Americas Summit

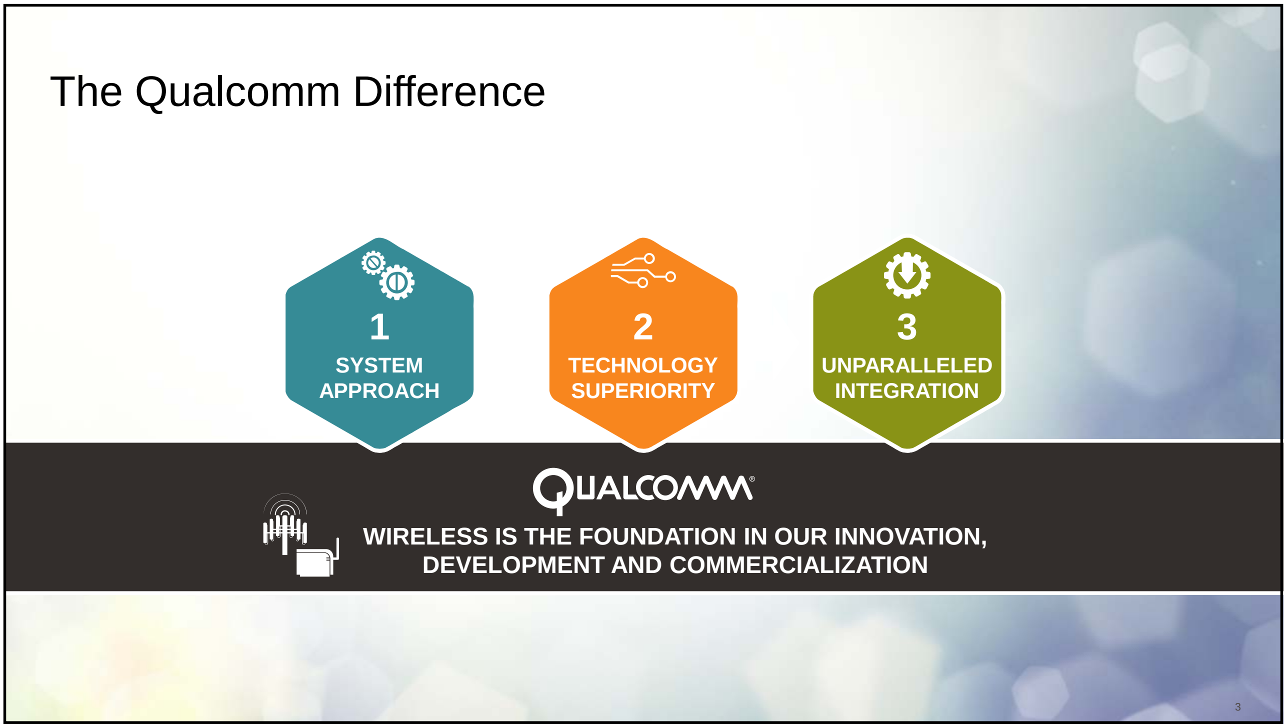
Our Wireless Advantage

Wireless is The Foundation in Innovation, Development and Commercialization

RAJESH PANKAJ,
Senior Vice President, Engineering

The Fundamental Reason to Buy Smart Devices?

SEAMLESS MOBILE CONNECTIVITY



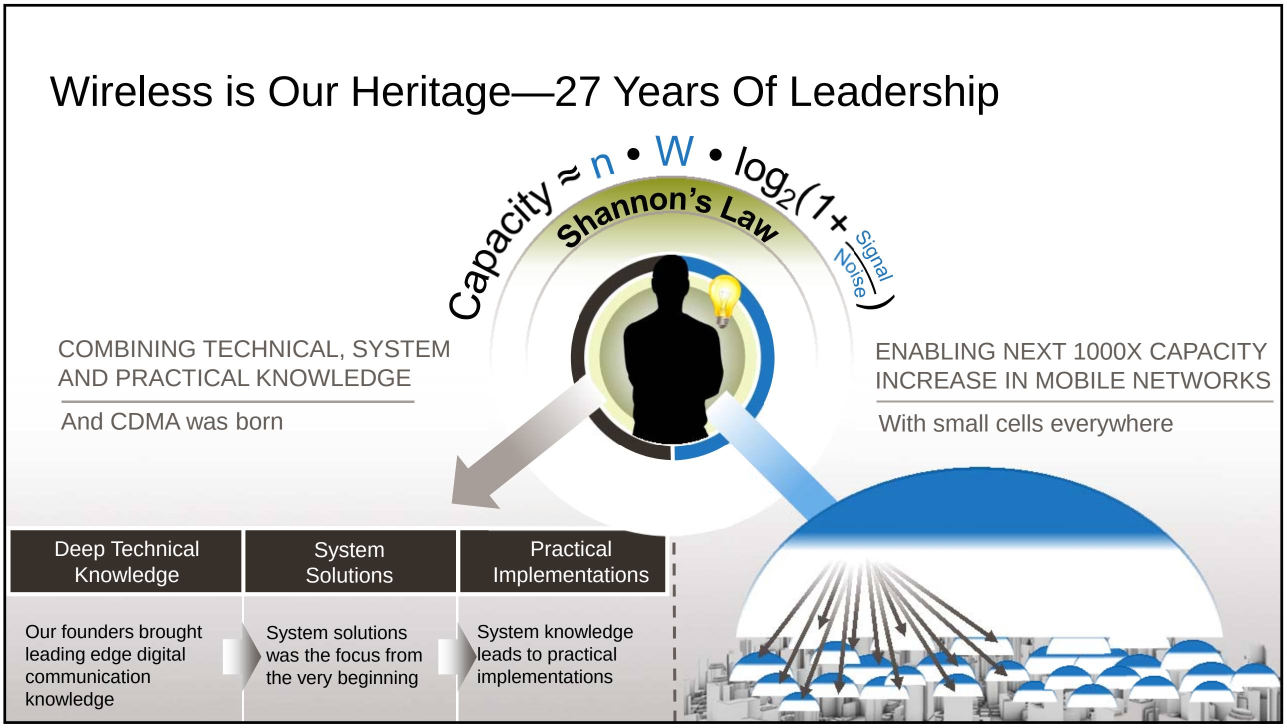
The Qualcomm Difference

1
SYSTEM APPROACH

2
TECHNOLOGY SUPERIORITY

3
UNPARALLELED INTEGRATION

WIRELESS IS THE FOUNDATION IN OUR INNOVATION, DEVELOPMENT AND COMMERCIALIZATION



Wireless is Our Heritage—27 Years Of Leadership

$$\text{Capacity} \approx n \bullet W \bullet \log_2\left(1+\frac{\text{Signal}}{\text{Noise}}\right)$$

