Connected Home Update: Shaping the Future of the Smart Home

Geoff Burke
CMO
A Comprehensive Strategy for the Connected Home

TR-069
- TR-069
- TR-369 User Services Platform (USP)

Home Connectivity and Management

Wi-Fi
- TR-398 (Measurement)
- OB-MAP (Mesh Wi-Fi)

Certification
- TR-069
- TR-369 (USP) Plugfests
LET’S GO BACK IN TIME

In early 2000s, broadband gateways became a regular part of operator deployments.

Deploying, onboarding and managing the broadband gateway was hard! Truck rolls, CD-ROMs, UPnP…

The key issues: LIFECYCLE MANAGEMENT, MAINTENANCE AND MONITORING, PROVISIONING NEW SERVICES

TR-069 CPE WAN Management Protocol (CWMP)
TR-069 Architecture

Single ACS operated by ISP manages devices with a standardized data model over HTTP

- ISP Support, OSS/BSS, and other systems
- Proprietary NBI
- TR-069 Autoconfiguration Server (ACS)
- TR-069 Sessions

Device:2 (TR-181) Data Model Managed Gateway

Other devices by proxy

Other Protocol

Device:2 + VoiceService, FAPService, StorageService, STBService enabled devices managed via TR-069 through NAT/Firewall

Proprietary NBI

Managed Gateway

Other Protocol

Other

devices
by
proxy
ISP see *need for life-cycle management, monitoring, and provisioning* for gateway routers. CWMP (TR-069) is born.

Cable/MSOs incorporate TR-069 for management of *advanced gateways/Wi-Fi using Device:2* data model.

- **2004**: TR-069 expands to manage more interfaces and more devices, like STB, VoIP, Wi-Fi, and more.
- **2010**: Explosion of new technologies and challenges for both networking and consumer electronics: IoT, Wi-Fi/Mesh, handling over-the-top and third party services, and desire for end-user control. USP created in 2018.
- **2016**: USP 1.1 released with Device:2.13. Valuable for consumer electronics as well as CSPs for analytics, customer self-care, onboarding, real-time IoT control, managed Wi-Fi, and more.

The evolution of the managed user experience.
The User Services Platform (USP) is a system of Controllers and Agents that enables remote manipulation of software and hardware capabilities.
Why is this evolution necessary?

**Bigger SCOPE**
- New devices, new services, and the presence of virtualization
- User control, enabling 3\textsuperscript{rd} party interactions
- Desire for seamless user experience, anywhere

**Bigger SCALE**
- Orders of magnitude more devices and connections
- More data/bulk telemetry needed to enable Machine Learning (ML)
- Increased need for real-time configuration management

**Bigger STAKES**
- Security and product lifecycle/upgrade concerns
- Privacy and data security concerns
- Ownership, responsibility and access control concerns
USP enables all uses to coexist within single ecosystem

USP Controllers and Agents have:

- **Persistent connections** to reduce handshakes
- Clear trust relationship establishment
- Optional **end-to-end application layer TLS** session context
- **Rule-based access control** to service elements for privacy and security
- Flexible transport that can be **cloud independent** or not

Data collector

Third party MSP, vendor, or application provider

Broadband Network

Persisting connections

Clear trust relationship

Optional end-to-end application layer TLS

Rule-based access control

Flexible transport that can be cloud independent or not

Data collector

Third party MSP, vendor, or application provider

USP Controller as ACS, or co-existence with TR-069

USP messages

Network setup and config

Network and security feature control

Software container management

Firmware and software upgrades

Diagnostic commands

Bulk data telemetry

Custom commands & events

IoT sensors and controls

Home automation gateway

Local end-user with app on computing device

USP messages

Mobile end-user with app on computing device

Device and application capabilities managed and controlled with standard TR-181 data model, directly or by proxy

TR-181/Device:2 Data Model Capabilities
The Open Source USP Agent - OB-USP-Agent

Blackbird Release (2.0) posted to GitHub on October 14, 2019

- CoAP Support (including DTLS support)
  - Raises USP MTP support to include both STOMP and CoAP
- New Command Line Arguments
- Data Model Improvements
- Bug Fixes

See https://github.com/BroadbandForum/obuspa/releases for details

Release 3.0 planning starting soon…

Possible features could include: MQTT MTP support, WebSockets MTP support, Controller Trust enhancements, end-to-end application-layer security, etc.
Demonstration: Services as a USP extension

**DOMOS**

vodafone

**Axiros**

**KAON**

Endorsed by Vodafone

Deploy applications on the smart gateway with USP software module management

**COMMSCOPE**

**prpl**

**OB-USP-Agent**

Docker Container

Docker Container

Docker Container

CommScope Controller

Fault handling
Deployment
Management

**DOMOS-USP A-E extension**

**DOMOS-USP Agent**
Moving it forward, interop and compliance

The **Broadband Forum** schedules regular plugfests around USP that allow multiple developers from different companies to work together to harden their implementations.

