World’s First 5G WiFi
802.11ac SoC
AGENDA

- 5G WiFi Market Dynamics & Opportunity
- Broadcom 802.11ac for Enterprise Introduction
- Summary
**1st Generation**
- **802.11**
- **Data Rate:** 2 Mbps
- **Use Case:** Internet

**2nd Generation**
- **802.11b**
- **Data Rate:** 11 Mbps
- **Use Case:** Email

**3rd Generation**
- **802.11g/a** - Wi-Fi starts to become ubiquitous
- **Data Rate:** 54 Mbps
- **Use Case:** Rich-data Web experience

**4th Generation**
- **802.11n**
  - **Data Rate:** Up to 600 Mbps; Most prevalent flavor 150 Mbps
  - Enhanced range due to use of MIMO
  - **Use Case:** Medium-resolution video streaming
  - Higher throughput

**5th Generation**
- **802.11ac**
  - **Data Rate:** Up to 3.6 Gbps; First solutions < 1.8 Gbps
  - **Use Case:** coverage for video “Wired” Compliment

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### >5BU Consumer Electronic Devices in 2014

<table>
<thead>
<tr>
<th>Attach Rate</th>
<th>2008</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Wi-Fi</td>
<td>Wi-Fi</td>
</tr>
<tr>
<td>Medium</td>
<td>Wi-Fi</td>
<td>Wi-Fi</td>
</tr>
<tr>
<td>High</td>
<td>Wi-Fi</td>
<td>Wi-Fi</td>
</tr>
</tbody>
</table>

Source: ABI Research, 2011

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GROWING WIRELESS ADDICTION IN THE ENTERPRISE

- Access point installation growing at a CAGR of 21% (2011-2016)

- Overcrowding in 2.4 GHz
  - IT Managers looking to expand use of 5 GHz band

- Wireless devices drive up usage of WLAN
  - 92% of the Future 500 are testing or deploying iPad
  - 80% of the top hospitals in the US are now testing or piloting the iPad

- Employees shifting to use of tablets and smartphones and away from PCs

- Use of bring your own device growing

Exhibit 4: Employee-Owned Devices Lead in the Enterprise

<table>
<thead>
<tr>
<th>Devices</th>
<th>Employer-Supplied</th>
<th>Employee-Owned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tablets</td>
<td>35%</td>
<td>65%</td>
</tr>
<tr>
<td>Smartphones</td>
<td>31%</td>
<td>69%</td>
</tr>
</tbody>
</table>

Source: Yankee Group’s 2011 US Enterprise Mobility: Employee Survey, Wave 2
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Enterprise Verticals looking at Cloud Based WLAN Networking

- Retail
- Government
- Branch Offices
- Hospitality

Virtual Centralized Management
Automatic Distribution of Security Policies
Reduces Capex and Opex
Up to 65 percent of mobile data traffic can be offloaded to Wi-Fi

+90 percent of mobile data usage occurs in a non-mobile environment

Wireless Broadband Access

Suburban | Urban

Mobile Internet Services

Private Venue | Public Venue | Home Hotspot

Network Infrastructure

Offloading data from 3G to Wi-Fi delivers 70-percent savings per byte

Offloading can reduce OPEX by up to 50 percent
HOTSPOT 2.0 WILL PLAY A LARGE ROLE

Enables Cellular-like Roaming for Wi-Fi-enabled Devices

Source: Informa Telecoms & Media
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5G WiFi
WHAT IS 5G WIFI (802.11ac)?

- Fifth generation Wi-Fi
- Adds more capacity through wider channels
  - 80 and 160 MHz
  - 256 QAM Encoding
- 11ac is primarily a 5 GHz Technology
  - 2.4 GHz will still be 11n rates

<table>
<thead>
<tr>
<th>Number of Streams</th>
<th>802.11n 20 MHz</th>
<th>802.11n 40 MHz</th>
<th>802.11ac 80 MHz</th>
<th>802.11ac 160 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75 Mbps</td>
<td>150 Mbps</td>
<td>433 Mbps</td>
<td>867 Mbps</td>
</tr>
<tr>
<td>2</td>
<td>150 Mbps</td>
<td>300 Mbps</td>
<td>867 Mbps</td>
<td>1.7 Gbps</td>
</tr>
<tr>
<td>3</td>
<td>225 Mbps</td>
<td>450 Mbps</td>
<td>1.3 Gbps</td>
<td>2.6 Gbps</td>
</tr>
</tbody>
</table>
802.11ac FOR ENTERPRISE AND CARRIERS

- Streaming content
- Access to the “Cloud”
- Video Conference

- Supports higher density of users
- Fewer dead spots throughout the business
- Work longer
5G WIFI DATA RATES & RANGE

802.11ac Coverage

- 11ac (3-antenna)
- 11n (1-antenna)
- 11n (3-antenna)

Data rate in Mbps vs. Distance in Meters

- 1 Room
- 2 Rooms
- 3+ Rooms

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ADOPTION WILL OCCUR RAPIDLY

Wi-Fi Chipset Shipments

- 802.11n/802.11ac
- 802.11ac (5 GHz)
- 802.11n (dual-band)
- 802.11n (2.4 GHz)

Source: ABI Research, 2011
EXPECTED TO PENETRATE ALL PRODUCT SEGMENTS

WW 11n/11ac Phone Forecast

WW 11n/11ac Portable PC/Tablet Forecast

WW 11n/11ac AP Forecast

WW 11n/11ac Fixed CE Forecast
- Delivering multiple .11ac chip sets
- Addressing the broadest set of segments and devices
- Features tailored for Enterprise and Carrier
  - Airtime fairness
  - Beam forming
  - Spectrum analysis
- Economies of scale to optimize size, cost & power
BCM43460: MISSION CRITICAL WLAN ACCESS

Enterprise and Carrier Class Wireless Infrastructure for the Next-Generation Access Point

Mission Critical Wireless Infrastructure
Gigabit Wireless Access with 5G WiFi
Hotspot 2.0-enabled Access Points in 2012
Airtime Fairness for Dense Client Environments
Complete Enterprise and Carrier Class AP solutions

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NEW FEATURES OPTIMIZED FOR ENTERPRISE

Transmit Beam Forming
- Supporting both explicit and implicit beam forming for more robust coverage

Airtime Fairness
- Enables better performance for dense networks with a variety of speeds

Spectrum Analysis
- Full FFT capture capability to support monitoring and diagnosis of non-Wi-Fi interference
- Enables more robust WLANs for Enterprise &Carrier networks
Complement to Gigabit Ethernet
- Mobile devices
- Video conferencing
- CRM

Enables exploding growth in Wi-Fi enabled devices
- PCs, Tablets & Smartphones

New Features provide range, coverage & higher network efficiency
- MU-MIMO
- Beam-forming

Enables deployment of Enterprise Cloud without risk of locally stored data
COMPLEMENTS 3G/4G NETWORK

802.11ac and Hotspot 2.0 Complement 4G-LTE
SUMMARY

- Explosive growth of content consumption
  - Proliferation of wireless devices in the Enterprise
  - Need for faster and more reliable business class wireless infrastructure

- 802.11ac superior to .11a/b/g/n
  - Faster throughput
  - Higher capacity
  - Broader coverage
  - Longer battery life

- Broadcom strongly positioned to lead in .11ac
  - World’s broadest portfolio of 802.11ac solutions
Thank You