Shannon's Law

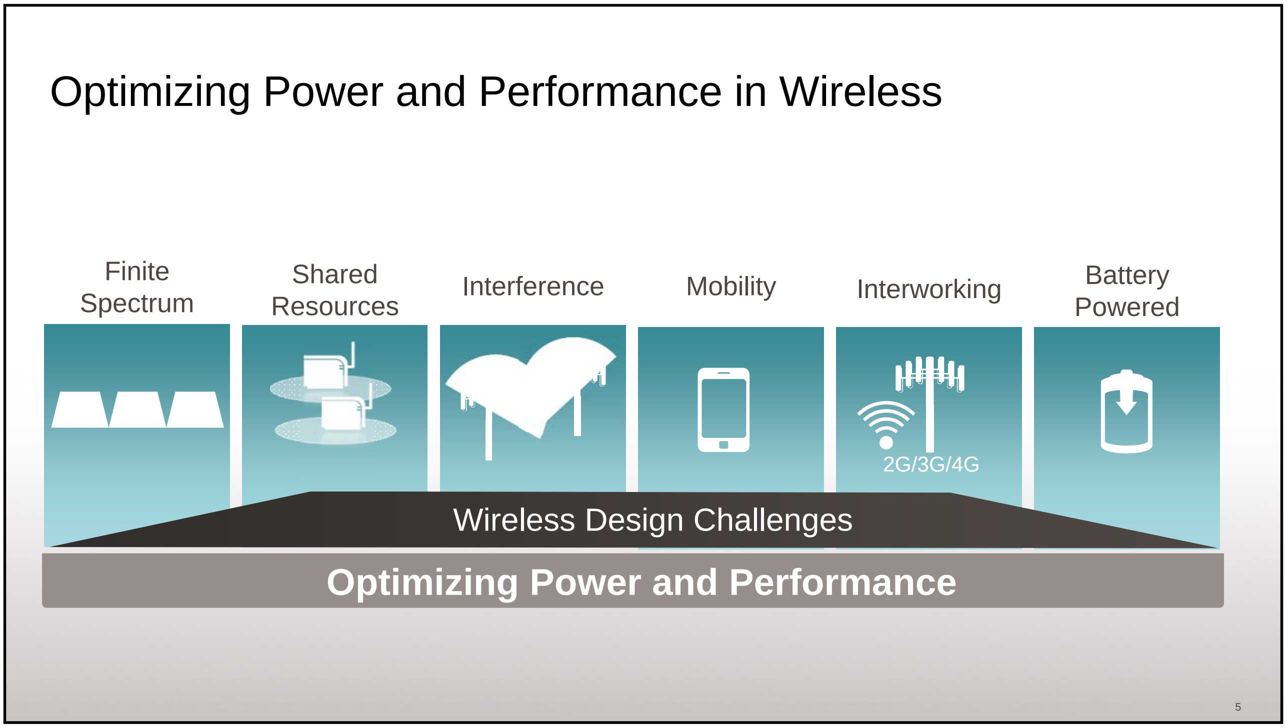
COMBINING TECHNICAL, SYSTEM AND PRACTICAL KNOWLEDGE

And CDMA was born

ENABLING NEXT 1000X CAPACITY INCREASE IN MOBILE NETWORKS

With small cells everywhere

Deep Technical Knowledge	System Solutions	Practical Implementations
Our founders brought leading edge digital communication knowledge	System solutions was the focus from the very beginning	System knowledge leads to practical implementations



