



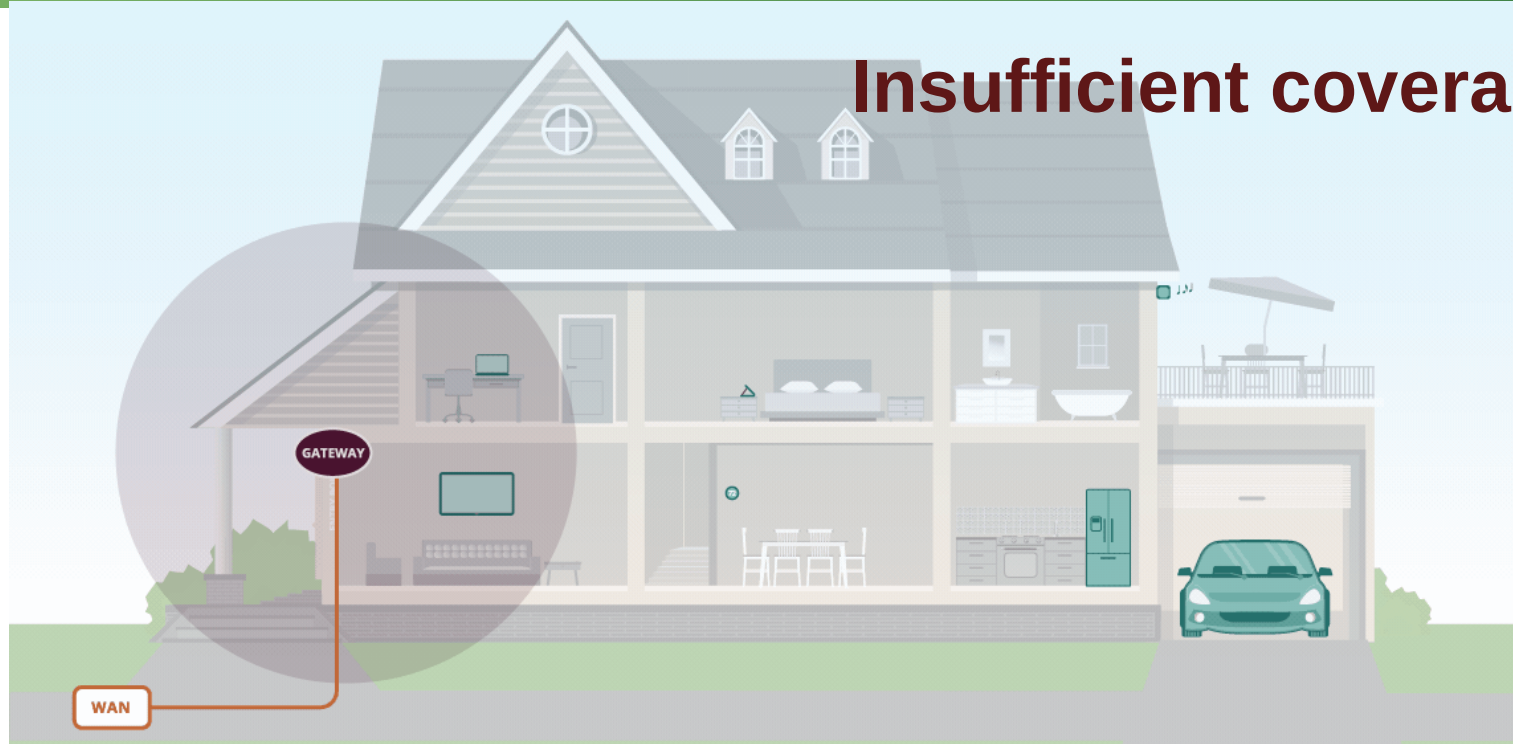
**prplMesh:
Open-source Implementation
of the spec underlying
Wi-Fi CERTIFIED EasyMesh™**

