SUMMARY OF VENICE CLOSING SYMPOSIUM
MARCH 8-9, 2016
WWW.HOMEGATEWAY.ORG
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Summary of HGI History and Highlights

- HGI started in April 2005 to define future HGs with a focus on QoS, Energy Efficiency, s/w modularity
- Expanded to digital home ecosystem, smart home, test plans
- Luca’s personal selection of the most important older work: Residential Profile, QoS, Energy Efficiency, SWEX
- Luca’s highlights of newer work: Wi-Fi System Requirements, Hardware virtualisation, Hybrid Access, Smart Home
  - Architecture, Smart Device Profile, Wireless HAN requirements, Open Platform 2.x
- Other comments about key HGI work
  - HGI Test Programme
  - Multisession requirements
  - Diagnostics
  - Home Network Infrastructure Devices
DAVE THORNE, HYBRID ACCESS

Summary of HGI work in HGI-SBI054 and related BBF Architecture work:

- **Business drivers**: increase service availability, provide higher broadband speeds, reduce service provisioning time
- **Architecture choices**:
  - HHG (Hybrid Home Gateway) only
  - HHG and HAG (Hybrid Access Gateway)
- **Issues**
  - **HG**
    - Multiplexing, packet re-ordering, QoS, 1 or 2 box, charging, User policy input
  - **Access**
    - Variable transport – different characteristics of different paths
    - Combining management and diagnostics
  - **HAG**
    - Business ownership, DS traffic steering, multiplexing
- **HGI work**
  - use case summary done
  - nodal requirements not done.
  - In-home architecture, 1 vs 2 box, other issues are well explained
VINCENT DANNO, WI-FI SERVICES

Summary of HGI work in HGI-RD057 setting out system level requirements for Wi-Fi services:

• **WiFi Services in HG**
  - Easy Pairing – with NFC – Options for HG
    - HG hosts tag
    - Hosts a tag and the smartphone mediates
    - HG hosts reader

• **Guest Access in HG**
  - Under control of the subscriber
  - 2\textsuperscript{nd} SSID is used for guests

• **Hotspot**
  - Under control of the operator – well-known SSID
  - For example, Orange provides this service
  - Low security vs high security modes (802.1x)
  - Users can opt out (but most don’t)
  - Spoofing of hotspot SSID doesn’t seem to be a concern for customers
Summary of HGI work in HGI-RD045v2 setting out some technical requirements for Wi-Fi integrated on the Home Gateway

- Dual 2.4/5GHz radio using 802.11ac
- 5GHz is cleaner spectrum so more able to support video streaming
- Providing clear requirements focused on Automatic Channel Selection
- Channel measurements

Future Wi-Fi/wireless networking directions, especially considering TNO research directions:

- Need for dynamic topology discovery - being considered in BBF
- Extension to 5 GHz helps capacity, but it is also limited
- 60 GHz range is very limited – in-room coverage only
- TNO is looking at 60 GHz nodes connected with a backbone (possibly wireless)
- Inter-AP communication for spectrum coordination”
DUNCAN BEES: OPERATOR ROUND TABLE ON WIRELESS HAN NETWORKS

Discussion about Service Provider requirements for Wireless Home Area Networks, inspired by work leading up to HGI-RD039

- SPs have key requirements in installation/configuration, performance, resilience, power consumption, privacy, diagnostics
- Range of wireless technologies includes licensed spectrum (DECT, ULE) and unlicensed Wi-Fi, Zigbee, Z-Wave, Bluetooth, etc.
- Some technologies have very well developed ecosystem; also, some newer ecosystems with a very complete approach: OIC (OCF), Thread, AllJoyn
- HGI’s SDT (Smart Device Template) is helping to make a common device model view available to applications via abstraction layer
- SP Panel then commented about key factors for their companies.
RUTH WILSON: VOICE AND DECT FORUM

Ruth summarised a range of collaboration between DECT Forum and HGI over the years. Highlights:

