SDR'11-WInnComm: Puncturing Myths to Make Way for Next Generation Technology

Sprint Data Growth and Devices
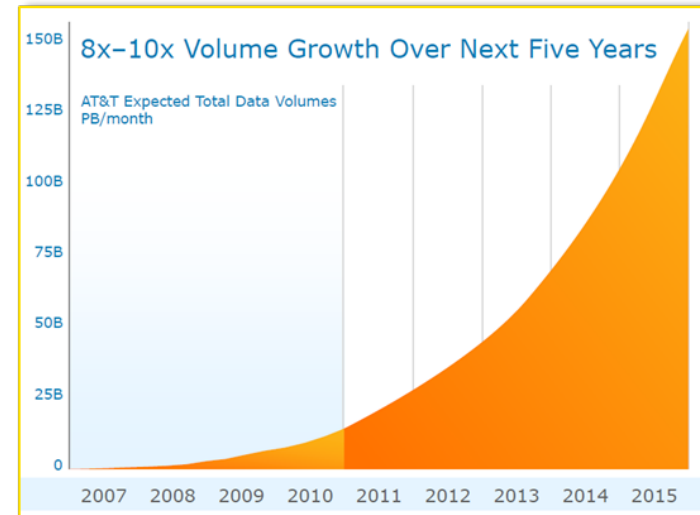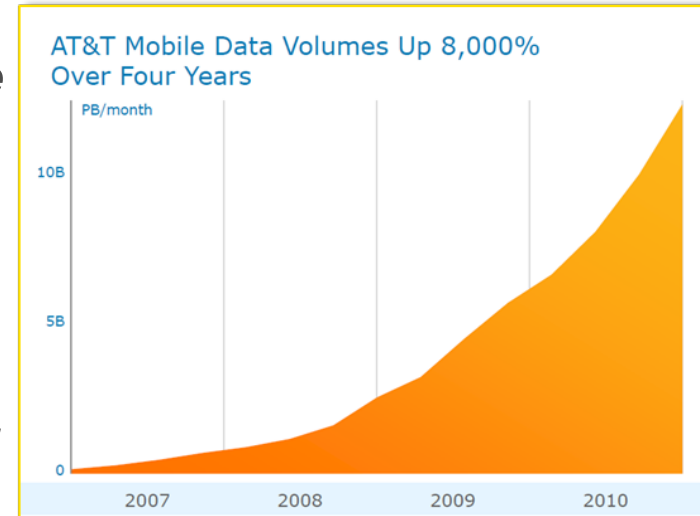
2011 network tonnage is expected to more than double the 2010 total

Petabytes of Traffic

80

60

40

20

0

More Than Forty 4G Devices Planned by 2013

2009 2010 2011 2012 2013 2014

AT&T's Principle Arguments in T-Mobile Takeover Application

- *Capacity: AT&T alleged that it faced unique spectrum constraints that result from an explosive growth in the demand for data services.*

- *Coverage: AT&T asserted that T-Mobile's acquisition would "eventually" allow it to roll out its 4G service to 97% of the US population six years after consummation.*

- *Network: AT&T claimed that it has simply run out of options short of the acquisition to improve performance sufficiently to meet demand.*

AT&T Mobile Data Volumes Up 8,000% Over Four Years
PB/month

8x–10x Volume Growth Over Next Five Years
AT&T Expected Total Data Volumes PB/month

AT&T's Conceit of Ubiquitous Explosive Demand 1

- *While demand for wireless services has increased markedly over the last five years, AT&T's demand increase is wholly unexceptional.*
  - > *AT&T's demand increase is, if anything, smaller than the demand increases experienced by other carriers.*
  - > *According to the Nielsen Company, which analyzed nearly 65,000 U.S. cell phone bills from the first quarter of 2011, Android owners consume 582 MB of data each month compared to 492 MB for iPhone owners. The iPhone accounts for approximately 65% of all smartphone sales on the AT&T network but a much smaller (or zero) share on other networks.*

- *Broadband demand is variable and localized, but AT&T referenced only aggregate data.*

