Qualcomm Overview

Bill Davidson
SVP, Global Mkg & Investor Rel

Mobile: A Vibrant, Unprecedented Opportunity

$1.3T
Estimated ANNUAL REVENUE (2011)

5.9B MOBILE CONNECTIONS   #1 MOST USED DEVICE

The First Natural Wave of Growth

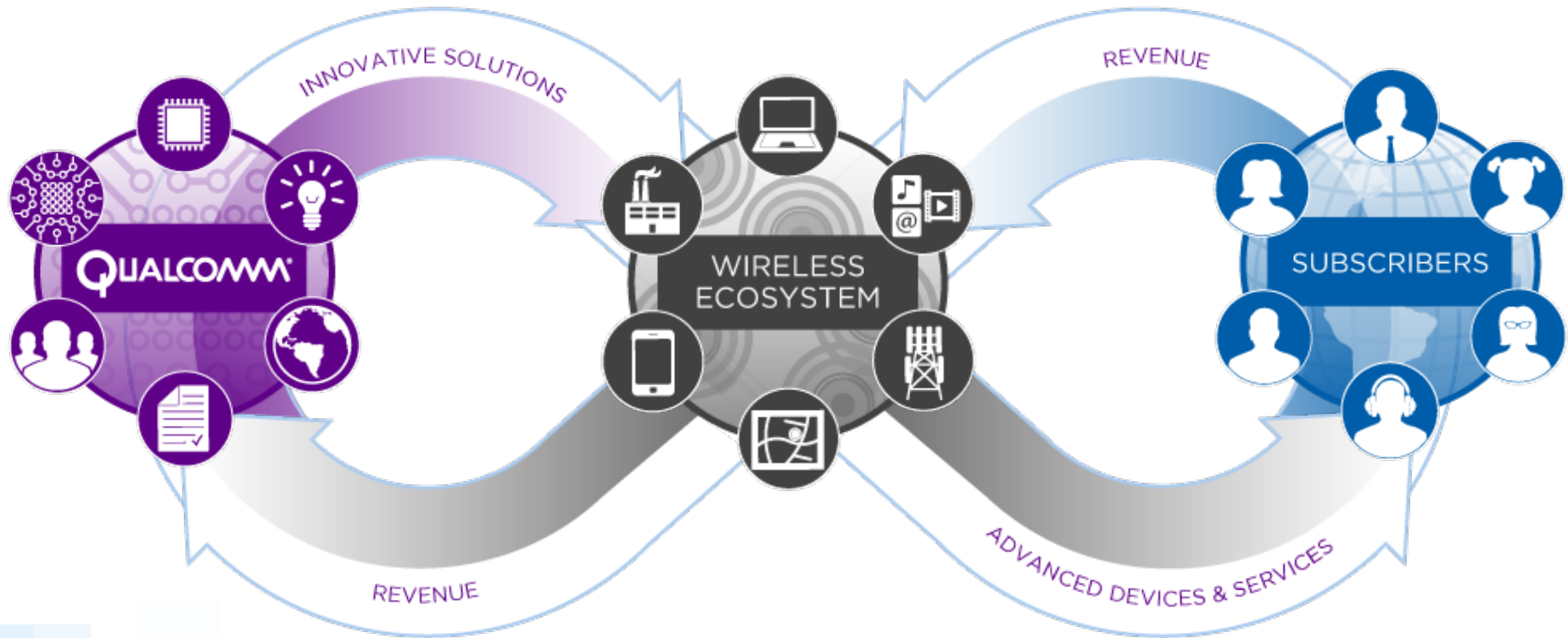MOBILE COMPUTING TAKING THE IMPACT OF THE WEB TO THE NEXT LEVEL

RETAIL

ADVERTISING

Your Ad Here

1.3T

MEDIA/ ENTERTAINMENT

NEWS

COMPUTING

Another Wave of Growth Coming

RESHAPING INDUSTRIES

RETAIL

HEALTH CARE

ENERGY

ADVERTISING

MEDIA/
ENTERTAINMENT

1.3T

BANKING/FINANCE

AUTO

COMPUTING

Well Positioned to Drive Growth

GROWTH DRIVERS FOR QUALCOMM

Smart
Phones

Non-Handset
Devices

Emerging
Regions

Advanced Network
Technologies

Connectivity

Smartphones

Consumer Demand Driving Continued Smartphone Innovation

Processing Power
(1 GHz+)

Multi-Core

High-Speed Connectivity
(HSPA+/LTE)

Graphics
(1080p, 60fps)

Significant Smartphone Growth

FASTEST IN EMERGING REGIONS

Emerging Regions	Developed Regions

~0.3B
UNITS in **2010**

Emerging Regions	Developed Regions

1B+
UNITS in **2015**

EMERGING REGIONS PROJECTED TO BE 50%+
OF SMARTPHONE SHIPMENTS IN 2015

Expanding Diversity of Affordable Smartphones

T-Mobile Comet
(~$125)

Orange Barcelona
(~$145)

Huawei Ascend II
(~$130)

Samsung Admire
(~$129)

Vodafone Smart
858 (~$110)

ZTE N600
(~$150)

Movistar Chat
(~$102)

Personal Touch
(~$100)

Huawei C8500
(~$150)

Non-Handset Devices

Expanding Mobile Broadband Opportunities

NON-HANDSET MOBILE BROADBAND DEVICE SHIPMENTS EXPECTED TO GROW AT ~40% CAGR FROM 2010–2015

Continued Data Plan Experimentation

GLOBAL WIRELESS DATA REVENUES GREW 24% YOY IN Q2 2011

DATA INCLUDED PLANS

USAGE-BASED

MULTI-DEVICE SUBSCRIPTIONS

CONTENT-SUBSIDIZED

FAMILY PLANS

AD-SPONSORED

METERED-BASED

Source: Informa (July 2011).

The Evolving Computing Opportunity

~600M

LAPTOPS AND TABLETS ESTIMATED
TO BE SOLD IN 2015

The Evolving Computing Landscape

MOBILE ARCHITECTURE DRIVES IMPROVED
USER EXPERIENCE AND FORM FACTORS

Windows 8
on ARM

SMART + INTEGRATED
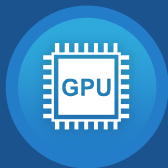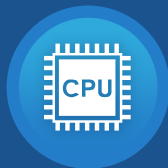
MEMS Display

Emerging Regions

Drivers for 3G Growth in Emerging Regions

Communications

Internet Access

Gaming

Social Networking

Shopping

Apps

3G NETWORK ROLLOUTS

AFFORDABLE SMARTPHONES

DATA DEMAND

~1.4B NEW 3G CONNECTIONS FORECASTED
IN EMERGING REGIONS BY 2015

Source: Wireless Intelligence (October 2011).

Advanced Network Technology Adoption

How to Meet Growing Data Demand

MOBILE DATA
TRAFFIC GREW

>2x

IN 2010

AND IS PROJECTED
TO GROW

10–12x

FROM 2010–2015

New Techniques   Network Offload   More Spectrum   Het Nets

Advanced Network Adoption Momentum

HSPA	EV-DO	LTE
152 HSPA+ Launches	**129** Rev. A Launches	**35** Launches
49 Dual-Carrier	**10** Rev. B Launches	**185** Network Commitments
35 UMTS900 Launches	**20** Rev. B Commitments	**27** LTE-TDD Trials/Demos

Sources: GSA (October 2011); CDG (October 2011).
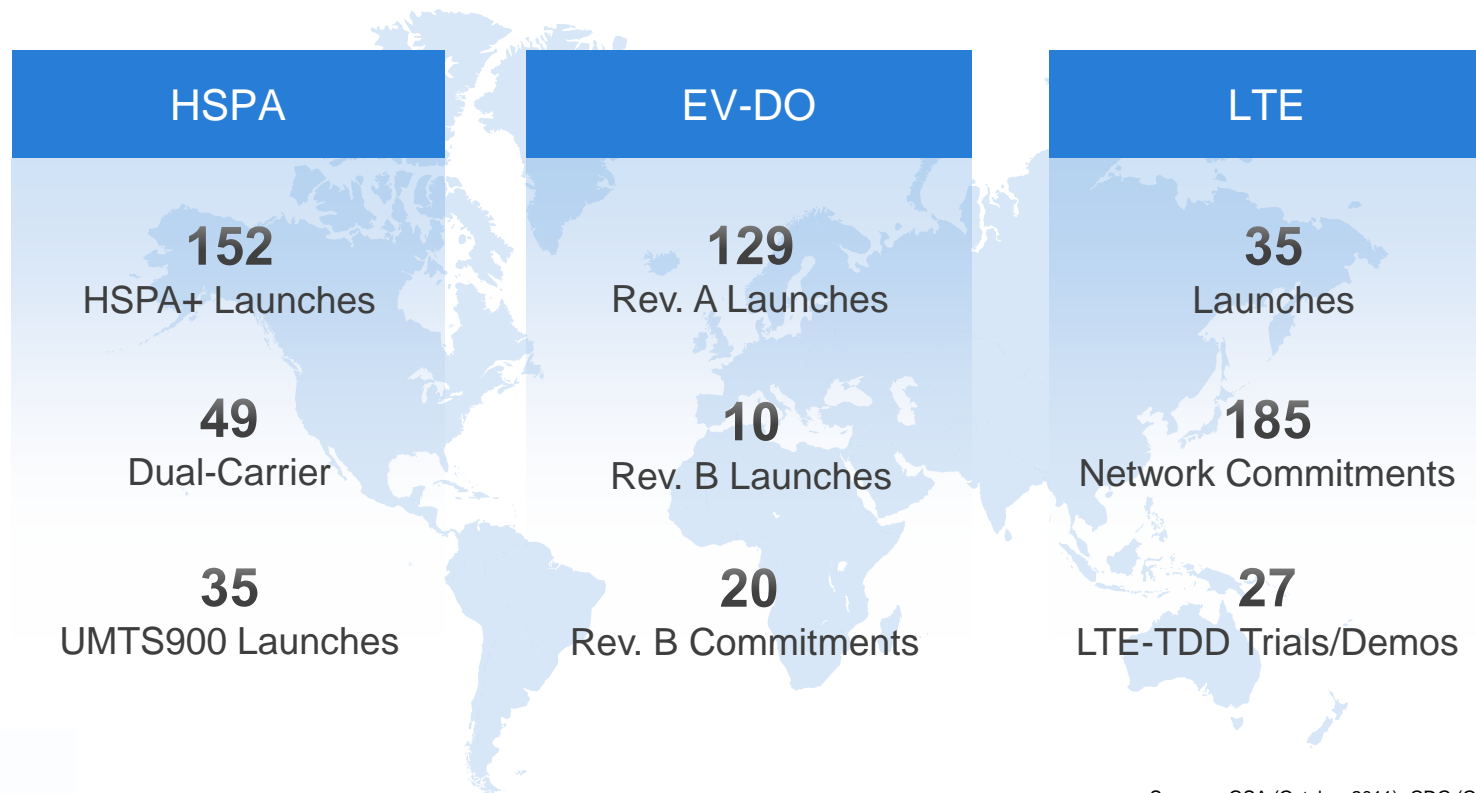
Multimode Is Critical

2G   3G   LTE   WI-FI
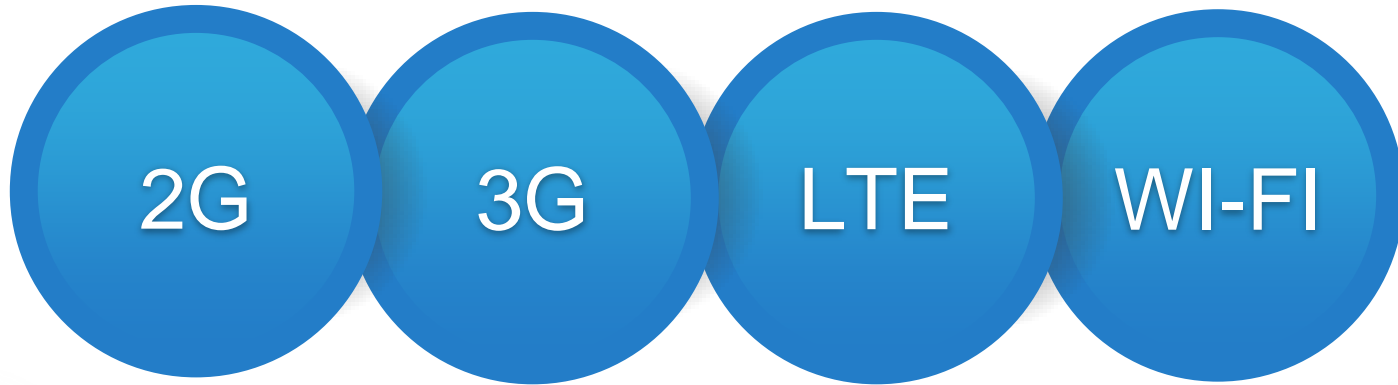
Connectivity

Multi-Radio Environment

WWAN−WLAN−PAN

Evolving Connectivity Opportunities

CONTROL
IoE: Smart Energy
Smart Home M2M

CONSUME
Access Media,
Content, and
Services Everywhere

CONNECT
Communications,
Email, Browse, Chat

Enabling an Internet of Everything

CONNECTED HOME	CONNECTED CAR	SMART ENERGY	GROWING/EMERGING

CONNECTED HOME

Security & Home Energy Mngt.