Optimizing Power and Performance in Wireless

Finite Spectrum

Shared Resources

Interference

Mobility

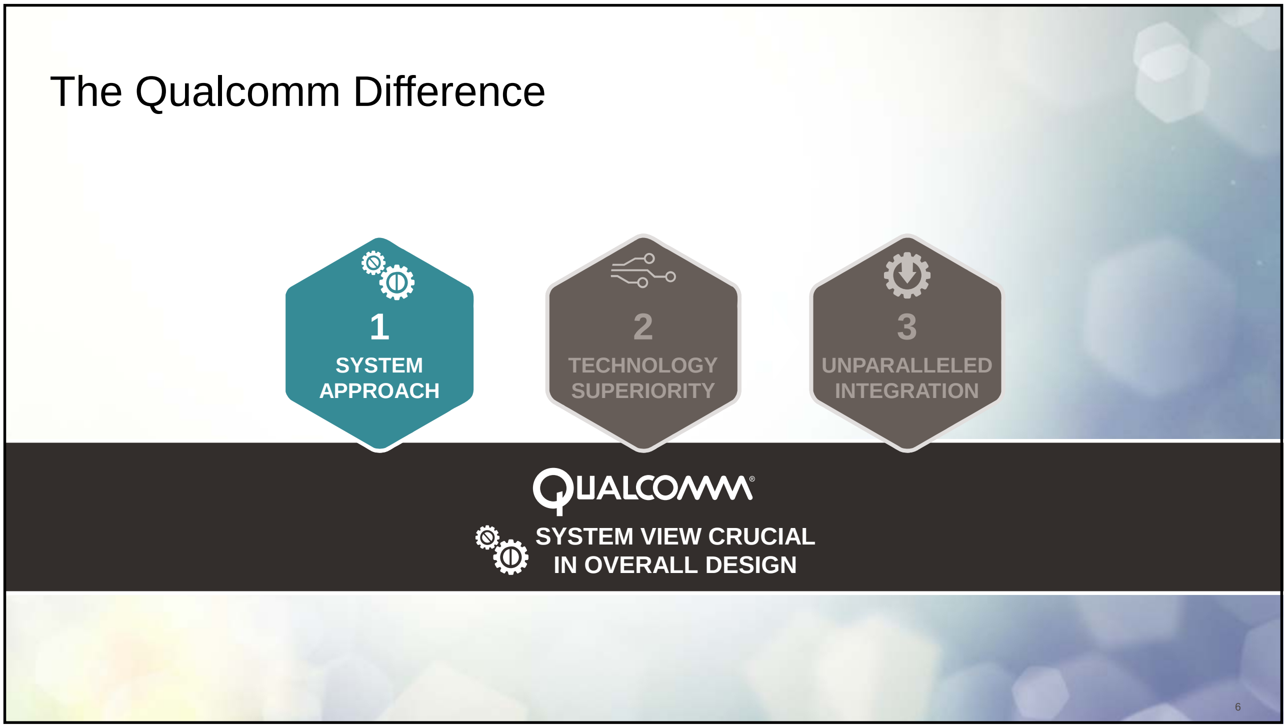
Interworking

2G/3G/4G

Battery Powered

Wireless Design Challenges

Optimizing Power and Performance



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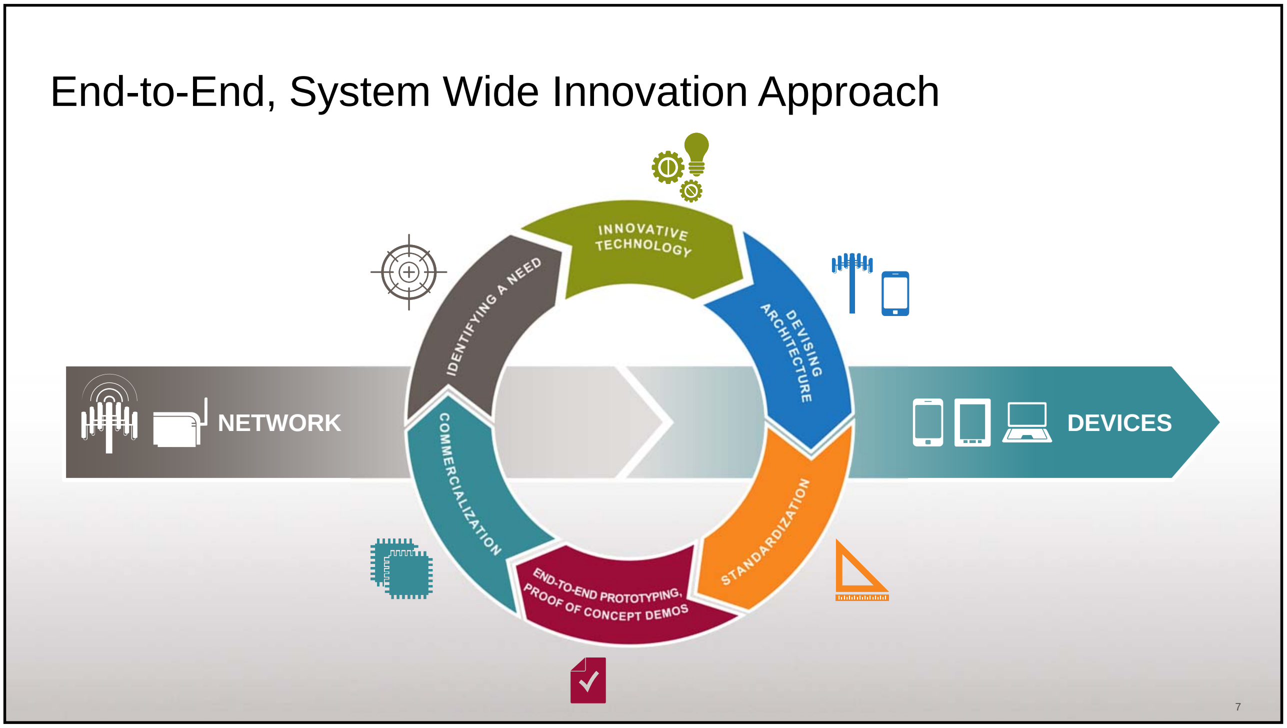
SYSTEM VIEW CRUCIAL
IN OVERALL DESIGN



End-to-End, System Wide Innovation Approach

INNOVATIVE TECHNOLOGY

DEVISING ARCHITECTURE

STANDARDIZATION

END-TO-END PROTOTYPING, PROOF OF CONCEPT DEMOS

COMMERCIALIZATION

IDENTIFYING A NEED

NETWORK

DEVICES

7

Example: Pioneering LTE Advanced HetNets

Early LTE Advanced Definition

Today

STANDARDS LEADERSHIP

- Instrumental in driving HetNets (eICIC/IC)
- Major contributor for ITU IMT-Advanced submission

