HGI SYMPOSIUM IN VENICE
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SUMMARY OF HGI ACHIEVEMENTS

LUCA GIACOMELLO, HGI CHAIRMAN

WWW.HOMEGATEWAY.ORG
On April 2005, after a few months of discussion among operators, we started a common work with home gateways manufacturers and chipset vendors to build up standard specifications for the future home gateways and home networks. Home gateway functional requirements, specific documents on Quality of Service, energy efficiency, Home Gateway testing and software modularity have been produced during the years. All were based on in-depth discussions between operators and manufacturers for producing specific, testable requirements. Not just the documents produced, but also participation in these discussions provided invaluable insight....
...and after a few years the mission evolved, joining efforts to build up the future **digital home ecosystem**, with specific focus on smart home services.

With this in mind we continued our activity publishing our requirements and test plans, software architecture for smart home, device templates for IoT ecosystems support etc., with the aim of helping applications, home gateway middleware and devices to connect seamlessly. Some work used open-source approaches. We always kept the good habit to share hot topics and big “headaches” arising from the digital home deployment, to find common solution and consolidate them in useful requirements and guideline documents.
...and now!

...Now the mission is completed and it’s time for consolidation!
MAIN ACHIEVEMENTS

My personal selection: some of the historical ones...

- Residential Profile 2007-2008
- Quality of Service requirements
- Energy Efficiency requirements
- Software Execution Environment (SWEX) requirements

...and most of the recent:

- Wi-Fi requirements for channel selection, NFC use, hot spots
- Hardware Virtualisation in Home Gateways
- Hybrid Access Use Cases and Architecture Alternatives
- Smart Home Architecture
- Smart Device template (SDT)
- Wireless Home Area Network requirements
- Open Platform 2.x (SWEX evolution)
Oldies but goodies
RESIDENTIAL PROFILE 2007-2008

Title
  • Home Gateway Technical Requirements

What is inside

Used by a number of bodies (ETNO, ETSI, ITU) as main reference for HG architecture together with TR-124 from BBF
QOS REQUIREMENTS

Title
• QoS Home Gateway Technical Requirements/QoS white paper

What is inside

Fig. 1 and 2
Upstream and downstream transit queue structure

Used by a number of operators to write HG specifications. Still quite advanced solution
ENERGY EFFICIENCY REQUIREMENTS

Title
- Requirements for an energy efficient home gateway, followed by
  Requirements for Power Management of Home Network Devices

What is inside

Figure 5: Example implementation of energy controller interfaced to a CPU

Figure 14: Wi-Fi power state diagram

Used by HGI and single operators to contribute to EU CoC initiative
SOFTWARE EXECUTION ENVIRONMENT

Title
• Home Gateway Requirements for Software execution environment

What is inside

Referenced by a number of HGI operators and sent as contribution to OSGi Alliance
The new wave
WI-FI REQUIREMENTS (1)

Title

- Wi-Fi requirements for Automatic Channel Selection and Repeaters

What is inside

- Wi-Fi Automatic Channel Selection
  - Most HGs implement an algorithm to automatically choose a Wi-Fi channel at startup. This is also required by HGi requirements.
  - Performance of such algorithm can vary a lot among implementations, leading in some cases to the choice of unusable channels affected by non-Wi-Fi interference.
  - It would be useful if Wi-Fi certification tests will include in the future the assessment of performance of HGs in presence of both Wi-Fi and non-Wi-Fi interference.
  - HGi defined additional requirements and a set of test cases to be brought as part of the HGi test specifications, as well as future contribution to WFA.

- Wi-Fi repeaters and Extenders
  - Wi-Fi repeaters/range extenders are extending the coverage of a Wi-Fi network, publishing a SSID and forwarding to the HG the traffic of paired devices. Particularly useful for Wi-Fi 5 GHz (higher speed but less coverage). Wi-Fi certification from WFA is not available for repeaters.
  - Since multiple options exist for implementing a Wi-Fi repeater, interoperability with HGs and user experience can vary among devices.
  - Some issues related to repeaters:
    - HGs of repeater different from WFA of HG helps to overcome the normal repeater's operation but prevents devices from performing interference test HGs and can lead to interoperability issues when HG is used to reselect the operation.
    - 5 GHz repeaters can support only 2.4 GHz band and will not work with HGs operating at 5 GHz in 2.4 or 5 GHz software.
    - MAC address seen by HG for devices associated to repeater can be different from the actual devices MAC address.
    - HGi defined high level requirements for repeaters, not yet ready for building test specifications but useful for addressing the specific market.

