Wi-Fi Alliance Vision

Seamless connectivity
Wi-Fi CERTIFIED: Worldwide network of member companies

• Model collaboration forum of more than 500 member companies, enabling Wi-Fi® adoption

• Wi-Fi CERTIFIED™ is a world-class interoperability validation program that promotes accelerated adoption of new technology, and delivers the best user experience

• More than 15 distinct initiatives underway in 2013
Seven new Wi-Fi CERTIFIED programs and continued strong certification growth in 2012

**Wi-Fi CERTIFIED™ Products 2009-2012**

- Consumer Electronics
- Networking
- Handsets
- Computing & Peripherals
- Other
- Reference Design and Modules

- **Computing and peripherals:** 12% average annual growth
- **Networking:** 26% average annual growth
- **Handsets:** 63% average annual growth
- **Consumer electronics:** 92% average annual growth

Proprietary | © Wi-Fi Alliance
2013 Outlook: New technologies, compelling solutions, and a broadening portfolio

One of the world’s most loved technologies

- 17 percent of people around the world use Wi-Fi*
- More than 5 billion units shipped since 2000**
- More than 1.4 million hotspots and growing***

It just keeps getting better

- Market growing at double-digit rates
- Application advancements: Miracast™, Passpoint™, and much more
- New high-performance technologies in 5 GHz and 60 GHz this year

*Strategy Analytics  
**ABI Research  
***Informa Telecoms & Media
Technology portfolio expanding for an exciting range of applications

Wi-Fi and WiGig Chipset Shipments by Frequency Band
(Millions of Units)

- Dual-band 11n (2.4 and 5 GHz)
- Single-band 11n (2.4 GHz)
- Tri-band 60 GHz 11ad/WiGig, 11ac (5 GHz) and 11n (2.4 GHz)
- Dual-band 11n (2.4 GHz) + 11ac (5GHz)

Source: ABI Research, December 2012
Industry liaisons enable collaboration to deliver specialized solutions

CableLabs
Continua
CSEP
CTIA
dlna
ECC
EPRI
GSMA
HGI
HomePlug
JasPar
NSC Forum
Wireless Broadband Alliance
ZigBee Alliance
Wi-Fi Alliance certification and market-enabling programs

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<th>Wi-Fi CERTIFIED™ programs</th>
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<td>IBSS with Wi-Fi Protected Setup™</td>
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Wi-Fi CERTIFIED™ ac: Wi-Fi technology’s next generation, coming soon

- Stream up to three lightly compressed HD video streams, rapidly sync large files, and connect for demanding applications at gigabit data rates
- Wi-Fi CERTIFIED ac technology builds on Wi-Fi CERTIFIED n and interoperates with legacy 5 GHz devices
- Dual-band (2.4 and 5 GHz) networking products are expected to be very widespread, keeping legacy devices connected
- Includes WPA2™, the latest-generation security technology
- Certification program planned for first half 2013
Wi-Fi CERTIFIED ac supports rapid sync-and-go

- Jitter and delay are not critical; time spent to do transfer is valuable
- Download HD movies for a trip as you’re walking out the door
  - Transfer a 25GB HD movie file in 5 minutes
- Instantly share photo albums with friends
  - 150 JPEG files of 1.25MB each will transfer in less than 2 seconds
WiGig/60 GHz technology is an exciting companion to Wi-Fi networking technology

- 60 GHz devices deliver multi-gigabit data rates and low latency to support a range of applications
  - Stream uncompressed HD video
  - Enjoy video gaming with no noticeable latency
  - Dock a range of devices without cables

- Multi-band devices will seamlessly hand over data streams from 60 GHz to Wi-Fi, providing whole-home, high-performance networking, boosted with islands of even higher data rate 60 GHz connections

- Wi-Fi Alliance and WiGig Alliance are finalizing an agreement to consolidate all technology development and certification activity in Wi-Fi Alliance; transition to begin in Q1 2013

- First certification program expected to launch late 2013
Transfer uncompressed HD movies between devices on the go

- Public kiosks with downloadable movies, such as at an airport, are a great way to make movies available to users with portable devices.
- At multi-gigabit download speeds, a user can download an uncompressed, HD movie in one minute, or on the way to an airport gate before boarding.
- The kiosk can support multiple simultaneous transfers, which means even less time waiting in line.
60GHz is multi-Gbps wireless