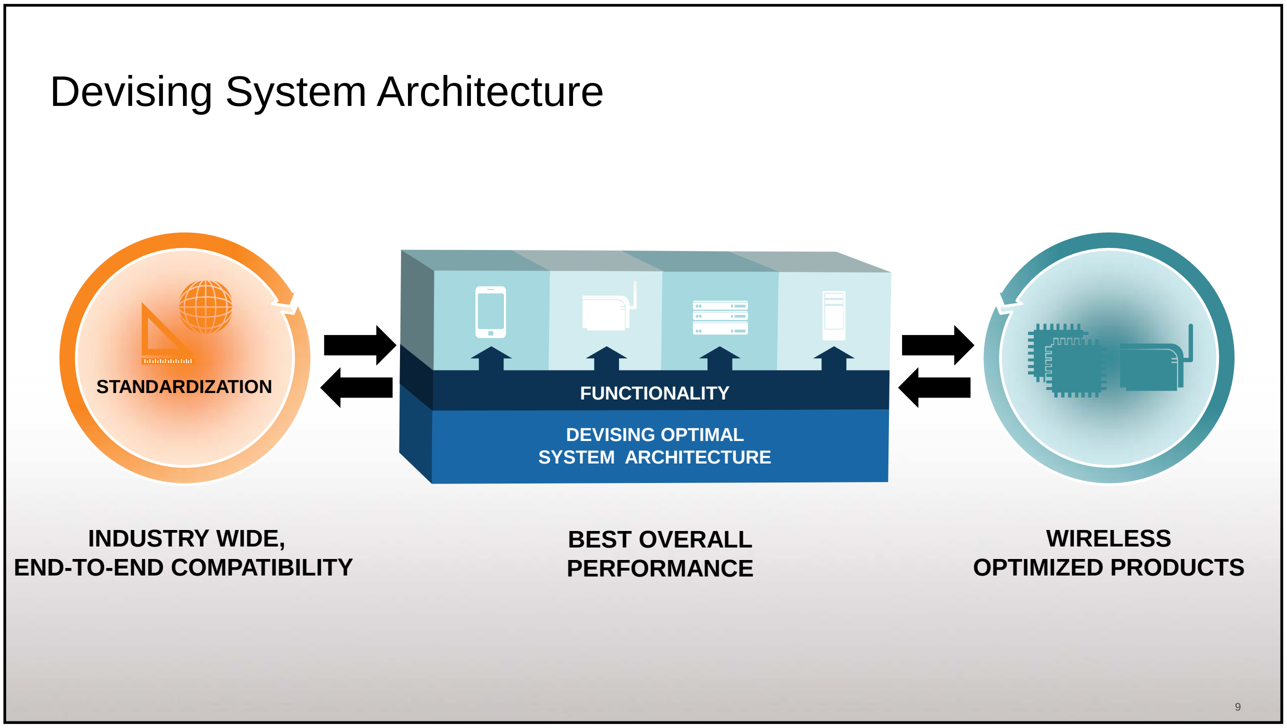
INDUSTRY-FIRST HETNETS DEMOS

- MWC 2011: Live Demo
- MWC 2012: Live, Over-The-Air Mobility

Industry was buzzing around 1Gbps peak rate

But we promoted HetNets enhancements
(Such as CEO Paul Jacobs 2008 MWC talk)

Everyone is talking about small cells and HetNets



Devising System Architecture

STANDARDIZATION

FUNCTIONALITY

DEVISING OPTIMAL
SYSTEM ARCHITECTURE

INDUSTRY WIDE,
END-TO-END COMPATIBILITY

BEST OVERALL
PERFORMANCE

WIRELESS
OPTIMIZED PRODUCTS

Standards Leadership

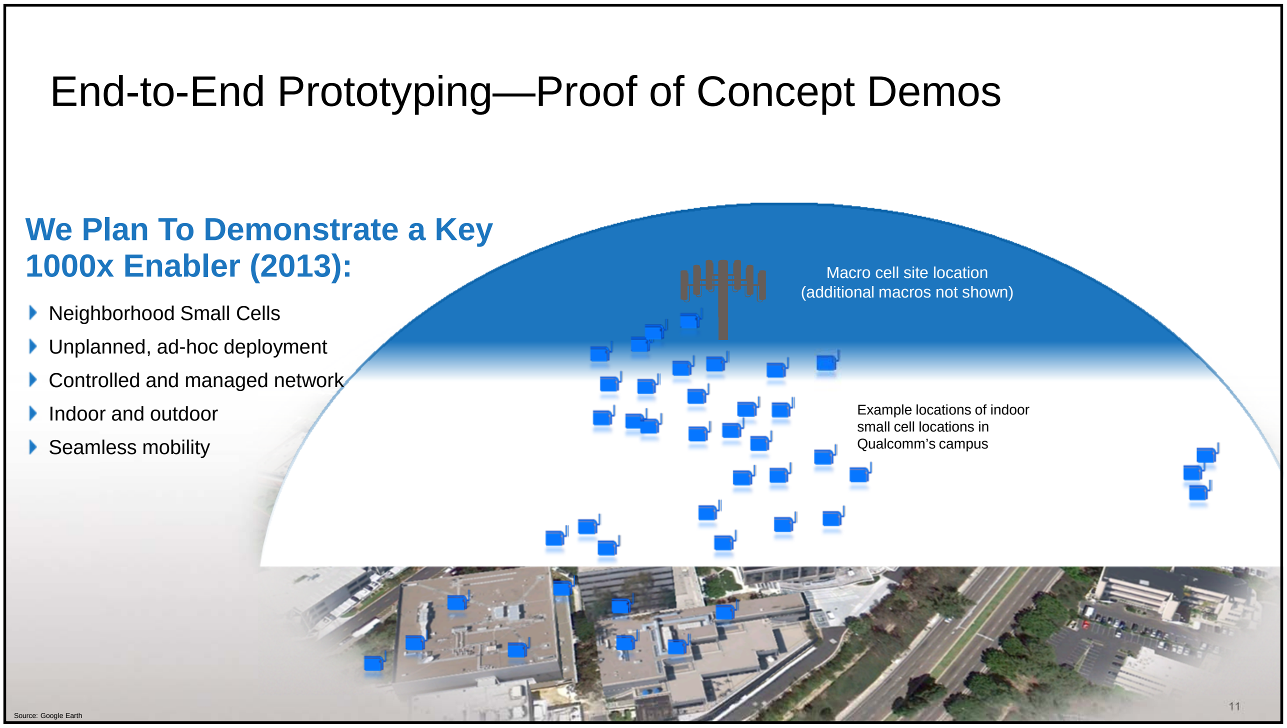
Driving Industry Adoption
Standards are the vehicle for industry adoption

Driving Interoperability
Complex wireless system requires standards

+110
ADDITIONAL ORGANIZATIONAL MEMBERSHIPS

Breadth and Depth
Active in standards across the whole stack: Radio, IP mobility, Multimedia, Codecs, …

Industry Wide Innovation
Innovation adopted by standards brings benefits the whole industry