**Arnout
Vandecappelle
Essensium/Mind**

Overview

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

Multiple access points in house

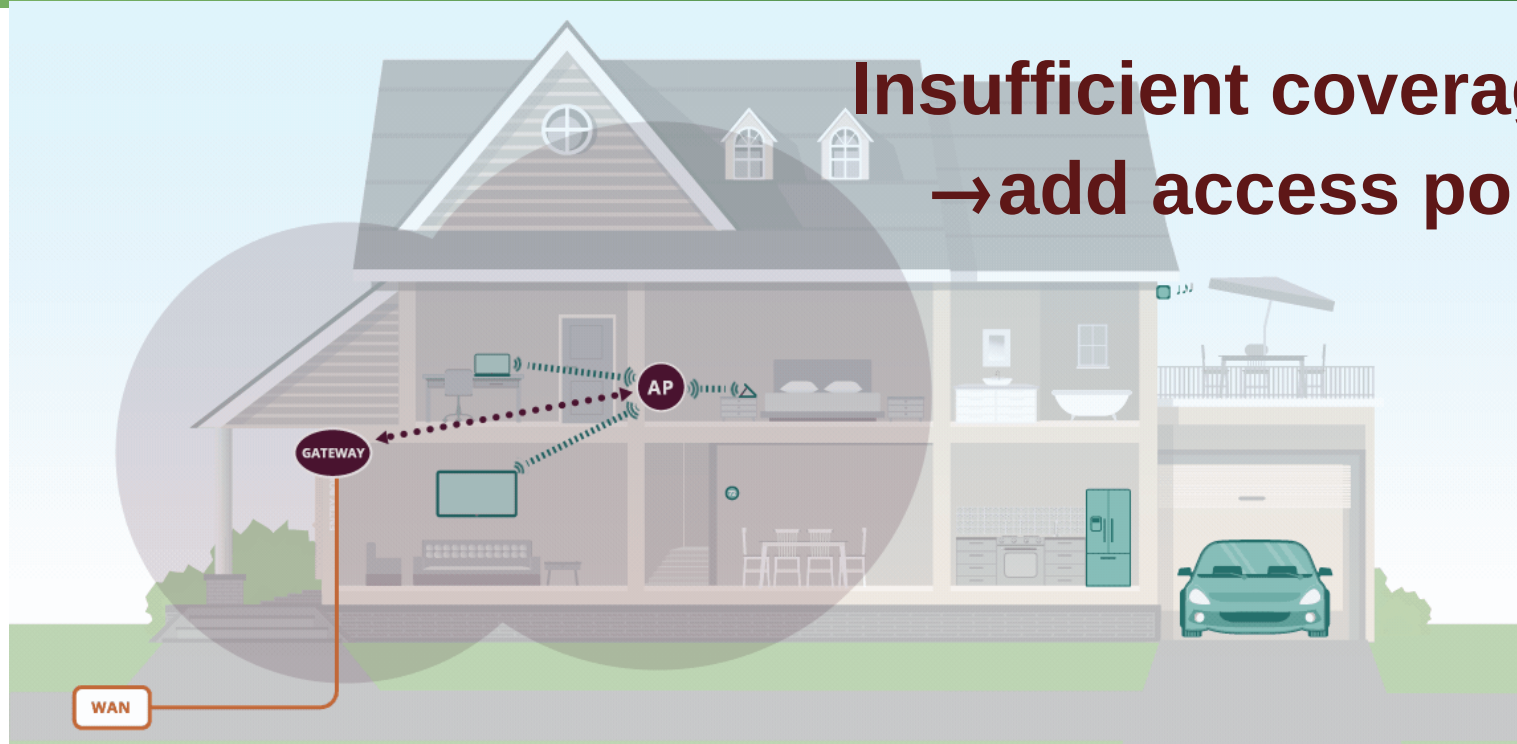


Insufficient coverage

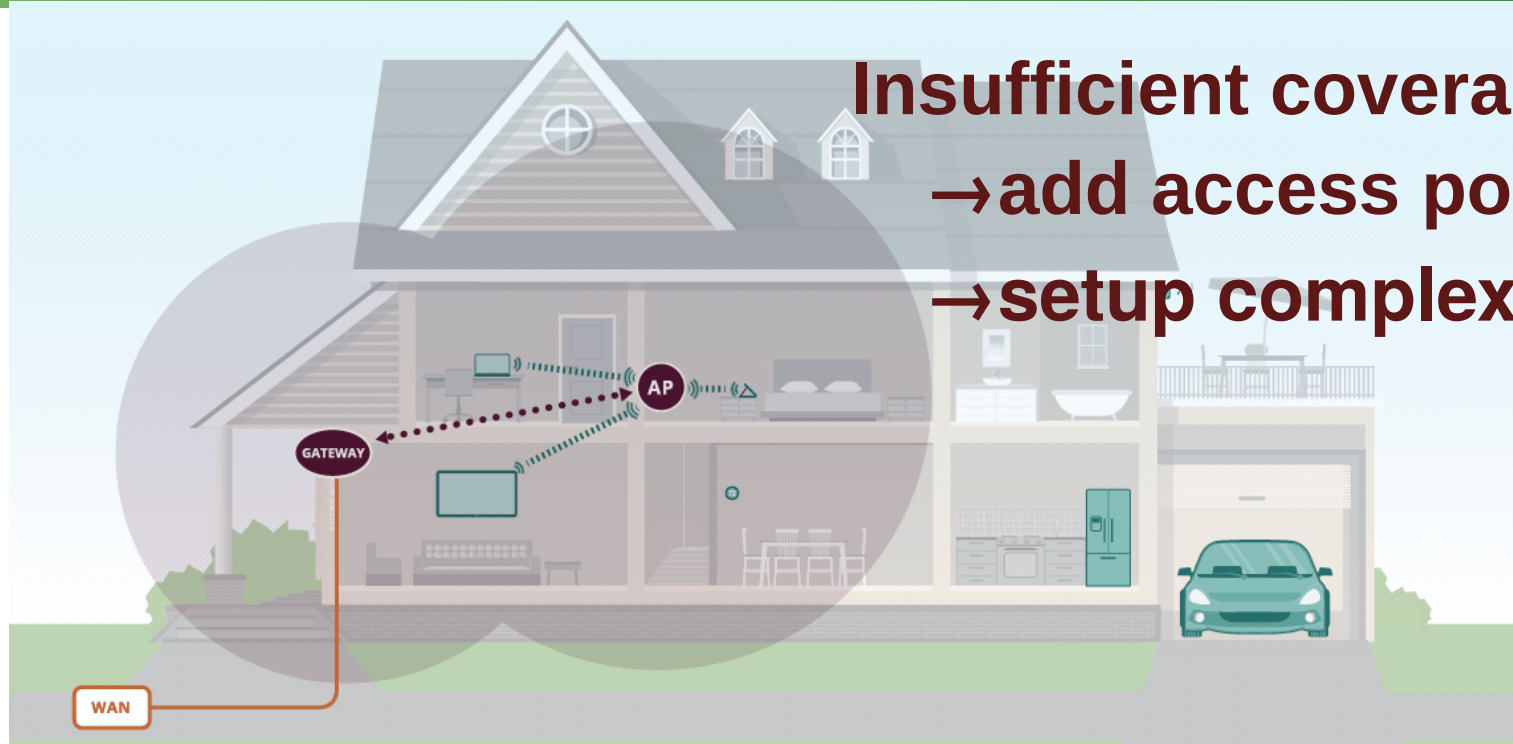
GATEWAY

WAN

Multiple access points in house

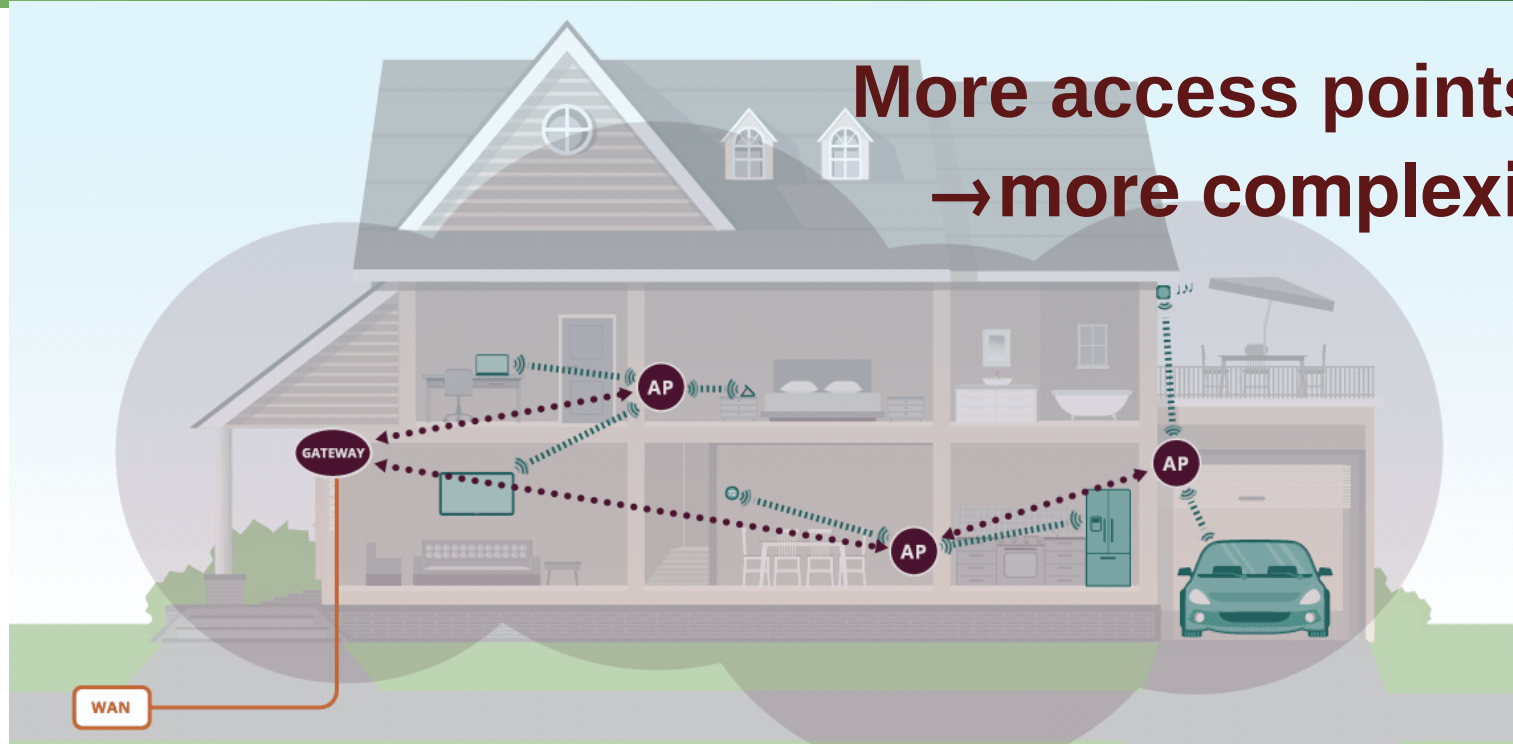


Multiple access points in house



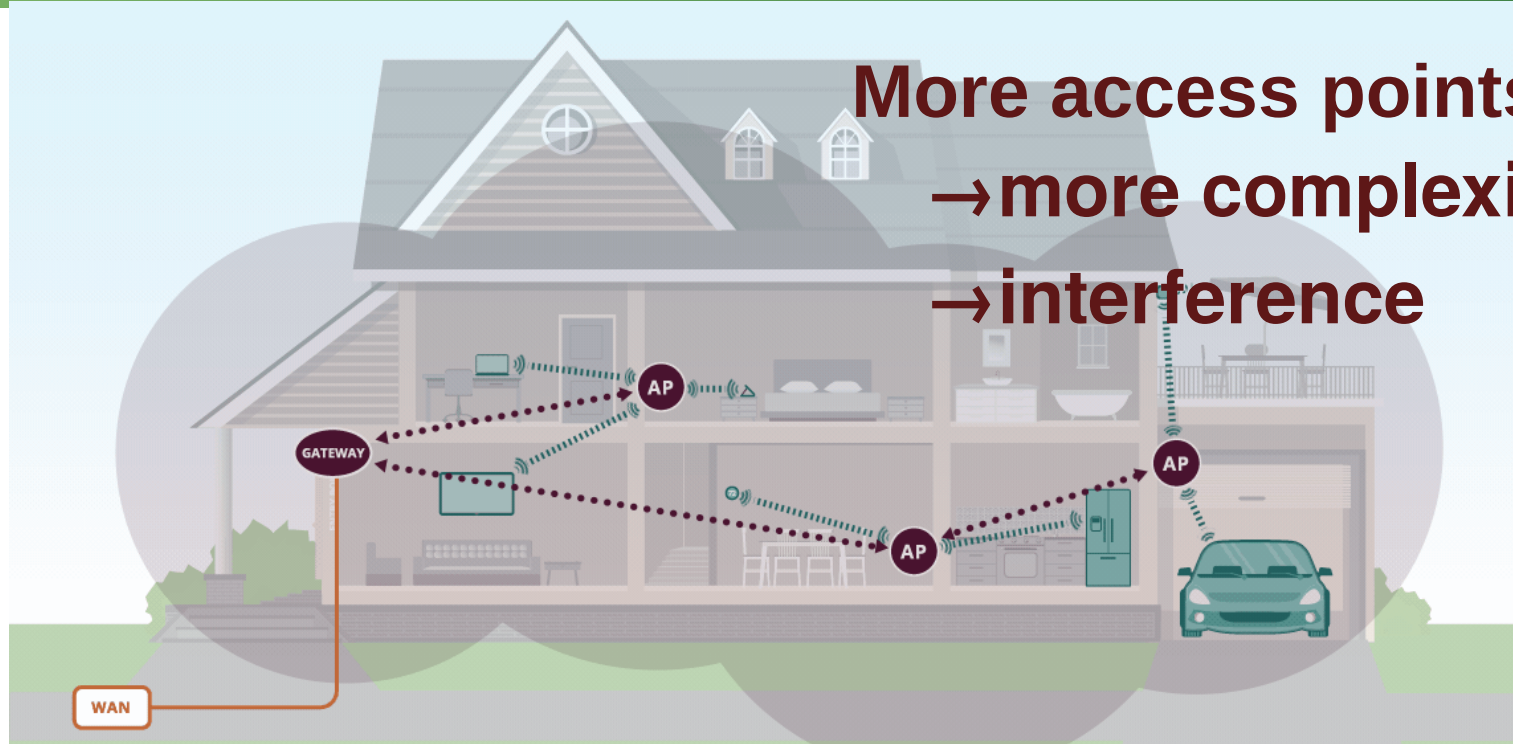
Insufficient coverage
→ add access point
→ setup complexity

