prpl Working Groups roundtable

Certification Technical WG

Timothy Winters

prplOS WG

Olaf Wachendorf

prplMesh WG

Frederik Van Bogaert

Low Level API WG

Wouter Cloetens

LCM Life-Cycle Mgmt WG

João Freitas

prplSecurity WG

Brendan Black&Evgueni Tzvetanov

High Level API WG

David Cluytens

Moderator

Dave Barr

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Working Group Updates

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2023 Achievements

- Program Guide for Certification Tests (on prpl public website)
- High-Level API Test Plan (published on prpl public website)
- prpl Data Model (initial version published on Confluence site)

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Work Items for 2023

- Test devices for High-Level API
  - Initial devices certified
  - Finalize Data Model profiles
- prplOS Certification - early 2024
  - Focus on High-Level API Data Model Functionality
  - Develop parts of the test plan

Roadmap 2024 and beyond

- Low-Level API Certification
  - Focused on Hardware
  - Additional tools necessary
- prplMesh Certification
- LCM Certification
  - Configuration and testable items to be discussed

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prplOS working group

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prplOS working group achievements

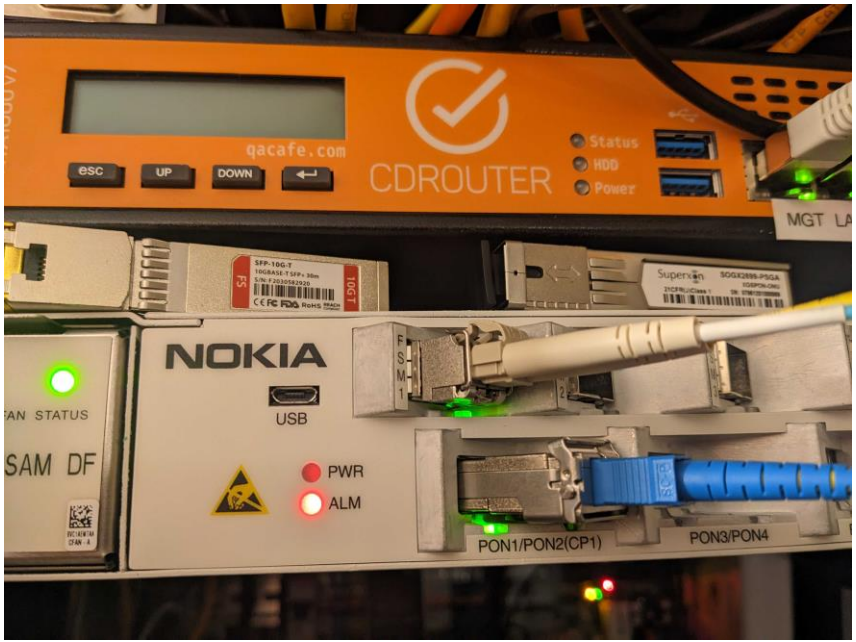
prplOS-3.0 released

- OpenWrt 22.03, Linux 5.15 LTS
- Latest prplWare integrations:
  prplMesh 4.1.0, pwhm 4.18.4, LCM 1.4
- Wi-Fi 6E (6GHz)
- mod-dhcpv4c (replacing udhcp client)
- unbound-prpl (replacing dnsmasq as local DNS server)
- Global Time-Of-Day scheduler facility

- TR-181i2-v16 (data model updates for Firewall and SSH)
- TR-181 Logical Interface Manager
- IPDiagnostics UploadDiagnostics and
  DownloadDiagnostics methods
- LCM network management and host object

- Supporting multiple carrier-grade
  prpl Foundation reference HW platforms
  - MaxLinear's Open Service Platform (OSP)
  - WNC's Haze Qualcomm platform