End-to-End Prototyping—Proof of Concept Demos

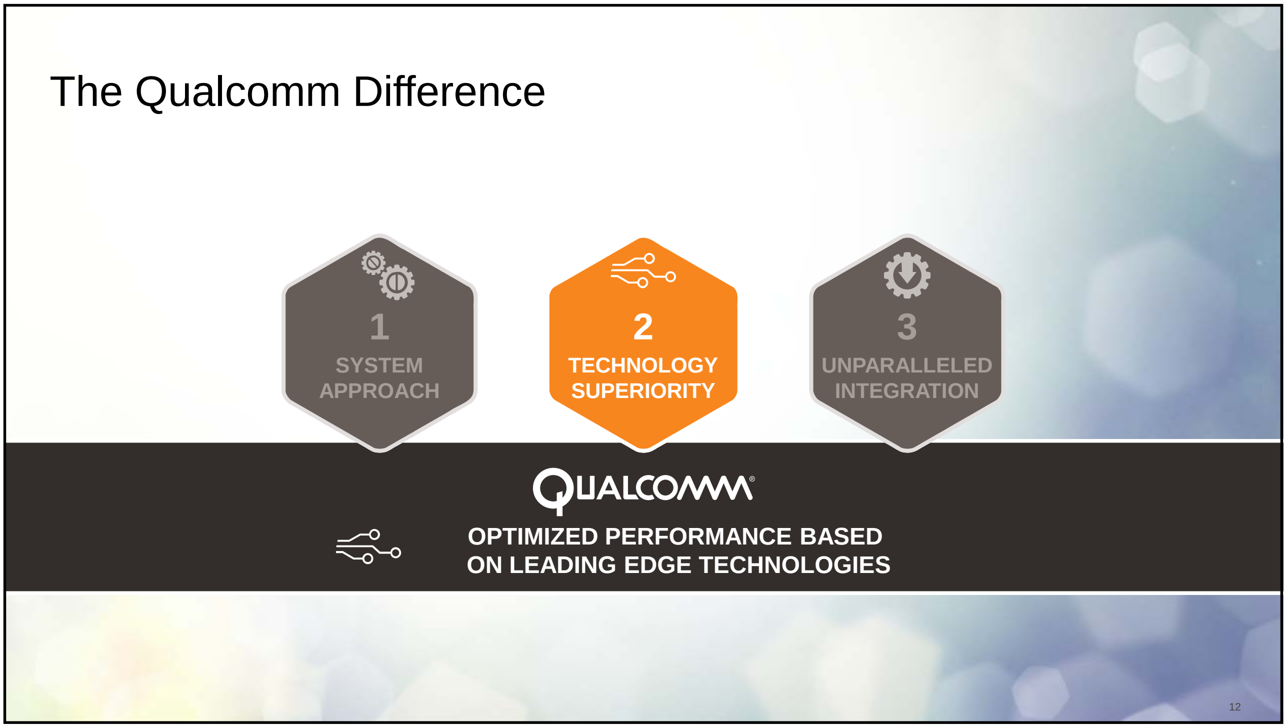
We Plan To Demonstrate a Key 1000x Enabler (2013):

- Neighborhood Small Cells
- Unplanned, ad-hoc deployment
- Controlled and managed network
- Indoor and outdoor
- Seamless mobility

Macro cell site location
(additional macros not shown)

Example locations of indoor
small cell locations in
Qualcomm's campus

Source: Google Earth



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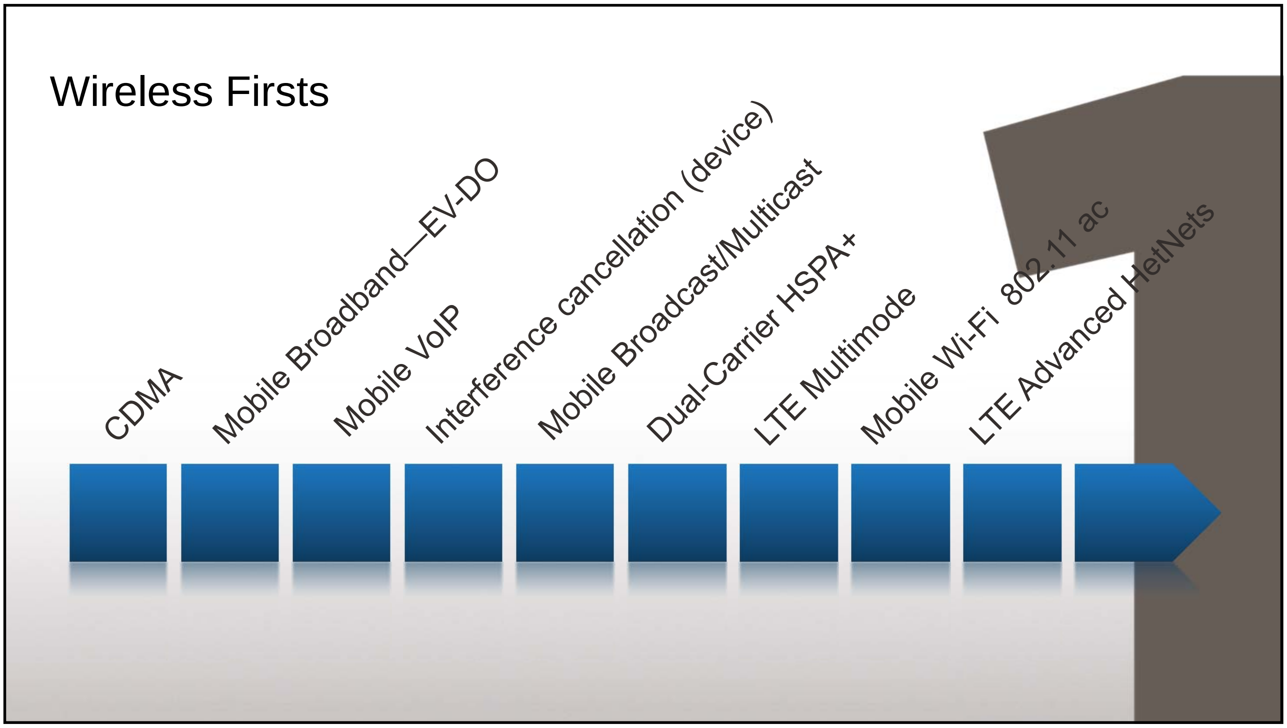
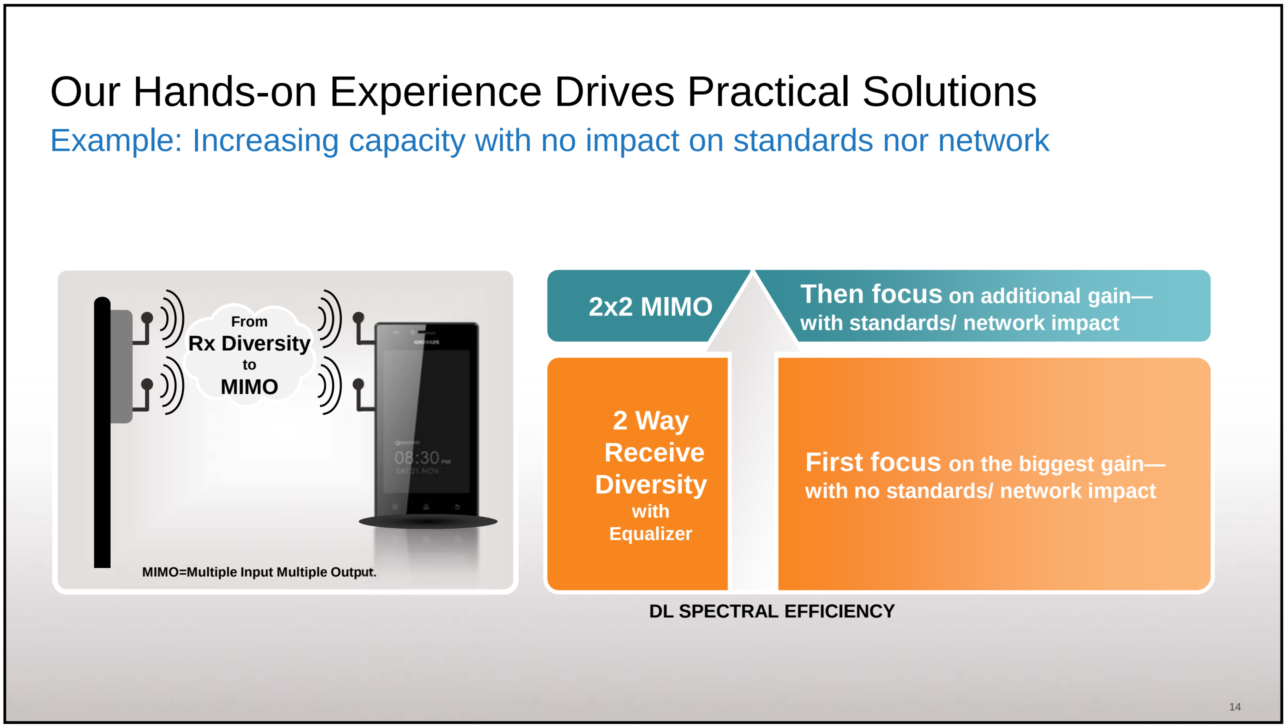
OPTIMIZED PERFORMANCE BASED ON LEADING EDGE TECHNOLOGIES