Smart Appliances & EV Charging Station

CONNECTED CAR

Smart Car & Telematics

Aftermarket Telematics

SMART ENERGY

Smart Utilities & Smart Grid

Remote Monitoring & Control

GROWING/EMERGING

mHealth   ATM / POS

Retail & Digital Signage   Tracking & Location

Digital 6th Sense

Consumers Expect the Amazing

DRIVING THE MOBILE COMPUTING EXPERIENCE

Connectivity   SoC   Technology Enablers   IoE

QCT Products and Strategies

Rob Chandhok
SVP & Pres, QIS; Pres, QuIC

Fiscal 2011 Highlights

Fiscal 2011 Highlights

- Record revenues and operating profit
- Record MSM shipments, 483 million, up 21% YOY
- Snapdragon leadership, 300 devices and 350 in development
- Snapdragon unit sales grew faster than overall smartphone device sales
- Industry-leading, tiered 3G/LTE roadmap
- New and existing customer traction
- Strategic investments to expand opportunities
  - Mobile computing
  - Qualcomm Atheros

Source: Qualcomm data.

Leadership Position Across Businesses

MOBILE

COMPUTING

CONSUMER ELECTRONICS

NETWORKING

Feature and Smartphones

Tablets, Laptops, All-in-One PCs

Gaming, eReaders, DTV, STBs, PNDs

Switches, Routers, Gateways, PLC

Qualcomm

Atheros

Increased Snapdragon Quarterly Unit Share

SMARTPHONE AND TABLET AP UNIT SHARE

Snapdragon

Competitor A
Competitor B
Competitor C
Competitor D
All Others
Competitor E

Q1'10   Q2'10   Q3'10   Q4'10   Q1'11   Q2'11

Source: Strategy Analytics (August 2011).
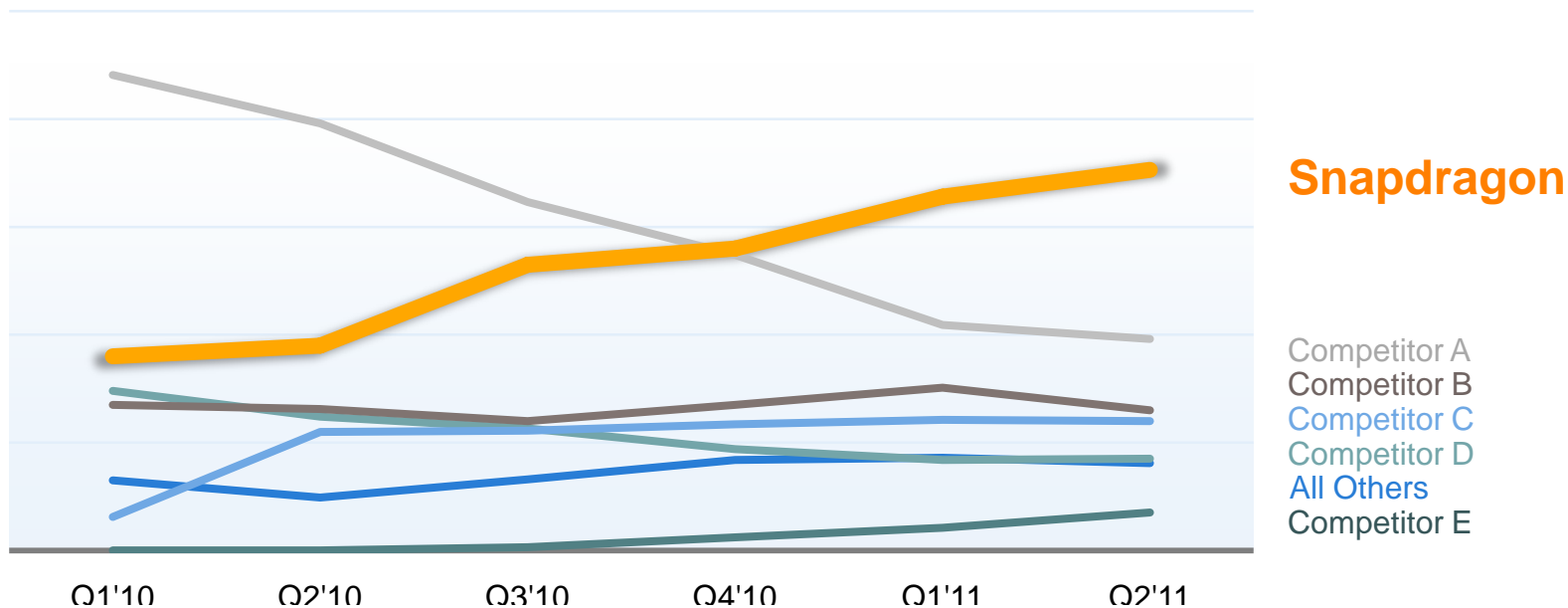
Strategy

Strategy: Enabling Smart Connected Devices

3G/4G Migration into
New Connected
Opportunities

Smartphone
Expansion into
New Mobile
Categories

Solutions for
New, Adjacent
Categories

Strategy: Enabling Smart Connected Devices

MOBILE AT THE CENTER OF THE ECOSYSTEM

Mobile Experience Becoming the Expectation in Other Device Categories

Always Connected

Always On and
Up to Date

Power Efficient

Scale

MOBILE IS THE NEW ARCHITECTURAL APPROACH

Mobile Is the New Architectural Approach

DRIVING QUALCOMM LEADERSHIP TO NEW CATEGORIES

~4x

Millions

2,500
2,000
1,500
1,000
500
-

■ Smartphone ■ PC ■ Tablet ■ Connected TV ■ Connected Gaming

MOBILE SCALE DRIVING DEVELOPER AND ECOSYSTEM MOMENTUM

Snapdragon System Spans Hardware, Software, Services, and Ecosystem Tools

ECOSYSTEM SUPPORT	Developer Hardware	Developer Software Tools	Developer Ecosystem Events and Community	Carrier-Friendly Services			

ADVANCED SOFTWARE TECHNOLOGY	Entertainment	Connectivity	Camera	Web	Natural User Interface	AllJoyn™	Augmented Reality

BROAD SUPPORT FOR HLOS

bada · BlackBerry · brew mp · Windows · Windows Phone

LEADING HARDWARE	CPUs	GPUs	3G/4G MODEMS	MEMORY	DSPs	VIDEO/ AUDIO	LOCATION AND SENSORS	WiFi BT FM	POWER MGMT	RF

Why We Are Winning

ROADMAP BREADTH AND DEPTH

SYSTEM APPROACH

INTEGRATION

TECHNOLOGY SUPERIORITY

EXECUTION, ECOSYSTEM, COLLABORATION
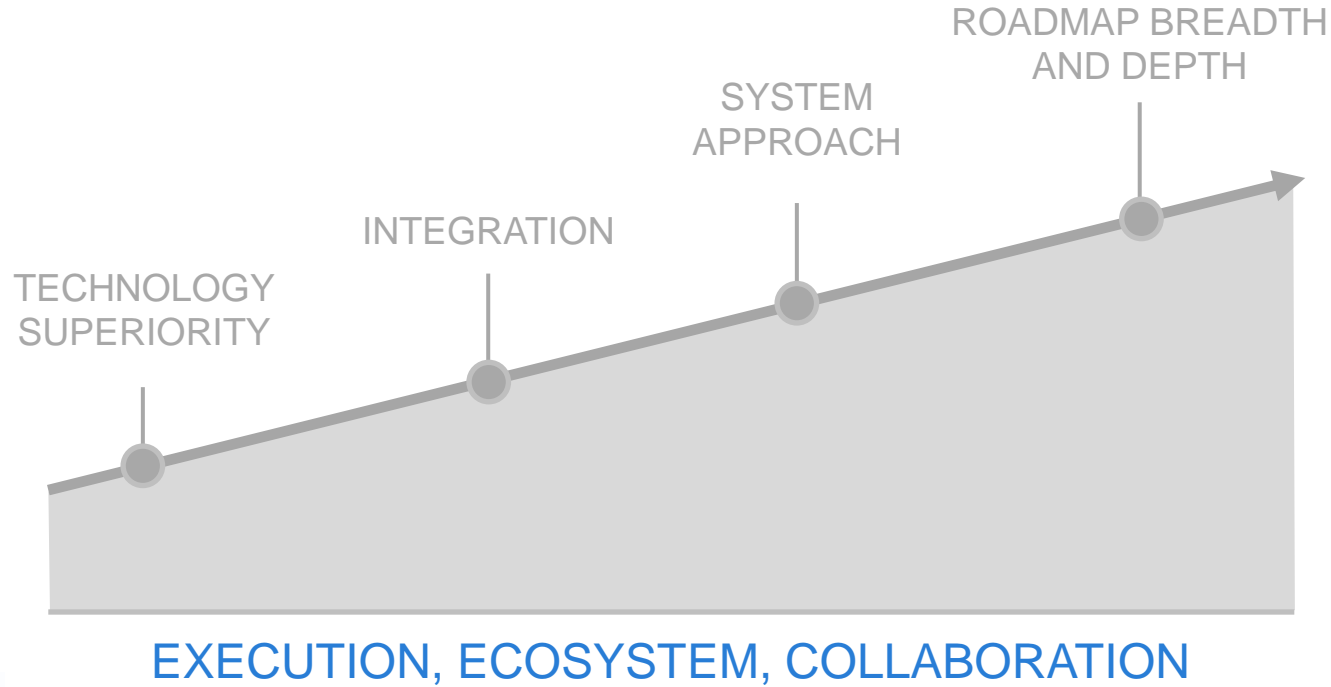
Looking Ahead

Growth Drivers

Smartphones

Emerging Regions

Non-Handset Devices

Connectivity

Advanced Network Technologies

Growth Drivers

| Smartphones | Emerging Regions | Non-Handset Devices | Connectivity | Advanced Network Technologies |

Snapdragon Supports All Device Price Tiers

2015 — Emerging Regions — Developed Regions — **1B+** UNITS

Source: Gartner (October 2011).

Growth Drivers

Smartphones

Emerging Regions

Non-Handset Devices

Connectivity

Advanced Network Technologies

Growth from China

RESULTS TO DATE

Over 15x Smartphone
Unit Sales Growth in 2011

Growing Relationship
with 75% of Top 2G Producers

POISED FOR GROWTH

- Strong roadmap
  - Integrated 3G, LTE-TDD, and TD-SCDMA
  - Snapdragon S1 reference designs

- Strong 3G growth
  - From 2G providers
  - 125M to 551M 3G subs (2010–2015)
- Preferred smartphone solution
- Increasing importance of carrier

Source: Wireless Intelligence (October 2011).

Growth Drivers

Smartphones

Emerging Regions

Non-Handset Devices

Connectivity

Advanced Network Technologies

Qualcomm Leadership in Windows 8

SMARTPHONE EXPERIENCE
COMING TO THE PC

~7x MORE EFFICIENT
THAN X86

STRONG GLOBAL
LAUNCH PARTNERS

Snapdragon Demonstration
at Microsoft Build Event

Connected Standby Demonstrated
First on Snapdragon

Sources: Qualcomm testing of mW per core using industry standard benchmark, CoreMark.

Growth Drivers

| Smartphones | Emerging Regions | Non-Handset Devices | Connectivity | Advanced Network Technologies |

Qualcomm Atheros: Enhanced Connectivity, New Channels

LOCATION
Multi-Technology Portfolio

FM
Mobile Platforms

ETHERNET
Computing, Networking, and CE

BLUETOOTH
Mobile and Computing Platforms

PLC
Home Networks, Smart Grid/Smart Home

WLAN
Built on Leading WLAN

PON
Next-Generation Broadband Access

NETWORKING
Retail, Carrier, Enterprise, M2M

COMPUTING
Tablets, Notebooks, Desktops, All-in-One PCs

CONSUMER ELECTRONICS
Mobile and Fixed CE, Automotive/PNDs

Atheros Acquisition:
Driving Growth, New Opportunities

INTEGRATION PROGRESSING VERY WELL, ON PLAN

CROSS-SELL MOBILE AND CE

DRIVE CONNECTED HOME AND NETWORKING

DELIVER INTERNET OF EVERYTHING

Great Start Selling More Connectivity into Mobile and Consumer Platforms

Qualcomm Mobile Architectures into Home and Enterprise Channels; End-to-End Platforms

Low-Power Expertise and Deep Portfolio to Capture Growing M2M

Growth Drivers

| Smartphones | Emerging Regions | Non-Handset Devices | Connectivity | Advanced Network Technologies |

Growth from Simplifying Wireless Complexity

LTE LEVERAGES NEW, WIDER AND UNPAIRED SPECTRUM

■ Commercial   □ Future

	2011	2012	2013	2014+
	Rel-8 **LTE** (FDD and TDD Commercial)	Rel-9 **LTE** (Future)	Rel-10 **LTE Advanced**	Rel-11 and Beyond

HSPA → Rel-7 **HSPA+** (Commercial) → Rel-8 → Rel-9 **HSPA+** (Future) → Rel-10 → Rel-11 and Beyond **HSPA+ Advanced**

CDMA2000 1X → **1X Advanced**

SIMULTANEOUS 1X VOICE AND EV-DO/LTE DATA (SVDO/SVLTE)

EV-DO — Rev A → Multicarrier → H/W Upgrade **EV-DO Rev. B** (Commercial) → **DO Advanced**

Note: Estimated commercial dates; created September 19, 2011.

