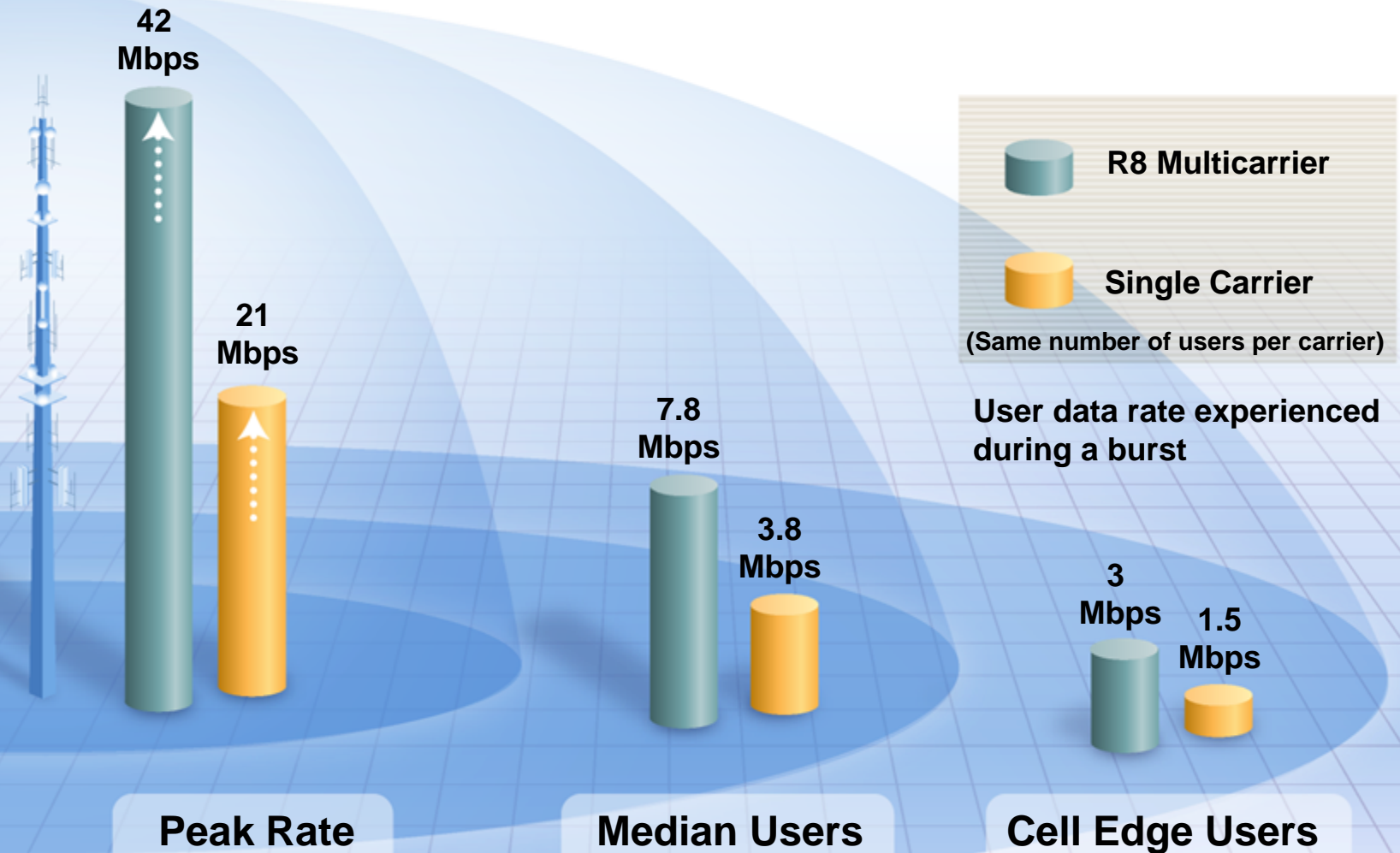
Multicarrier Enhances Broadband Experience



- Aggregating multiple 5 MHz carriers creates a bigger data pipe
- Increased data rates and lower latencies for all users
- Increased capacity for bursty applications, e.g., Web applications

Cost-effective software upgrade to multicarrier

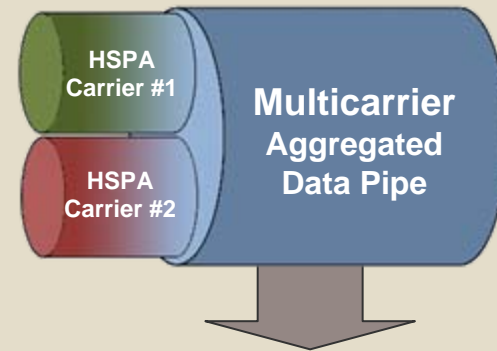
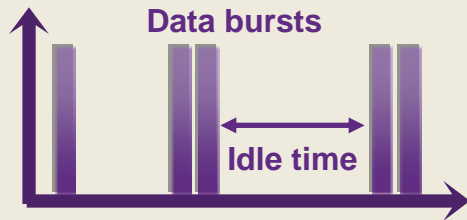
R8 Multicarrier Doubles Data Rates to *All* Users



Qualcomm simulations. Each scenario is based on the same total number of users (eight users), see R1-081890 for details. Shows the theoretical peak data rate and the burst data rate for the median users and the 10% worst (cell edge) users. No MIMO with Multicarrier in R8. Peak data rates are scaled down a factor 2.