Wireless Firsts

CDMA
Mobile Broadband—EV-DO
Mobile VoIP
Interference cancellation (device)
Mobile Broadcast/Multicast
Dual-Carrier HSPA+
LTE Multimode
Mobile Wi-Fi 802.11 ac
LTE Advanced HetNets



Our Hands-on Experience Drives Practical Solutions

Example: Increasing capacity with no impact on standards nor network

From
Rx Diversity
to
MIMO

MIMO=Multiple Input Multiple Output.

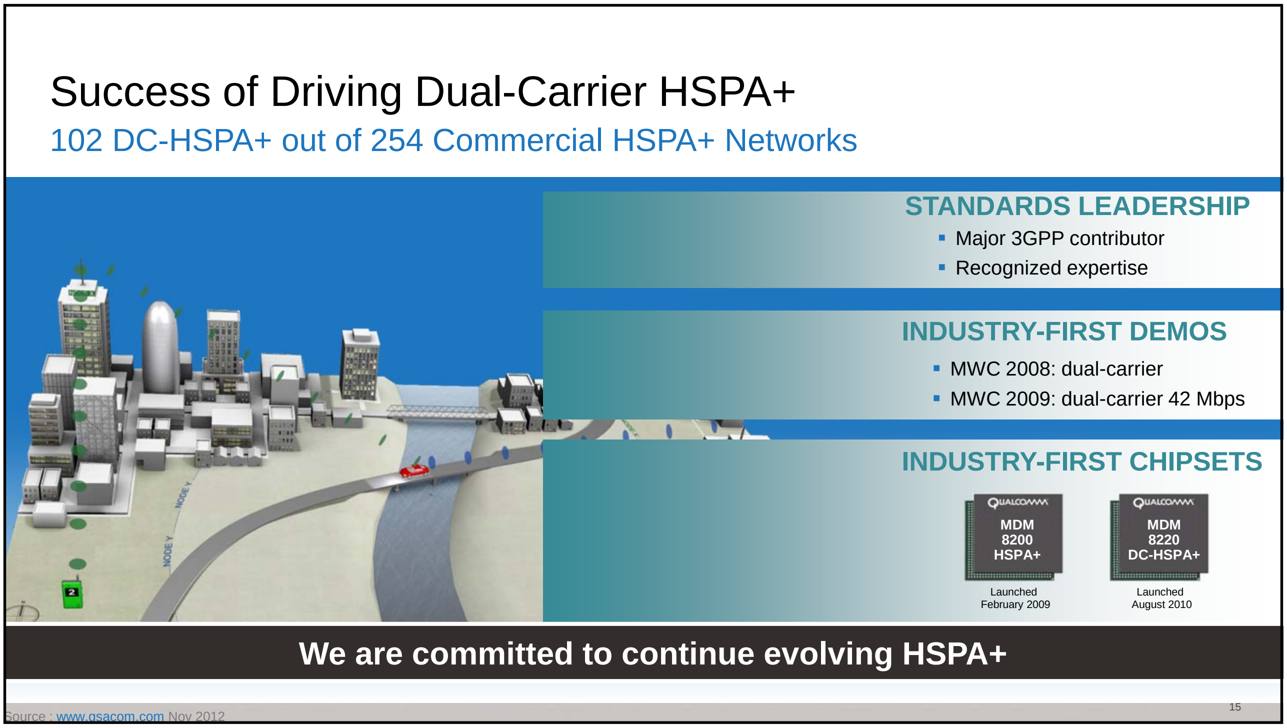
2x2 MIMO

Then focus on additional gain—
with standards/ network impact

2 Way Receive Diversity
with
Equalizer

First focus on the biggest gain—
with no standards/ network impact

DL SPECTRAL EFFICIENCY



Success of Driving Dual-Carrier HSPA+

102 DC-HSPA+ out of 254 Commercial HSPA+ Networks

STANDARDS LEADERSHIP

- Major 3GPP contributor
- Recognized expertise

INDUSTRY-FIRST DEMOS

- MWC 2008: dual-carrier
- MWC 2009: dual-carrier 42 Mbps

