CERTIFIED EasyMesh™
Whole-home Network Coverage

Wi-Fi CERTIFIED EasyMesh™:
Smart, extended coverage home Wi-Fi®
Problem Statement

Whole-home self-organising network

Proliferation of mutually incompatible extender solutions.
Lack of operator control and visibility.
What is EasyMesh?

- Protocol name: Multi-AP
  - Based on IEEE1905.1
- One Controller
  - Master of the mesh
- Several Agents
  - Wireless access points
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→ EasyMesh standard
Management API
The Central Configuration Problem

- **Stand-alone access point**: configuration through web UI, mobile app, remote management system
- **Distributed network of access points**: configuration through Controller, requiring careful synchronisation logic, through web UI, mobile app, remote management

- Different API for each? Let configuration client detect the use case and select?

  Logical solution: converge to single API, always through Controller regardless of whether extenders are present.
Central API Access through Controller

Remote Management / Telemetry / Diagnostic Systems

Protocol Adapters

HTTP  TR-069  USP  Netconf  WebPA  SNMP

Web UI / Mobile Apps

Northbound API

Configuration & State

WLAN Config  WLAN State  Network Topology

Local Agent  Remote Agents

wireless  wired  wireless  wired

Network Protocol

IEEE1905.1 / EasyMesh

Remote Agents

IPC Bus I/F
Management API

Today: different OSS implementation, different web UI/mobile app per gateway
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Different management API’s

Development cost of customer UI’s and OSS.
Difference between single AP and distributed network.
Management API

prplMesh: single, common, standardised API → reuse of OSS / UI development
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   → Standardised management API
Northbound Interface
Outside World Interface to prplMesh

Control Function API

Evolution of the prpl Foundation High Level API

Defined by: Broadband Forum OB-MAP project stream, prpl

Defined as:
• object/parameter getters and setters
• real time subscription to changes and events
• functions

Access:
• local, through the local IPC bus of the router OS
• over the network, translated by a protocol adapter

Scope: control, state, diagnostics, telemetry, topology
• wireless configuration (HL API, TR-181, RDK-B)
• EasyMesh configuration (EasyMesh, OBMAP)
• wireless state (Data Elements, RDK-B wifihal, OpenSync)
• network topology (IEEE1905.1, EasyMesh, TR-181)
• event logging
• self-organising network control operations (EasyMesh Controller)
Wireless Management Complexity
Evolution of Complexity

Wireless Access Point in 2013: Best effort service
- IEEE802.11a/b/g/n/ac
- Dual-band, dual-concurrent
- DFS in 5GHz, radar detection
- Per-region regulatory frequency issues
- Single SSID, security mode, credentials
- WPA, WPA-2, WPA-Enterprise

Wireless Access point in 2019: Critical infrastructure
- IEEE802.11ax
- OFDMA, scheduling
- Coordinated channel change
- Upcoming 6GHz band
- Wireless backhaul links: concurrent operation as AP and STA
- Distribution of credential configuration, WPA3, EasyConnect
- Hotspot, Agile Multiband (ANQP)
- Band, client steering
- QoS, low latency
- Diagnostics and telemetry collection

Can everyone keep up?
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3. Growing wireless management complexity
   - Ongoing effort and cost.
   - Divergent behaviour.
Wireless Management

prplMesh: portable, common, open source implementation
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Growing wireless management complexity
Ongoing effort and cost.
Divergent behaviour.
→ Common wireless management implementation
Wireless Silicon Interface
Management API

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Different management API’s

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→ Standardised management API

Different wireless silicon driver interfaces

Portability impediments.
Development cost of HAL implementations.
OpenWrt

Management Platform
Data Model / API

Web UI
Data Model / API

prplMesh
hostap
nl80211

Router Stack C
Data Model

prplMesh
hostap
nl80211

Linux kernel
cfg80211

Driver
vendor 1

Radio
vendor 1

Driver
vendor 2

Radio
vendor 2

Hardware

Radio
vendor 1

Radio
vendor 2

prplMesh

Data Model / API

Data Model

Data Model

Data Model
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Why Invest in prplMesh?

Chip vendors gain scalability: convergence towards fewer SW platforms to support
- precious resources better spent on value-add product differentiation

OEMs gain consistency and commonality between different chip vendors
- making it easier for OEMs to switch SoCs

In turn, ISPs gain consistency and commonality between different OEMs
making it easier to switch OEMs

prplMesh is seeking investors to quickly catch-up and keep-up with proprietary stacks
- contribute funding, or SW resources (we have a skill-set profile)
- coding = Technicolor, Intel, Minim, GlobalLogic, Quantenna, CableLabs
- funders = SoftAtHome, Verizon, Intel, CommScope, Vodafone, SmartRG, Quantenna
prplMesh Project Goals

Wi-Fi CERTIFIED EasyMesh™ Reference Implementation
- Business friendly BSD 2-clause + patent licence
- Pass EasyMesh (Release 1) certification of Agent and Controller protocol on a reference platform

Platform Independence
- Allow for integration into any router Operating System based on a recent version of the Linux kernel
- Implementations of open source router Operating Systems: OpenWrt and RDK-B

Advance prpl Foundation Carrier Interest Group low-level API recommendations
- Use prpl low-level API for wireless, Ethernet switch, Ethernet port, Ethernet PHY

Common Wireless Management
- Standardised central control of ever more complex wireless management across all router stacks

Reference Platform
- Turris Omnia with:
  - Wi-Fi 5: retail Qualcomm wireless radio cards (802.11n+802.11ac) with open source Linux mac80211 device drivers
  - Wi-Fi 6: Intel wav600 wireless radio cards (802.11ax) with production Intel cfg80211 device driver
prplMesh Project Goals

**Cooperation with open source communities**
- Collaborate with the linux-wireless community to bridge any gaps in cfg80211
- Collaborate with the hostap community, and upstream support for EasyMesh in hostapd and wpa_supplicant
- Integration in OpenWrt and RDK-B

**Cooperation with standards bodies**
- The Broadband Forum’s OB-MAP project will define standard interfaces and define add carrier manageability features

**Cooperation with wireless silicon vendors**
- Generic, interoperable solution supporting all wireless silicon solutions

**Allow for solution vendor differentiation**
- Any Controller or Agent decision making capability is optional. It must be possible to add algorithms, outside the prplMesh code, to provide functions such as:
  - Channel optimisation
  - Band Steering
  - Client Steering
  - Backhaul topology optimisation
High Level Architecture

**Wireless Management** of a router/AP/extender shifts to prplMesh and is controlled through the **northbound API**.

**EasyMesh Protocol** can be deactivated if not needed. **Other Protocols** can be added to support already deployed proprietary solutions.

Local wired network interfaces are passively managed, wireless interfaces fully controlled by prplMesh through the **southbound API**.

Integration into a router OS: Software build integration IPC bus interface

**Westbound API:**
Other services interaction Persistent storage
Demonstration
Analyzer id: sta1
Name: N/A
IP: 0.0.0.0
parent MAC: 04:00:21:24:24:17
MAC: 58:d9:c3:ac:20:de
channel: 36
Thank you