prplOS CI ready for XGSPON




```
leg:isadmin># show equipment ont status channel-pair ont ng2:11/1/9
================================================================================================================================
channel-pair table
================================================================================================================================
        |            |             |admin   |oper    |olt-rx-sig |ont-olt      |      |      |         |
chanpair|ont         |sernum       |status  |status  |level(dbm) |distance(km) |desc1 |desc2 |hostname |ranging-status
--------+------------+-------------+--------+--------+-----------+-------------+------+------+---------+-----------------------
1/1/1/1  ng2:11/1/9   ALCL:96F0E9A0 up       up       -13.0       0.1                       undefined pref-ranged
--------------------------------------------------------------------------------------------------------------------------------
channel-pair count : 1
================================================================================================================================
leg:isadmin>#
```

```
   3 nokia-olt
 > XPON.ONU.1.Enable=1
XPON.ONU.1.
XPON.ONU.1.Enable=1

<  dm:object-changed> XPON.ONU.1.Enable = 0 -> 1

<  dm:object-changed> XPON.ONU.1.ANI.1.TC.ONUActivation.ONUID = 0 -> 1022
<                   > XPON.ONU.1.ANI.1.TC.ONUActivation.ONUState = 01 -> 02-3

<  dm:object-changed> XPON.ONU.1.ANI.1.TC.ONUActivation.ONUID = 1022 -> 0
<                   > XPON.ONU.1.ANI.1.TC.ONUActivation.ONUState = 02-3 -> 04

<  dm:object-changed> XPON.ONU.1.ANI.1.Status = Dormant -> Up

<  dm:object-changed> XPON.ONU.1.ANI.1.TC.ONUActivation.ONUState = 04 -> 05

<  dm:instance-added> XPON.ONU.1.ANI.1.TC.GEM.Port.65535.PortType = unicast
   0 urx851-b0-dk
            Domain-Name (15), BR (28), NTP (42), Vendor-Option (43)
            Lease-Time (51), RN (58), RB (59), Classless-Static-Route (121)
            Unknown (212)
          Hostname (12), length 6: "prplOS"
          Vendor-Class (60), length 12: "udhcp 1.35.0"
15:33:47.675874 00:0d:b9:58:6b:62 > ac:9a:96:f0:e9:a0, ethertype IPv4 (0x0800), length 342: (tos 0x10, ttl 128, id 0, offset
    10.0.0.1.67 > 10.0.0.2.68: BOOTP/DHCP, Reply, length 300, xid 0x7e88be5c, secs 1564, Flags [none]
        Your-IP 10.0.0.2
        Client-Ethernet-Address ac:9a:96:f0:e9:a0
        Vendor-rfc1048 Extensions
          Magic Cookie 0x63825363
          DHCP-Message (53), length 1: Offer
          Server-ID (54), length 4: 10.0.0.1
          Lease-Time (51), length 4: 120
          Subnet-Mask (1), length 4: 255.255.255.0
          Default-Gateway (3), length 4: 10.0.0.1
          Domain-Name-Server (6), length 8: 1.1.1.1,8.8.8.8
```

Congrats to first the XGSPON platform successfully integrated into prplOS CI:

MaxLinear's AnyWAN™ URX

prplOS Working Group 2024 Roadmap Wish-List

- First deployments
- Updates to OpenWrt & Kernel
- Evolution on the Application Development Framework
- Wi-Fi 7, WiFi Sensing extensions
- prplOS profile for Wi-Fi extenders
- Power Management
- Matter IoT (Thread)
- Fixed Wireless Access
- Enhance resource- and process-monitoring
- Additional carrier-grade reference platforms
- Touchscreen support
- DHCPv6, UPnP-IGD carrier enhancements
- LCM hardening
- Your ideas?...

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prplMesh Working Group Update

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prplMesh 2023 Successes

- EasyMesh R4 and R5 support - verification in-progress
  - BSS Coloring (spatial re-use)
  - Service Prioritization (QoS)
  - R5 now in development
- "Virtual BSS" steering (collaboration with CableLabs on Mobile Wi-Fi. See their demo.)
- Continued collaboration with BBF and their sister-project OB-MAP for Multi-APs
- Wireless Hardware Manager adoption
  - Harmonized platform-independent framework
  - Replaces vendor-specific and inflexible nl80211 backends
  - Unified implementation of TR-181 Device.WiFi Objects
- Platform-independent persistent storage of configuration settings
- Backhaul Optimization refinements
  - Capability to enable/disable multi-hop backhaul "daisy-chain«
- Wi-Fi Sensing basics: CSI stream delivery to containerized sensing apps