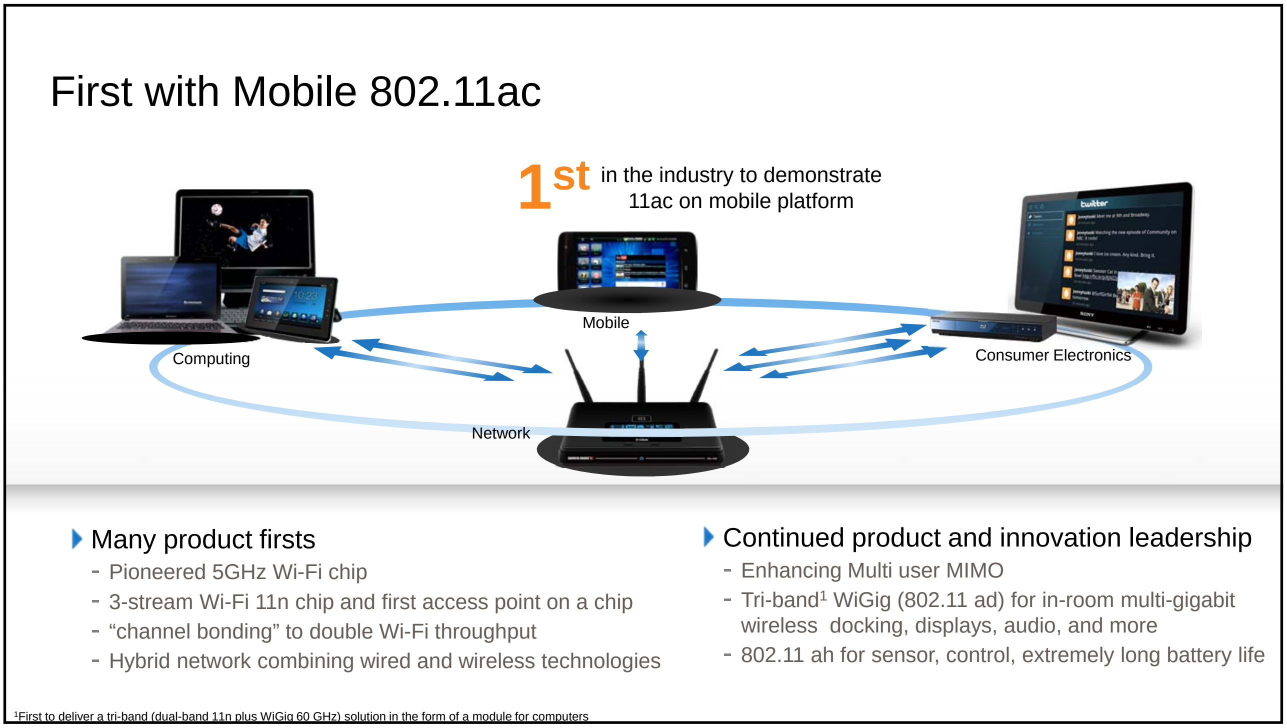
INDUSTRY-FIRST CHIPSETS

Launched February 2009

Launched August 2010

We are committed to continue evolving HSPA+

Source : www.gsacom.com Nov 2012

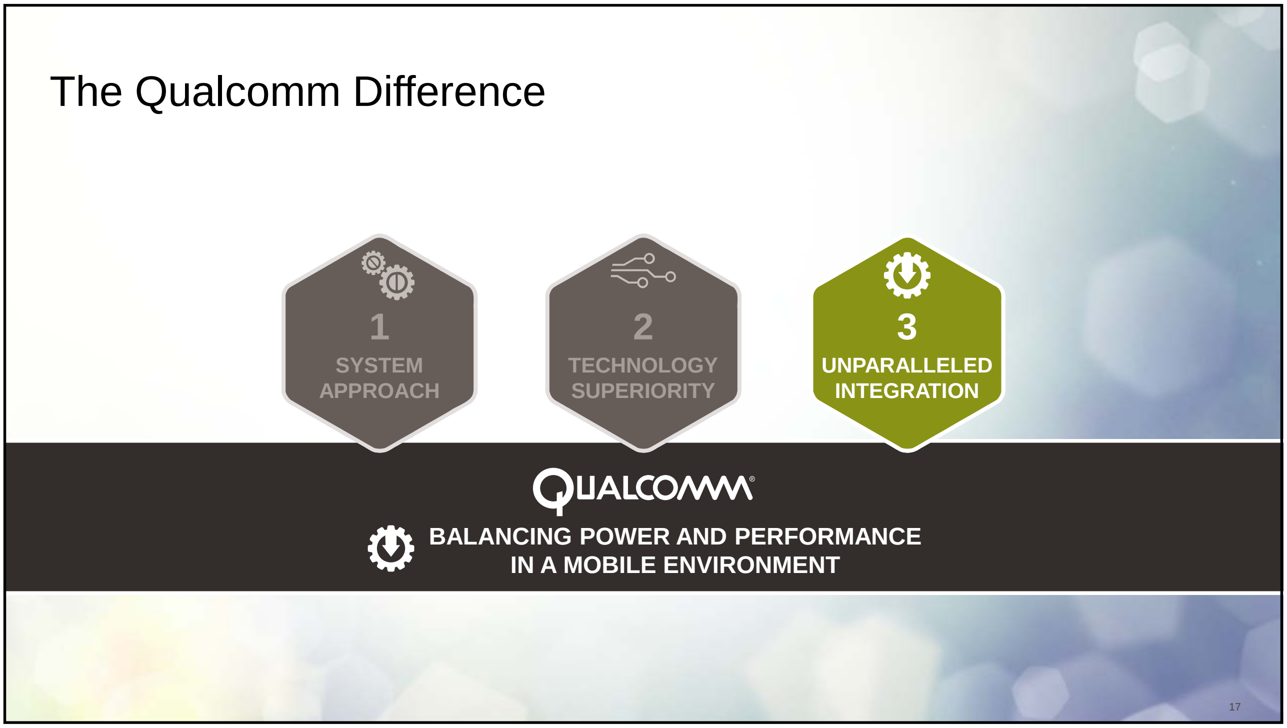


First with Mobile 802.11ac

1st in the industry to demonstrate 11ac on mobile platform

- **Many product firsts**
  - Pioneered 5GHz Wi-Fi chip
  - 3-stream Wi-Fi 11n chip and first access point on a chip
  - “channel bonding” to double Wi-Fi throughput
  - Hybrid network combining wired and wireless technologies
- **Continued product and innovation leadership**
  - Enhancing Multi user MIMO
  - Tri-band[1] WiGig (802.11 ad) for in-room multi-gigabit wireless docking, displays, audio, and more
  - 802.11 ah for sensor, control, extremely long battery life

[1] First to deliver a tri-band (dual-band 11n plus WiGig 60 GHz) solution in the form of a module for computers