- The unlicensed 60GHz band is the key to realize multi-Gbps wireless
- The 60GHz spectrum is well harmonized around the world, thus easing worldwide adoption of 60GHz products
- Allows up to 4 non-overlapping channels of around 2 GHz each
- Simple, low power modulation schemes can easily reach 2 Gbps
## WiGig/802.11ad: summary to current 802.11

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<th>Item</th>
<th>WiGig/802.11ad</th>
<th>Technical details</th>
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<td>Network architecture</td>
<td>Infra-BSS, IBSS, PBSS</td>
<td>Backward compatibility to 802.11 + native WPAN support</td>
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<td>Medium access</td>
<td>Scheduled access and contention access</td>
<td>Enables both the low power and the high performance devices</td>
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<td>Power saving</td>
<td>Advanced power saving techniques</td>
<td>Can be more power efficient than today’s 802.11</td>
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<tr>
<td>Security mechanism</td>
<td>GCMP</td>
<td>Secure communication at Gbps rates</td>
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</table>
| PHY                   | SC and OFDM, with common preamble and coding              | • Up to 7Gbps with OFDM  
|                       |                                                          | • Up to 4.6Gbps with SC                                                          |
| Beamforming           | Unified and flexible beamforming scheme                   | Enables robust communication at ranges beyond 10m                                |
| Fast session transfer | Multi-band operation across 2.4/5/60 GHz                  | Built-in efficient and seamless support for multi-band radios                     |

An Introduction to the WiGig/IEEE 802.11ad MAC/PHY C.Cordeiro (Intel)
Wi-Fi CERTIFIED Miracast™: Easy-to-use Wi-Fi display, available now

- Connect devices for a rich audio/video experience without cables or a connection to an existing Wi-Fi network
  - Watch videos from a smartphone on a big screen television
  - Share a laptop screen with the conference room projector

- Miracast certified products entering the market in volume this year

- Find Wi-Fi CERTIFIED Miracast smartphones, TVs, tablets, etc. at wi-fi.org
Consumers are embracing connected entertainment…

• The average mobile user owns 3 internet-connected devices and 18% own 5 or more (Juniper Networks)

• Exploding range of entertainment offerings:
  - Users worldwide watch 4 billion hours each month on YouTube
  - U.S. Netflix users have streamed more than 2 billion hours from the service
  - In Japan, Niconico video has 26.48 million subscribers as of March 2012
  - In Korea, TVing, first launched in 2010, has over 3.5 million users and is the country’s biggest multi-screen service for smartphones, tablets, PCs and other screens
  - Use of apps continues to skyrocket – extending beyond smartphones to tablets, ebook readers, and TVs
Miracast brings your apps to life from the small screen to the big screen

- Many CE vendors
- Broad silicon support
- Proven technology

Any Device, Any Content
- Industry-standard content protection
- WPA2™ Security

Industry-Wide Solution

Easy to Use
- Wi-Fi Direct™
- Wi-Fi Protected Setup™
- Simplified Configuration

Any Device, Any Content

Easy to Use
Wi-Fi CERTIFIED Miracast™ allows users to display content between certified devices from any brand

- Wi-Fi Alliance has begun testing and certifying Miracast devices in laboratories worldwide.
- Display devices like tablets, handsets, TVs and notebooks can now pursue certification
- Broad support across silicon, computing, and consumer electronics vendors
- Wi-Fi CERTIFIED Miracast devices:
  - Use Wi-Fi Direct™ - access to a Wi-Fi network is not needed
  - Interoperate with other brands
  - Implement WPA2™ security
  - Support premium content
  - Provide simplified discovery and setup
Watch your content where you want

View videos from a smartphone or tablet on a television

Watch live programs from your cable/satellite box on any tablet
Devices connect directly, even without a network

Share a laptop screen with the conference room projector in real-time
Wi-Fi CERTIFIED Passpoint™ streamlines connectivity in hotspots

• Wi-Fi CERTIFIED Passpoint devices deliver an automated, security-protected connection experience in service provider hotspots

• Complementary work in Wireless Broadband Alliance to leverage Passpoint as a key enabler of inter-provider roaming

• Public Wi-Fi hotspots are critical to service provider strategy:
  – Forecast of 120 billion connections** each year in nearly six million hotspots worldwide* by 2015
  – Annual global mobile data traffic predicted to grow 4x today’s volume to more than 82 exabytes by 2015***

• Passpoint Release 2, coming late 2013, adds features to support creation of new accounts on-the-spot, and makes it easier for users to find hotspots recommended by their service provider