Multiple access points in house



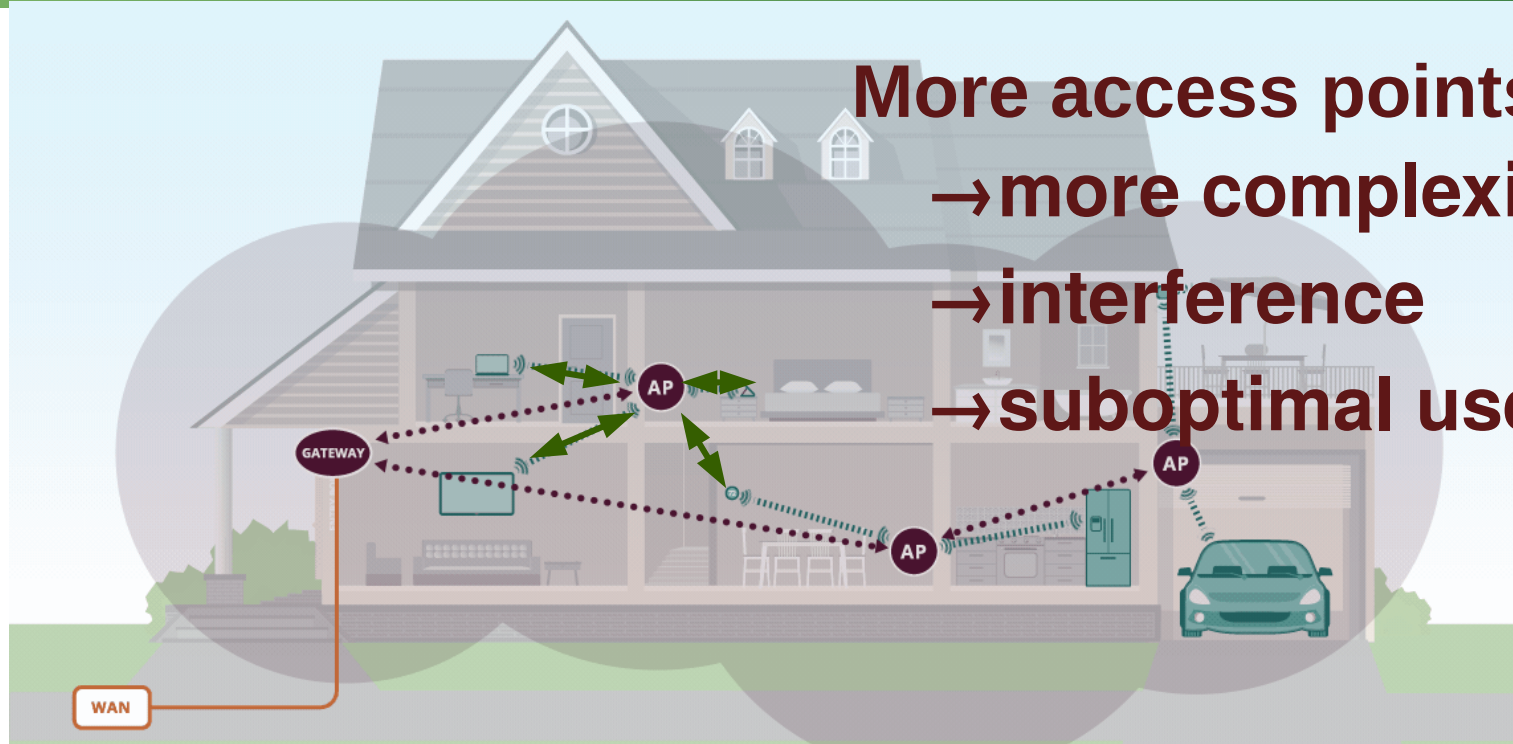
More access points
→ more complexity

Multiple access points in house



More access points
→ more complexity
→ interference

Multiple access points in house



More access points
→ more complexity
→ interference
→ suboptimal use

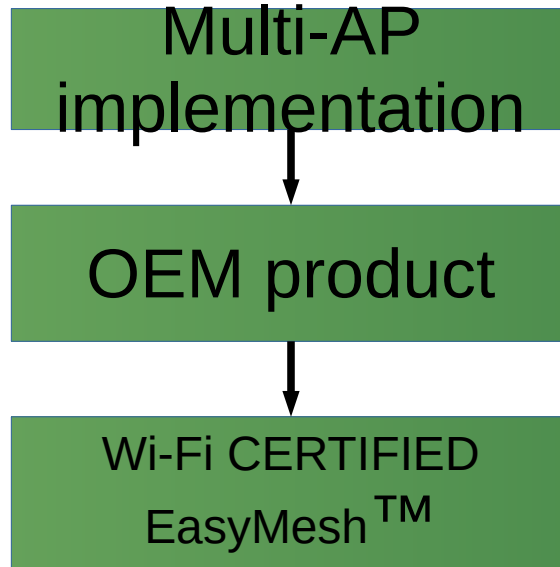
Wi-Fi CERTIFIED EasyMesh™:

Smart, extended coverage home Wi-Fi®



<https://www.wi-fi.org/discover-wi-fi/wi-fi-easymesh>

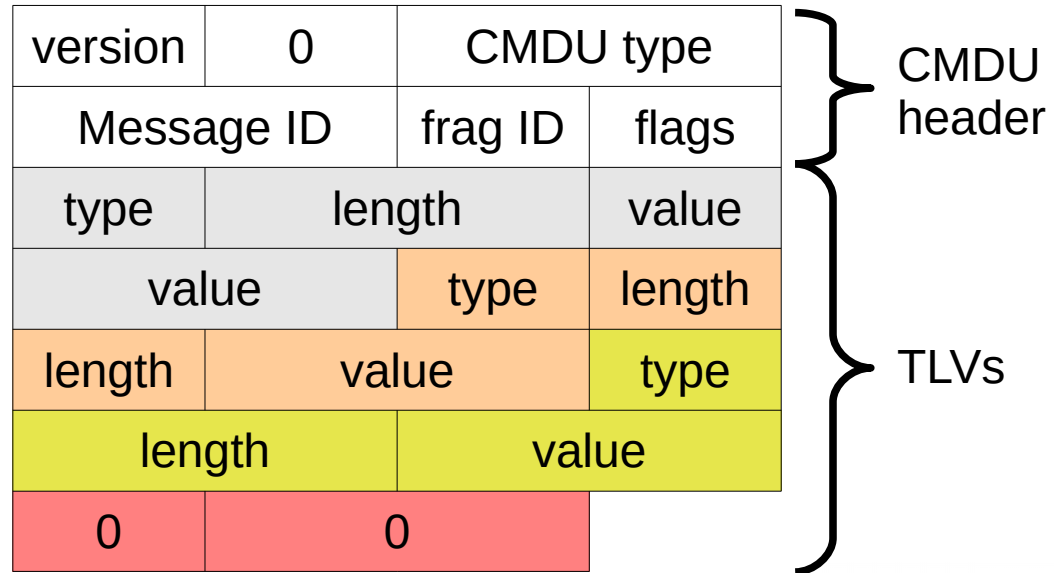
Wi-Fi Alliance Multi-AP specification underlies Wi-Fi CERTIFIED EasyMesh