Average Monthly Data Usage (MBs)
Q1'11 Nielsen Customer Value Metrics, National

Android OS	582
Apple iOS	492
HP WebOS	448
Windows Phone 7	317
Windows Mobile	174
RIM BlackBerry OS	127

  - > *AT&T never accounted for variations in data consumption by user handset types, user profiles, or user consumption patterns.*
  - > *AT&T did not account for geographic variations between urban, rural, and suburban areas.*
  - > *AT&T did not capture monthly, daily, weekly, or hourly fluctuations in data traffic.*
  - > *These omissions were glaring.*

- *AT&T's network performance has none of the hallmarks of a carrier facing <u>real</u> capacity constraints.*
  - > *Objective, third-party drive tests show not only that performance differences among all of the carriers studied are minimal, at best, but also that all of the nationwide mobile operators face similar or perhaps even greater capacity issues than AT&T.*
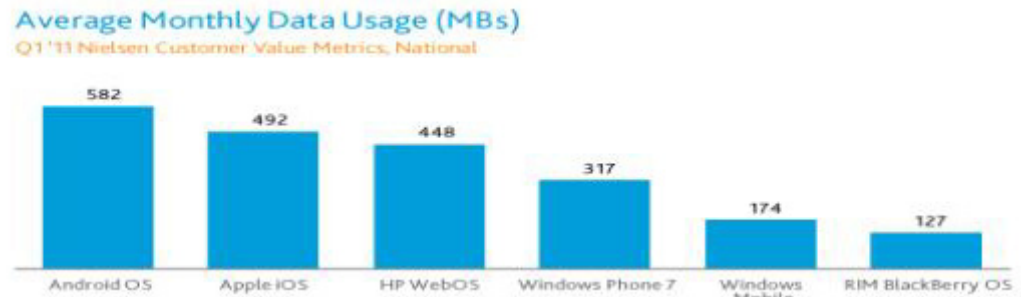
AT&T's Conceit of Ubiquitous Explosive Demand 2

- *Verizon already serves more customers with less spectrum than AT&T.*

- *Data demand on Verizon's network is already larger than the data demand on AT&T's network.*

- *Yet Verizon, which has less spectrum than AT&T, has indicated it needs no additional resources through 2015*

*Comparison of Data Demand on AT&T's and Verizon Wireless' Networks*

	1Q11	2Q11	3Q11	4Q11
Number of 3G and 4G Users				
AT&T	44,927	46,764	49,612	51,188
Verizon Wireless	43,655	48,463	52,679	56,897
Average Weighted MB Usage/User/Month				
AT&T	265	296	341	378
Verizon Wireless	248	304	364	427
Total Subscriber Data Demand (TB/month)				
AT&T	19,479	21,792	25,233	28,463
Verizon Wireless	20,801	25,930	31,302	37,152
Difference in Data demand, VZW-AT&T	7%	19%	24%	31%
Y/Y Change				
AT&T	86%	79%	69%	66%
Verizon Wireless	68%	79%	94%	106%

JP Morgan, North American Equity Research, (Feb. 4, 2011)
Telecom Services & Towers Report, *Breaking Down Data - Part Deux: T and VZ Network Demand Similar, but Growing Faster*

Simple Solutions: Deploy, Use, Invest

- *AT&T can greatly increase the capacity of its existing spectrum through using three well-established "levers":*
  - > *Deploy warehoused spectrum*
  - > *Use more efficient, 1990s- and 2000s-era technologies*
  - > *Invest in additional infrastructure*
    - – *More macrocells and cell splits*
    - – *More heterogeneous network that includes far more microcells, picocells, femtocells and other infrastructure*