The Connected World—Our Growing Opportunity

MOBILE

COMPUTING

CONSUMER ELECTRONICS

NETWORKING

Feature and Smartphones

Tablets, Laptops, All-in-One PCs

Gaming, eReaders, DTV, STBs, PNDs

Switches, Routers, Gateways, PLC

QUALCOMM PLATFORM APPROACH

Development tools, Enabling Technologies and Value-Added Software

Connectivity: Wi-Fi, Bluetooth, FM, Location, Powerline, Ethernet, PON

Multimode Modem: 3G, LTE, PC-Certified Modules

Applications Processor: CPU, GPU, Multimedia

SoC/Snapdragon Solutions

Alex Katouzian
SVP, Product Management

QUALCOMM®

SoC Snapdragon Solutions

Qualcomm Platform Approach

MOBILE

COMPUTING

CONSUMER ELECTRONICS

NETWORKING

Feature and Smartphones

Tablets, Laptops, All-in-One PCs

Gaming, eReaders, DTV, STBs, PNDs

Switches, Routers, Gateways, PLC

Development tools, Enabling Technologies and Value-Added Software

Connectivity: Wi-Fi, Bluetooth, FM, Location, Powerline, Ethernet, PON

Multimode Modem: 3G, LTE, PC-Certified Modules

Applications Processor: CPU, GPU, Multimedia

Leading Technology

Utilizing the Full SoC for Optimized Performance

Powerful DSP for Offloading functions from CPU

Large High-Speed Memory Access

Broad Software Compatibility (Android, Windows)

Broad Support of Sensors

Low Power 28nm Hardware

Open GL/GPU Graphics Engine

High Performance Multi-Core CPU

Integrated Connectivity

Benefit from Custom CPU Architecture

ENABLES PERFORMANCE AND SCHEDULE LEADERSHIP

8x
Snapdragon S1

Performance (CoreMark)

Snapdragon S1   Snapdragon S2   Snapdragon S3   Snapdragon S4 Dual   Snapdragon S4 Quad

Source: Qualcomm testing using industry standard benchmark, CoreMark.
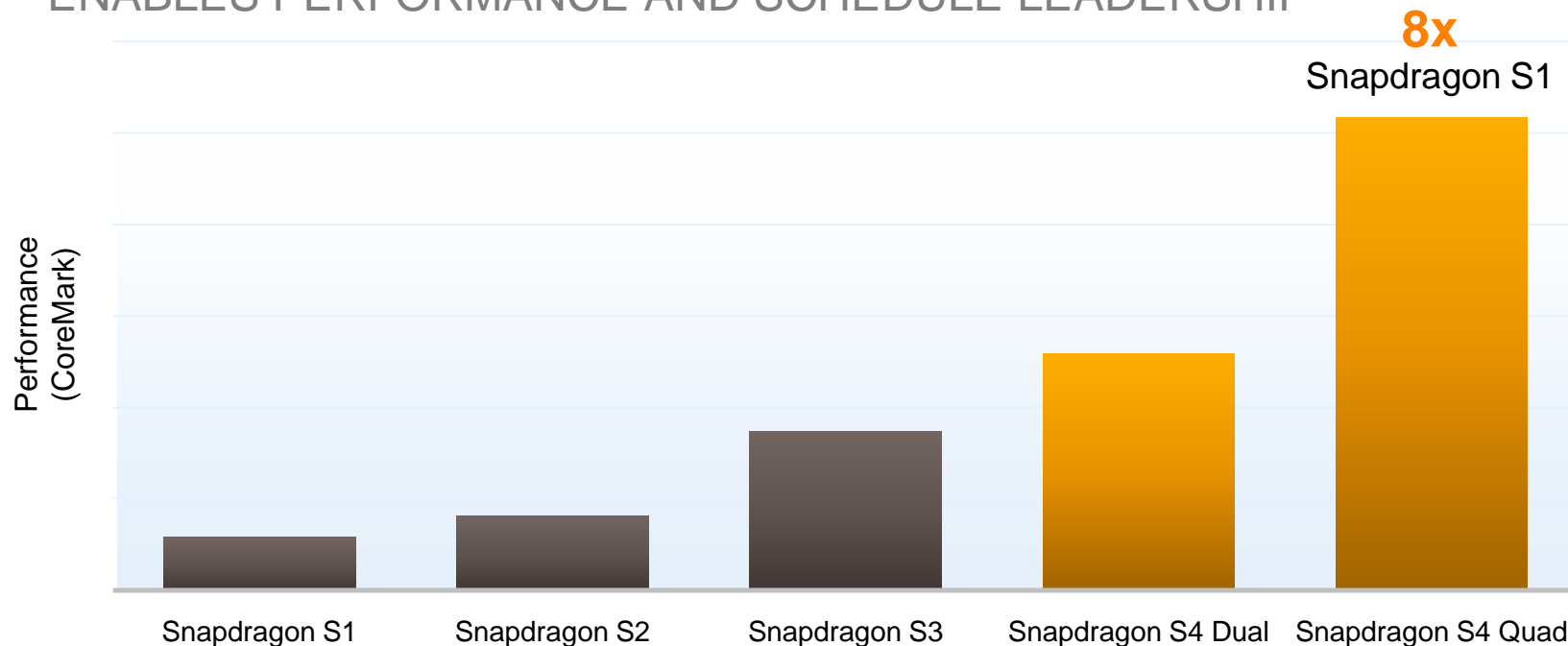
Benefit from Custom CPU Architecture

ENABLES LEADING POWER EFFICIENCY

Source: Qualcomm testing using industry standard benchmark, CoreMark.
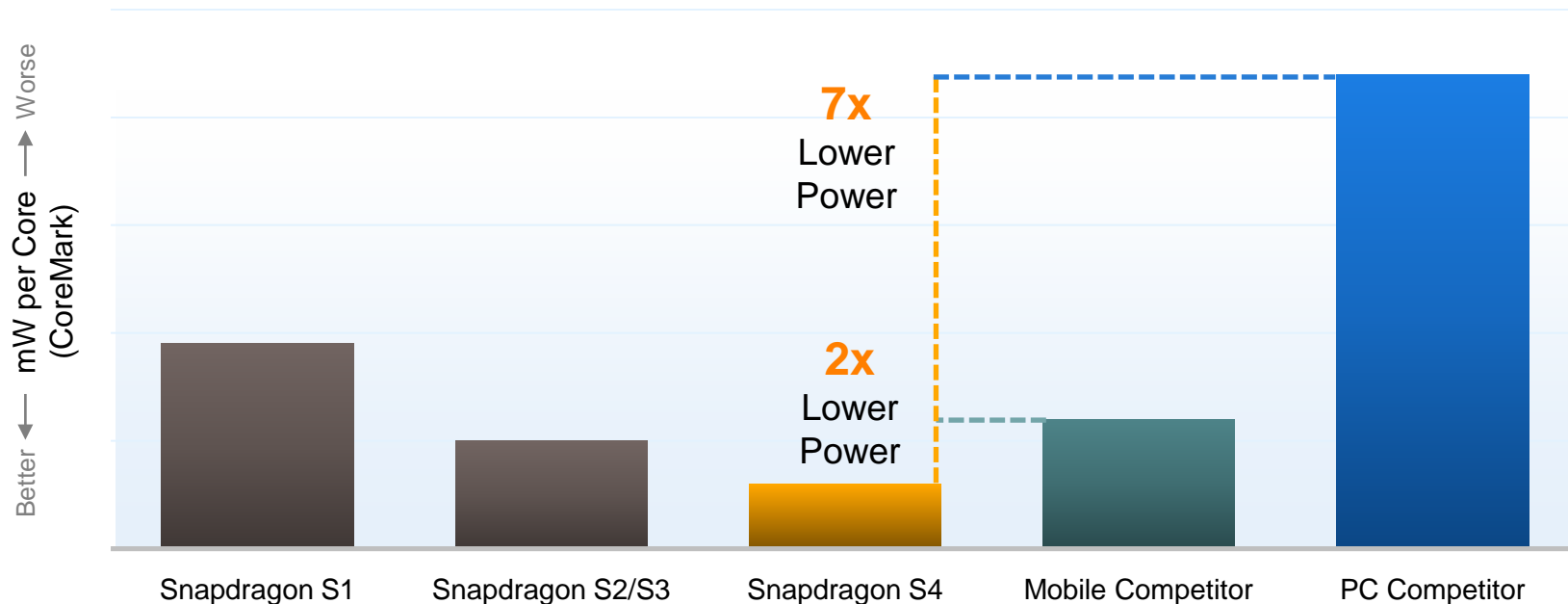
Benefit from Custom GPU Architecture

ADRENO 320: A LEADER IN MOBILE GRAPHICS PERFORMANCE

Performance Relative to Adreno 200 GPU

Shipped **MORE** GPUs in Q3'11 Than Any Mobile or PC Silicon Provider

Adreno 200   Adreno 205   Adreno 220   Adreno 225   Adreno 320

Sources: Adreno Performance and shipments: Qualcomm data; Shipments: John Peddie (JPR) analysis of GPU shipments (integrated + discrete) for Q3 CY2011 (November 2011).
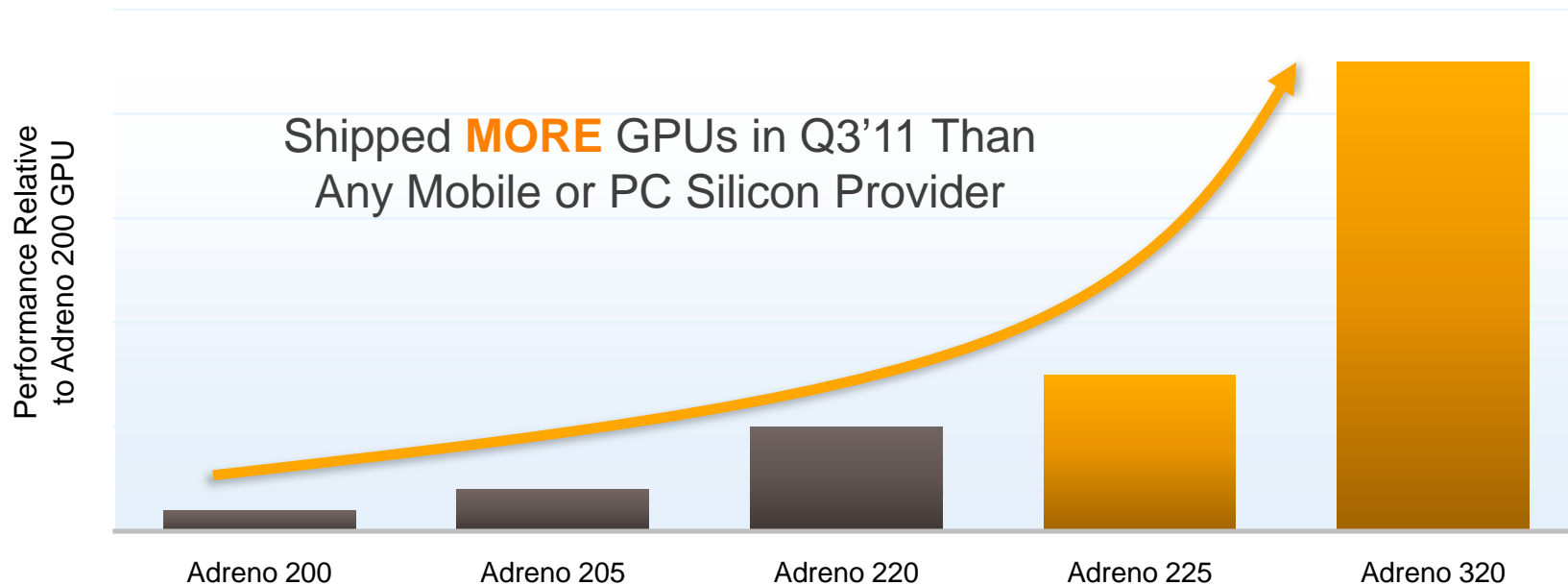
Superior Modem Performance