• Initial question raised related to requirements for Software Updated Over the Air (SUOTA)
• Focus on HDVoice clarified a joint operator position on Optional/Mandatory requirements for CAT-iq 2.0
• Further discussion enabled requirement specification for CAT-iq 2.1
• HD-Voice workshop brought link with other fora, defined key relationship between HGI/DECT Forum/ETSI and subsequently Cablelabs
• Operator branding requirements drove engagement with GSMA HDVoice initiative resulting in joint logo across the industry
• Who will speak for operator voice now that HGI is closing? Somewhat left as an open question
HANS-WERNER BITZER – SERVICER PROVIDERS AND SMART HOME

- Initial HGI goal in 2005 attracted huge interest. Goal to provide a low cost, high capability HG. To avoid the operator simply becoming a bit pipe provider, and this motivated the initial discussions on services

- HGI residential profile brought a lot of material together and filled a key standards gap

- Software modularity rather than firmware update was a supporting idea
  - Modules have many advantages vs complete firmware update: no reboot, no monolithic set of features, easier testing, developable by 3rd parties

- Motivating an execution environment:
  - Did not want to deploy modules directly with native code (reliability, etc.)
  - Desired: proven technology, secure access to sensitive functions; deployment across HG brands; OS and HW independent modules

- Java, but has no built-in concept of modules

- OSGi provided a solution with Core, EE, and life cycle services/security

- Qivicon box followed HGI spec on Open Platform
  - Intention to do the router integration, currently a 2-box solution
LINDSAY FROST- OPEN PLATFORM

Lindsay Frost introduced the latest work on HGI Open Platform 2.1, AKA SWEX, in HGI-RD048v2

- Introduction to HGI Open Platform in HG as a component of a Service Provider services architecture
- Interoperability between applications (including Cloud) and home components is a key HGI goal
- Modular s/w applications in a dedicated virtual execution environment allows services to be updated frequently
- Key requirements on OP2.1 include avoiding conflict with native s/w and supporting all the module lifecycle functions, while staying independent of operating system
- HGI Open Platform has been HIGHLY RECOMMENDED in OSGi Residential Release 6
- Orange, NTT, DT, Teliasonera, Telekom Austria, Telecom Italia all have trials or products based on the HGI work, as outlined in Lindsay’s slides
WILLIAM LUPTON – BBF’S USER SERVICES PLATFORM

• Broadband 20/20 Vision is to enable value added services via technologies such as NFV and SDN

• USP (User Services Platform) is essentially v2 of TR-069
  – Bringing the management plane to the environment of multiple devices/services/retail devices
  – Broadband User Services (BUS) Work area is BBF Home group new name
    • Develop TR-069 to cover IoT and virtualization
    • New info models to expand scope
    • Requirement for devices (not just HG)
  – Supporting TR-069 for C1 constrained devices
  – Removing requirement to setup a session, support for multiple ACS controllers per device (hierarchy), defining clean protocol layers, reusing existing data models
  – 111 service providers responded to a BBF survey. TR-069 is key to new services (smart home)
  – Looking for SP leadership in providing input on USP

• BBF Innovation Track
  – Invitation to participate in a kind of HN Business Requirements group under either market requirements track or innovation track
  – People could talk to William or Robin Mersh, and Wojtek Makowski can help coordinate HGI people to approach BBF

• Some questions about how USP and oneM2M compete/collaborate
PHILIPPE CALVET/VINCENT DANNO – SECURITY IN HG

Overview provided of recent security discussions for HG, now brought by Orange into HGI-RD044 residential profile.

