Communication Concept for Smart Metering, Smart Grid and Home Automation

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Outline.

- Status Home Energy Management
- Requirements of Federal Office for Information Security
- Communication Concept Proposal
- Contributions to Standardization Work
- Conclusion
HGI has published a document “Use Cases and Architecture for a Home Energy Management Service” (HGI-GD017-R3) after several workshops with other industry consortia and standardization groups.

- The generic architecture suggests the collocation of Home Gateway and Energy Gateway, categorizes different HN areas and defines logical interfaces.
- Several interfaces being considered such as Zigbee, Z-wave, DECT, Homeplug, G.hn, Wi-Fi, and others.
- HGI is introducing applications (home energy management, also health, security, automation) in the home that interact with IP and non-IP devices.
- HGI has defined an execution environment incl. a first set of standardized APIs (“HG Requirements for Software Execution Environment" HGI-RD008-R3).
- Home Energy Management logic (and other application logic) can run (and interact) on the Home Gateway in combination with cloud based functions.
Status Home Energy Management.
HGI Architecture.


- Introduction of Protection Profiles for the components of a Smart Metering System required in the EU Member States.
- German Federal Ministry of Economics and Technology mandated German Federal Office for Information Security (BSI) to develop a Protection Profile for the Smart Meter Gateway.
- Protection Profile for the Target of Evaluation
  - describes threats concerning security and privacy,
  - defines requirements for countermeasures.
- Products will be certified based on the Protection Profile.
- German Regulatory Agency (BNetzA), Federal Metrology Institute (PTB), and professional organizations were involved in the development of the Protection Profile.
- Final draft “Protection Profile for the Gateway of a Smart Metering System” v01.01.01 recently issued.
“The Gateway shall offer a user interface to the HAN that allows CLS or consumers to connect to the Gateway in order to read relevant information.”

- HAN = Home Area Network
- LMN = Local Metrological Network
- CLS = Controllable Local System e.g. white goods, air con, solar plant

- Technical Guideline TR-03109 for the operation of a Smart Metering system under development.
- Requirements for the interoperability of a Smart Metering system comprising the elements that are certified by the Protection Profile.
- First draft presented on 14th October, next meeting in December.
- Document expected to be issued by April 2012.
Differentiation between Critical Infrastructure Energy Domain and Customer Domain because of different security profiles.
- No direct physical connection between those two domains.
  - Customer access via web services over Internet.
  - Local unidirectional wireless meter readout possible, SRD band (Short Range Devices).
- If appliances in the resident’s premises are connected to a managed service (e.g. time shifted power connection of white goods), there shall be no possible interference from that appliance to the service in general.
- Both domains follow different roll-out speed and logic.
- Market communication of the utility business is another independent domain.
Communication Concept Proposal.

**Customer Domain**

Electrical appliances/loads, e.g., white goods, displays, sensors, actors, ...

- IHD
- ZigBee
- KNX
- Non-IP Communication

LAN 1..n

- Web portal
- Third party

Transfer time ≤ 10 s for command and alarm signals
Transfer time ≤ 5 min for energy measuring, supply management

**Critical Infrastructure Energy Domain**

Electrical appliances/loads, e.g., PV, µCHP

- Sensor 1
- Sensor 2
- Meter 1
- Meter 2

Actor 1
Actor 2

Gate-way 2

Privately Managed Network

Transfer time ≤ 2 s for command control, load shedding and peak shaving

**IP Service Provider Platforms**

- IPTV
- VOIP
- Internet
- Connected Home

**Third Parties**

- Web Portals
- Value added services, e.g., safety, heating control, ...

**Utility Business Market Communication**

- Secure B2C
- Secure B2B
- Public

CLS: Controllable Local System
EDM: Energy Data Management System
IHD: In Home Device
µCHP: Micro combined heat and power plant
PV: Photovoltaic generation
HA: Home Automation

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Communication Concept Proposal. Propositions on Connectivity.

<table>
<thead>
<tr>
<th>Customer Domain</th>
<th>Critical Infrastructure Energy Domain</th>
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<tbody>
<tr>
<td>Customer has final control and responsibility</td>
<td>Responsibility for successful delivery, fixed SLAs, possible contractual penalties</td>
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<tr>
<td>Guarantee on the delivery of the service dependent on SLA, if managed</td>
<td>Guarantee on undisturbed operation without danger of tampering, intrusion or service blocking</td>
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<tr>
<td>Service dependant variable reliability level</td>
<td>High to very high reliability level</td>
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<tr>
<td>Service dependant variable security level</td>
<td>Secure actor contact to start and stop decentralized generation</td>
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<tr>
<td>Direct customer access to infrastructure possible</td>
<td>Signature &amp; authentication &amp; encryption mandatory</td>
</tr>
<tr>
<td>Signature or authentication or encryption optional</td>
<td>Transfer time ( \leq 2 \text{ s} ) for command control, load shedding, peak shaving</td>
</tr>
<tr>
<td>Transfer time ( \leq 10 \text{ s} ) for command &amp; alarm signals, ( \leq 5 \text{ min} ) for energy measuring, supply management</td>
<td>Connection/disconnection of single loads typically ( \leq 3 \text{ kW} ) (max. consumption household appliance)</td>
</tr>
<tr>
<td>Connection/disconnection of single loads typically ( \leq 3 \text{ kW} ) (max. consumption household appliance)</td>
<td>Connection/disconnection of single loads typically ( 100 \text{ kW} ) (consumption of devices with net impact)</td>
</tr>
</tbody>
</table>
Conformance of Proposal with BSI Requirements.

- Separation of Critical Infrastructure Energy Domain and Customer Domain.
- HAN access only via dedicated interfaces.
- HAN may have access to the Internet.
- Requirements regarding local unidirectional wireless meter readout between Smart Meter in Critical Infrastructure Energy Domain and HA Gateway in Customer Domain not yet defined by BSI.
Contributions to Standardization Work.

- Incorporated into draft ETSI 102 935 “Applicability of M2M architecture to Smart Grid Networks – Impact of Smart Grids on M2M platform” as Smart Grid / Smart Metering Customer Domain Use Case, Deployment Scenarios.
- National German SDOs.
- Input to requirements document of Home Gateway Initiative (HGI).
Conclusion.

- Differentiation between Critical Infrastructure Energy Domain and Customer Domain because of different security profiles.
  - Both domains follow different roll-out speed and logic and belong to different “control regimes” although they are one Home Domain for the inhabitant.
- Local unidirectional wireless meter readout possible.
- Concept Proposal has been contributed to Standardization.
Thank you for your attention.