Capacity Model Forecasted Supply Will Exceed AT&T Data Demand Forecasts
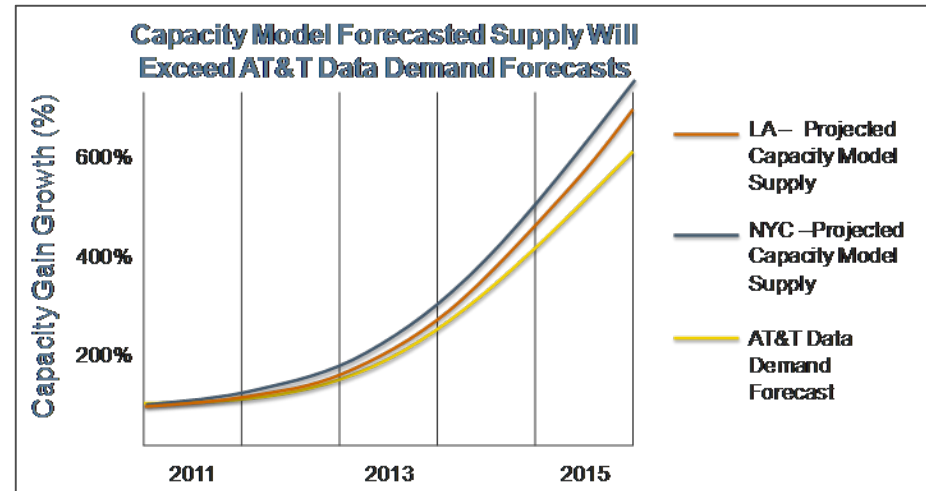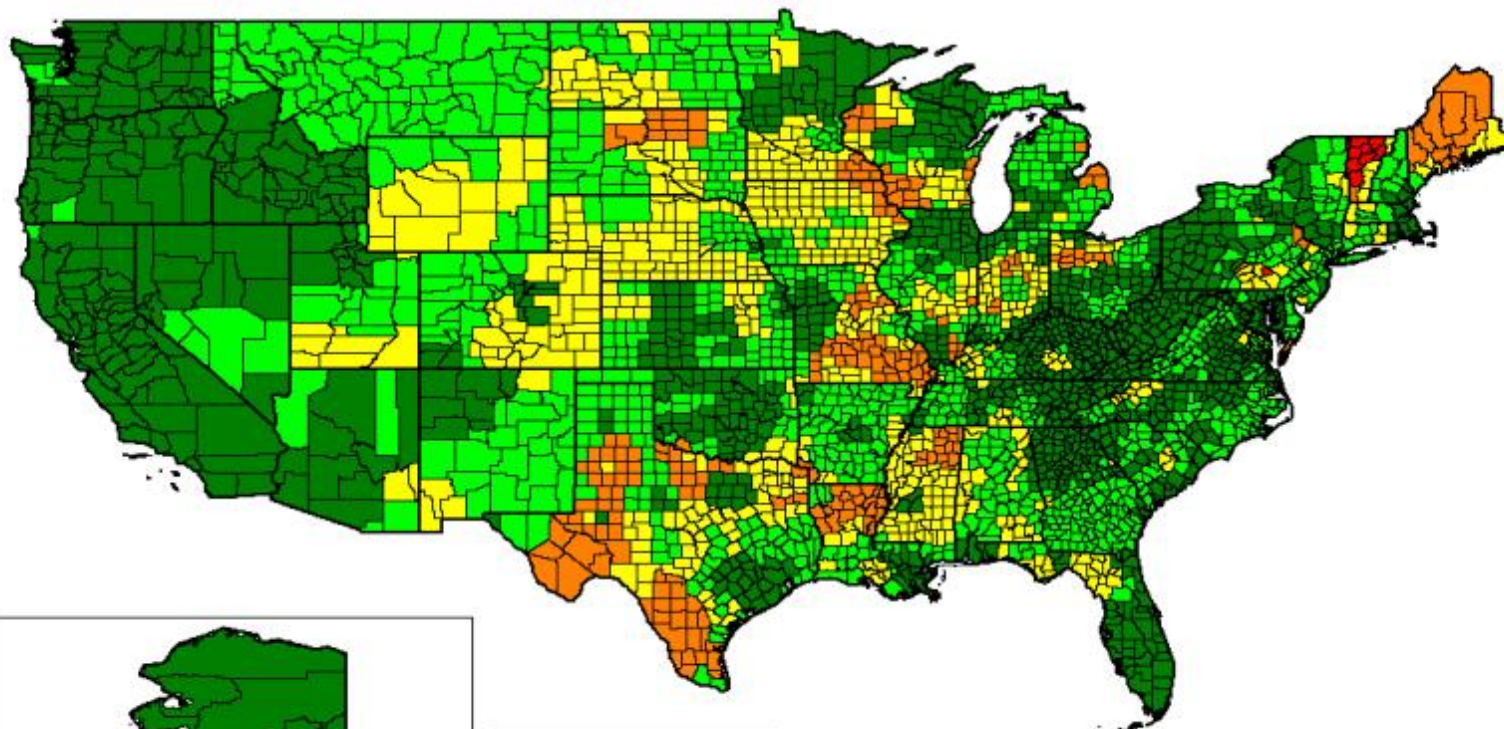
- *Even the most conservative capacity-gain assumptions show that AT&T could more than meet its demand forecast in even its most congested markets*
  - › *None of these "levers" is new or unusual or requires any technological advance*
  - › *Indeed, much of the estimated 800%+ capacity increase that we have analyzed AT&T could achieve comes from simply ending bad practices that encourage consumers to use highly inefficient devices that needlessly tax the network*