• Security is important to protect secrets stored in HG such as service or Wi-Fi credentials. But the HG is customer premises equipment under SP management. With more s/w execution in the HG, including 3rd party, larger “attack surface”. Also route hacking is a factor

• Operator requirements
  – System integrity: must not be possible to replace legitimate s/w with illegitimate code → secure boot, s/w authentication, and anti-rollback are required
  – System hardening - system must not allow any malicious 3rd party or customer to take disallowed actions
  – Remote management: operator must be able to remotely force upgrades on boxes, with authentication mechanisms

• Secure execution environment uses hardware (separate devices or virtualisation) to isolate application code

• Kernel hardening: Kernel provided by chipset vendors must work with hardcos to harden the reference kernel, harden the reference applications (compilation with secure options), and provide long term support

• David Armand of Orange is a key contact
WOJTEK MAKOWSKI – HW VIRTUALISATION

An overview of HGI-SBI052 on Hardware Virtualisation of the HG processor
• Explaining Virtual Machine, HW Virtualisation, Multi-OS, and Containers
• Virtualisation allows faster feature development and deployment
• NFV is basically extending home network to the cloud. For some functions it makes sense.
• Recommended approach: Mixed embedded fog architectural approach = NFV + resource distribution + cloud empowering
WOLFGANG JOHN – ULE ALLIANCE

Wolfgang John presented an overview of ULE approaches including at semantic layer

- Some new developments with ULE:
  - Integration of 6LoWPAN
  - HAN FUN is in existing products
  - IOTivity or AllJoyn is able to be supported natively or by translation
  - Thread consortium – nothing in the works now
Presented an overview of testing approaches in the digital home

- Smart home automation testing challenges
  - Technology fragmentation
  - Many players in the value chain
  - Have the exposed APIs been tested?

- Quality Issues:
  - in various APIs and test points including at technology protocol layer.
  - Interoperability as well as specification compliance and APIs.

- In the industry fora, getting the development of test material completed within specific timescales and scope is hard when it is based in voluntary contributions of individual companies. This is why there is a case for a contracted 3rd party provider to help take care of test case development within an industry alliance.
SCOTT LOFGREN – OIC/OCF

Scott and colleagues presented an overview of the Open Connectivity Foundation (new organization replacing OIC)

• 160 members
• OCF is helping with standards consolidation. UPNP folded into OIC. Microsoft, Qualcomm, Electrolux have joined OCF board and will bring a lot of the AllJoyn code they contributed. That will be finalised next week
• Protocol Plugin will be used. Msoft will support natively in Windows10.
• OCF defines data model and common communications framework. (RAND-Z or RAND). Keeps a link to the open source project (Apache 2.0)
• Specification and certification. Open source code: iotivity (Linux Foundation) associated with the spec.
• Increase in complexity due to plethora of devices. Need to get to massively connected system.
• Apps&Services/ Profiles&Data Resource Model/ Communications Protocols/Transports
• Apps&Services sits on OCF Comms Framework \(\rightarrow\) essentially abstraction layer
• OneIOTA is a data modelling approach
• Constructive data modelling: derived device data model:
• Shim layer provides for conversion of examples such as AllSeen
Wojtek and Luigi presented initial HGI views on requirements for a carrier grade OpenWRT solution

• **OpenWRT**
  - Started in 2004
  - Standardised firmware, 10 major versions
  - Has never been a standardised product, but is a framework for customised projects, demonstration, starting point of product. Lantiq, Ikanos, QC use it for their BSP as OpenWRT configuration. IEEE HomeNet WG. Bufferbloat project for QoS
  - Lacking telephony, hardware acceleration (which are not standardised) which has a big impact on s/w structure, carrier grade access

• **Suggestions for Carrier Grade**
  - Enable painless s/w downstreaming between openWRT trunk and operator firmware. Basically support carrier features even when useless for retail. H/w acceleration and power saving. Support data models 20k items. Emphasise standards compliance over footprint.
  - Involve chipset vendors but not features under NDA. Standardise main interfaces.
  - Innovation pace. Leverage on RDK-B. Collaborate with upstream such a Linux Kernel.