Faster Response Time for Bursty Applications

**Bursty data application
(e.g. Web browsing)**



**Reduces over-the-air latency ~50%
for all users in the cell¹**

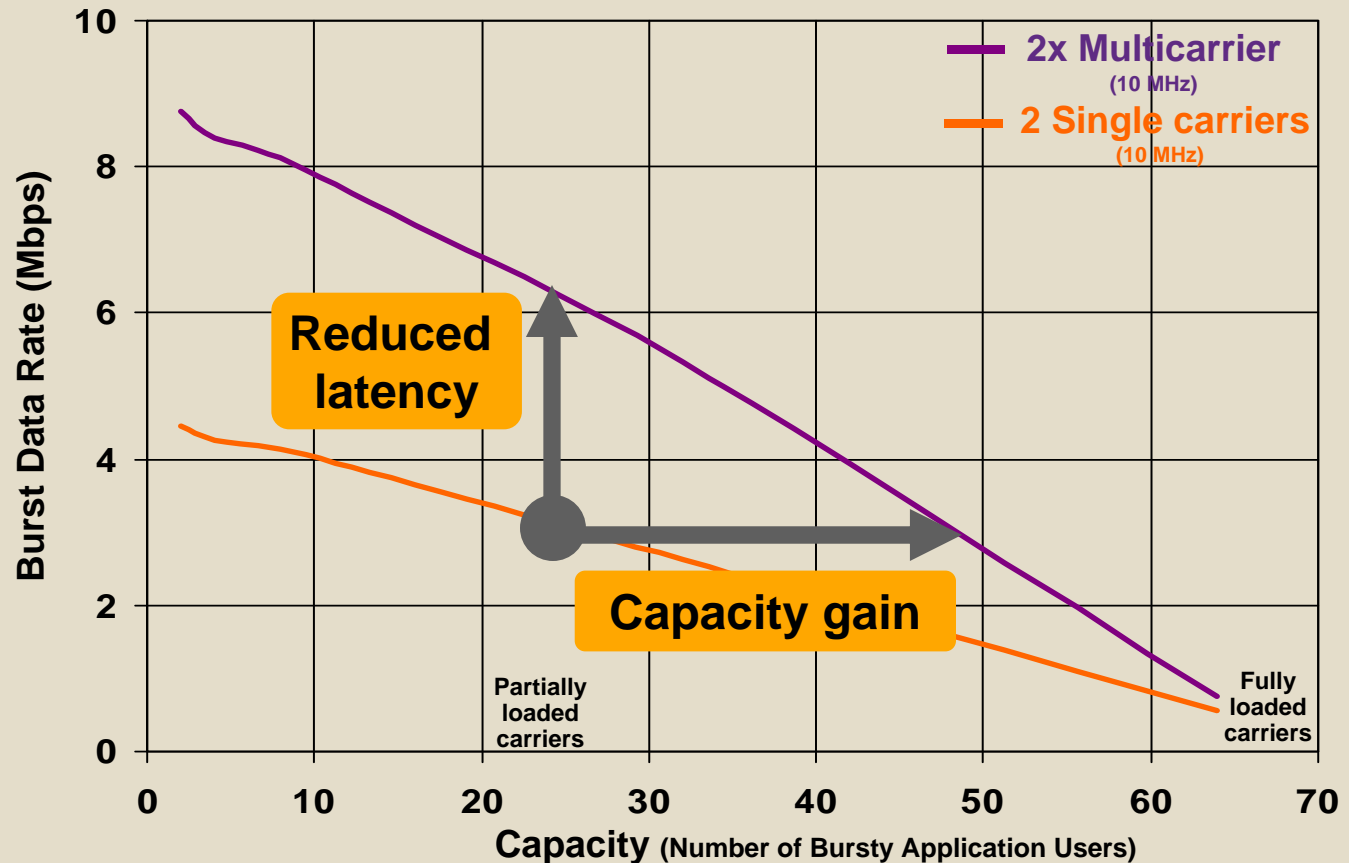
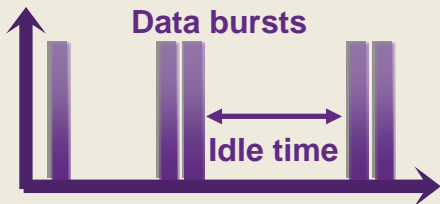
**Performance improvement can also
be used to leverage capacity²**

Same bursty application and # users on a dual carrier or two single carriers

¹Qualcomm simulations, see R1-081706 for details. The average burst download time (over the air) is reduced ~ 50% thanks the fatter data pipe. ²The bursty nature of the application means that a multicarrier can support more bursty application users, compared to two single carriers, for the same response time.