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prplMesh wishlist for 2024

- HW support
  - More next-gen Wi-Fi 7 SoC vendors (beyond MaxLinear and Qualcomm)
  - New carrier-grade HW platforms into prplMesh CI/CD
- Wi-Fi 7 support (e.g., MLO Backhaul)
  - EasyMesh 2024 release compliance
  - Including Early AP capability
- Wi-Fi Puncturing (to avoid interferers)
- Wi-Fi AFC (to enable 6GHz at standard power)
- DPP support
  - DPP Cloud Provisioning
  - Enables backhaul link security over IEEE 1905
- Wi-Fi Sensing enhancements
  - Coordination of multiple participating stations
  - Multicast streaming of CSI data to multiple sensing application containers

Testing and Certification

- Wi-Fi Alliance EasyMesh Testbeds used for weekly, daily and CI/CD
  - some testing of WFA Data Elements

- prpl Certifications
  - Pivoting to CDRouter-based testing (away from Boardfarm)
  - **Certify prpl's superset additions beyond EasyMesh (i.e., prpl Data Model)**

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Low-Level API Working Group

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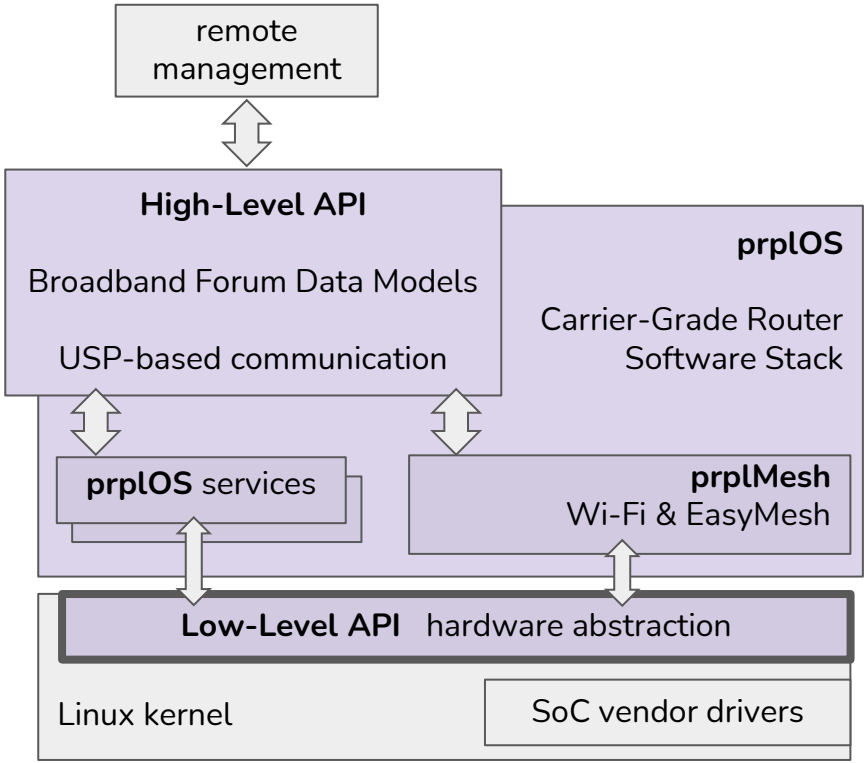
What is the Low-Level API?

Hardware abstraction
Benefit: portability in code and behavior

Policies: align with open source

Mostly Linux kernel API

Also user-space projects such as hostap and ModemManager



2023 Accomplishments

- Ethernet port name / Linux interface name modeling
- Cellular
- QoS across Wi-Fi mesh
- Wi-Fi Sensing
- Wi-Fi 7

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Challenges

- Wide time zone range (far East to U.S. Pacific)
- Very Limited Resources
- Need to engage open-source communities (Linux, hostap)
- Verifying compliance is not simple. Combination of:
  - code audits -- can reveal gaps in Specification / API
  - blackbox testing -- prplOS components and prplMesh expose low-level functionality through data model, using LL API
  - whitebox testing -- may be hard to automate

Call to Action

- New feature standardization before implementation
  - Opportunity for SoC vendors to work on new API's together
  - Current model:
    - implement proprietary API
    - be forced to add new standard API
    - deprecate old proprietary API with ongoing support for deployed projects

2024 Roadmap wishlist

- Definition:
  - IoT (802.25.4, BLE)
  - Wi-Fi (Wi-Fi 7, gap analysis)
  - Wi-Fi Sensing (phase 2, IEEE802.11bf)
  - Display / touchscreen
  - SFP
  - Power consumption
  - Multicast
- Certification
- Implementation
  - Interface naming, Ethernet WAN interface selection, Wi-Fi Sensing, pushbutton, QoS (schedulers, mesh), cellular

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prpl LCM (Life-Cycle Management)

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2023 Achievements:

Releases
- LCM 1.5 (October)
- LCM 1.4 (July)

Builds
- Crun (February)
- OCI Runtime Bundles (March)

Features
- “Containers additional rights” (NetworkConfig, HostObject).
- Pre-embedded Containers & Auto-Detection

Platforms
- RDK (rbus)
- prplOS

Bug-Fixes
- Reliability & Stabilization.
- Performance (e.g.: run operations in parallel).

