prplMesh: Open-source Implementation of the spec underlying Wi-Fi CERTIFIED EasyMesh™

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Essensium/Mind
Overview

- Multiple access points problem
- Wi-Fi CERTIFIED EasyMesh™
- prplMesh architecture
- Security
- Missing features
Multiple access points in house

Insufficient coverage
Multiple access points in house

Insufficient coverage → add access point
Multiple access points in house

Insufficient coverage
→ add access point
→ setup complexity
Multiple access points in house

More access points → more complexity
Multiple access points in house

More access points → more complexity → interference
Multiple access points in house

More access points → more complexity
→ interference
→ suboptimal use
Wi-Fi CERTIFIED EasyMesh™:
Smart, extended coverage home Wi-Fi®

Wi-Fi Alliance Multi-AP specification underlies Wi-Fi CERTIFIED EasyMesh
Wi-Fi Alliance Multi-AP specification

- Based on IEEE 1905.1
  - ethertype 0x893A
  - fixed multicast address
  - device “AL MAC” address

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CMDU header

TLVs
Wi-Fi Alliance Multi-AP specification

• Based on IEEE 1905.1
  – Topology discovery
  – Onboarding (push-button)
Wi-Fi Alliance Multi-AP specification

- Based on IEEE 1905.1
- New CMDUs and additional TLVs
- Extended onboarding procedure
- Capability / metric collection
- Configuration, channel selection, steering
- *Controller* and *Agent* roles
WFA Multi-AP architecture
WFA Multi-AP Metrics
WFA Multi-AP Steering

Diagram showing a house with multiple access points (APs) and agents, indicating a network setup with a controller and steering mechanisms. The diagram includes labels for the controller, agents, and a gateway, with arrows indicating signal paths between the components.
WFA Multi-AP Onboarding

Controller
Agent

Search
Agent

Gateway

WAN
WFA Multi-AP Onboarding

Controller
Agent

WSC

Agent

Agent

Agent

Agent

WAN
WFA Multi-AP Onboarding

Controller
Agent

Gateway

AP

WSC

Agent

Agent

Agent

WAN

mind

prpl
Implementation stakeholders

- Chip vendors start implementing Multi-AP
- OEMs want to use different chips without changing their software
- Carriers want interoperability and manageability
prpl Foundation

• An open-source, community-driven, collaborative, non-profit foundation

• Working on standards, APIs and software for IoT, embedded devices and the smart society of the future

• International membership of 30+ member organizations, and 200+ active engineers
prpl combines standardisation & open source

- **High-level API**: A single API for on-device software
- **Low-level API**: A single API for chipsets and SoCs
prplMesh Multi-AP implementation

- Open source reference implementation for Linux
- *Agent* ready for Wi-Fi CERTIFIED EasyMesh™
- *Controller* as differentiator
- Match with prpl APIs, add carrier manageability
- Contracted Essensium/Mind for implementation
Path to certification

prplMesh

OEM product

Wi-Fi CERTIFIED EasyMesh™
BroadBand Forum and Multi-AP

- Delivers IEEE 1905.1a stack
  https://github.com/BroadbandForum/1905.1a

- Define architecture and interface for carrier management
  - QoS
  - metrics acquisition for diagnostics
  - ...

- Define additional test plans
prplMesh architecture

- Control
- Data model
- 1905.1 Multi-AP
- Platform integration
- Drivers
prplMesh Data Model

- **local device**
  - radio phy0
  - AP SSID1

- **remote device**
  - radio phy1
  - AP SSID1
  - Backhaul SSID2
  - radios
  - BSSes
prplMesh Data Model

local device

radio
phy0

addAP()
→ cfg80211
+ hostapd

remote device

radio
phy1

addAP()
→ vendor driver
+ forked hostapd

radios

addAP()
→ Multi-AP CMDUs
OpenWRT platform integration

- access
  - ubus
- persist
  - UCI
  - rpcd
- AP creation
  - hostapd
- metrics/control
  - socket
  - nl80211

- prpl API
- hostapd API
- /etc/config
- netifd
- prpl
- mind
- THE LINUX FOUNDATION
Stretch goal: unified AP interface

access

prpl API
hostapd API

persist

ubus
UCI rpcd

AP creation/metrics/control

socket
hostapd
cfg80211

nl80211

/etc/config

prpl
Multi-AP messaging is protected against out-of-network eavesdropping through utilization of encryption feature(s) of its underlying network connectivity.

A Multi-AP interface is considered authenticated when the underlying networking technology encryption mode has been successfully configured.
Missing features

- Specification of NAT/firewall/VLAN rules
- Separate networks (guest, fon)
- Quality of Service
- End-to-end authentication / encryption
- Controller election
Router with multiple bridges

- lan: wired LAN ports, PSK Wi-Fi
- wan: NATed from other bridges
- guest: open Wi-Fi, isolated
- dmz: PSK Wi-Fi, firewalled