Wi-Fi Alliance Multi-AP specification

- Based on IEEE 1905.1

- ethertype 0x893A
- fixed multicast address
- device "AL MAC" address



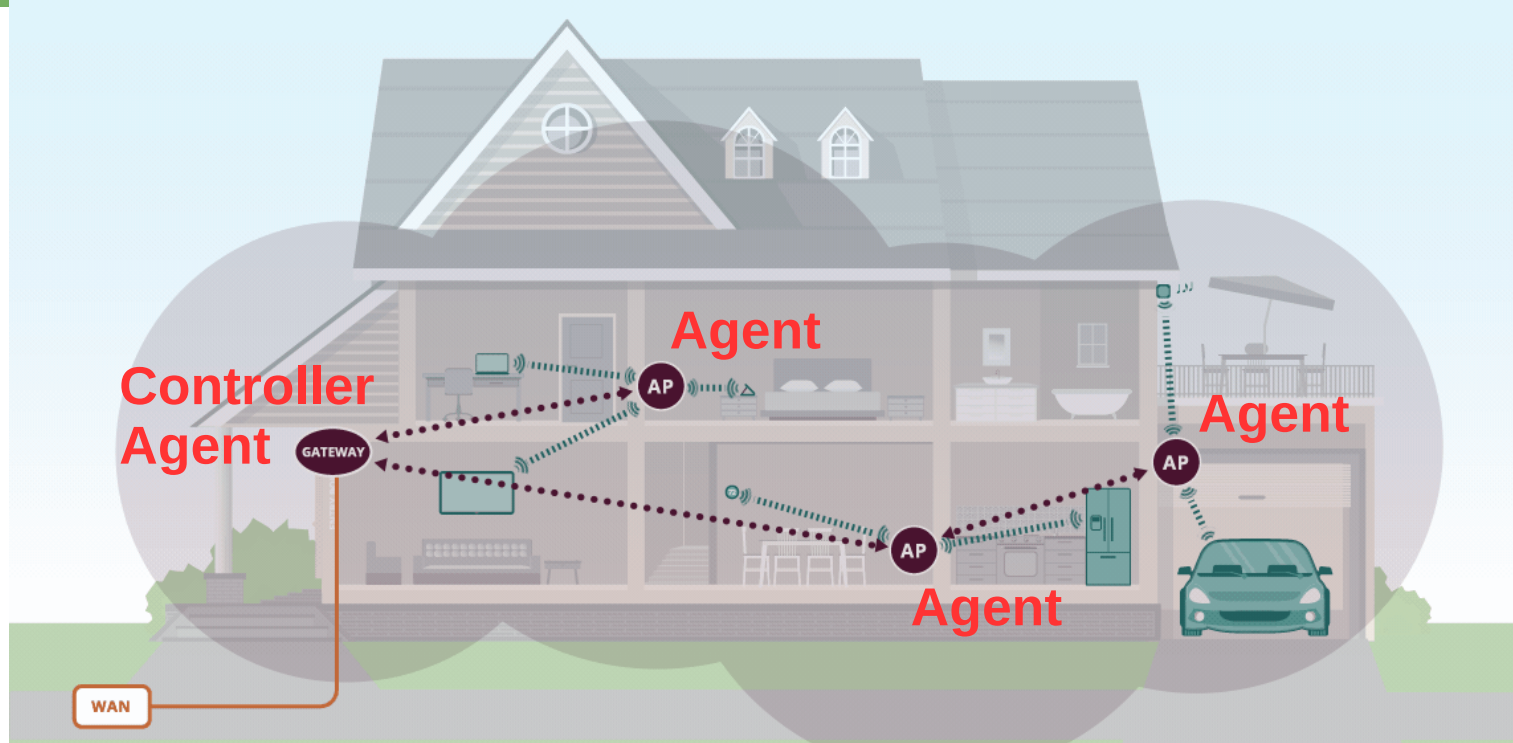
Wi-Fi Alliance Multi-AP specification

- Based on IEEE 1905.1
 - Topology discovery
 - Onboarding (push-button)