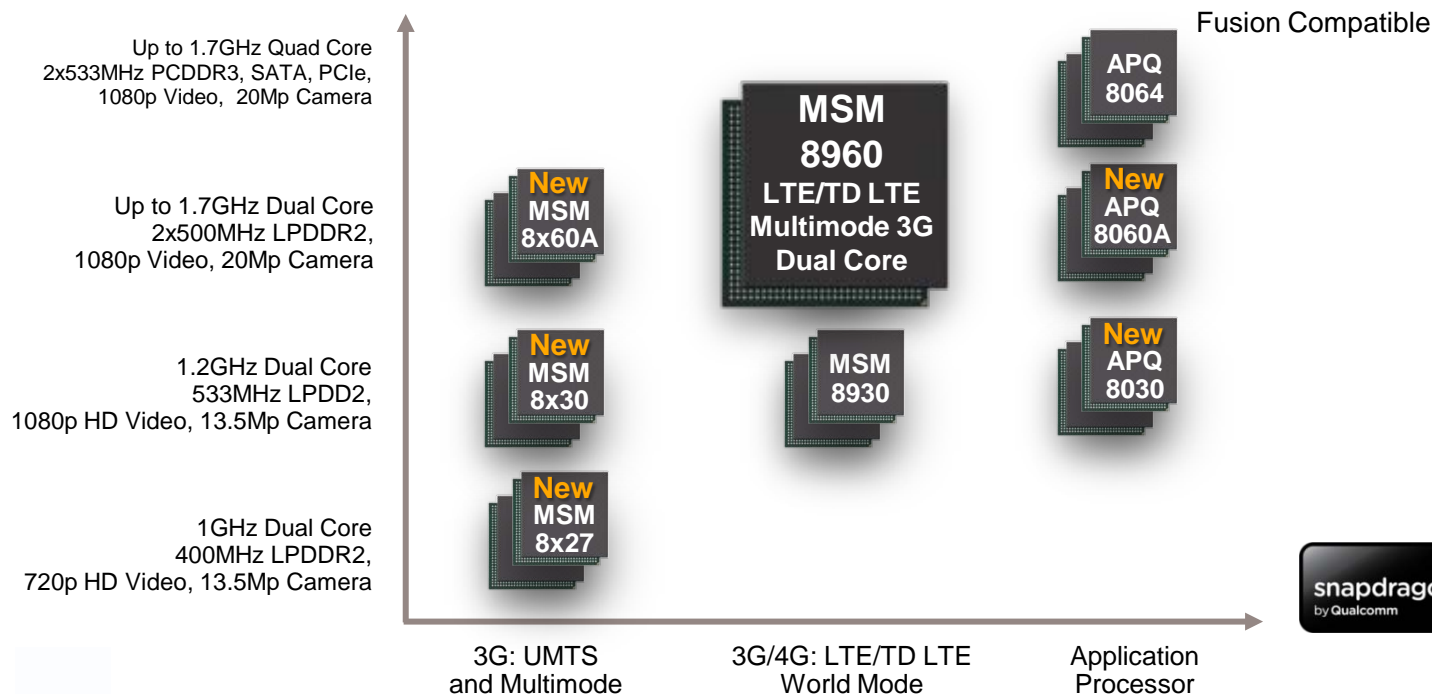| ONLY GLOBAL 3G/4G MULTIMODE	SIMULTANEOUS VOICE AND DATA	LEADING TECHNOLOGIES
▪ LTE/TD-LTE ▪ TD-SCDMA ▪ DC-HSPA+, HSPA ▪ 1x R99 ▪ 1xDO Rev B ▪ GERAN	▪ First simultaneous CDMA voice and LTE data handset ▪ First UMTS voice and LTE data handset	▪ Advanced receivers ▪ 100 Mbps peak LTE rates ▪ 42 Mbps peak 3G rates

MULTIMODE IS KEY FOR LTE HANDSETS

Source: Qualcomm data.

System Integration

Snapdragon Breadth: Full S4 Platform

EXPANSION OF MSM8960 28nm TO ALL TIERS

Fusion Compatible

Up to 1.7GHz Quad Core
2x533MHz PCDDR3, SATA, PCIe,
1080p Video, 20Mp Camera

APQ 8064

Up to 1.7GHz Dual Core
2x500MHz LPDDR2,
1080p Video, 20Mp Camera

New MSM 8x60A

MSM 8960
LTE/TD LTE
Multimode 3G
Dual Core

New APQ 8060A

1.2GHz Dual Core
533MHz LPDD2,
1080p HD Video, 13.5Mp Camera

New MSM 8x30

MSM 8930

New APQ 8030

1GHz Dual Core
400MHz LPDDR2,
720p HD Video, 13.5Mp Camera

New MSM 8x27

3G: UMTS
and Multimode

3G/4G: LTE/TD LTE
World Mode

Application
Processor

snapdragon by Qualcomm s4

Qualcomm Is a Leader in LTE Technology

ALREADY ON THIRD GENERATION OF LTE

THIRD-GENERATION LTE MULTIMODE CHIPSETS

QUALCOMM
MDM 9x25
LTE Cat4
150Mbps
HSPA+ 84 Mbps

QUALCOMM
APQ 8055

QUALCOMM
APQ 8060

SECOND-GENERATION LTE MULTIMODE CHIPSETS

QUALCOMM
MDM 9x15
LTE Cat3
DC-HSPA+/DOrB
TD-SCDMA

QUALCOMM
MSM 8960
LTE Cat3
DC-HSPA+/DOrB
EDGE, TD-SCDMA

WORLD'S FIRST INTEGRATED LTE/ 3G MOBILE CHIP

WORLD'S FIRST LTE/3G CHIPSETS

QUALCOMM
MDM 9600
LTE Cat3
DC-HSPA+/
DOrB /EDGE

QUALCOMM
MDM 9200
LTE Cat3
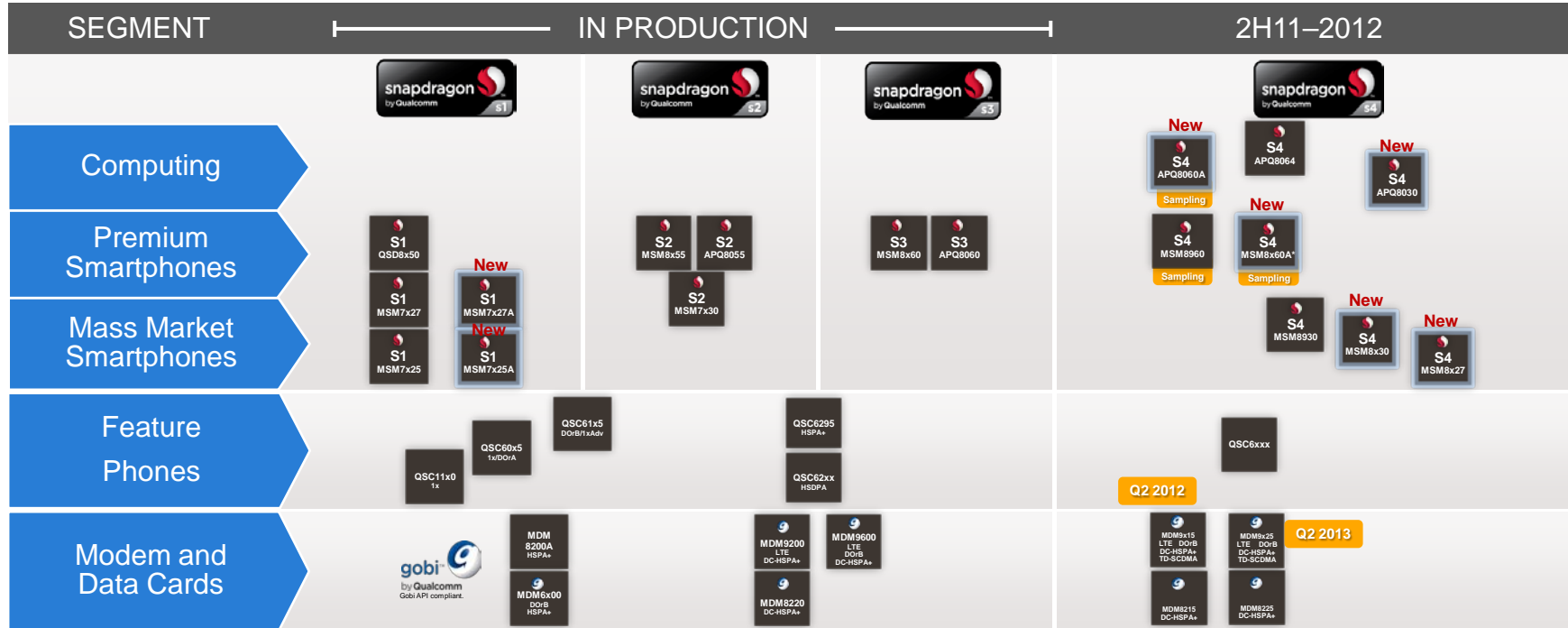DC-HSPA+ EDGE

Integrated Support for FDD and TDD

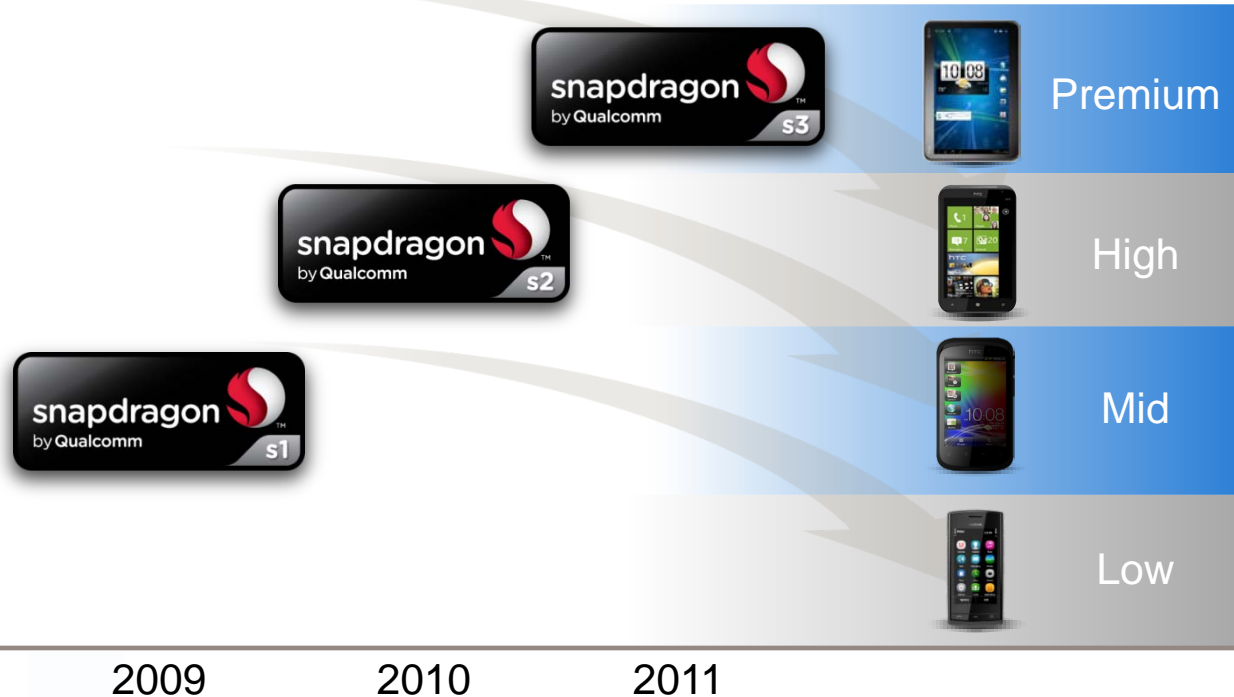| 2010-11 | 2012 | 2013 |

ALL MULTIMODE, ALL BANDS, PERFORMANCE EVOLUTION

Industry-leading AP and Modem Roadmap

*Reflects a numbering change; formerly known as MSM8270.

Generational Evolution

EACH NEW GENERATION ALSO DRIVES TECHNICAL INNOVATION DEEPER INTO PORTFOLIO

Premium

High

Mid

Low

Examples

- Advanced Camera
- 3D
- HDMI
- Gaming
- WiFi
- HD Video

2009   2010   2011

Generational Evolution

S4 PROVIDES A COMPLETE PORTFOLIO OF MOBILE SOLUTIONS

Premium

High

Mid

Low

Snapdragon System Spans Hardware, Software, Services, and Ecosystem Tools

ECOSYSTEM SUPPORT

Developer Hardware	Developer Software Tools	Developer Ecosystem Events and Community	Carrier-Friendly Services

ADVANCED SOFTWARE TECHNOLOGY

Entertainment	Connectivity	Camera	Web	Natural User Interface	AllJoyn™	Augmented Reality

BROAD SUPPORT FOR HLOS

LEADING HARDWARE

CPUs	GPUs	3G/4G MODEMS	MEMORY	DSPs	VIDEO/ AUDIO	LOCATION AND SENSORS	WiFi BT FM	POWER MGMT	RF

Snapdragon Delivers Better Software Experiences

SMOOTH UI

- Fast rendering of complex UI

REAL WEB EXPERIENCE

- Quick page download and render

TRUE HD ENTERTAINMENT

- First 1080p video in browser

Source: Company testing using industry standard Android benchmarks, comparing devices of similar consumer price points using Snapdragon and competitive chipsets.

Snapdragon Advanced Optional Software Technology
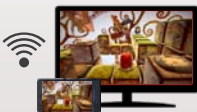
CURRENT FEATURE PORTFOLIO

VIDEO AND DISPLAY

- 1080p Stereoscopic 3D Video playback
- 2D to 3D Video conversion
- Browser with HTML-5 and 1080p Flash video
- Wireless Display

1080p HD Video

Wireless Display

CAMERA

- Multi-shot / Zero Shutter Lag with Scalado Rewind
- Stereo 3D Video Capture & Playback
- Face detection/recognition, gaze/blink, smile detection & face contour

Stereoscopic 3D Capture
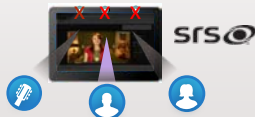
Multi-Shot Zero Shutter Lag

AUDIO

- Fluence PRO – Dual / Quad Mic Support
- SRS playback
- Ultrasound EPOS Pen
- Active Noise Cancellation
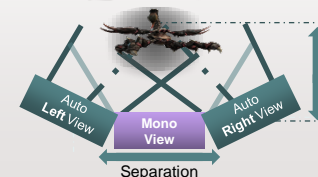
Ultrasound EPOS Pen

Fluence Multi-Mic

GAMING

- HD (720p) Stereoscopic 3D Games
- 2D to 3D Game conversion

Stereoscopic 3D Gaming

2D to 3D Gaming

Auto **Left** View   **Mono View**   Auto **Right** View

Separation

Large and Expanding Ecosystem

Snapdragon Leadership: Android

225+
DESIGNS LAUNCHED WITH QUALCOMM

30+
MANUFACTURERS SHIPPING WITH QUALCOMM

QUALCOMM SUPPORTS ANDROID FROM MASS MARKET TO HIGH END

Source: Qualcomm data.