Deploy: AT&T's Unused Spectrum

AT&T Spectrum Warehouse

Mobile Spectrum that AT&T Owned, but Chose Not to Deploy for Mobile Services in the U.S. at time of Takeover

Legend:
- Greater than 40 MHz
- 31 MHz to 40 MHz
- 21 MHz to 30 MHz
- 11 MHz to 20 MHz
- Up to 10 MHz
- None

Use: AT&T's Underused Spectrum

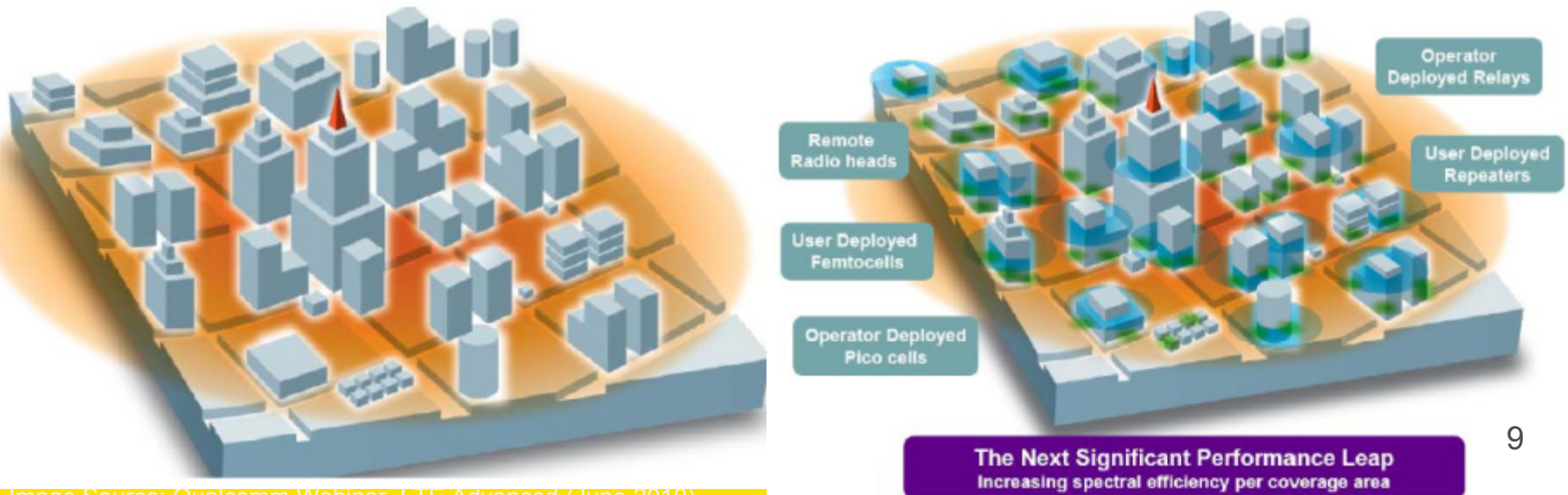Image Source: AT&T Website (June 24, 2011)

- *AT&T continues to saddle some of its most-prized, highest-value spectrum with the oldest, least efficient technology.*