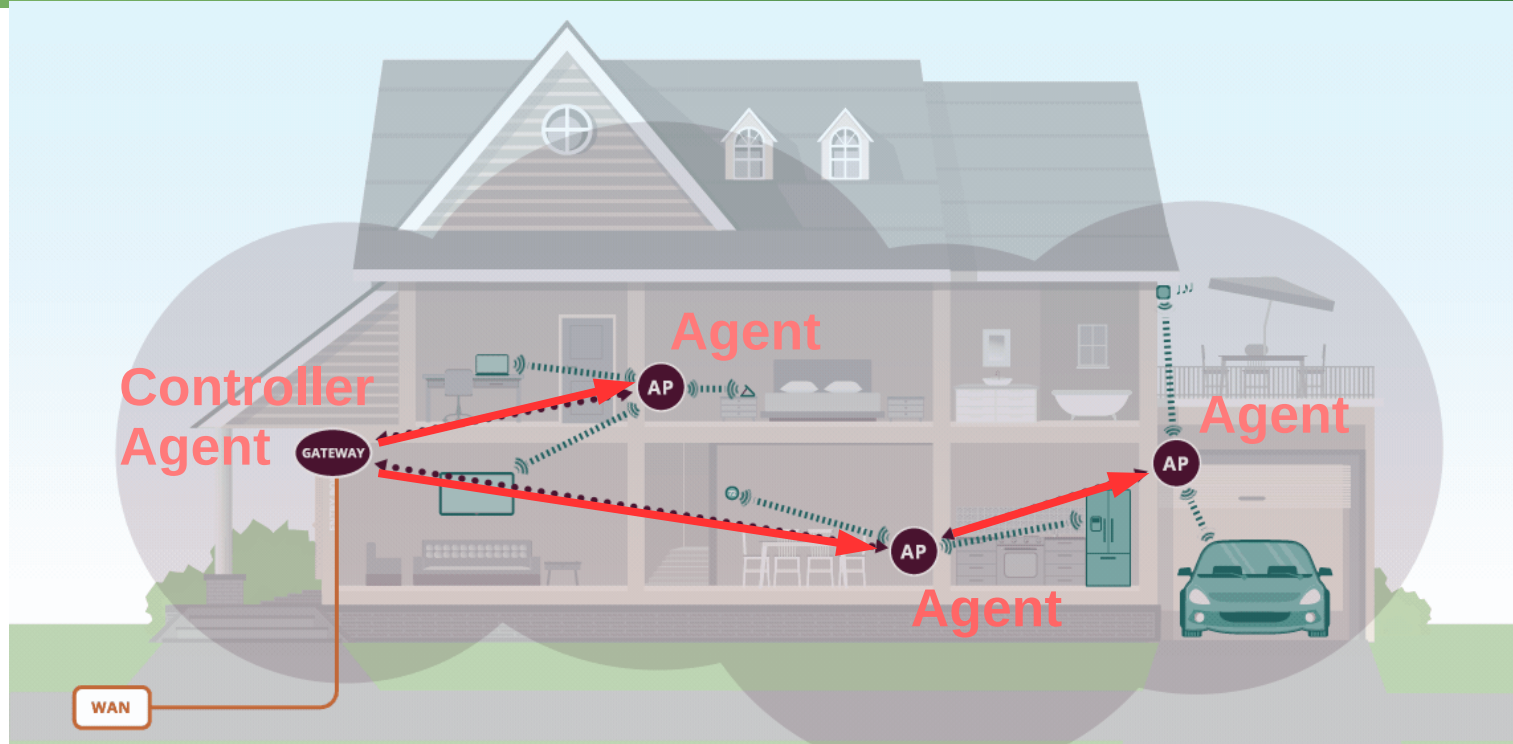
Wi-Fi Alliance Multi-AP specification

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

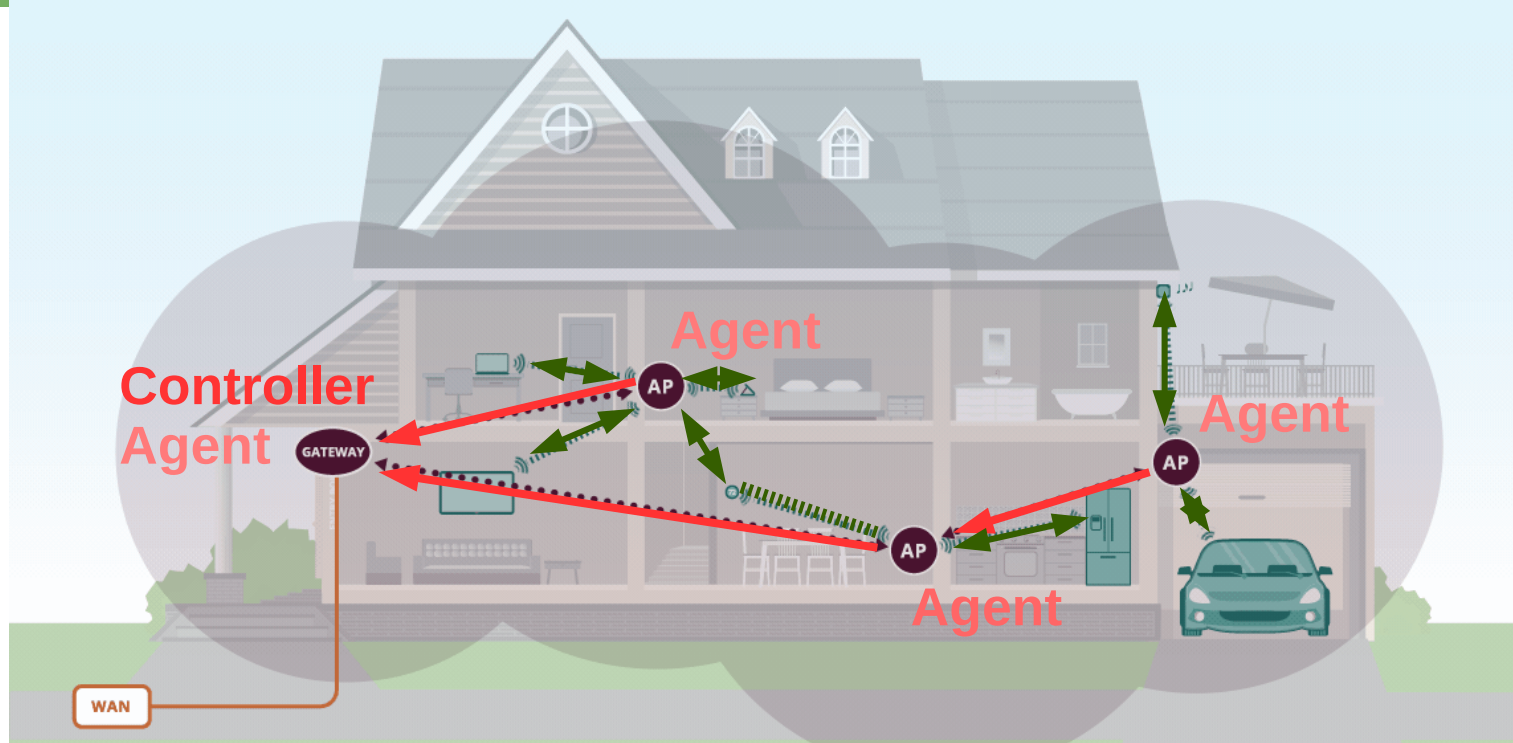
WFA Multi-AP architecture



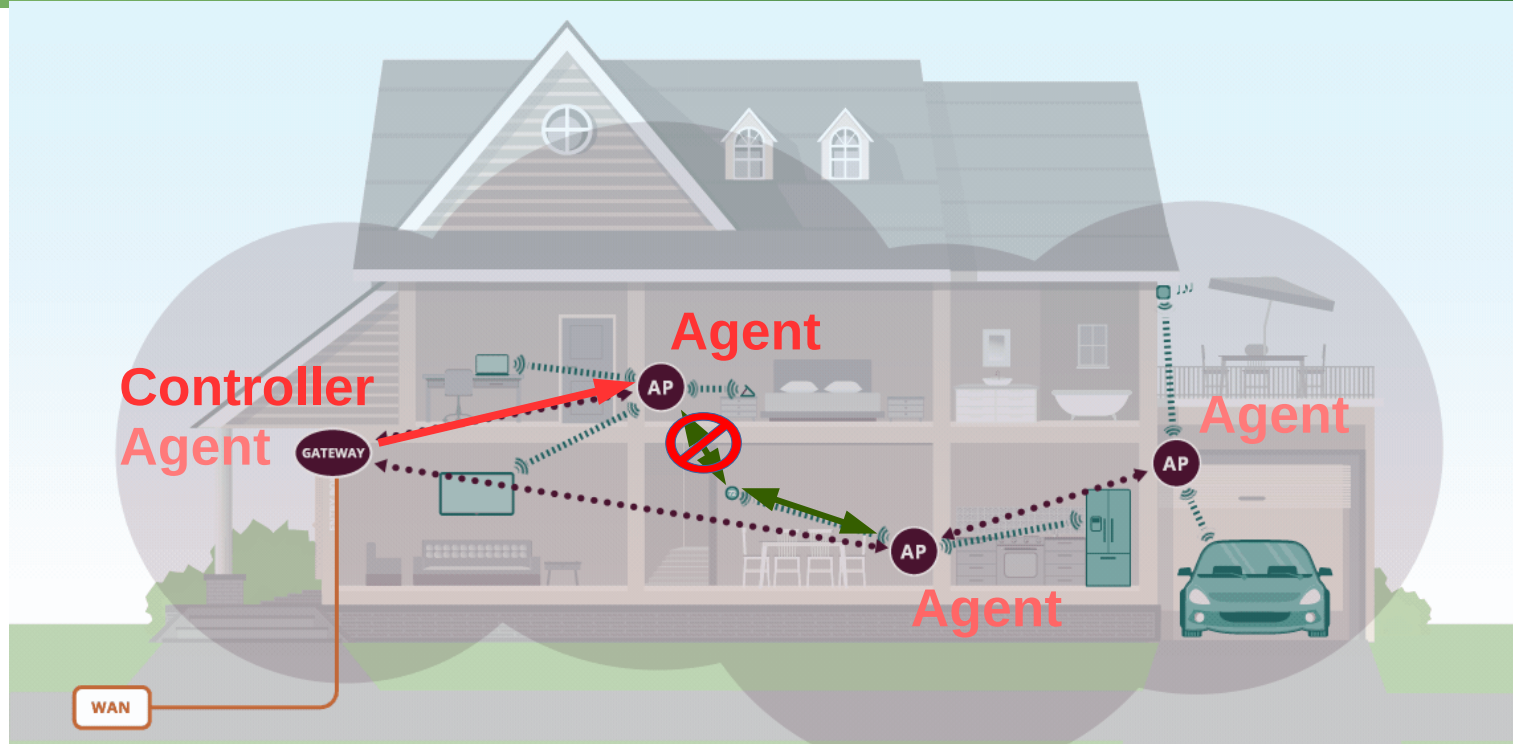
WFA Multi-AP Discovery



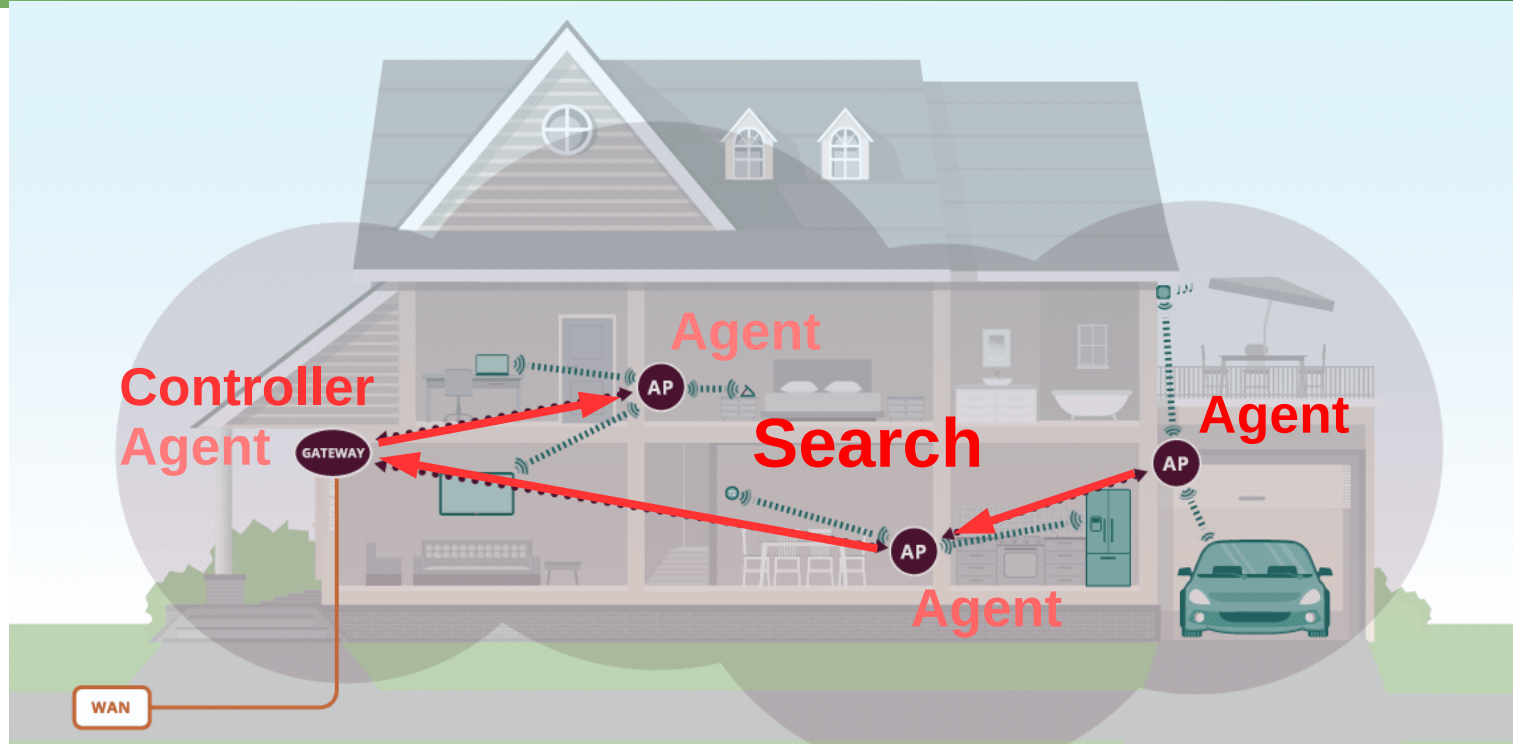
WFA Multi-AP Metrics



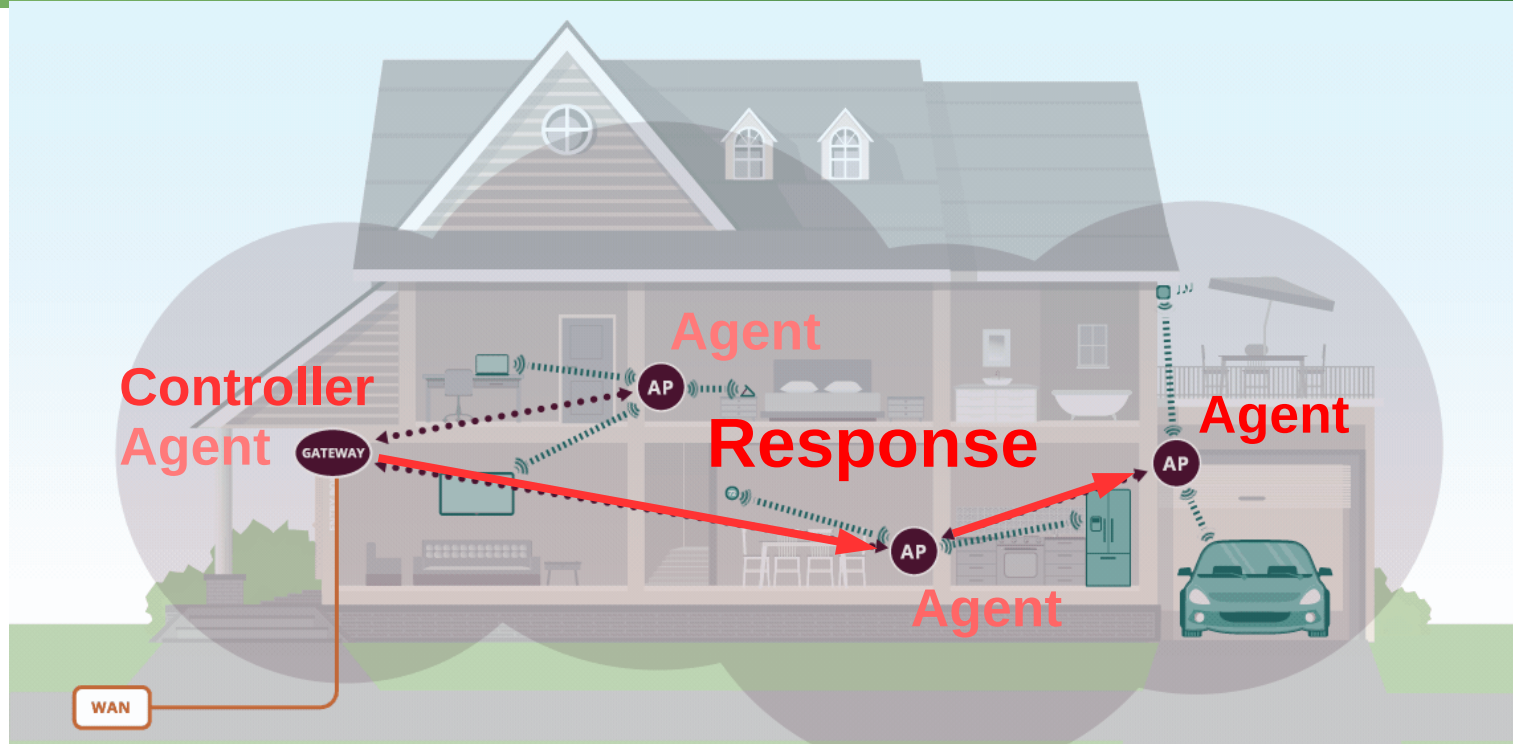
WFA Multi-AP Steering



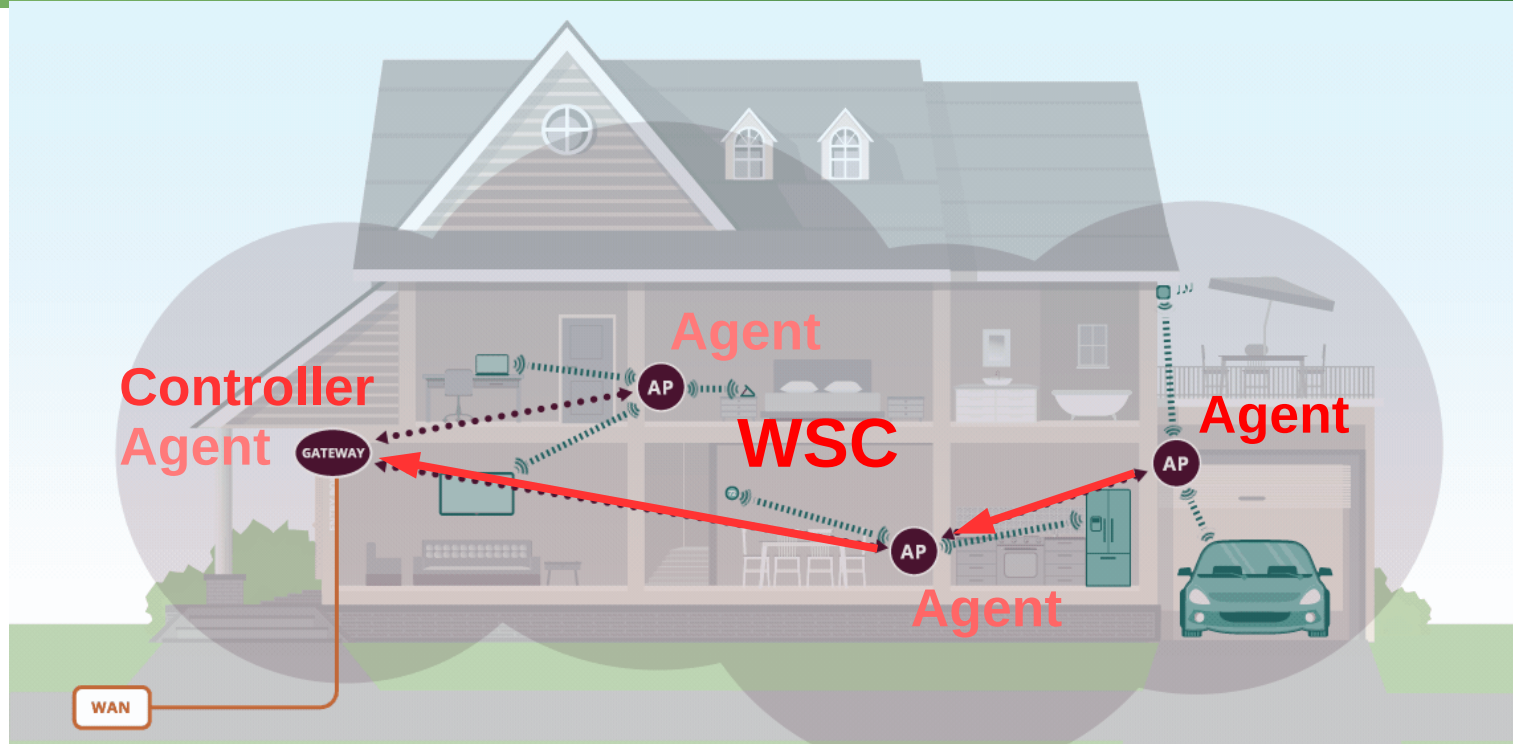
WFA Multi-AP Onboarding



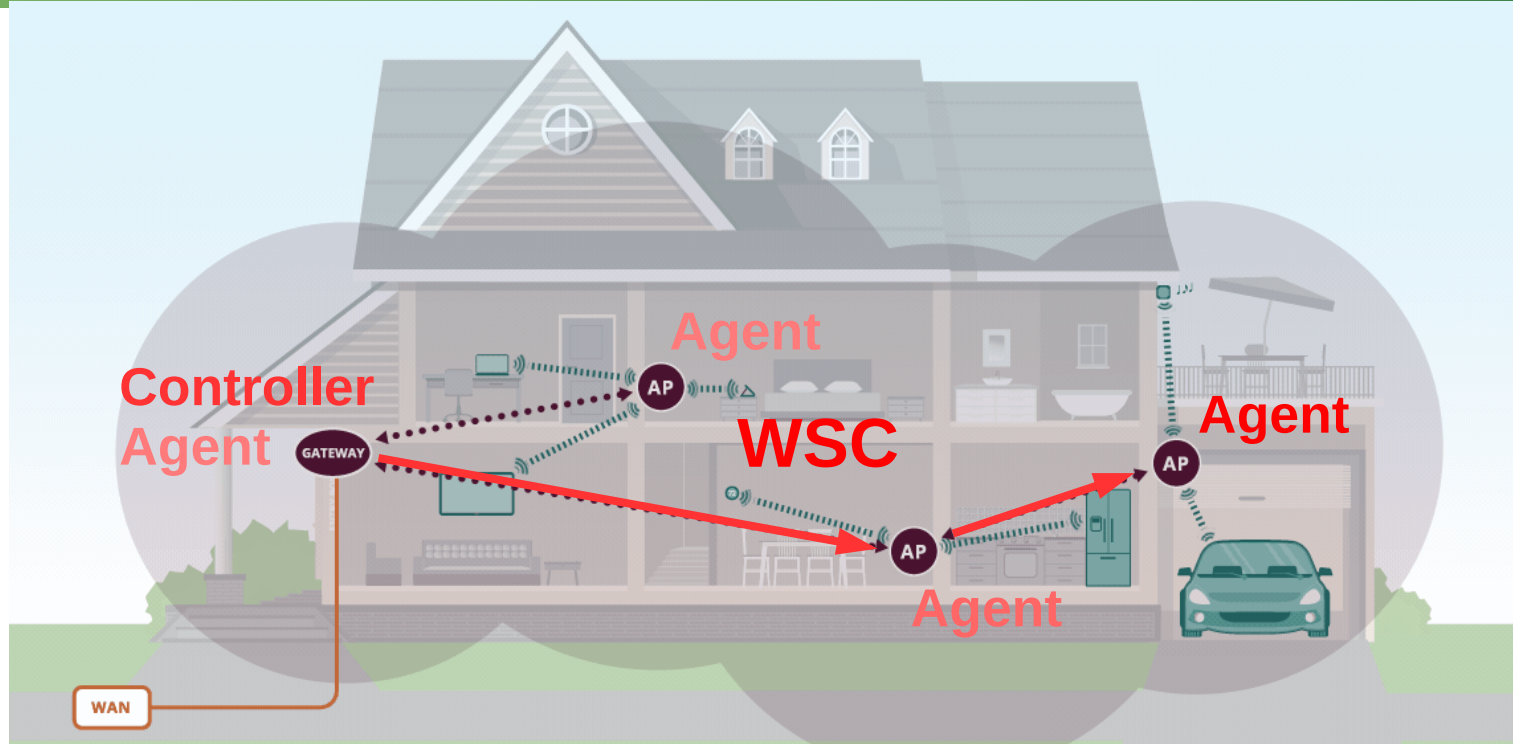