Snapdragon Leadership: Windows

SNAPDRAGON POWERS WINDOWS

THE ONLY PROCESSOR THAT
POWERS THE ORIGINAL
WINDOWS PHONE…
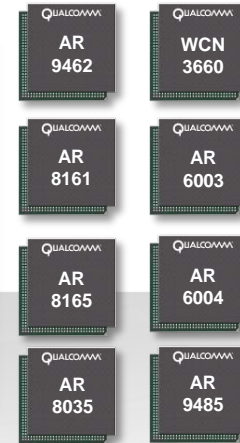
…AND MANGO

snapdragon™
by Qualcomm

Next Significant Segment: Compute

BROAD OPPORTUNITY ACROSS
AP AND CONNECTIVITY

CONNECTED
STANDBY

STRONG LAUNCH
PARTNERS

Platform Approach Allows Us to Expand in the Next Wave of Growth

3G/4G Migration into New Connected Opportunities

Smartphone Expansion into New Mobile Categories

Solutions for New, Adjacent Categories

QUALCOMM®

Follow us on:

> Thank you

For more information on Qualcomm, visit us at:
www.qualcomm.com
www.qualcomm.com/blog

Mobile Broadband Evolution

Peter Carson
Sr Dir, Product Mgmt

Modem Evolution and Adoption Trends

9 Years | **"4G" —LTE**

LAUNCH   TBD Years   PEAK

10 Years | **3G—WCDMA**

LAUNCH   19 Years   PEAK

8 Years | **2G—GSM**

LAUNCH   20 Years   PEAK

1G—AMPS

LAUNCH   19 Years   PEAK

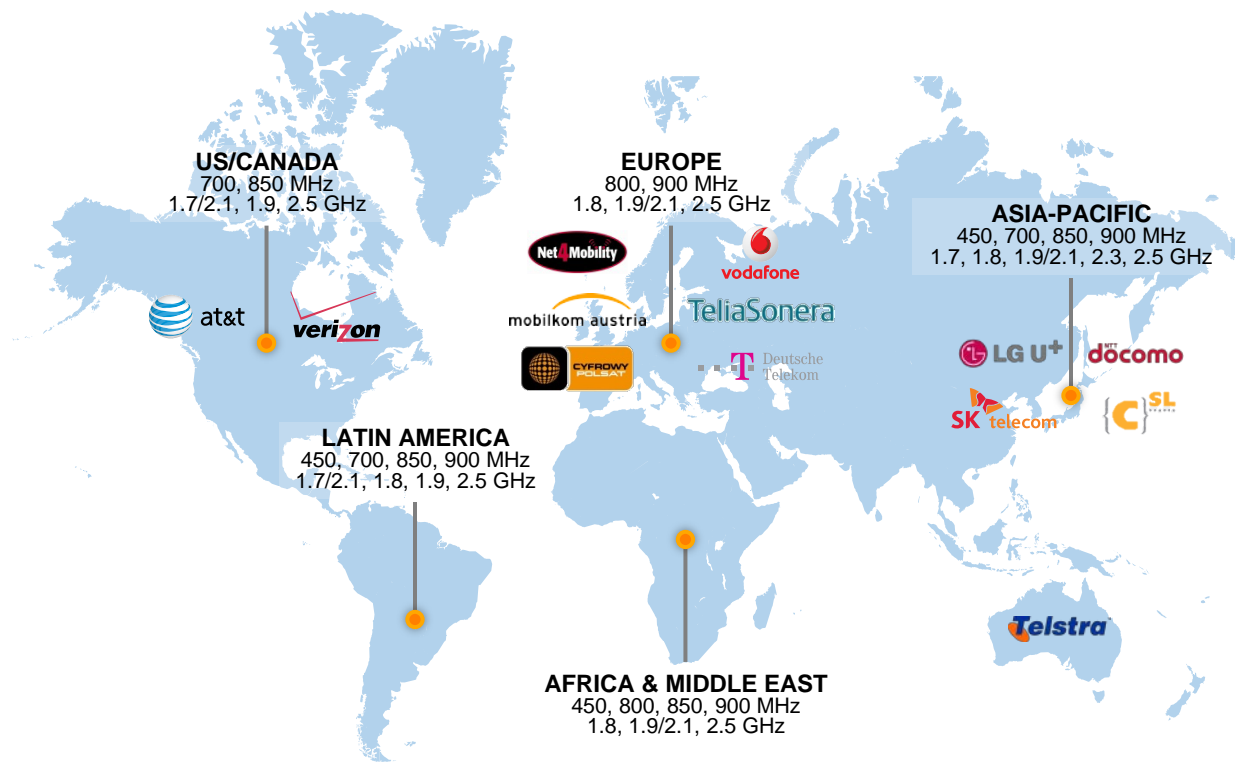3-4G: DATA DRIVES MODEM EVOLUTION

1-2G: VOICE DRIVES MODEM EVOLUTION
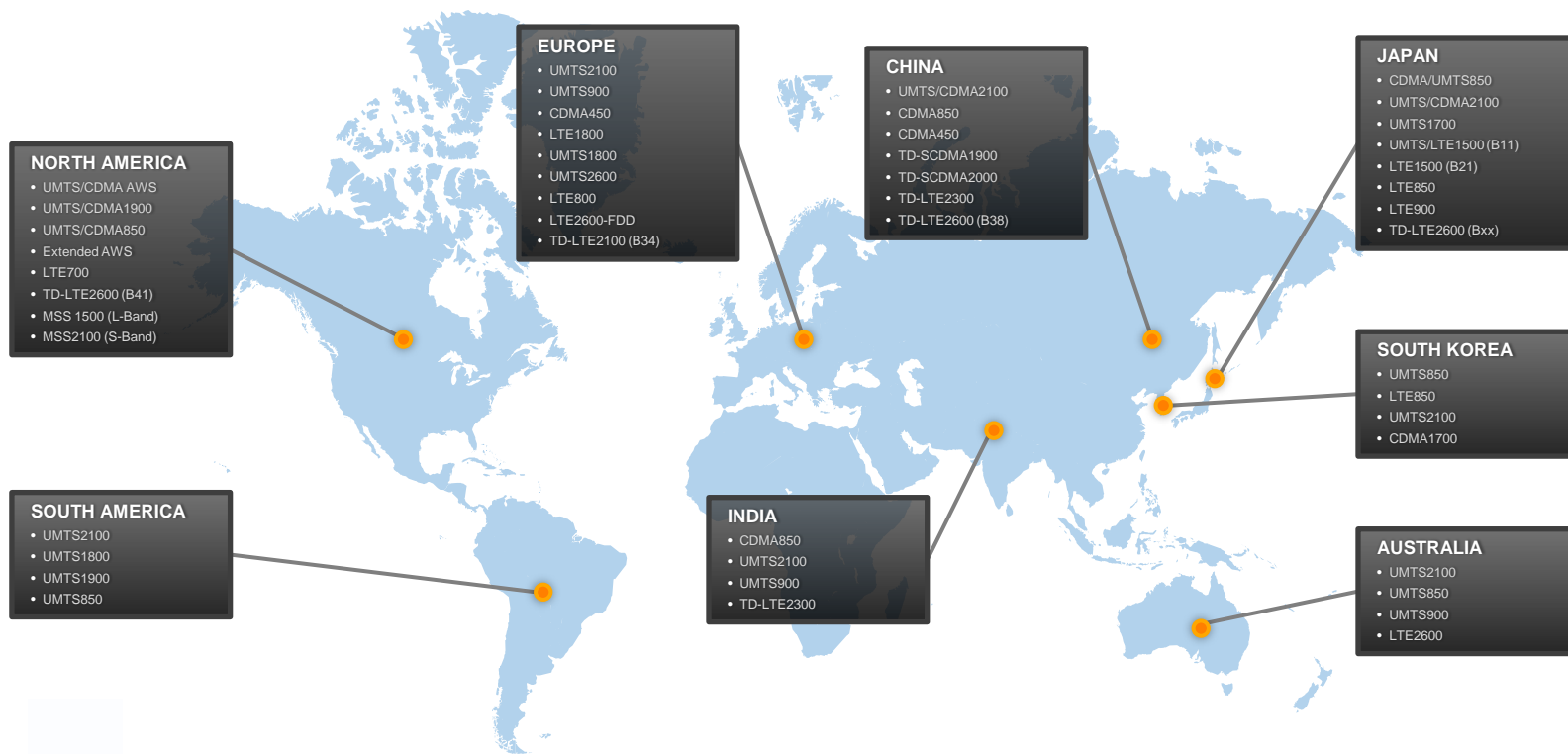
1983   **2025**   **TBD**
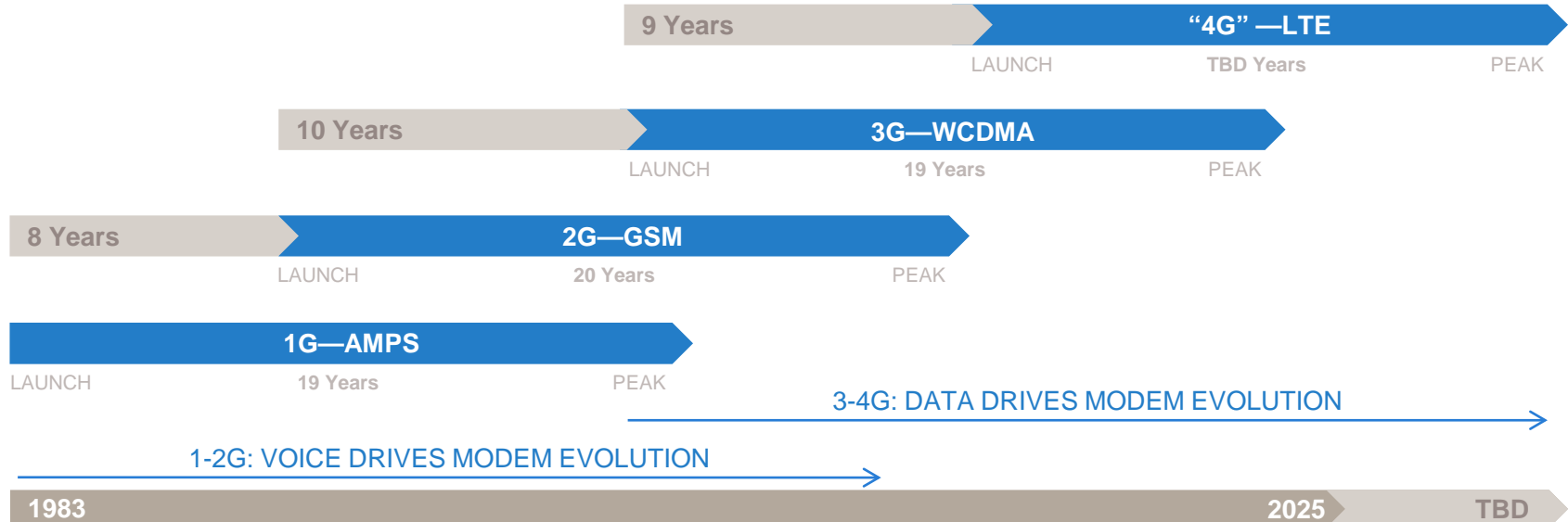
19-20 years from first launch of new generation to total market peak device volume
Each generation produces significantly higher volume than previous

Qualcomm Supporting LTE Launches Globally

US/CANADA
700, 850 MHz
1.7/2.1, 1.9, 2.5 GHz

EUROPE
800, 900 MHz
1.8, 1.9/2.1, 2.5 GHz

ASIA-PACIFIC
450, 700, 850, 900 MHz
1.7, 1.8, 1.9/2.1, 2.3, 2.5 GHz

LATIN AMERICA
450, 700, 850, 900 MHz
1.7/2.1, 1.8, 1.9, 2.5 GHz

AFRICA & MIDDLE EAST
450, 800, 850, 900 MHz
1.8, 1.9/2.1, 2.5 GHz

Source: LTEmaps.org & GTI

Support for Over 40 RF Bands Required

EUROPE
- UMTS2100
- UMTS900
- CDMA450
- LTE1800
- UMTS1800
- UMTS2600
- LTE800
- LTE2600-FDD
- TD-LTE2100 (B34)

CHINA
- UMTS/CDMA2100
- CDMA850
- CDMA450
- TD-SCDMA1900
- TD-SCDMA2000
- TD-LTE2300
- TD-LTE2600 (B38)

JAPAN
- CDMA/UMTS850
- UMTS/CDMA2100
- UMTS1700
- UMTS/LTE1500 (B11)
- LTE1500 (B21)
- LTE850
- LTE900
- TD-LTE2600 (Bxx)

NORTH AMERICA
- UMTS/CDMA AWS
- UMTS/CDMA1900
- UMTS/CDMA850
- Extended AWS
- LTE700
- TD-LTE2600 (B41)
- MSS 1500 (L-Band)
- MSS2100 (S-Band)

SOUTH KOREA
- UMTS850
- LTE850
- UMTS2100
- CDMA1700

SOUTH AMERICA
- UMTS2100
- UMTS1800
- UMTS1900
- UMTS850

INDIA
- CDMA850
- UMTS2100
- UMTS900
- TD-LTE2300

AUSTRALIA
- UMTS2100
- UMTS850
- UMTS900
- LTE2600

Modem/Multimode Trend

PEAK DOWNLINK USER DATA RATES

Integrated single-chip multimode
(includes QB GERAN)