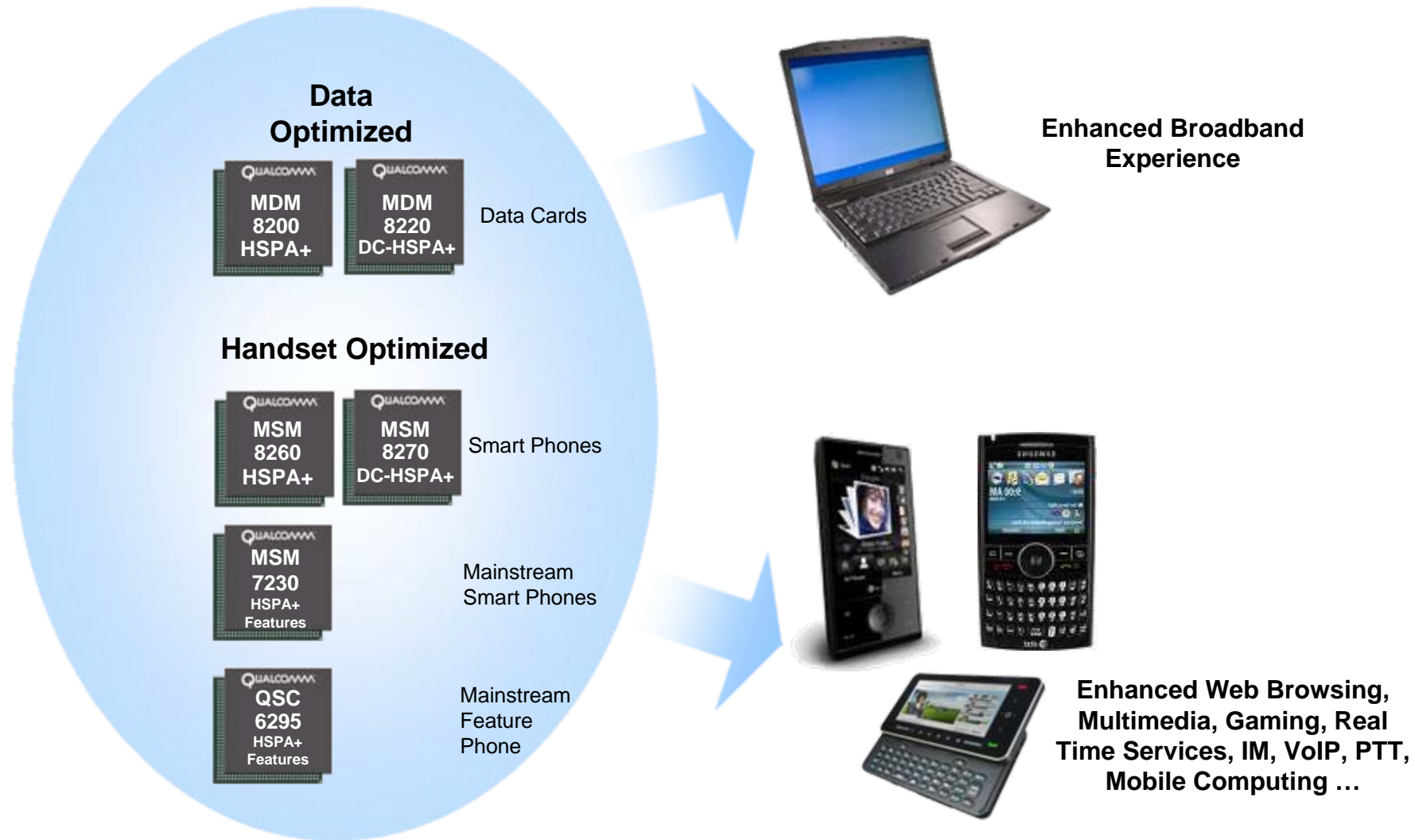
Multicarrier Can Double Capacity for Bursty Applications

Bursty data application
(e.g. Web browsing)



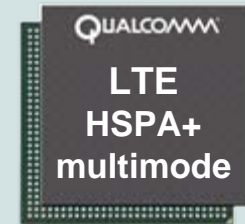
Qualcomm simulations, see R1-081706 for details. The average burst download time (over air) is reduced ~ 50% for all users. The bursty nature means that a multicarrier can support more users at the same response time for partially loaded carriers. The gain depends on the load and can exceed 100% for fewer users (less loaded carrier) but less for many users (starting to resemble full buffer).