• Find [Wi-Fi CERTIFIED Passpoint](http://wi-fi.org) devices at wi-fi.org

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* Source: Wireless Broadband Alliance and Informa, 2011  
** Source: In-Stat, 2011  
*** Source: Cisco Visual Networking Index, 2012
Passpoint operation

Mobile device states

Discovery
Provide network information (including operator network information) before association to allow optimized selection

Registration

Provisioning

Secure Access

WPA2 Enterprise for authentication and encryption provide notification of session expiration, renewal

Passpoint Release 2

Operator Policy – Wi-Fi Alliance Specification

Online Signup – Wi-Fi Alliance Specification
Passpoint discovered

- At this point the mobile device will *gather network information for selection criteria*.  
  - The Connection Manager software within the mobile device takes over.

- Based on the user requirements (mobile device) more information may be requested from the Passpoint network.
CWG-RF

• The Converged Wireless Group is a joint co-operation between CTIA and the Wi-Fi Alliance.

• CWG implements a test plan that dovetails with the CTIA OTA activities to measure:
  - Conducted and Over-The-Air RX and TX RF performance of Wi-Fi devices
  - The interaction and desensitization of both the cellular and Wi-Fi radios during simultaneous operation

• CWG testing is becoming more and more popular
  - The rate of new certs is increasing rapidly
  - Surpassed 1300 certifications in 2012
CWG Tests and some redacted results from 200 802.11 b/g Devices

- Conducted TX Power
  - Max 22 dBm, Min 5 dBm, Avg. 15 dBm
- Total Radiated Power (TRP)

- Conducted RX Sensitivity
  - Max -93 dBm, Min -55 dBm, Avg. -81 dBm
- Total Integrated Sensitivity
Wi-Fi <-> Cellular Interference Testing

- Co-located radios interfere with one another because the TX of one can swamp the RX of the other causing an apparent reduction of RX sensitivity and poor performance.

- Three main categories of tests are done with the device in free space in an anechoic chamber.
  - **Highest Cellular Frequency** – a cellphone call on the cellular frequency closest to the Wi-Fi band is set up with a base station emulator. Desensitization of Wi-Fi is measured.
  - **Harmonic Desensitization of Wi-Fi** – a cellphone call is set up on frequencies known to have a harmonics that lie on Wi-Fi channels. Desensitization of those Wi-Fi channels is measured.
  - **Wi-Fi Desensitization of Cellular** – Cellphone calls are set up on a large number of different channels and the error rate of the cell call is checked when the Wi-Fi radio is switched on.

- In the example chart some devices exhibit very high levels of desense – several devices by more than 20dB.
Antenna Radiation Pattern

• A useful by-product of the OTA testing is that the radiation pattern of the Wi-Fi antenna can be plotted in 3D for analysis of “hot” or “cold” zones

• CWG is the only test program in the world making these measurements
Spectrum & Regulatory Task Group

- Respond to calls for action from regulators around the world
  - Consultations, Rule Making, Petitions, …
  - Response transmittal
- Outreach to regulators
  - FCC
  - ETSI
  - Ofcom
  - MIIT and others
  - Encourage more unlicensed spectrum for Wi-Fi
  - Update regulators of Wi-Fi Alliance activity
  - Establish links between Wi-Fi Alliance and regulators
- Outreach to Wi-Fi Alliance Task Groups
  - Internal resource for other Wi-Fi Alliance Task Groups
  - Communicate regulations to newly formed TGs
  - Ensures regulatory compliance at program rollout
Wi-Fi Test Bed Architecture

**Wired Connections**
- Control Network
- Test Network
- Test Network (optional)
- Device Control Link
- Power Cord

**Multiplicity Notation**
- (*) Zero or More
- (0..1) Zero or One
- (1) One
- (1..*) One or More

Ex. The UCC PC connects directly to the DUT or through a Control PC; each Control PC connects to one and only one device.

**Notes**
1. A Test Bed STA may also be a converged, non-converged voice, CE, or other device with or without a Control PC.
2. The Control PC, if used, utilizes the Test Network as a Control Network for Test Bed APs before and after testing.
Thank you!

- User demand for Wi-Fi continues with increased device shipments and growing certification momentum
- New Wi-Fi CERTIFIED programs will change the mobile connectivity landscape
- Lots of exciting innovation on the horizon
- Point of contact: www.wi-fi.org
  - facebook.com/wificertified
  - @wifialliance