

IEEE 802.11 update

IEEE 802.11 standardization
and Wi-Fi Alliance programs

Linux wireless summit
Barcelona 2012

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Overview

- Previous, similar presentation at the Berlin summit in 2009
- Including updates since then
 - IEEE 802.11 work
 - Wi-Fi Alliance programs based on public information

Published standard

- Base standard
 - IEEE Std 802.11-2012
- Amendments
 - IEEE Std 802.11ae-2012
 - IEEE Std 802.11aa-2012

Work in progress

- TGac
- TGad
- TGaf
- TGah
- TGai
- TGaj
- TGmc
- PAD SG
- GLK SG
- ARC
- JTC1
- WNG

IEEE 802.11 process

- Study group
- Task group
 - Call for proposals
 - Downselect process
 - Working group letter ballots and recirculations
- IEEE-SA Comment resolution committee
 - Usually same set of people as the task group
 - IEEE-SA letter ballot and recirculations
- Publication

IEEE Std 802.11-2012

- Current base standard
 - From TGmb
 - IEEE Std 802.11-2007
 - 802.11k-2008, 802.11r-2008, 802.11y-2008, 802.11w-2009, 802.11n-2009, 802.11p-2010, 802.11z-2010, 802.11v-2011, 802.11u-2011, 802.11s-2011

IEEE Std 802.11k-2008

- (already covered in Berlin 2009)
- Radio Resource Measurement
- Partly included in WFA Voice-Enterprise
- Still mostly unimplemented in upstream Linux

IEEE Std 802.11r-2008

- (already covered in Berlin 2009)
- Fast BSS Transition (FT)
- Partly included in WFA Voice-Enterprise
- Mostly implemented in upstream Linux

IEEE Std 802.11y-2008

- (already covered in Berlin 2009)
- 3600-3700 MHz operation in USA

IEEE Std 802.11w-2009

- Protected Management Frames
- Included in WPA Protected Management Frames
- Fully implemented in upstream Linux
 - Though, not all drivers support this
 - CCMP changes, BIP/AES-CMAC

IEEE Std 802.11n-2009

- High Throughput
- Included in Wi-Fi CERTIFIED n
- Mostly implemented in upstream Linux

IEEE Std 802.11p-2010

- Wireless Access for the Vehicular Environment
 - Operation outside the context of BSS
 - No authentication, association
 - New channels
- Not yet implemented in upstream Linux

IEEE Std 802.11z-2010

- Extensions to Direct Link Setup
- Included in WFA TDLS
- Upstream Linux has basic functionality
 - Security setup (wpa_supplicant) available
 - Incomplete support for offchannel operations and power save
 - When to setup links is still somewhat open area
 - Automatic? Application API?

IEEE Std 802.11v-2010

- Wireless Network Management
 - Diagnostics, event reporting, multiple BSSID advertisement (single beacon), flexible multicast, directed multicast, proxy ARP, TIM broadcast, WNM-Sleep mode, traffic filtering, location tracking
- Parts included in WFA Passpoint
- Not yet implemented in upstream Linux
 - But there is starting to be interest..

IEEE Std 802.11u-2011

- Interworking with External Networks
 - E911 emergency services, emergency alert system, QoS mapping, media independent handover, network advertisement / discovery / selection, generic advertisement service (GAS)
- Parts included in WFA Passpoint
- Partially implemented in upstream Linux
 - GAS/ANQP in hostapd/wpa_supplicant

IEEE Std 802.11s-2011

- Mesh Networking
- Mostly implemented in upstream Linux

IEEE Std 802.11ae-2012

- Prioritization of Management Frames
 - QoS negotiation
 - Use of QoS with Management frames
- To address concerns regarding increased use of Management frames
 - e.g., logging from 802.11v
- Not yet implemented in upstream Linux

IEEE Std 802.11aa-2012

- Video Transport Streams
 - Enhancements for robust audio/video streaming
 - More reliable groupcast
 - BlockAck extensions
- Not yet implemented in upstream Linux

IEEE P802.11ac

- Very High Throughput <6 GHz
 - At least 500 Mbps
 - Below 6 GHz, excluding 2.4 GHz
- P802.11ac/D4.0 went through WG letter ballot
- Expected to be stable for main functionality
 - Vendors moving ahead with products
- Upstream Linux work ongoing
 - Changes to mac80211/hostapd
 - Will need new drivers, too