- *AT&T has three basic technology choices: GSM, HSPA, and LTE.*
  - > *GSM/EDGE is roughly only one-sixth as efficient as HSPA.*
  - > *HSPA is only one-half as efficient as LTE.*
  - > *AT&T has slow-rolled its deployment of hyper-efficient LTE technology that it still has yet to deploy, and, perversely, AT&T has continued to subsidize inefficient GSM handsets.*
  - > *These are not the actions of a spectrum-constrained carrier.*

- *AT&T sells and subsidizes highly inefficient GSM-only phones to both pre-paid and post-paid customers.*
  - › *GSM-only models include: Samsung SGH-a107, Samsung SGH-1197, AT&T R225, and the LG Prime GoPhone.*
  - › *For $9.99 or less a customer can get a Samsung SGH-a107 GSM only phone, and pay as little as $2 per day for voice and SMS service, only on the days when they actually make calls.*

- *Migrating users is a matter of routine operation for mobile network operators worldwide and one of the fastest, most cost effective means of improving capacity.*
  - - *Even AT&T has successfully migrated users before: when AT&T decided to migrate customers from its TDMA network to GSM, it was able to move approximately 9% of that subscriber base in just one quarter.*

Invest: Build Smarter Infrastructure

- *AT&T should add more sectors – a technique used extensively by mobile network operators worldwide over the last 15 years that is immediately applicable to GSM and WCDMA networks*

- *AT&T should build more macrocell sites and – more important – invest in a mix of microcells, picocells, femtocells and similar technologies – a "heterogenous network" that alone promises 250%+ capacity increases*

- *AT&T should invest in more WiFi hotspots and in-building systems that would allow AT&T to offload a substantial amount of data traffic onto WiFi networks*

- *AT&T's claim that these infrastructure investments as well as tower- or RAN-sharing, which carriers have implemented successfully the world over, would require more expense, complexity, or time than a large scale network integration strained credulity.*

Operator Deployed Relays
Remote Radio heads
User Deployed Repeaters
User Deployed Femtocells
Operator Deployed Pico cells

The Next Significant Performance Leap
Increasing spectral efficiency per coverage area

Sprint's Plan: Deploy, Use, Invest

Sprint's $5 B+ Network Vision deploys unused PCS G Block spectrum and, more importantly, installs multimode equipment at every tower that can support any and all frequencies

Today
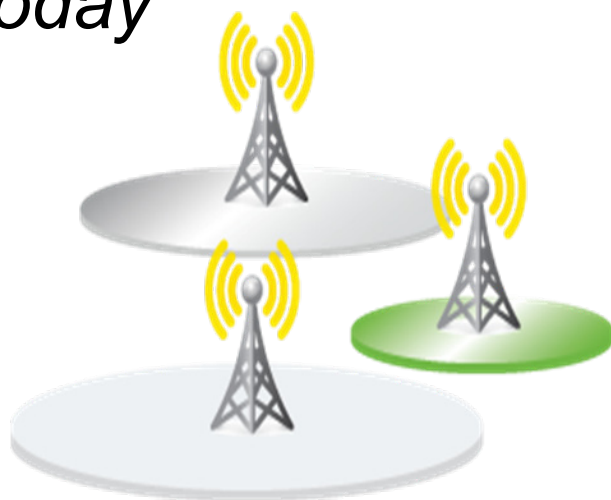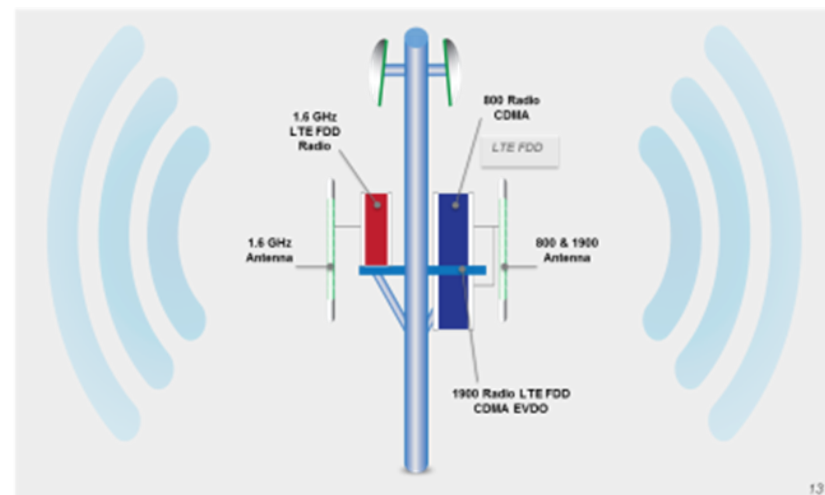
Three networks, with distinct technology and spectrums