Industry's First HSPA+ R7 and R8 Chipsets



HSPA+ and LTE are on Parallel Evolution Paths

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



Industry's first LTE/3G multimode solutions



LTE

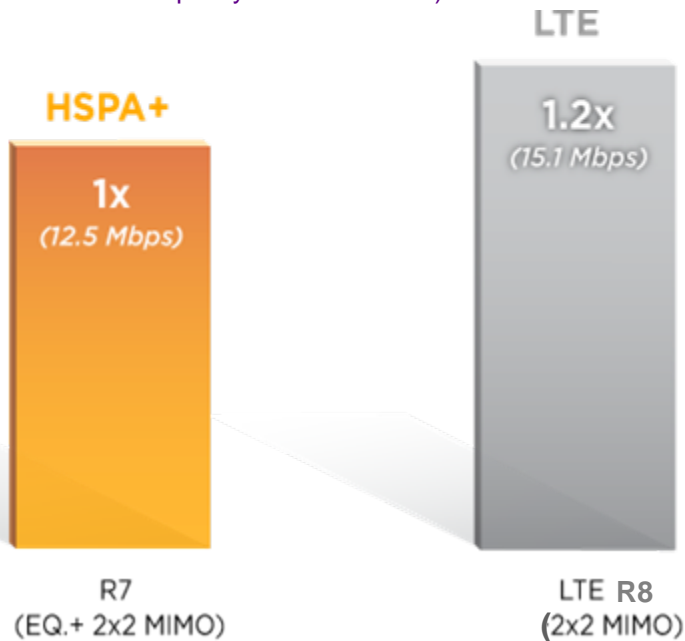
WCDMA/HSPA+ Coverage

HSPA+ ensures similar user experience outside the LTE coverage

Similar HSPA+ and LTE Performance

Similar Spectral Efficiency

with the same number of antennas and bandwidth
(Downlink sector capacity in 10 MHz FDD)



Note: Handset Interference Cancellation and HSPA+ multicarrier MIMO would further improve HSPA+ spectral efficiency.

Similar Peak Data Rates

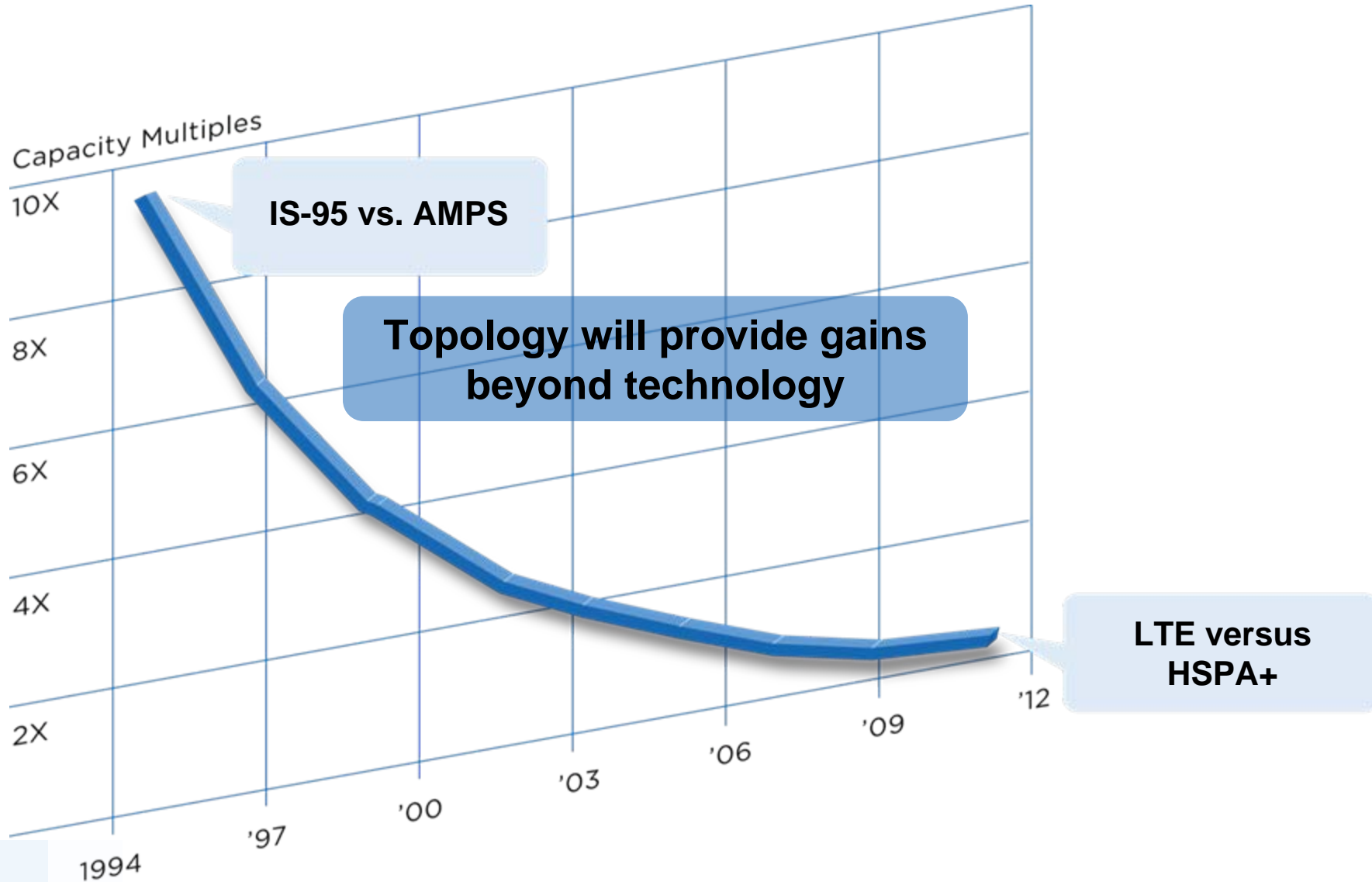
with the same bandwidth and number of antennas
(Downlink peak data rate in Mbps)