Data-Models
- NetworkConfig (param in InstallDU and displayed in EE).
- HostObject.
- ApplicationData. (standerdization).

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2024 Wishlist (Highlights)

Data-Model Extensions:

- Close gap with TR-181 standerdization.
- Linux Capabilities.
- Constraints Management.

Bug-Fixes

- Stabilization.
- Interoperability Improvements (RDK).

Scope

- mDNS Discovery (for containers).
- Unprivileged Containers (full support).
- ApplicationData (implementation).

Certification

Unit Tests:

- ~50 - 80% Code Coverage.

Integration Tests:

- Data-Model Conformance & Functional via Device.SoftwareModules.

System Tests:

- USP / TR-369

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prplSecurity Working Group Update

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WG Objectives & Organisation

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Your Workgroup Chairs (since 2019):

Brendan 'I'm Not The Expert' Black <brendan.black@prplfoundation.org>
Evgueni 'Joining' Tzvetanov <evgueni.joining@prplfoundation.org>

Working Group Objectives: (the very short version)

Create security standards for prpl, based on best practices from wider industry.
Drive security practices within prpl ecosystem, based on the those standards.

2023 Successes

- **prpl Packet Intercept API**
  - Implementation in gitlab repo since Jan - thanks to Marten *et al*.
  - Testing & Feedback gratefully received from BitDefender → Improvements, including a future Fast-Path approach
- **prpl Secure Manufacturing Data Standard published**
  - Standardizes formats & methods of securing sensitive data embedded in CPE devices at time of manufacture
- **prpl Secure Boot Requirements published**
  - An extensive process to refine & generalize the original work contributed by Orange
- **prpl Introduction to Secure Boot White Paper published**
  - A general introduction to the technology & terminology

Workgroup 2024-2025 challenges

- **prpl Flash Layout Recommendations**
  Currently in final phase of work, that leads into:
- **Secure Firmware Upgrade discussion**
  Compare & contrast existing vs. proposed solutions
- **Software Bill of Materials**
  A key step to introducing:
- **prpl Security Incident Response Process / Team**
  This may require sponsorship (get your checkbooks out…)
- **prpl Standard Crypto API**
  That works whether or not you have a TEE or Security Co-Processor
- **Flow Management API**
  Needed for flow monitoring, distinct from inspection or diagnostics
- **BBF Standardisation of Security-related APIs**
- **And lots more…**

How many beers do I owe Evgueni now?

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prpl High-Level API

Working Group Update

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What happened

- prpl contributions to BBF released as TR-181i2-v16 and TR-369a3
- Official UDS aka “internal” iMTP Specification is now available
- OB-USP-Agent open-source now being updated to latest Specs
  (co-sponsored by AT&T and BBF)

Contributions to USP and TR-181i2-v16 and -v17

via close collaboration between prpl and: broadband forum

- Specification enhancements
- Syslog management
- Log Rotation management
- RouterAdvertisement: RDNSS and DNSSL options
- DNS: Zone File concept and tweak cache settings
- DNS: SD Advertisement
- DSL: xTU-C and xTU-R parameters
- PON: Password support added
- WiFi: AssociatedDevice KPIs

Firewall:

- InterfaceSettings: ICMP echo reply, StealthMode, Spoof protection.
- Lease duration for Pinhole and DMZ entries
- Origin parameter for PortTrigger, PortMapping, Pinhole and DMZ
- ALG support
- MaxNumberOffPortMapping/PortTrigger

SoftwareModules:

- ModuleVersion parameter
- NetworkConfig

2024 Roadmap

- USP v1.4 enhancements for Internal Services
- Data Model contributions (expansions & enhancements)
- Enhance the Software Modules Management API
- Enhance the HL-API to support more and better Apps

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Thank you

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