The **Broadband Forum** is developing both a certification test plan including conformance, interoperability, and functional testing, as well as a certification program. Look for more details later in 2019.
Wi-Fi Is the Cornerstone for Home Broadband Services

How devices are connected in the home

Source: Ovum 2019 The Role of Wi-Fi in the Premium Home Broadband Market

Rapid transition to 802.11ac standard

Source: IHS Markit Home Networks Intelligence Service
Home Wi-Fi Issues Impact Broadband Experience

Wi-Fi Issues and Challenges

- **High Wi-Fi Complaints**
  - Wi-Fi now accounts for 30–60% of broadband customer service calls

Source: Ovum 2019 The Role of Wi-Fi in the Premium Home Broadband Market

Top 5 Typical Issues with Home Wi-Fi

- 5 typical Wi-Fi problems (68% of total Wi-Fi issues)
- Poor Wi-Fi coverage
- Screen pixelization
- Game offline

Source: Huawei’s Home Network lab data
An Urgent Need for Authoritative Wi-Fi Performance Test Standards

Users have no idea of the real speed of Wi-Fi CPEs, and know only the theoretic air interface speed (11ac 1200 Mbps, and so on).

There was no evaluation standard or user experience standard for Wi-Fi testing.

Wi-Fi technology evolving to meet to service requirements

<table>
<thead>
<tr>
<th>Year</th>
<th>Wi-Fi Speed</th>
<th>Concurrent Connections</th>
<th>Better Multi-user Service Experience</th>
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<tbody>
<tr>
<td>1995</td>
<td>802.11</td>
<td>100Kb/s</td>
<td>1Mb/s</td>
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<td>2000</td>
<td>802.11b</td>
<td>1Mb/s</td>
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<tr>
<td>2020</td>
<td></td>
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</tbody>
</table>
Broadband Forum TR-398: Wi-Fi In-Premises Performance Test

TR-398 is the first industry developed test plan using absolute performance requirements, providing a definitive pass/fail result for Wi-Fi testing.

RF Performance
- Ability to receive weak signals
  - e.g., Minimum RF sensitivity
  - >38dB @ 64-QAM 11an,
  - >21dB @ 256-QAM 11ac.

Coverage
- Performance through walls and among different rooms:
  - >560M@Short Distance(11ac)
  - >100M@Long Distance
  - <40% Throughput variation during 360-degrees test.

Capacity
- Capability to support multiple stations
  - e.g., support 32 STAs with a minimum of 2M throughput.

Interference
- Performance loss under various interferences:
  - <5% @ Same Channel
  - <60% @ Overlapping Channel
  - <5% @ Adjoining Channel.

Bandwidth
- Maximum throughput can be achieved.
  - Throughput
  - >100M @ 11n 2*2,
  - >560M @ 11ac 2*2.

Stability
- Long-term stability under stress
  - Throughput deviation <20% during 24 hours.

16 companies took part in developing TR-398, including device manufacturers, operators, and test manufacturers from around the world.
The Next Steps in Home Broadband Standards

Open Broadband – Multi Access Point (OB-MAP) Project
- Delivering Carrier-Grade EasyMesh
- Collaborative open source project between:

  - Produces requirements, specification details, and open source code to enable Carrier-Grade, scalable extensions to PRPL Foundation’s implementation of Wi-Fi Alliance EasyMesh
  - Allows for easy onboarding, provisioning, control, and automated management of APs in the home network

Announced October 16, 2018
Operators need to stretch beyond pure speed to differentiate their services

Can’t be delivered WITHOUT controlling the CONNECTED HOME

Average country broadband speed versus monthly ARPU

- Average download speed (Mbps)
- Average monthly ARPU ($)

+530%
+1%
The Emergence of Broadband QED

**Broadband QED:** Great speed-test does not equal great User Experience - QED is a framework for measuring Quality of Experience Delivered

- Captures Throughput, Packet Loss and Latency allowing for pinpointed experience improvements
- Is Technology independent and verifiable
- Probability based with Mathematical framework
- Standardized
- Facilitates estimates of the actual Quality of Experience

QED Demos @ BBWF
The Next Steps in Home Broadband Standards

- Carrier-Grade Support of Multiple APs
- Consideration for the upcoming Wi-Fi 6
- User Services Platform (USP/TR-369)
- Testing of QoE
- Mesh/Hybrid Networks (Backhaul)
- 5G & Wi-Fi
Connected Home Update: Shaping the Future of the Smart Home

Geoff Burke
CMO
June 2-4, 2020
Den Haag, The Netherlands

THE DATE HAS BEEN SET!
An event by tech innovators for tech leaders!

Powered by:
BAS{e} broadband forum TNO
Thank you

Learn more about the Broadband Forum at:
http://www.broadband-forum.org/

Interested in joining? Contact membership development leader Rhonda Heier at:
rheier@broadband-forum.org