Bandwidth	HSPA+	LTE
5 MHz	42 Mbps	37 Mbps
10 MHz	84 Mbps	73 Mbps
20 MHz	3GPP R9 Candidate ²	150 Mbps

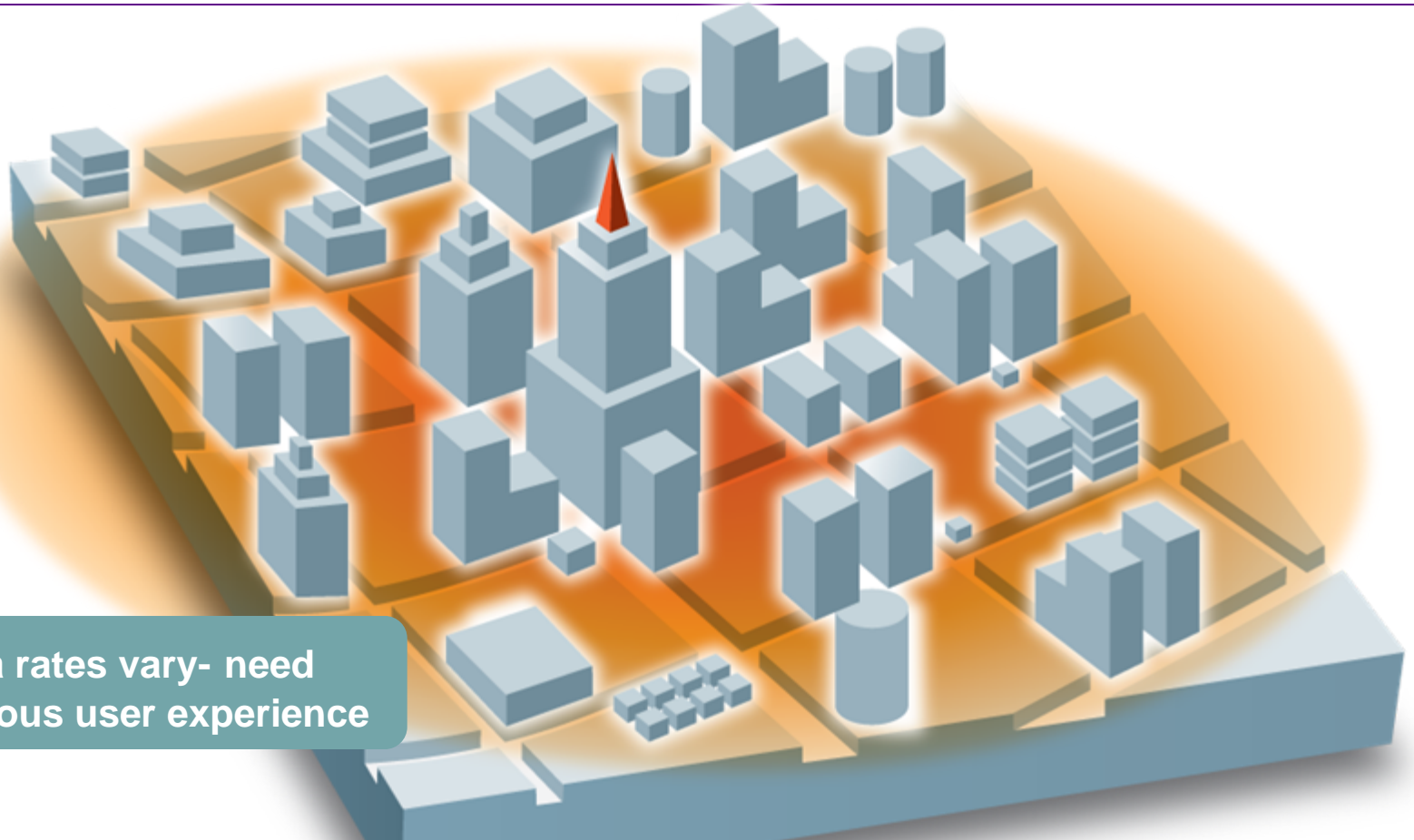
Note: Assuming 2x2 MIMO. LTE supports 4x4 MIMO but initial deployments will support 2x2 MIMO. 10 MHz HSPA+ Multicarrier supported in R8. MIMO and multicarrier considered for HSPA+ R9.