Sent as contribution to Wi-Fi Alliance
WI-FI REQUIREMENTS (2)

Title

- Wi-Fi requirements for NFC pairing, guest access, hotspot

What is inside

<table>
<thead>
<tr>
<th>No.</th>
<th>Requirement</th>
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<tbody>
<tr>
<td>HOTSPOT1.</td>
<td>The HG MUST support 1 SSID dedicated to the each mode of the hotspot service that is supported.</td>
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<tr>
<td>HOTSPOT2.</td>
<td>The HG MUST NOT forward any frames/packets between devices connected to the hotspot and any other local devices connected to the HG.</td>
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<tr>
<td>HOTSPOT3.</td>
<td>The HG MUST allow the primary user to enable and disable the hotspot service (subject to any commercial limitations).</td>
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<tr>
<td>HOTSPOT4.</td>
<td>The HG MUST classify the traffic coming from the hotspot SSID into the low priority queues, as per the mechanisms in Error: 2 origine riferimento non è stata trovata.</td>
</tr>
<tr>
<td>HOTSPOT5.</td>
<td>The HG MUST allow the Service Provider to remotely enable and disable the hotspot service.</td>
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<tr>
<td>HOTSPOT6.</td>
<td>The gateway SHOULD be able to limit the number of devices simultaneously connected to the hotspot.</td>
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<tr>
<td>HOTSPOT7.</td>
<td>The HG SHOULD be resistant to Denial of Service attacks from hotspot users or devices attempting to connect to the hotspot.</td>
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<tr>
<td>HOTSPOT8.</td>
<td>The HG MUST NOT apply any firewall rules or parental control to traffic from hotspot devices.</td>
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<tr>
<td>HOTSPOT9.</td>
<td>The HG MUST implement a DHCP L3 relay to insert options 82, sub options 3 and 2, in IPv4 DHCP packets.</td>
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<tr>
<td>HOTSPOT10.</td>
<td>The HG MUST support GRE encapsulation as defined in RFC 1701 (Error: L’origine riferimento non è stata trovata.). NOTE: This may have implications for HG performance unless hardware acceleration is used.</td>
</tr>
<tr>
<td>HOTSPOT11.</td>
<td>The HG MUST encapsulate all the Ethernet frames coming from the hotspot SSIDs and forward into the GRE tunnel, except DHCP frames (Type=0x0081 IPv4 Authentication) that are forwarded in RADIUS messages. For the high security mode, the HG MUST encapsulate traffic if and only if prior authentication has been successful.</td>
</tr>
<tr>
<td>HOTSPOT12.</td>
<td>The HG MUST support the IEEE 802.1X protocol (authenticator role) for connectivity of wireless devices. [2]</td>
</tr>
</tbody>
</table>

For possible downstream to Wi-Fi Alliance
HARDWARE VIRTUALIZATION

Title
- Hardware virtualization in home gateways and comparison with multi-threading, containers and NFV

What is inside

Baseline + Extension SW
(e.g. networking, switching, routing, HGW GUI, DLNA DMS...)

Operating System (OS)

Host Hardware

Liaised to prpl foundation for possible downstream

Fig. 1 and 2
Traditional vs virtualized home gateway architecture

SW1
OS1
Virtual Machine #1
Hypervisor
Host Hardware

SW2
OS2
Virtual Machine #2
HYBRID ACCESS AND HG

Title

- Use cases and business requirements for hybrid access

What is inside

For possible contribution to BBF hybrid access activities
SMART HOME ARCHITECTURE

Title
- Smart home architecture and system requirements

What is inside

Downstreaming to ETSI and OneM2M
SMART DEVICE TEMPLATE

Title
• Smart Device Template SDT on https://github.com/Homegateway

What is inside

Downstreaming to ETSI and OneM2M
WHAN REQUIREMENTS

Title
- Requirements for Wireless Home Area Networks supporting smart home devices

What is inside

Liaised and commented by various technology bodies, adopted by a number of operators to select SH technologies

Requirements for Wireless Area Network technologies

Important elements from the providers’ point of view:

- For wide deployment of the services
  - Easy installation & configuration without specialists

- For low-cost operation
  - Remote management of the WHAN.
  - Remote diagnosis and test of the WHAN.

- For reliable and stable services
  - Reliable & stable wireless performance
  - Proven security
OPEN PLATFORM (AKA SWEX “EVO”)

Title
- HG requirements for HGI Open Platform 2.1

What is inside

Downstream to ETSI
Possible Downstream to OSGi Alliance
The biggest thank you!!

Many Thanks to all the HGi contributors!!!!!!