Tomorrow

Multiple technologies operate on the Sprint network:
- *4G - LTE*
- *3G*
- *Sprint Direct Connect*

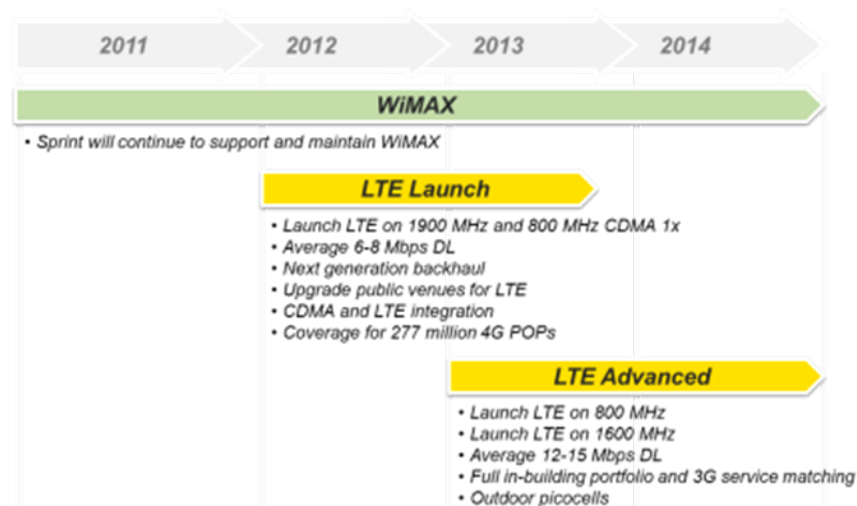**Unified networks, spectrums support any protocol / purpose**

Use a Multimodal Site Strategy

Individual 3G & 4G BTS Today

CDMA

4G

Multimodal BTS 3G/4G Combined

BTS – Base Transceiver Station

1.6 GHz LTE FDD Radio
800 Radio CDMA
LTE FDD
1.6 GHz Antenna
800 & 1900 Antenna
1900 Radio LTE FDD CDMA EVDO
13

2011	2012	2013	2014

WiMAX

• Sprint will continue to support and maintain WiMAX

LTE Launch

• Launch LTE on 1900 MHz and 800 MHz CDMA 1x
• Average 6-8 Mbps DL
• Next generation backhaul
• Upgrade public venues for LTE
• CDMA and LTE integration
• Coverage for 277 million 4G POPs

LTE Advanced

• Launch LTE on 800 MHz
• Launch LTE on 1600 MHz
• Average 12-15 Mbps DL
• Full in-building portfolio and 3G service matching
• Outdoor picocells

Invest in Small Cells

Sprint ›

Home FemtoCell Applications

Low power, Desktop device, Home ISP network

- ❑ 2007 initial launch
- ❑ More than 500k deployed
- ❑ Expected to surpass 1M by 2013

Enterprise FemtoCell Applications

Low/Med power, Wall mount, Enterprise ISP

- ❑ Successful Beta Program
- ❑ Launch in November 2011.
- ❑ Yearly deployments in the thousands.

Indoor PicoCell Applications

Med/High power, carrier provided backhaul

- ❑ Wimax deployed 2011
- ❑ LTE coming in 2012

Outdoor PicoCell Applications

High power, carrier provided backhaul

- ❑ Wimax deployed 2011
- ❑ LTE coming in 2012

5-C's of Small Cells Opportunities:

- ❑ *Coverage Benefits*: traditional macro systems aren't enough

- ❑ *Cost Reduction*: operators must do more with less

- ❑ *Customer Satisfaction:* consumers demand high voice and data performance

- ❑ *Conservation:* Lower power consumption and extended handset battery life is eco-friendly

- ❑ *Capacity:* Targeted capacity where the user demands it.