¹ Source: Qualcomm Simulation, details in 3GPP R1-070674. 500m ISD, HSPA+ R7 results scaled up from 10 MHz, HSPA+. HSPA+: 16QAM not considered for the UL and UE IC not considered for the DL. HSPA+ multicarrier and DL Interference Cancellation would narrow the gap with LTE. ² Future HSPA+ release may support up to 20 MHz.

Radio Link Improvement is Slowing, What Is Next?



Traditional Macro Networks



Data rates vary- need ubiquitous user experience

Macro network expansion challenges

- *Cell splitting*
- *Indoor coverage*
- *Site acquisition*
- *Network topologies change*

Add Pico and User Deployed Femtocells for Increased Capacity and Coverage



Interference

Scalability

Fairness

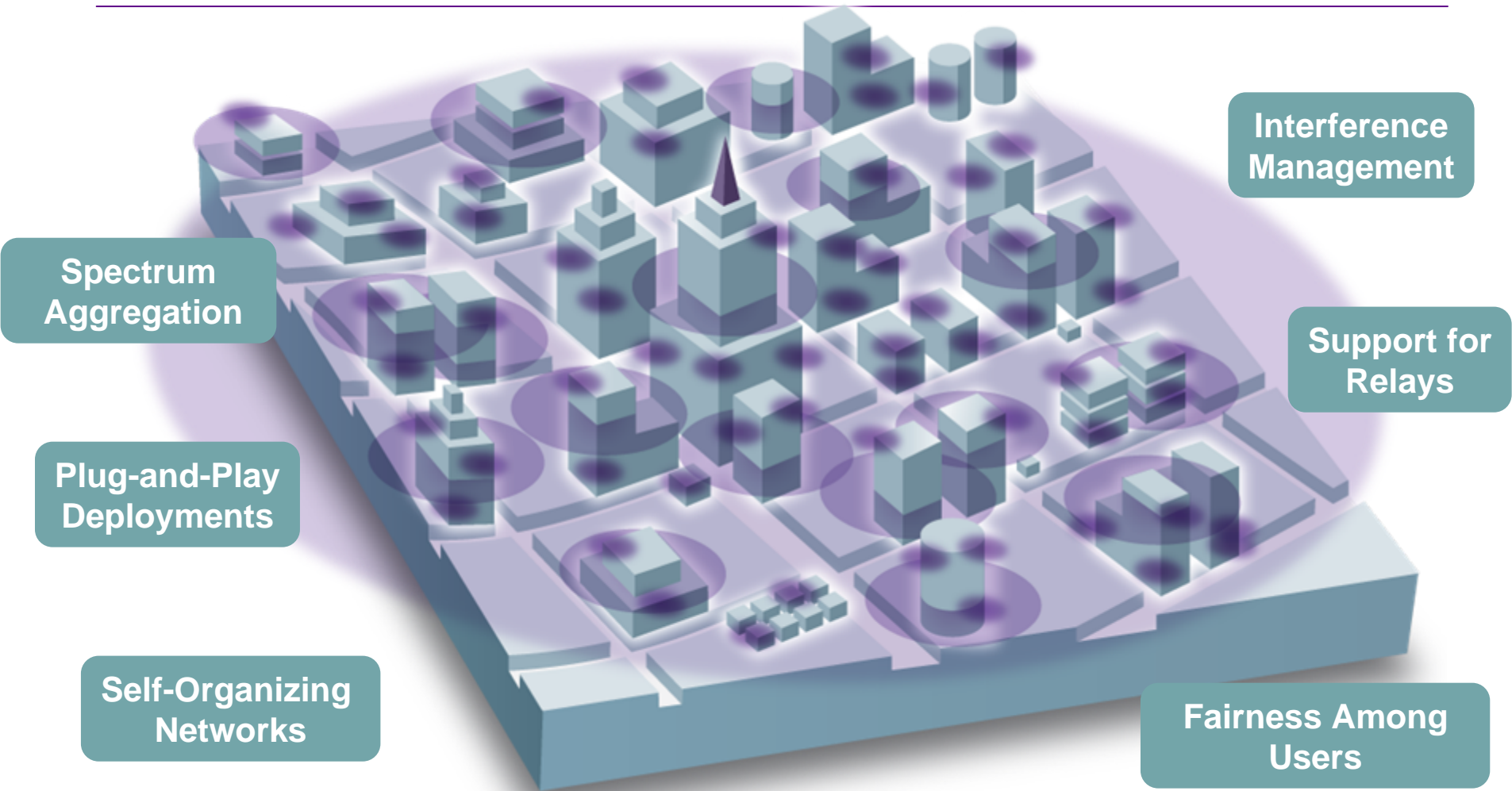
Operation & Management

Restricted Femto access

User deployed nodes

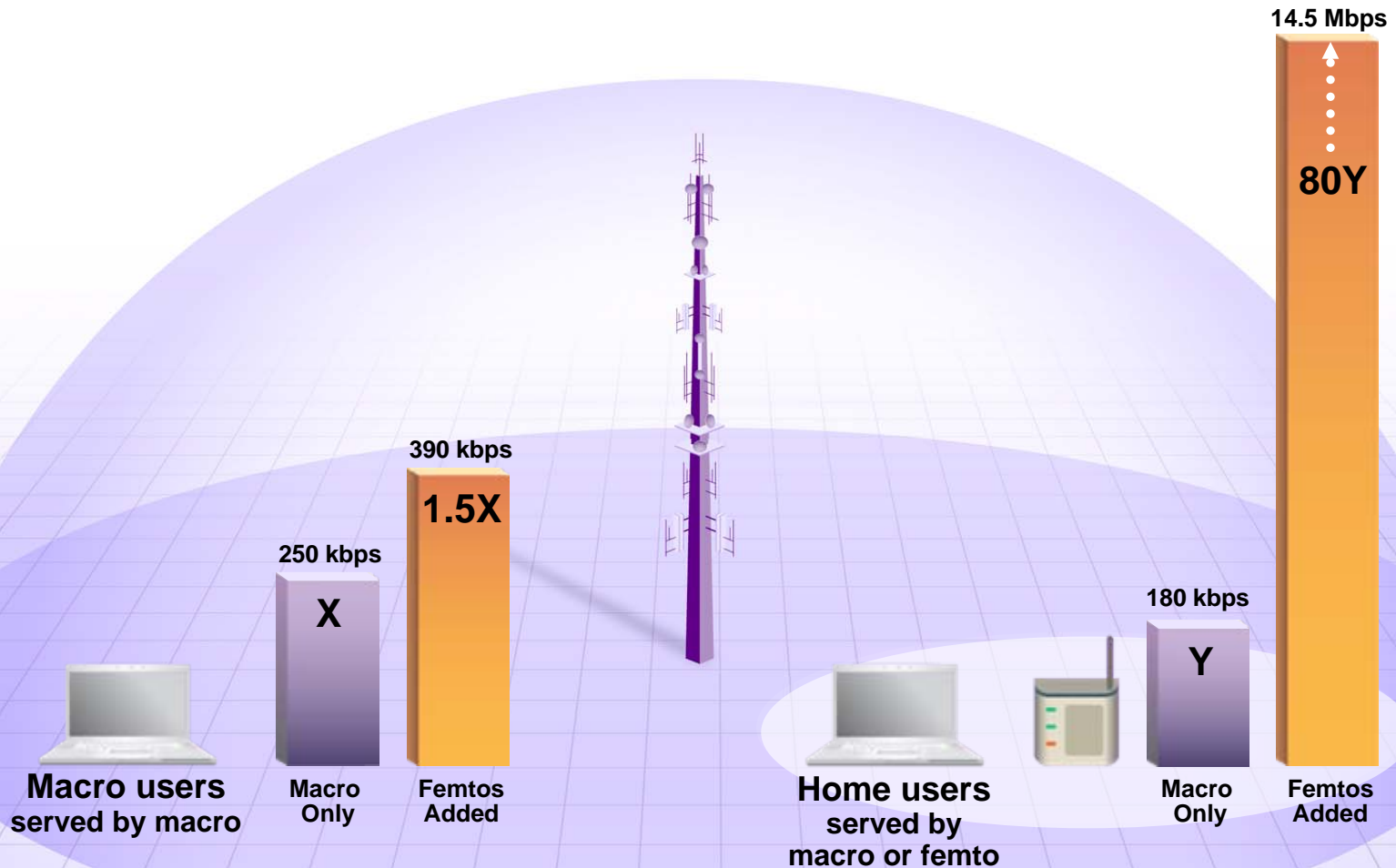
Mixed Networks
Impose Challenges

Advanced Topology Networks Improves Performance



*Some enhancements possible without standards impact
HSPA+ R8 introduces standardized support for femtocells*