WFA Multi-AP Onboarding



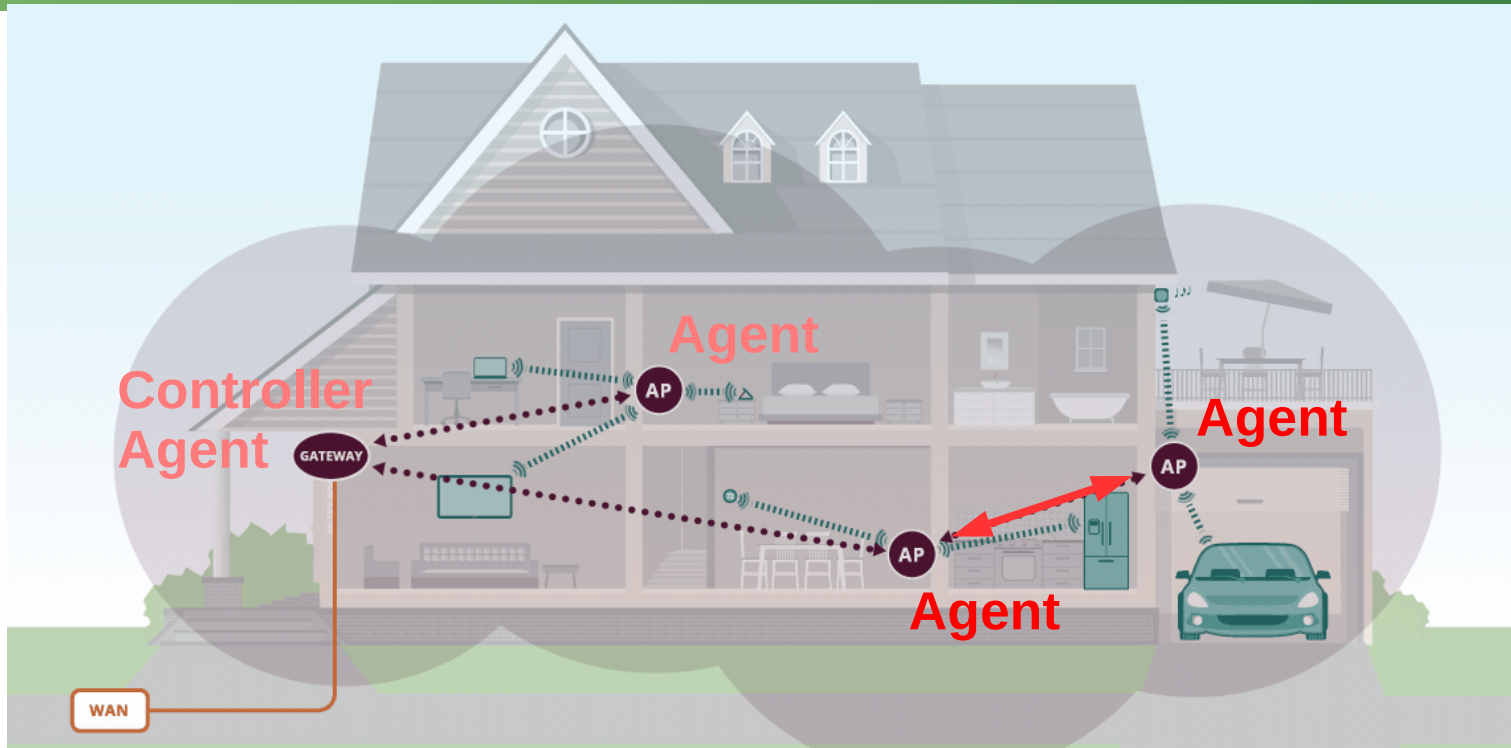
WFA Multi-AP Onboarding



WFA Multi-AP Onboarding



WFA Multi-AP WPS



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



altran



INTRINSIC ID



ECONET
Cloud • Open • Global • Emerging
A Company

SYNOPSYS

QUALCOMM



IOPSYS



intercede



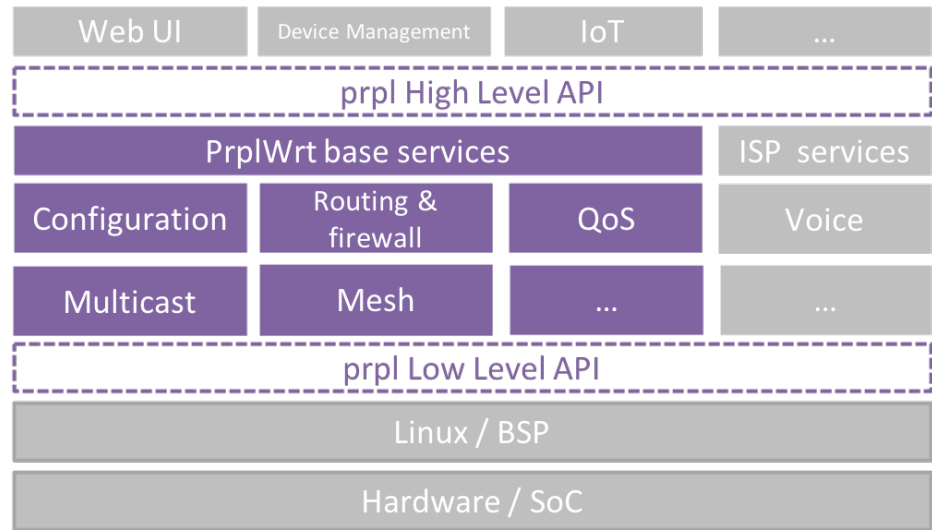
MIPS

SERCOM



prpl combines standardisation & open source

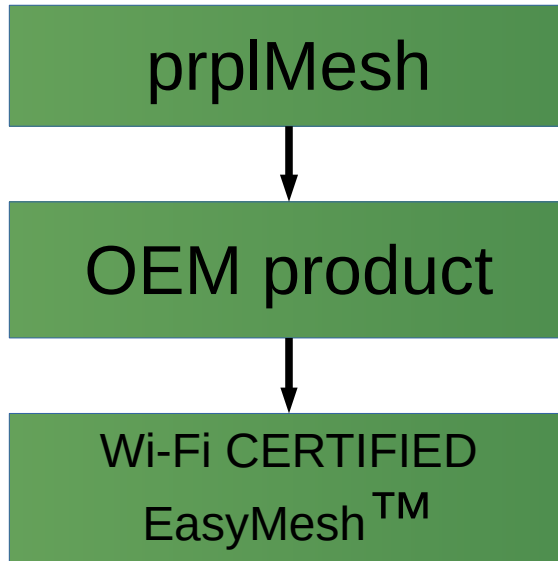
- High-level API
A single API for on-device software