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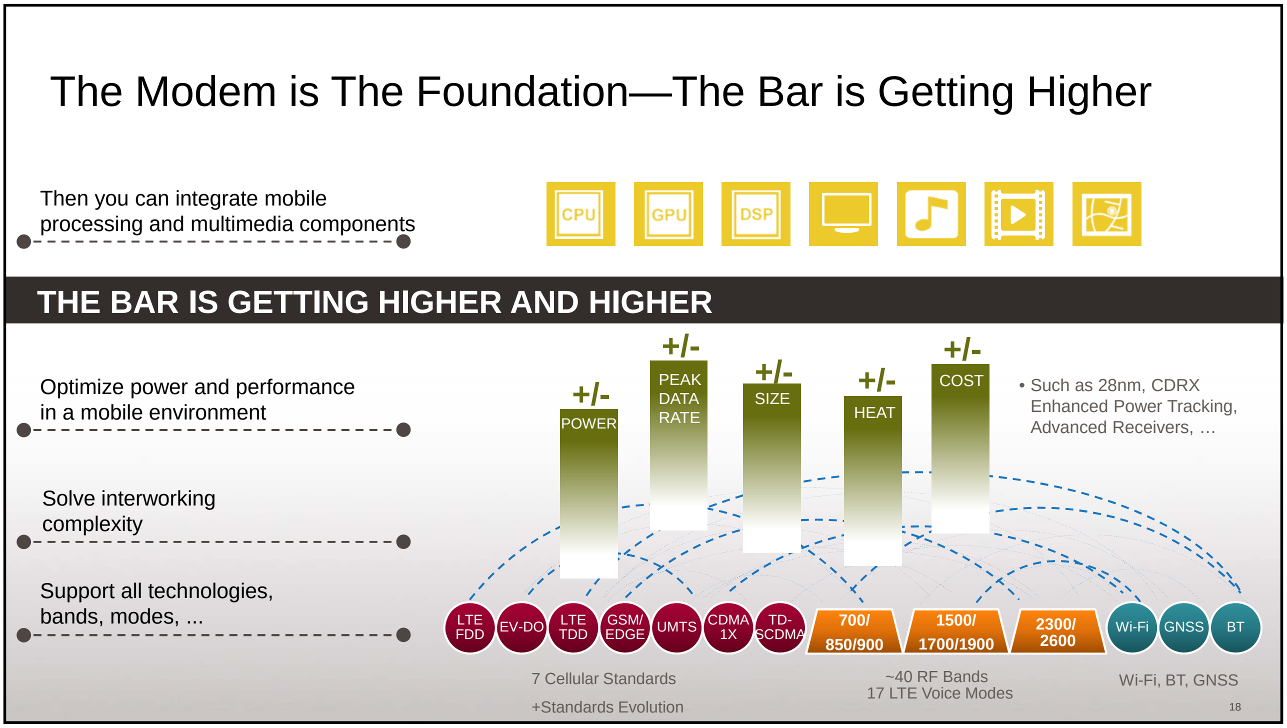
BALANCING POWER AND PERFORMANCE
IN A MOBILE ENVIRONMENT



The Modem is The Foundation—The Bar is Getting Higher

Then you can integrate mobile processing and multimedia components

THE BAR IS GETTING HIGHER AND HIGHER

Optimize power and performance in a mobile environment

Solve interworking complexity

Support all technologies, bands, modes, ...

- Such as 28nm, CDRX Enhanced Power Tracking, Advanced Receivers, …

7 Cellular Standards

+Standards Evolution

~40 RF Bands
17 LTE Voice Modes

Wi-Fi, BT, GNSS

Summary

1
SYSTEM APPROACH

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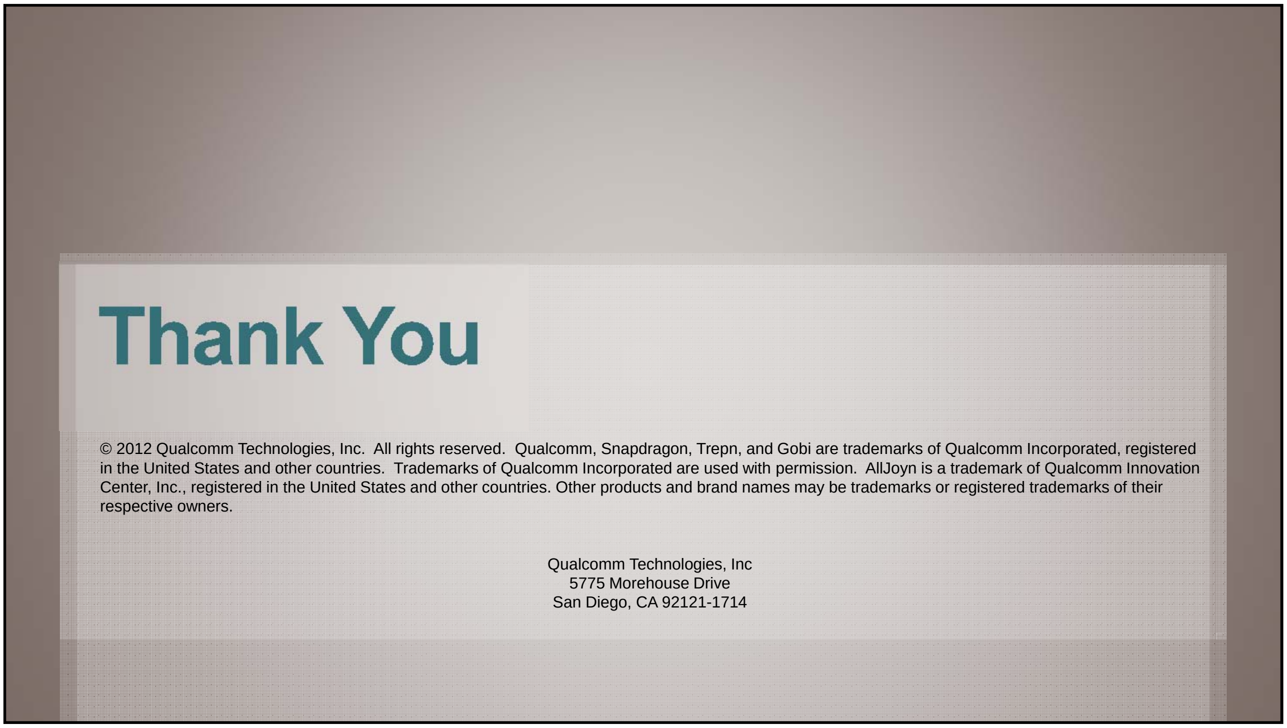
WIRELESS IS THE FOUNDATION IN OUR INNOVATION, DEVELOPMENT AND COMMERCIALIZATION



Thank You

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