• **Missing features to be added**
OPENWRT PANEL

Art Swift led a panel with Kathy Giori, Imre Kaloz, Wojtek Makowski and Luigi Mori on OpenWRT requirements

• Kathy: Key is to identify non-differentiating features and get them into OpenWrt as features. Push the hardware vendors to make features open
• Imre: co-founded openWRT in 2003. Upstream to Linux kernel is key.
• Luigi: need standard way of accessing lower layer. This takes a lot of effort to move from chip to chip. OpenWrt documentation is not so good.
• Wojtek: not so much about OpenWrt but about overall industry, providing standardised interfaces to chipset vendors. Possibly can work with RDK-B to help influence. Also, upstreaming toward Linux Kernel is key.
• Art: hopefully PRPL could help with upstreaming
• Art: US FCC proposing to lock down firmware and wifi parameters. Major industry question of how to comply while still allowing community innovation. Virtualisation? Kathy: fully open allows many innovations, e.g. at QC Atheros wifi mesh was developed. There should be a key that could lock or open innovation or close it.
ART SWIFT – PRPL FOUNDATION

Art Swift introduced prpl Foundation goals and activities on HG and related topics

• **Virtualisation**
  – Prpl demo’ed virtualized OpenWrt

• **openWRT**
  – Prpl is looking at funding OpenWrt projects of interest to the community and industry
  – FCC takes note of open source community objections – but still locking down.
  – Prpl is funding open source automated testing farm
  – Prpl proposing to organize and fund next OpenWrt Summit in 2016, location TBD

• **Security Guidance was published**
  – 1500 downloads in first 3 days
  – Open source, Interoperability, Root of Trust, Virtualisation
  – Complementary to HGI’s virtualisation

• **PRPL would like carry on with some of this work**
  – Carrier group in HGI would provide requirements focus and suggested features for carrier grade OpenWrt
  – Significantly reduced PRPL fees for HGI transferees

• **Discussion resumed at end of afternoon with HGI Board and prpl**
  confirmation of membership terms is coming
Andreas Kraft summarised SDT (Smart Device Template) current status

- Goal was: keep it simple.
- Domain, Device Sub-Device, ModuleClass, Property. Reusable XML modules to describe most things
- Latest version has complex data types, meta-data, property lists
- All available under Github
- SDT tool
  - SDT2→3, Generate documentation, Vorto import format, Java interfaces and classes
- Contributions forked on Github: Echonet, Energy@Home, ULE Alliance
- Eclipse Vorto: model repository
- oneM2M: TR17 home domain information model using SDT
Andreas Sayegh told us about his company's new products which use machine learning on the entire smart home using SDT as a modelling tool.

- SDT provides:
  - structured information on functionality of networked appliances
  - Mappings to an SDK imply the appliance API
  - SDT documentation defines semantics

- SDT mapping to their SDK using C++

- More complete smart home modelling info requires other elements such as “Appliance” including serial number, Feature using module class, location...

- Trying to apply machine learning to the entire smart home, not just to dedicated applications.
Colleagues from Energy@Home provided an overview of their work on data modelling

- E@H data model 1.1 available since 10/2015 UML based, automatic mapping to XSD and REST resources. Function-centric approach.
- Proposed complex data types to be added to SDT, this was done in SDT3.0. Now, E@H can be easily modelled in SDT framework.
- AGSuite implementation by Gemino = Gateway approach to IoT provisioning platform using TR069
Joerg provided an overview of current thinking in oneM2M on semantics

- oneM2M is like an HG in that it enables interworking and adds value
- Uses ontologies (OWL) to describe the system. Basics: a Thing and a Device (a Thing that can communicate)
- Compared to SDT, we can compose an ontology of sub-ontologies and model the real world. Annotations have semantic meaning
- Ontologies assist with Data Analytics and an M2M service provider could have role of Data broker/re-seller/analytics provider
Tim Ward provided a general overview of OSGi application in the IoT application space

• Challenges in IoT include locality (associated context); Privacy; Scale of Data; Security (providence of each s/w component); Evolvability

• Modularity

• OSGi is a Modular runtime for Java
  – Add/remove from a running framework; dependencies are enforced at runtime; remote management
  – Works across different runtimes; helps manage complexity; lots of remote management; dynamic service behaviours supported from OSGi Service Registry. Security built in.
  – Dynamic services represent connected devices.
Alex Edelmann provided a summary of the Eclipse Vorto project

- **Vorto DS**: domain specific language for each property describes:
  - Properties
  - Constraints
  - Measurement unit
  - Data type
  - Name
  - Mandatory/optional

- Importers and code generators can also use the repository with existing description languages like SDT. Also for UI generation.
Open source is important to support innovation in the IoT space with so many developers. Eclipse SH is one of many IoT open source eclipse projects. Eg. OM2M (open source oneM2M). IOT-Working group gives a discussion space.