MSM
8960

- TD-SCDMA
- CDMA
- WCDMA
- LTE

Mbps: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100
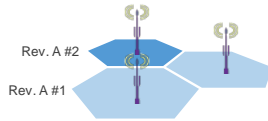
1X and EV-DO Have Strong Evolution Paths

EV-DO Rev. A

Excellent mobile broadband

Rev. A #2

Rev. A #1

REV. B MULTICARRIER

Leading operators have launched
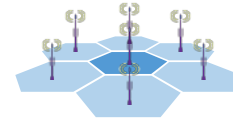Rev B multicarrier—
a software upgrade

Even higher performance
with H/W upgrade

Rev. A #3

Rev. A #2

Rev. A #1

Aggregated
Data Pipe

DO ADVANCED

Software upgrade that
benefits existing devices

Maximizes EV-DO
performance by exploiting
uneven loading

1X ADVANCED

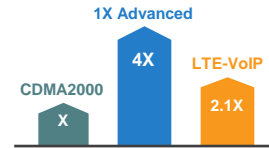Simple channel card upgrade

Up to 4X increase in capacity

Frees up spectrum for EV-DO

1X Advanced

4X

LTE-VoIP

CDMA2000

X

2.1X

CDMA2000 1X

Industry's leading voice capacity

Created February 8, 2011.
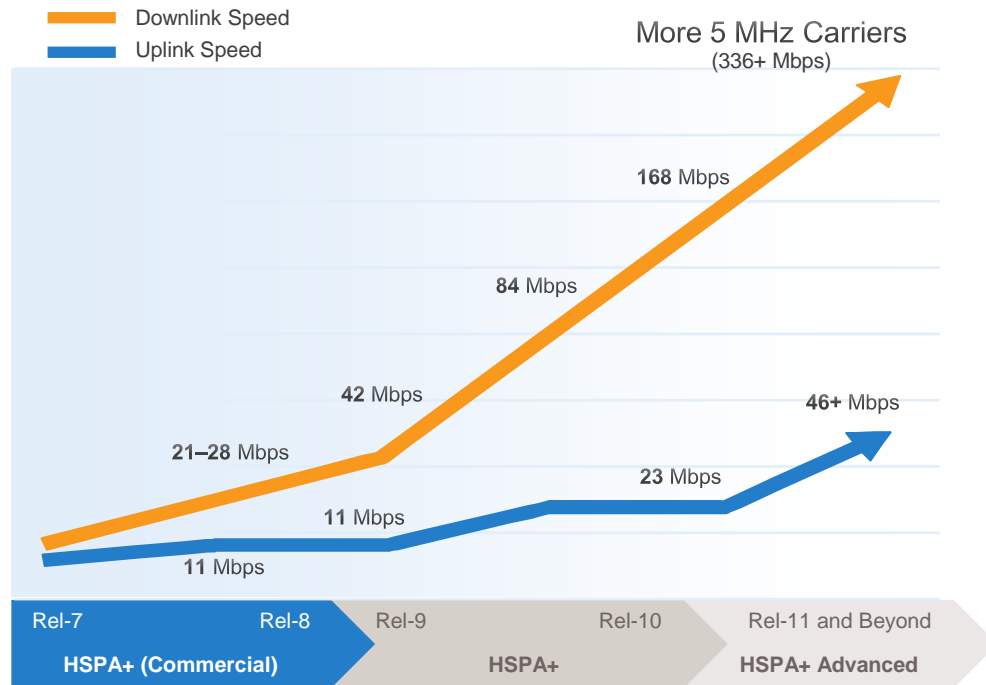
HSPA+ Has a Strong Evolution Path

- **R11 and Beyond: HSPA+ Advanced**
  - Expands HSPA+ to 40 MHz deployments
  - Further leverages multiple antennas (UL MIMO/Beamforming)
  - Exploits smart networks (multipoint) and HetNet enhancements

- **R10: 20 MHz Multicarrier**
  - Expands HSPA+ to 20 MHz deployments
  - Evolution to femtocell networks

- **R9: Expands Dual-Carrier**
  - 10 MHz dual-carrier in uplink
  - Combination of MIMO and dual-carrier in downlink
  - Aggregation across spectrum bands
  - Femtocell enhancements: active mobility

- **R8: 10 MHz Dual-Carrier**
  - Enhances broadband—doubled data rates to all users
  - Introduction to femtocell support
  - Alleviates signaling traffic, e.g., from smartphones

Downlink Speed
Uplink Speed

More 5 MHz Carriers
(336+ Mbps)

168 Mbps

84 Mbps

42 Mbps

21–28 Mbps

11 Mbps

11 Mbps

46+ Mbps

23 Mbps

Rel-7	Rel-8	Rel-9	Rel-10	Rel-11 and Beyond
HSPA+ (Commercial)		HSPA+		HSPA+ Advanced

Created February 8, 2011.
Notes: R8 reaches 42 Mbps by combining 2x2 MIMO and HOM (64QAM) in 5 MHz, or by utilizing HOM (64QAM) and multicarrier in 10 MHz. R9 combines multicarrier and MIMO in 10 MHz to reach 84 Mbps peak rates. Uplink multicarrier doubles the uplink peak data rate to 23 Mbps in 10 MHz in R9. R10 expands multicarrier to 20 MHz to reach 168 Mbps. R11 expands multicarrier to 40MHz to reach 336 Mbps.

Q-ICE™, QLIC, gRICE: Advanced Receivers Increase Capacity, Coverage, and User Experience

Advanced Receivers

DEVICE
Receive Diversity | Equalizer | Interference Cancellation | etc.

BASE STATION
Receive Diversity | Interference Cancellation | etc.

Higher Capacity
Data throughput or voice capacity

Enhanced User Experience
Higher user data rates, improved voice quality

Extended Coverage

LTE Advanced Brings Different Dimensions of Improvements—Most Gain from HetNets

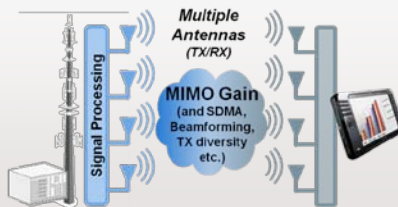## Utilize Wider Bandwidth

- Carrier aggregation across multiple carriers and multiple bands

Primarily higher data rates (bps)
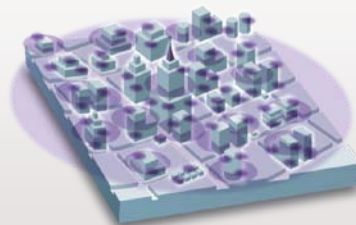
Utilize More Radio Links, More Antennas

- Downlink MIMO up to 8x8, enhanced Multi User MIMO and uplink MIMO up to 4x4

Higher spectral efficiency (bps/Hz)

Utilize Heterogeneous Network Topology (HetNet)

- With advanced interference management (low power picocells with adaptive resource partitioning and advanced receiver based devices)



Higher spectral efficiency per coverage area (bps/Hz/km2)

Technology Evolution and Device Commercialization

TECHNOLOGY TRACK	COMMERCIAL	IN PROCESS	FUTURE
UMTS	HSPA+ 42 Mbps	Smartphone Signaling Enhancements	HSPA+ up to 84 Mbps
CDMA	DO RevB 1x Advanced – Phase 1 (codec, QLIC, RxD)	DO Advanced	1x Advanced – Phase 2 (standards enhancements)
LTE FDD / TDD	Macro – initial coverage Single RF band Limited FDD bandwidths (typically 5-10 MHz) Cat3, <100 Mbps	Pico – coverage densification Multi-band Wider bandwidths (up to 20 MHz) Cat3, 100 Mbps	Femto – offload eICIC / NetNets eMBMS Cat4, 150 Mbps

QCT Solutions

Industry-Leading AP and Modem Roadmap
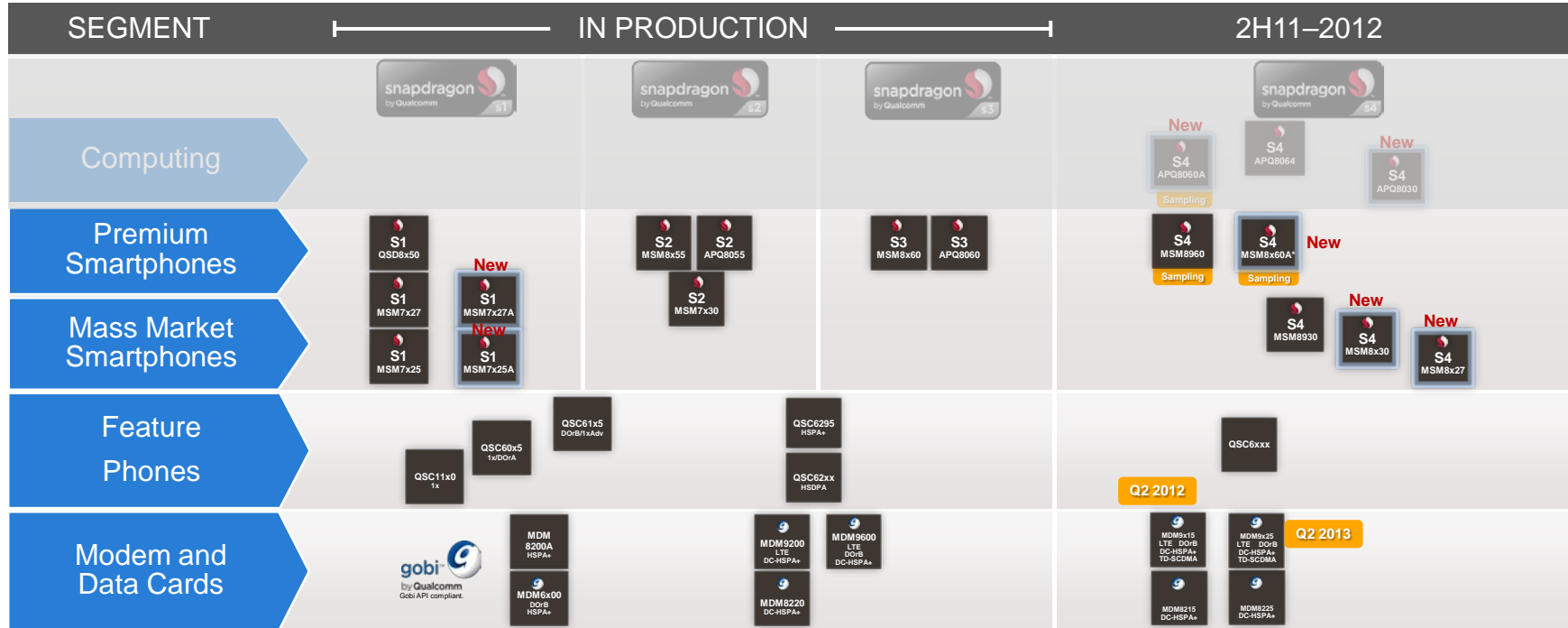
*Reflects a numbering change; formerly known as MSM8270.

Qualcomm Is Leading LTE Technology

ALREADY ON THIRD GENERATION OF LTE

THIRD-GENERATION LTE
MULTIMODE CHIPSETS

Integrated Support for FDD and TDD

MDM 9x25
LTE Cat4
150Mbps
HSPA+ 84 Mbps

SECOND-GENERATION LTE
MULTIMODE CHIPSETS

WORLD'S FIRST
LTE/3G CHIPSETS

MDM 9x15
LTE Cat3
DC-HSPA+/DOrB
TD-SCDMA

MSM 8960
LTE Cat3
DC-HSPA+/DOrB
EDGE, TD-SCDMA

**WORLD'S FIRST
INTEGRATED LTE/
3G MOBILE CHIP**

MDM 9600
LTE Cat3
DC-HSPA+/
DOrB /EDGE

MDM 9200
LTE Cat3
DC-HSPA+ EDGE

2010   2011–12   2013

ALL MULTIMODE, ALL BANDS, PERFORMANCE EVOLUTION

Source: Qualcomm data.

Second Generation LTE Smartphone Platforms

Key Modem Features

Multimode Mobility
LTE FDD/TDD, UMTS, CDMA, TD-SCDMA, GERAN

Data Continuity
Reselection, Redirection, PS Handover, IP continuity, QoS

LTE Voice
CS Fallback and SVLTE
VoLTE, SR-VCC

Integrated Connectivity
Bluetooth, GPS, GNSS, WLAN

QUALCOMM MSM 8960
QUALCOMM MDM 9x15

28 nm

LTE FDD (100 Mbps DL / 50 Mbps UL)

LTE TDD (68 Mbps DL / 17 Mbps UL)*

eMBMS

DC-HSPA+ (42 Mbps UL / 11 Mbps DL)

DO Rev. B (14.7 Mbps DL / 5.4 Mbps UL)

1X Advanced

TD-SCDMA

GSM/GPRS/EDGE

SUPPORT FOR FLEXIBLE RF FRONT-END CAPABLE OF MULTIPLE BANDS/MODES FOR TRUE WORLDWIDE ROAMING

*Data rates depend on TDD partitioning.