Challenges Remain

Sprint

Significant advances with small cells, but more progress is needed

❑ *Technology*

- *Cost of small cell devices must continue to be reduced to drive large scale adoption*
- *GPS location is challenging in many indoor environments*
- *Need to accelerate the movement to IP networks to simplify core development*
- *Continued improvement in LTE interference management to allow for the reuse of spectrum*

❑ *Scalability*

- *Business model still has maturity to achieve*
- *Must realize true vendor interoperability and consumer choice*
- *Simplification of core network integration*

❑ *Deployment*

- *Building access rights for public venues and for external coverage*
- *Availability, price and flexibility of backhaul sharing*
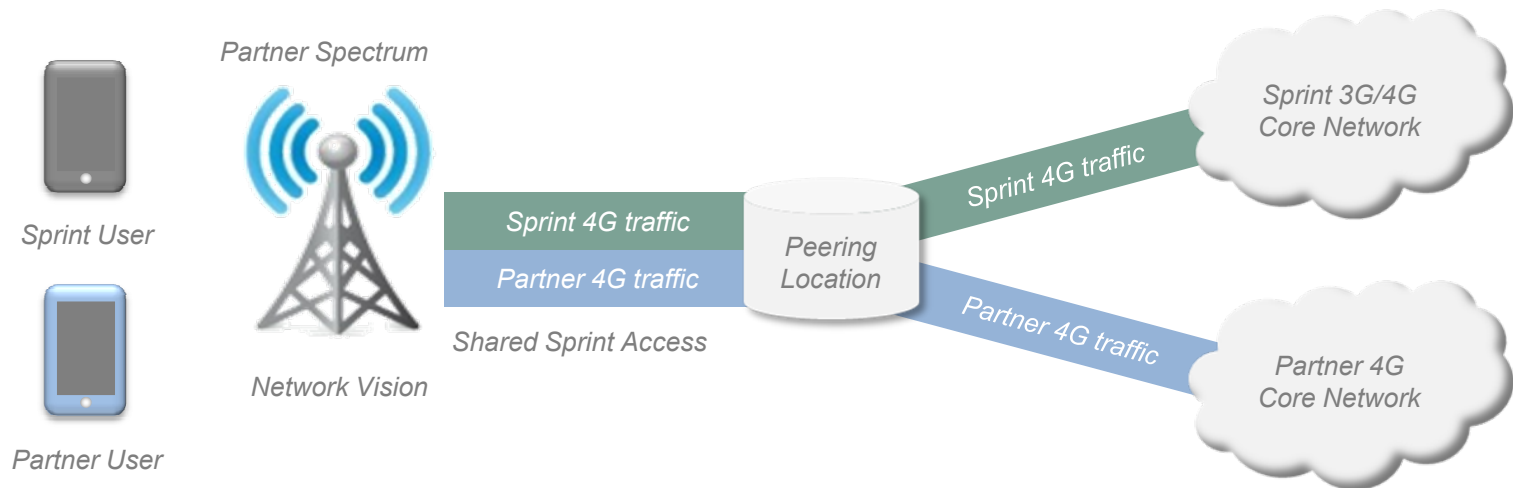- *Evolution of Network sharing concepts on a wide scale basis*

Sprint's Hosting Plans

Sprint

Network Partner

- Spectrum is owned by Partner, leased to Sprint

- Sprint is responsible for building, operating, and managing the network under a spectrum hosting arrangement

- Both Sprint and Partner share in improved economics and scale of the network

Proposed Small Cell Strategy

- Sprint and other carriers can share a common equipment infrastructure to increase deployment scale.

- Sprint owned and managed spectrum is deployed within the common infrastructure extending the value and utilization of the existing spectrum.

- Flexible building access and backhaul sharing costs arrangements are required.

Partner Spectrum

Sprint User

Partner User

Network Vision

Sprint 4G traffic

Partner 4G traffic

Shared Sprint Access

Peering Location

Sprint 4G traffic

Partner 4G traffic

Sprint 3G/4G Core Network

Partner 4G Core Network

Sprint will continue to look for opportunities to develop technology.