- Low-level API
A single API for chipsets and SoCs



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

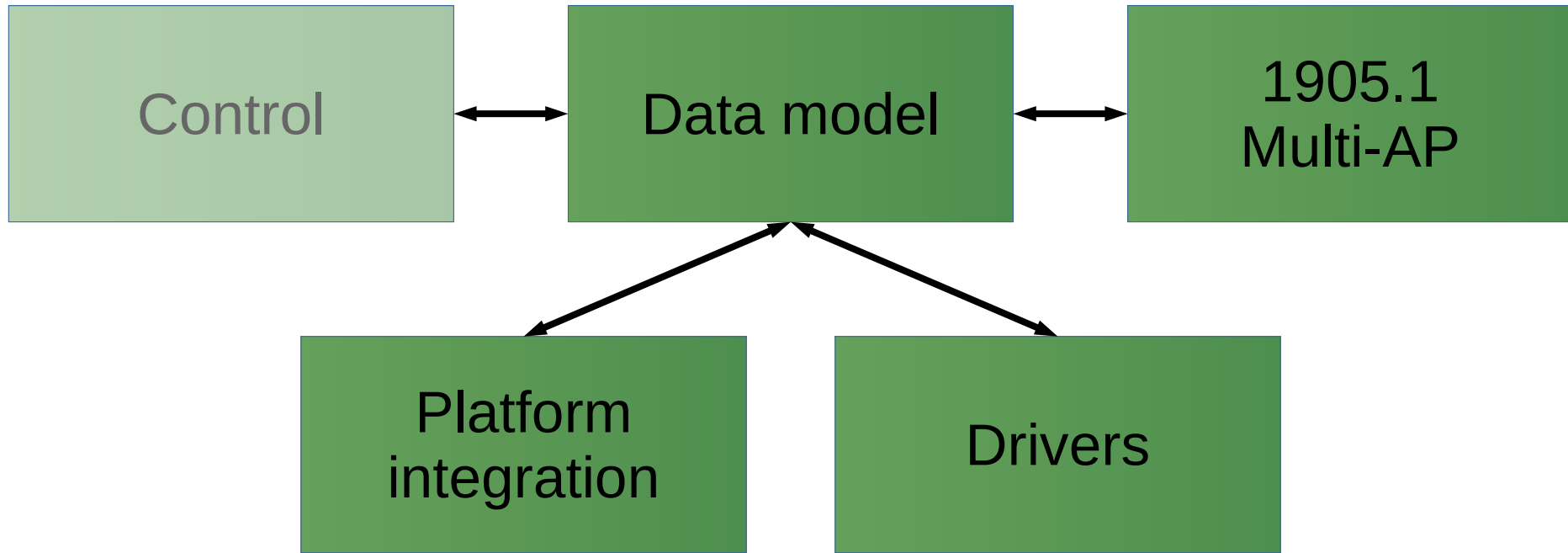
Path to certification



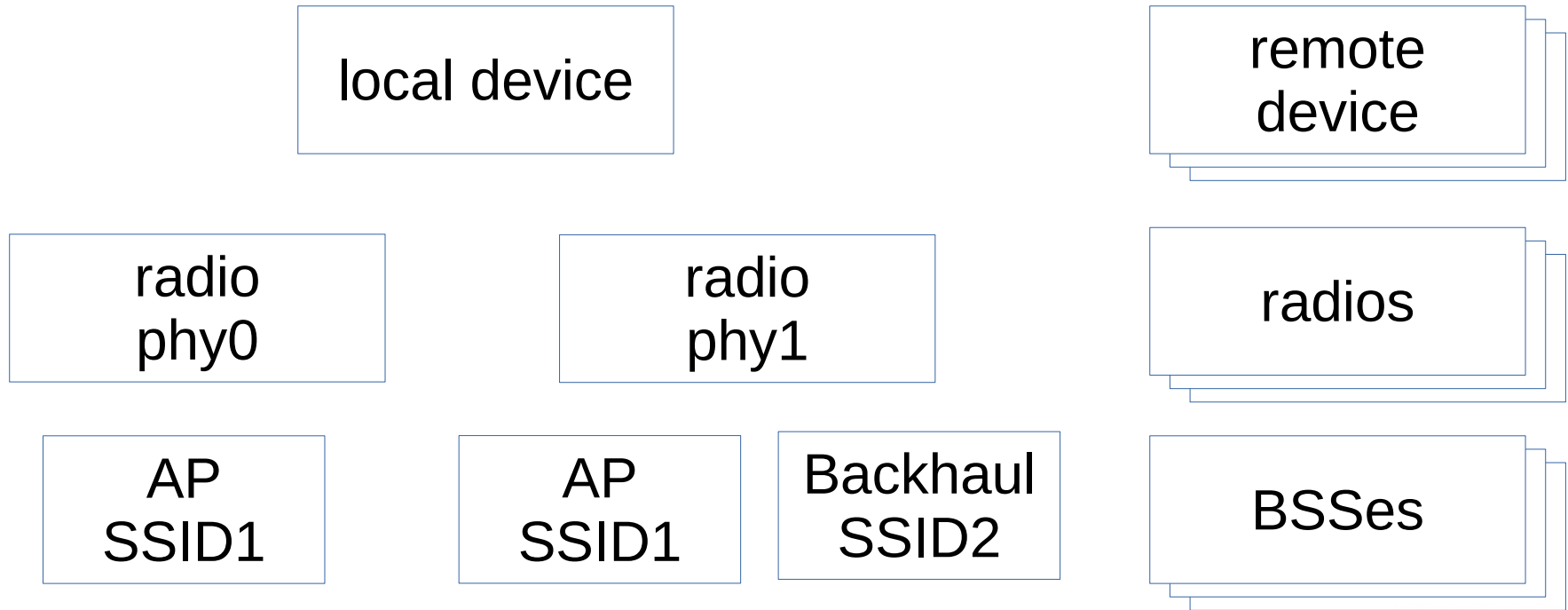
BroadBand Forum and Multi-AP

- 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



prplMesh Data Model



prplMesh Data Model

local device

remote device

radio
phy0

radio
phy1

radios

addAP()
→ cfg80211
+ hostapd

addAP()
→ vendor driver
+ forked hostapd

addAP()
→ Multi-AP
CMDUs



OpenWRT platform integration

access

persist

AP creation

metrics/control

ubus

socket

nl80211

prpl
API

hostapd
API

UCI
rpcd

hostapd

cfg80211

/etc/config

netifd



Stretch goal: unified AP interface

access

persist

AP creation/metrics/control

ubus

socket

nl80211

prpl
API

hostapd
API

UCI
rpcd

hostapd

cfg80211

/etc/config



Security

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



**Embedded Linux
Conference**

Europe



OpenIoT Summit
Europe

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