High Level Multimode Options for LTE Voice

Initial Launches **DATA DEVICES**	Initial Voice Solution **LTE DATA HANDSETS**	Long Term Voice Solution **LTE VOIP HANDSETS**
LTE FOR DATA ONLY	**LTE FOR DATA 2G/3G FOR VOICE**	**SIMULTANEOUS LTE VOIP AND DATA**

LTE / 3G / 2G Multimode (Redirection, PS Handover)

Dual Radio 1x Voice + 3G/4G Data

Circuit Switched Fallback to 2G/3G CS Voice & Data

VoLTE with Single Radio Voice Call Continuity + CSFB for Roaming

2G/3G COVERAGE CONTINUITY AND ROAMING

LTE Voice Options

Handset Architecture Comparison
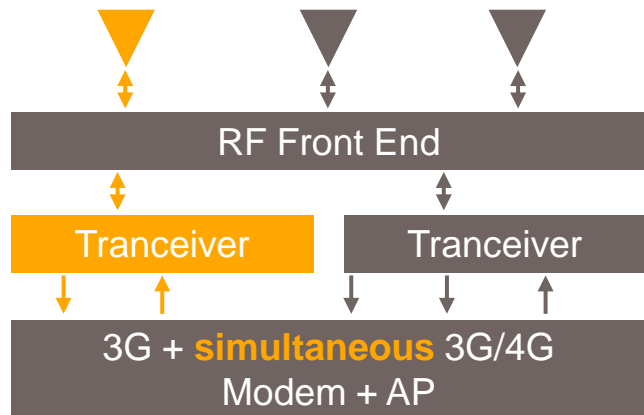
Dual Radio

- No network upgrade required
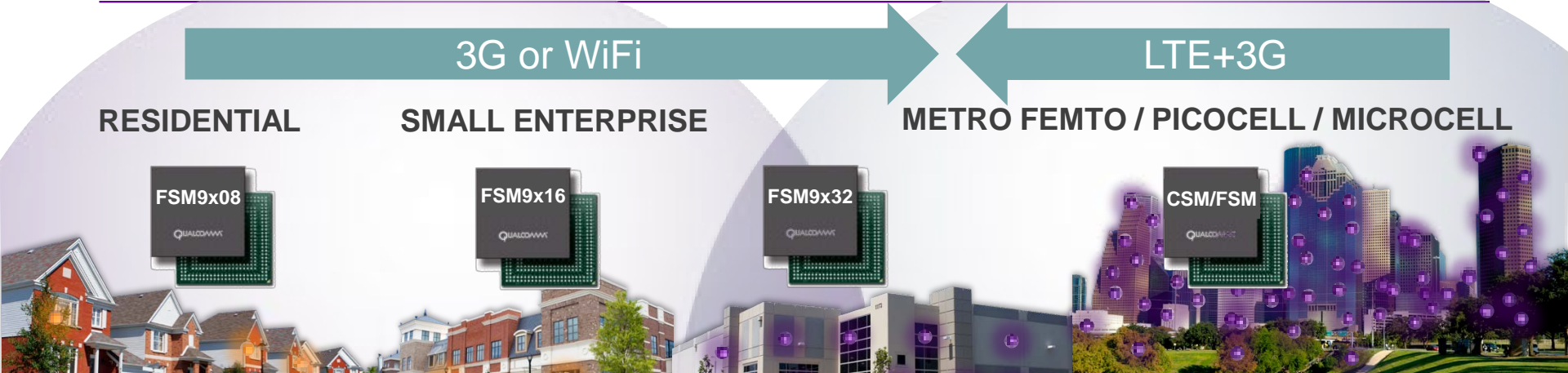- Simultaneous 1x voice/LTE data
- Fast to market
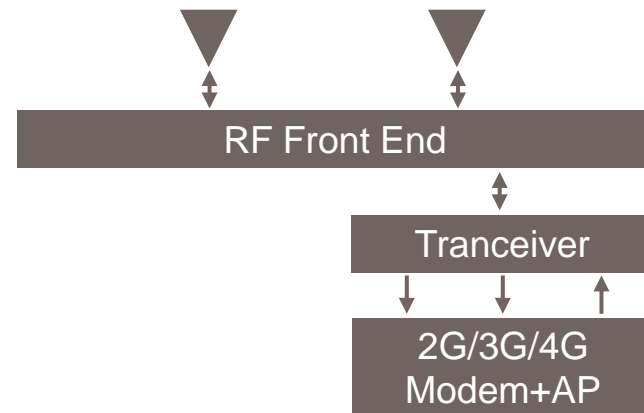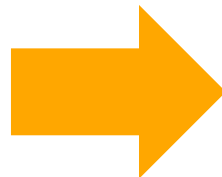
Single Radio

- CSFB to 1x/UMTS/GSM (Commercial)
- VoLTE w/SR-VCC
- Fully standardized

SINGLE RADIO ENABLES BETTER COST, POWER AND FORM FACTOR

3G+ WiFi Femtocells to 3G+4G Outdoor Small Cell Networks

3G or WiFi		LTE+3G
RESIDENTIAL	SMALL ENTERPRISE	METRO FEMTO / PICOCELL / MICROCELL
FSM9x08	FSM9x16	FSM9x32 / CSM/FSM

Initially: Indoor Hot-Spots

FEMTOCELLS EVOLVING FROM INDOOR TO OUTDOOR SMALL CELLS

Next: Denser Indoor and Outdoor Deployments

- Indoor voice coverage
- Deployed by user—"unplanned"
- User's backhaul connection
- Supports restricted access
- Mostly UE based WiFi offload

- Capacity increases in dense areas
- Deployed by operator
- Interference coordination
- Enterprise and venue open access
- Integrated WiFi offload

Qualcomm: Industry-Leading Modem Supplier

Only complete multimode modem solution with integrated 4G LTE/3G

#1 supplier of 3G modems worldwide

#1 in integrated multimode LTE+3G modems

Source: iSource, Q2 2011, QCT.

Connected Home

Craig Barratt
President, Qualcomm Atheros

Qualcomm Atheros Snapshot

MOBILE

COMPUTING

CONSUMER ELECTRONICS

NETWORKING

Feature & Smartphones

Tablets, PCs, AIOs

Handsets, Gaming, eReaders, DTV, STBs, PNDs

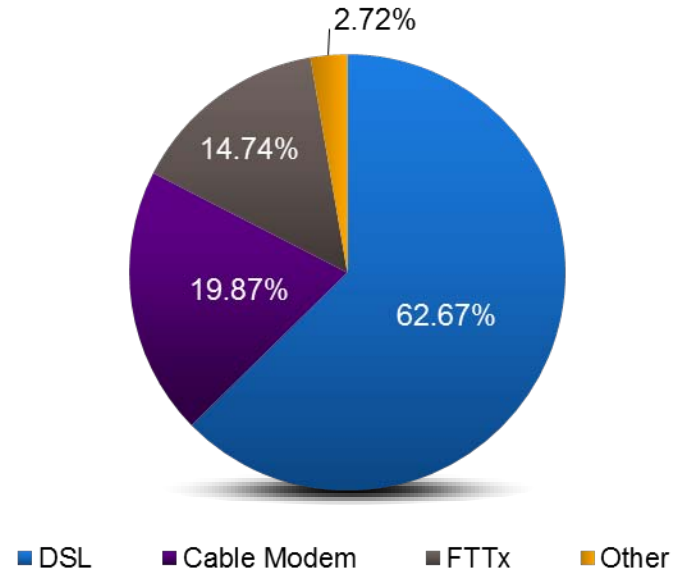**Switches, Routers, Gateways, PLC, Femto**

> The Connectivity Evolution

Consumer Demand for Broadband Connectivity

- **Worldwide broadband subscriptions show steady increase over time**
  - Steady growth rate ~12% per year
- **557.8 million fixed-line broadband subscribers worldwide as of mid-2011**

Top Ten Countries for Wired Broadband Subscribers	
• China	• UK
• US	• South Korea
• Japan	• Italy
• Germany	• Brazil
• France	• Russia

Total Broadband by Technology in 2Q 2011

2.72%
14.74%
19.87%
62.67%

■ DSL   ■ Cable Modem   ■ FTTx   ■ Other

Technologies Supporting Each Step in the Evolution of Connectivity

Category	Description	Technologies
CONTROL	**Smart Grid/ Smart Home** **M2M**	Low Power Wi-Fi PLC/Green PHY 3G/4G
CONSUME	**Accessing Media & Content Everywhere**	GLONASS PON 802.11n, ac, ad PLC Bluetooth HS LTE 3G/4G
CONNECT	**Communications, Email, Browsing, Chatting**	Ethernet GPS Bluetooth 802.11a/g/n 3G

Result: Growing Demands on Home Networks

- **More** digital media
- **More** connected devices consuming media
- **More** services delivering and moving media content around the home

Qualcomm Atheros Connectivity Vision

From the cloud to the network to virtually everything

- Moving HD content throughout the home in CE

- Providing robust IP connectivity to cloud content

- Driving video-over-wireless for HD-media capable WLAN

- Combining WLAN, PLC and Ethernet to enable hybrid, adaptive networks

- Enabling peer-to-peer content transfers

Qualcomm Connects the Digital Home

Wireless

- End-to-end Wi-Fi ecosystem
- Enhanced video over wireless
- Peer-to-peer content transfer
- Femtocells
- 3G/4G mobile broadband

Wired

- High-speed fiber-to-the-home (PON)
- HomePlug AV powerline
- Ethernet

How Qualcomm Atheros Enables the Connected Home

Broadband Connectivity to the Home

Wireless

- WAN as broadband access and M2M connection to the home
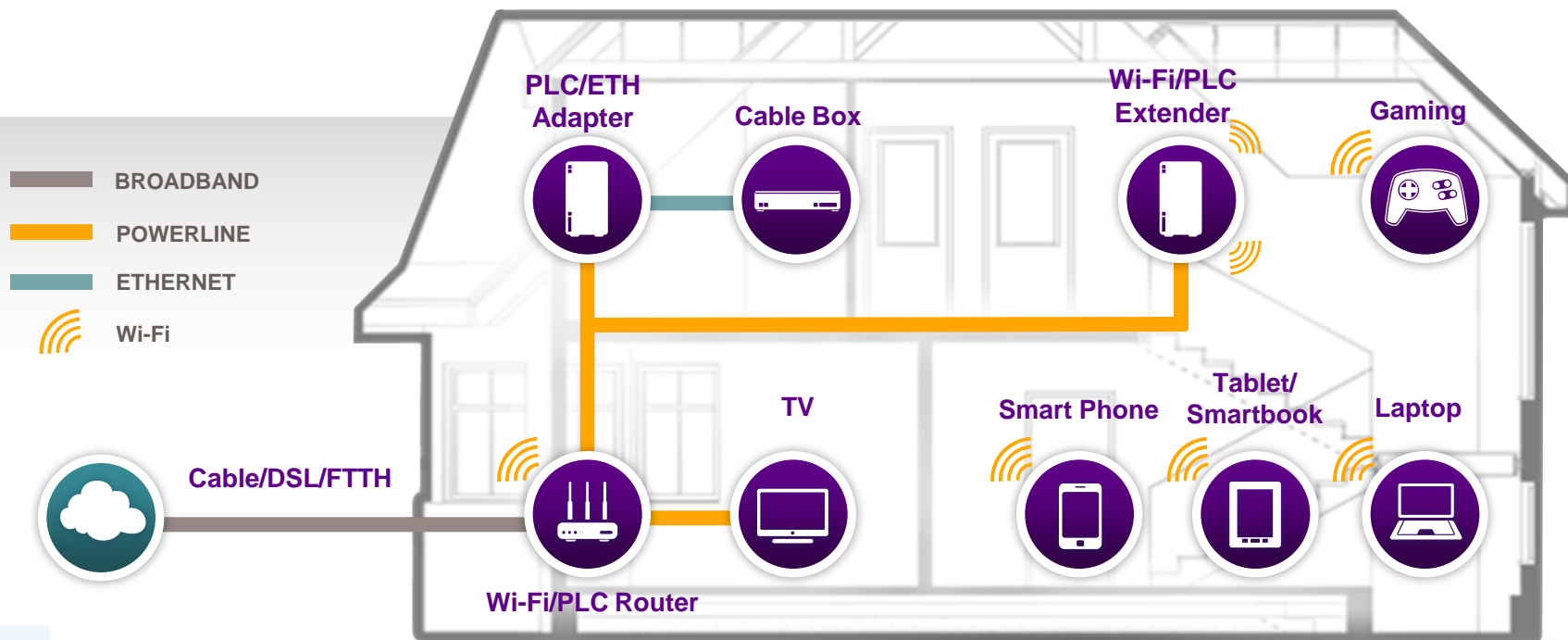 - Smart meters enabled with WAN
  - Hybrid LTE/Wi-Fi (Femtocells)