IEEE P802.11ad

- Very High Throughput 60 GHz
 - At least 1 Gbps
 - Typically 57-66 GHz
- P802.11ad/D9.0 completed sponsor ballot
- IEEE Standards Board approved 802.11ad
 - Publication expected late December 2012
- Upstream Linux work ongoing
 - First driver contribution being reviewed

IEEE P802.11af

- TV White Spaces Operation
 - Allow operation on frequency bands used for TV transmissions in areas where available bandwidth exists
 - TVWS band in US (54 – 698 MHz)
 - Enablement mechanism, database lookup
- P802.11af/D2.0 went through WG letter ballow

IEEE P802.11ah

- Sub 1 GHz
- Working on specification framework document
- No draft text started yet – targeting January 2013 for initial draft

IEEE P802.11ai

- Fast Initial Link Set-up
 - Speed up connection (to the point of working upper layer data connection)
 - Improvements to scanning/AP discovery
 - Including high density environments
 - Optimized security handshake
 - Option to include IP address assignment
- Completed specification framework document
- Working on initial draft text

IEEE P802.11aj

- China Milli-Meter Wave (CMMW)
 - Including 59 – 64 GHz and 45 GHz bands in China
 - Enable multi-Gbps throughput and lower power
- The first IEEE 802.11 TG to hold most interim meetings in China (separately from rest of the TGs)

IEEE P802.11mc

- New maintenance group
- Going through initial comment review on IEEE 802.11-2012
 - Mostly cleanup and fixes
 - But some new functionality, too
 - scope of the group is quite open
- Plans to integrate
 - 802.11ae, 802.11aa, 802.11ad, 802.11ac
 - May consider additional amendments like 802.11af
 - Aiming for 802.11-2015 approval in March 2015

PAD SG

- Pre-association Service Discovery study group
- Working on use cases
- Hoping to start as task group: TGaq

GLK SG

- General Link IEEE 802.11 study group
 - Similar group also in 802.1
- Aiming to enable better use of IEEE 802.11 with layer 2 bridges
 - Including station mode
- Hoping to start as task group: TGak

Wi-Fi Alliance

- Published specifications (since 2009)
 - Wi-Fi Display v1.0.0
 - Wi-Fi Simple Configuration v2.0.2
 - Wi-Fi P2P v1.1
 - already covered in the San Francisco summit 2010
 - Hotspot 2.0 v1.0.0

Wi-Fi Alliance Programs

- Protected Management Frames
 - IEEE Std 802.11w-2009
- Wi-Fi Direct™
 - Wi-Fi P2P (already covered in San Francisco 2010)
- TDLS (Tunneled Direct Link Setup)
 - IEEE Std 802.11z-2010
- WMM-Admission Control
 - WMM specification
- Voice-Enterprise
 - IEEE Std 802.11k-2008 and 802.11r-2008
- Passpoint™
 - Hotspot 2.0 Release 1
- Miracast™
 - Wi-Fi Display specification

Wi-Fi CERTIFIED Miracast™

- Uses Wi-Fi Direct for connection
- Allows video and audio to be displayed through other devices
 - E.g., from a smartphone to a big screen television or laptop to a conference room projector
 - Multi-vendor support – interoperability
- Upstream Linux has partial support
 - wpa_supplicant includes interface for implementing extensions to P2P
 - separate application needed for stream management

Hotspot 2.0

- Seamless Wi-Fi access in hotspots
- Release 1 (June 2012)
 - Network discovery and selection (from 802.11u)
 - Seamless network access (EAP, no captive portal)
 - Secure authentication and connectivity (WPA2-Enterprise)
- Additional features planned for 2013
 - Immediate account provisioning
 - Operator policy

Hotspot 2.0 implementation

- `cfg80211/mac80211` provides most low-level operations for user space implementation
- `hostapd`
 - GAS/ANQP server
 - Configuration of advertised information
- `wpa_supplicant`
 - GAS/ANQP client
 - automatic network selection
 - separate credential configuration
 - temporary network blocks

Hotspot 2.0 UI

- New mechanism for configuring Wi-Fi networks
 - credentials (e.g., username/password or certificate/private key, or SIM/USIM) instead of network block (SSID, EAP setup)
 - new data structure in wpa_supplicant
 - need to expose credential management through UI
 - need to decide how and when to use automatic network selection