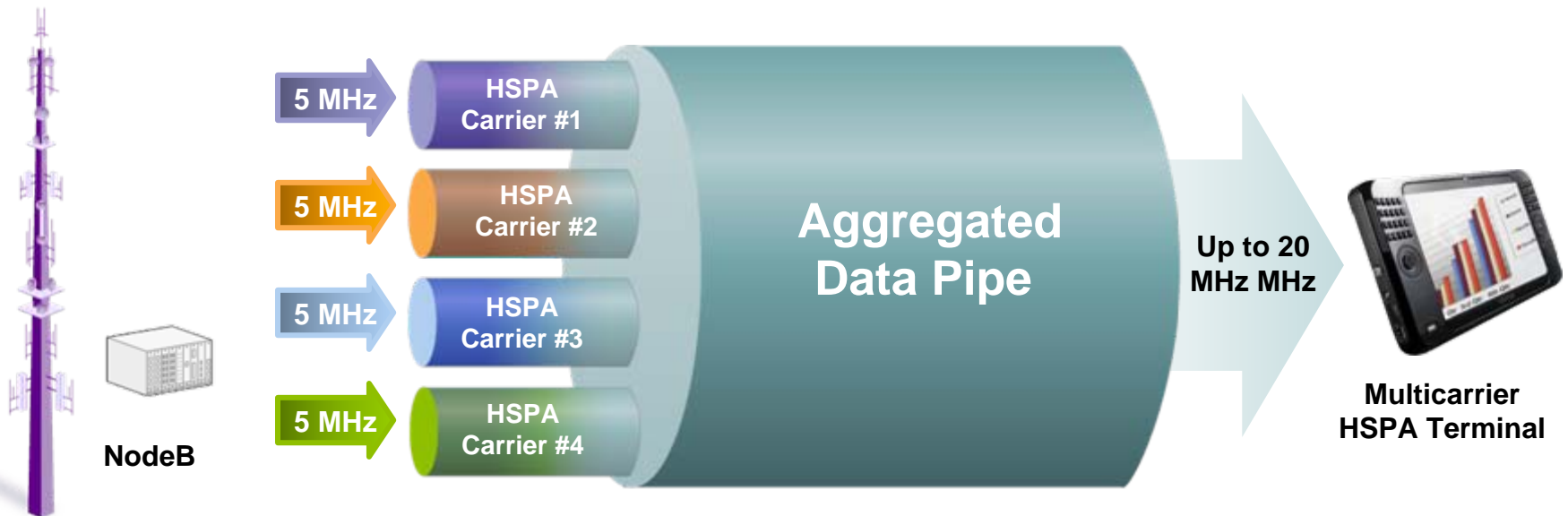
Femtocells Easily Increase Capacity Beyond 10x —Beyond what Technology Alone Could Provide



Note: Also, the worst 10% of macro users get ~15% higher throughput with proper interference management techniques.

Assumptions: Dense urban system simulation. 16 Users per cell: 10 macro users and 6 home users served either by macrocell or added femto cells. Rx diversity and MMSE Equalizer used. The median user data rates are shown. MIMO not considered

HSPA+ R9 Targets 20 MHz Multicarrier



- Up to 84 Mbps downlink peak data rates with four carriers (no MIMO)¹
- Leverages spectrum resources across different bands
- 2x Uplink aggregation – peak rates up to 23 Mbps

¹Multicarrier with MIMO could provide higher peak data rates.

Summary

42 Mbps Peak Data Rates

Evolution to 84 Mbps and beyond in R9+

Multicarrier Enhances Broadband Experience

R8 Doubles data rates and lowers latency for all users

Multicarrier Increases Bursty Appl. Capacity

Multicarrier can double capacity for partially loaded carriers

Standardized Support for Femtocells

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H
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P
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+

R8

Key HSPA+ R8 Features

<i>Feature</i>	<i>Key Benefits</i>
<i>Multicarrier HSPA+</i> (2X downlink in R8)	Enhanced user experience across cell Doubled average & cell edge rates Increased bursty application capacity
<i>MIMO and 64 QAM Combined</i>	42 Mbps peak rate in the downlink
<i>Enhanced Serving Cell Change</i>	Improved handover reliability Higher capacity (allows F-DPCH)
<i>Voice Call Continuity (VCC)</i>	VoIP service continuity to WCDMA/GSM
<i>Support for Home NodeB</i> RAN architecture with new Iuh interface to HNB gateway	Standardized support for femtocells (Home NodeB)

HSPA+ and LTE are on Parallel Evolution Paths

■ HSPA+

- The natural and most economical upgrade from HSPA
- Backward compatible with all UMTS evolutions: R99 through R6, R7, R8...
- Optimal performance for single and aggregated 5 MHz carriers
- High HSPA voice capacity and simultaneous voice and data services
- MIMO support

■ LTE

- Optimized mobile OFDMA solution for new and wider spectrum
- Optimal technology for TDD deployments
- Higher peak data rates through wider bandwidths
- Boosts data capacity in dense urban deployments
- Interoperates seamlessly with 3G through multimode devices



➤ Thank You