Wired

- High-speed fiber-to-the-home
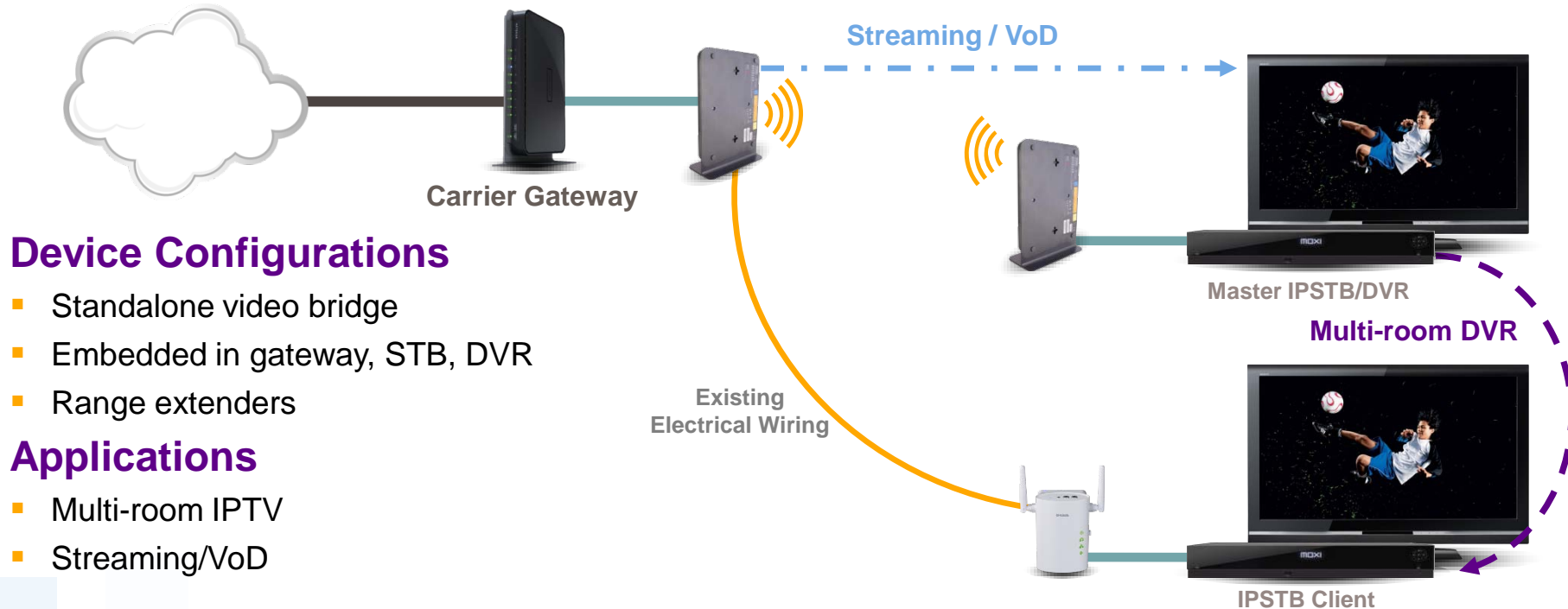 - Passive optical networking (PON)

3G/LTE/4G

Gateway/
Router

Internet BB
Access

PON
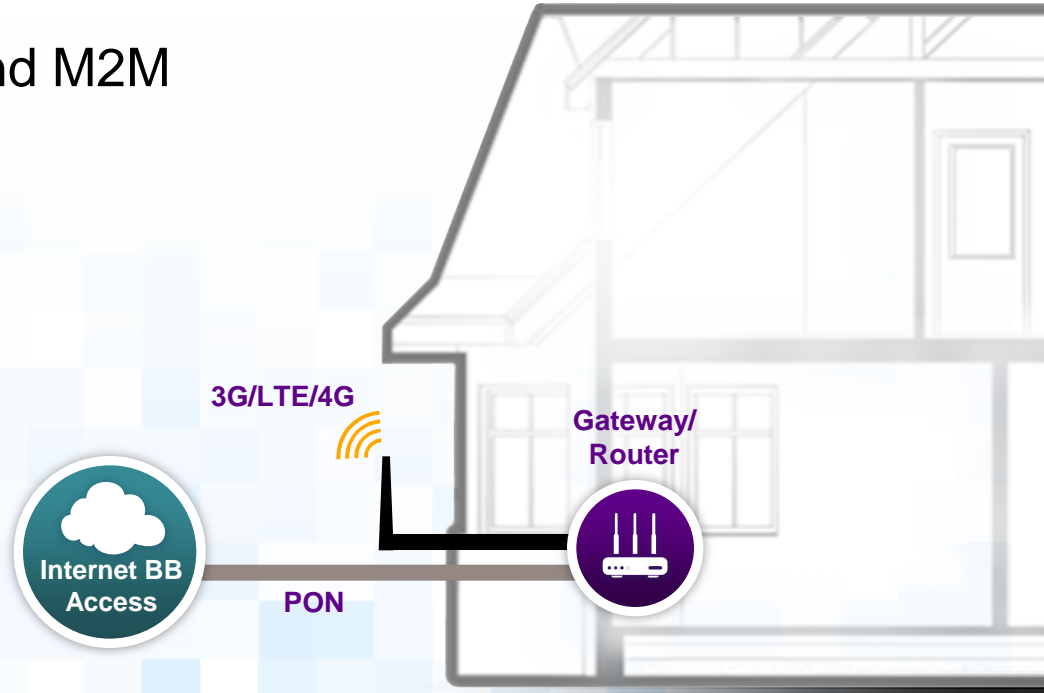
Hybrid Networks: A Game Changer
Flexible approach for connecting any device in any environment

Video: Driver for the Connected Home

Enabling seamless HD video distribution throughout the home

Streaming / VoD

Carrier Gateway

Master IPSTB/DVR

Multi-room DVR

Existing Electrical Wiring

IPSTB Client

Device Configurations

- Standalone video bridge
- Embedded in gateway, STB, DVR
- Range extenders

Applications

- Multi-room IPTV
- Streaming/VoD

A Myriad of Consumer Electronics Connected

The network and virtually every screen type in home and mobile domains

Smartphones
- Over 100 new handset designs in 2011
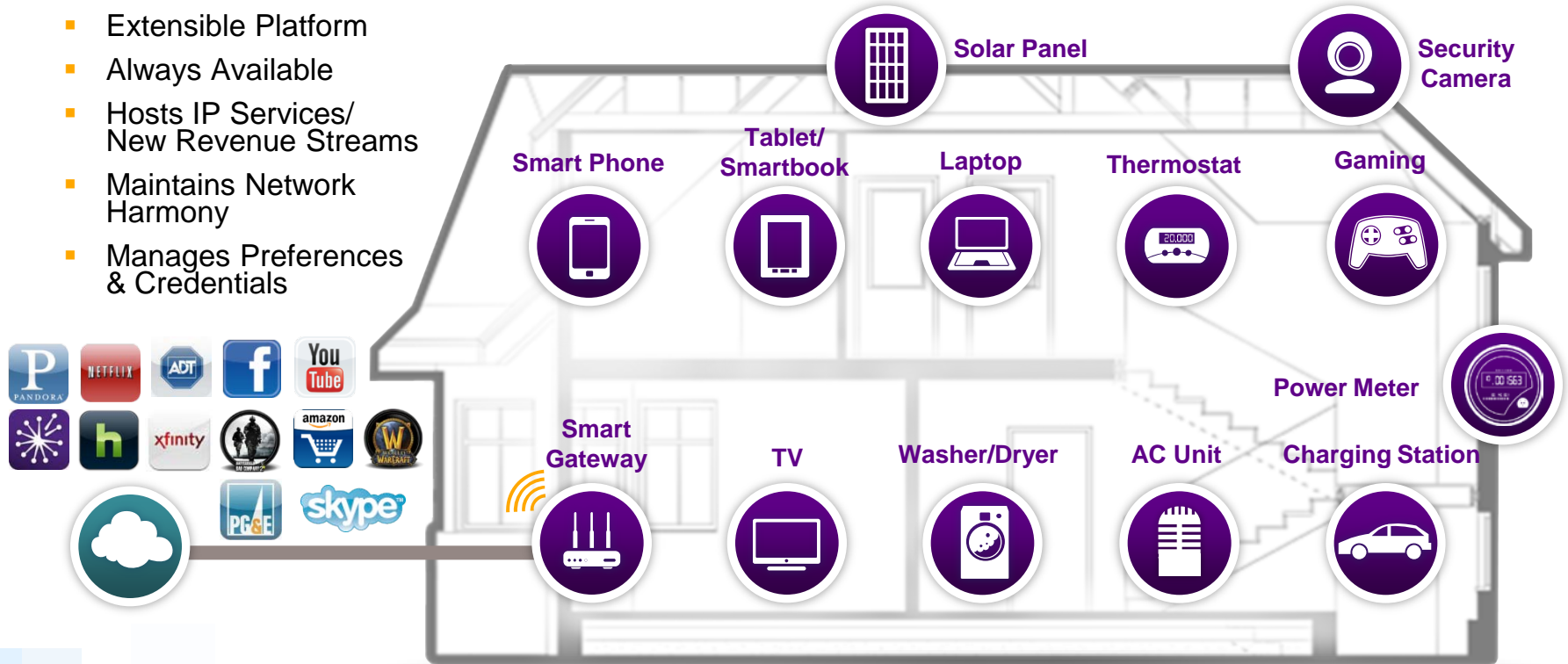
Platform Extends Well Beyond Connectivity to Enable the 3 Screens

O/S and Middleware
User Interface, Media Player, Security, Libraries, Drivers

Hardware
Processor, Graphics, Video Processing, Codecs, Security
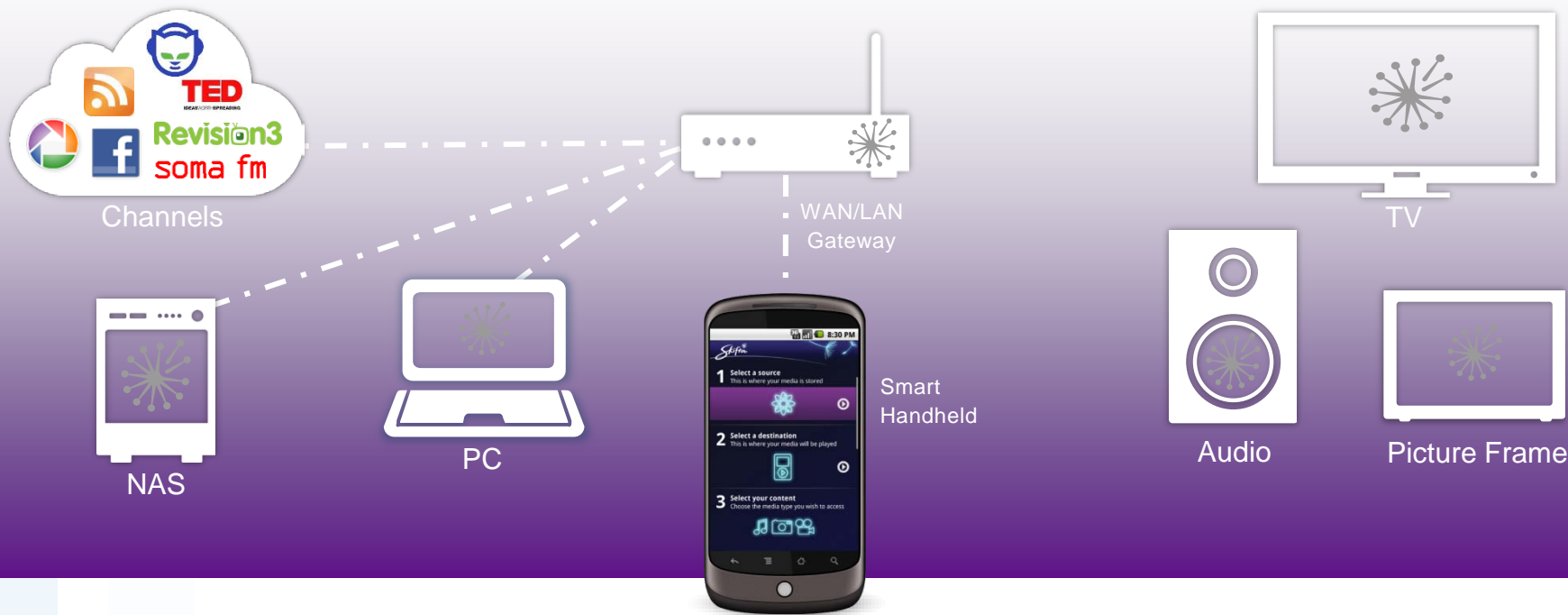
Applications
Video, Gaming, Music, Photo, Search, Information, Communication

Platform Commonality

Reliable Video-Grade Connectivity for Smart TVs

Qualcomm Atheros dual-band 11n Wi-Fi solutions with up to 150 Mbps actual throughput to support multiple HD streams

Console Quality Game

1080p Video with App, Widgets, Webpage, Overlay

Realistic 3D Video

Snappy, 2D/3D UI

HD Video-chat PIP with 3D Games

3D Webpage Rendering with Broadcast Video PIP

Internet of Everything:
Applications and Technologies

3G/4G

Optimized to reduce power, design complexity, and reliance on system resources

Latest powerline standard for low power, low data rate connectivity

Enabling WAN connectivity for M2M applications

Qualcomm Atheros

Qualcomm CDMA Technologies

Qualcomm: Broad Connectivity Portfolio

Wide Area Network Solutions

- 3G/4G cellular
  - Mobile station modems (MSM)
  - Mobile data modems (MDM)
  - Snapdragon
  - Gobi
  - Metro/femtocells
- Passive optical networking (PON)

Local Area Network Solutions

- Wi-Fi
  - 802.11n
  - Ultra-low power 802.11n
  - 802.11ac
- Powerline (PLC)
  - HomePlug AV
  - HomePlug Green PHY
- Ethernet

Personal Area & P2P Solutions

- Bluetooth
- Wi-Fi Direct
- Wi-Fi Display
- WiGig (802.11ad)
- Skifta
- AllJoyn

LOCATION TECHNOLOGIES