ESH: smart home gateways. Java/OSGi. A set of OSGi bundles. Discovery/configuration, rule engines, data handing/rest API, user interface

- Physical: protocol specific models, location, etc.
- Functional: abstract information model, functional grouping, etc.
- Use JSON not XML, because JSON is what is expected in web world

OpenHAB similar, good for DIY experimentation

Qivicon: extension of ESH
DAVE THORNE: GIGABIT ACCESS

Dave provided a summary of the evolution to a much higher access speed and the implications for the HG and Home Network

• “up to” 500Mbps (G.fast) – 1 Gbps (Fibre)
• Why G.fast not fibre? Customer experience is much better due to self install
• Applications are downloading huge files, streaming 4k, uploading files, and speedtests
• All this requires much more effective Wi-Fi. It has improved in last 3 years but needs distributed APs with a backbone – options include powerline, wireless, G.hn over twisted pair
• G.fast: want single box solution day-1
• Residential profile, RWD044: Performance requirements in RWD044 linked to access speed. High speed home network support via 1905.1 SSID inheritance, Speedtests, etc.
• Suggestion that the HGI Wi-Fi test cases should be published
LUCA GIACOMELLO – HGI DOWNSTREAM

- OneM2M – HG Architecture, SDT
- ETSI Publication of 3 HGI docs
- Outline options to be discussed
- See last chart for more discussion notes
ETSI and HGI agreed a supplement to their agreement on PAS

Adopted as early draft, April 30 will progress, July 13 officially published. HGI already did everything we need to do.

- RD-036 Smart Home Architecture Requirements
- RD-039 Wireless Home Area Network Requirements
- RD-048v2 Open Platform 2.1 Requirements
ENRICO SCARRONE – ONEM2M

- It deals with Applications and service layer, it uses network and transport service from the underlying networks
- Sharing of Information among different solutions is the key issue
- Diversity in IoT ecosystems is opportunity and big problem. Standardisation is trying to help simplify → OneM2M.
  - It doesn’t mean one single solution. OneM2M is an interworking framework at semantic level
  - The Interworking is made on top of the oneM2M distributed platforms, a specialized application called Interworking Proxy Element performs the interworking
- Specific non one ontologies and information models are mapped to oneM2M basic objects by the mediation of the oneM2M base ontology
- Rel 1 in 2015, several open source projects underway.
- Rel 2 features: security, industrial domain enablement, home domain, interworking framework, semantic interop.
HGI DOWNSTREAMING - DISCUSSION

• On Smart home, OneM2M could increase its role as aggregator for harmonizing different approaches (already collecting OIC, Allseen, HGI SDT etc.); maybe leveraging on an operators’ internal group?
• Wi-Fi requirements: Wi-Fi Alliance operators’ group and single HGI contributors could push for testable requirements on channel selection, repeaters, NFC use, hotspot to complement Wi-Fi certification, according to HGI views on the topics
• Open Platform will hopefully become an ETSI spec; how OSGi could manage that is to be discussed (we have different IPR policies)
• Could ETSI take over the maintenance of the test specifications produced by HGI on OP 2.0, soon public? If not the test activities? Or prpl?
• SBI could converge to BBF project according to the proposal received
• Hardware virtualization can be a topic for future developments by prpl, possibly also involving other silicon vendors
• Prpl carrier grade OpenWrt: a good occasion to aggregate a critical mass for getting tangible results and exploit them in future HGs software deployment