ESB Networks Smart Metering Project

Smart Metering HAN Strategy

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1 Executive Summary

The mandating of a dual fuel solution and an In Home Display (IHD) for all customers makes the selection of an appropriate and effective Home Area Network (HAN) standard critical for the rollout of smart metering in Ireland.

Early selection of the HAN standard prior to the procurement of meters will allow all contributors to the rollout a common understanding of the requirements for their component of the solution. It will also allow for integration design processes to commence. It could save 6 to 12 months during the design phase of the project as all contributors can simultaneously begin their design, specification and procurement processes without the need to wait for completion of the e-meter procurement process.

By eliminating uncertainty in the procurement process it will be possible to more effectively define integration requirements and costs for design and development. It should also allow for more effective sourcing of components ensuring a more competitive tendering process.

In other jurisdictions such as the UK, Holland, the US and Australia, where the HAN forms a significant component of the respective rollouts, significant work has been done to define a HAN standard at an early stage of the respective processes. This is especially the case where there are multiple contributors to the rollout. This is done to ensure conformity with standards, common understanding of the technical landscape, minimize costs and simplify integration.

Selection of HAN technology

The strategy to achieve the selection of an appropriate HAN standard comprises of four key tasks, to include

- Required Functionality Definition
- Technology Questionnaire
- Meter Proximity Study
- Propagation Study

Comparison of the propagation study results with those of the meter proximity study will give a clear indication as to the most appropriate RF frequency for provision of HAN facilities in the Irish housing environment.

This outcome coupled with required functionality compared against the replies from the technology questionnaire will allow for a decision to be made on the most appropriate available HAN technology to be selected for the full rollout.
2 Introduction

One of the key components of the Irish Smart Metering roll out will be the provision of a HAN capability for every home. This Utility HAN will contain the Smart Electricity Meter (e-meter), the Smart Gas Meter (g-meter) and a Display Device (IHD) capable of showing both Electricity and Gas usage information to Customers. The Utility HAN will also be capable of accommodating a second electricity meter if ultimately required, for sub-metering of micro-generators.

The Display Device deployed initially into the Utility HAN may be provided by the Distribution System Operator (DSO), Energy Retailer or the Customer themselves. An appropriate HAN standard must be chosen in advance, so that all Display providers can select appropriate devices which will interoperate securely with the Smart Meters.

The Customer may wish to deploy their own independent Customer HAN within the home containing any number and type of Smart Energy devices. The Customer will be free to choose any HAN technology for this purpose. However, the Customer may still require access to Electricity and Gas Energy Consumption information from the Smart meters in the Utility HAN. To accommodate this potential requirement, it is proposed that the Utility HAN and Customer HAN may be connected via a secure bridge/gateway. This interface will facilitate the passing of information from the Utility HAN to the Customer HAN.
The Utility HAN standard choice will impact on a number of parties including:

- ESB Networks as smart electricity meter and communications infrastructure provider
- Bord Gais Networks as the g-Meter Provider
- IHD providers
- Customer HAN provider (and any associated devices)

The Utility HAN Standards should be specified early in the design process. This is to allow for an early common understanding of the HAN technology to ensure interoperability of all the devices contributing to the HAN.

The objective of this document is to describe the strategy for selecting the Utility HAN standard.

3 Overview of Utility HAN functionality

The CER decision paper says that the Smart Electricity Meter will sit at the core of any proposed utility HAN infrastructure. The e-meter will act as a gateway between the HAN and the Smart Metering Infrastructure (SMI). The utility HAN will contain the e-meter, the g-meter and an IHD, at a minimum. The utility HAN will have the following minimum requirements:

- Security
- Data Encryption
- Secure and authenticated binding of HAN members
- Facilitate reading of the e-Meter and g-Meter and forwarding of data to central systems
- Secure communication of gas and electricity data to IHD
- Capability to accept a periodic (perhaps daily) gas calorific value from backend IT Systems and to send this onwards to the G-Meter and/or IHD
- Synchronisation of clocks on the Electricity Meter, the Smart Gas Meter and IHD with a central network clock
- Communications of Gas Meter valve operation commands from backend IT systems to the Gas Meter for execution
- Ability to facilitate firmware upgrades and configuration settings on the Smart Electric Meter, Smart Gas Meter and IHD, in response to instructions from the backend IT Systems
- Ability to de-register a Smart Meter or IHD from the HAN and to refuse all communications with the de-registered device going forward
- Ability to send Text Messages to the IHD (either from the utility itself or from 3rd parties). There may also be a requirement to accept responses from users to these messages and to deliver the responses back to the original sender of the message.
Additional HAN functionality may be identified once the industry workshops in the smart metering detailed design phase are completed.

In particular it is anticipated that a separate customer HAN may be required which will be the sole responsibility of the customer and which will contain customer owned devices. A bridge/end device must be acquired by the customer and registered with ESB Networks to facilitate transfer of metering data from the Utility HAN to the Customer HAN. This gateway must be common and authorised by the utility. All other Customer HAN devices will be deployed independent of the Utility.

The diagram below shows how the HAN will look

Figure 1 HAN Topology
4 Background

The National Smart Metering Plan envisages the electricity meter will act as a hub for the gas meter thereby facilitating a single communications infrastructure to support both electricity and gas smart metering. The plan also envisages that customers will be provided with in home displays. Therefore a utility HAN will include two-way home area network (HAN) communications between the electricity smart meter, gas smart meters, in home display devices and potentially an additional electricity meter for micro-generator.

In addition to this In-home devices and applications in the non-utility HAN may also require to interact with the smart metering system. These devices will be part of a customer HAN. The functionality for the smart metering full rollout solution should enable secure communications between the smart meter and an appropriate bridging device which will in turn pass this data on to the in home devices.

The detailed functional, security and performance requirements for the HAN will be determined during the Design stage.

Furthermore the decision paper from CER envisages a “watching brief” being kept on developments in Smart Home and Smart Grid technology areas to ensure that the smart metering solution is “future proofed” as far as possible to cater for any emerging functional requirements in these areas, assuming they are technically and economically viable to implement.
5 Standards

As defined by the National Institute of Standards and Technology (NIST) standards are specifications that establish the fitness of a product for a particular use or that define the function and performance of a device or system. Standards are key facilitators of compatibility and interoperability. They define specifications for languages, communication protocols, data formats, linkages within and across systems, interfaces between software applications and between hardware devices and much more. Standards must be robust so that they can be extended to accommodate future applications and technologies. Voluntary consensus standards are developed by organizations following formal rules. Government regulations may incorporate or reference voluntary standards.

6 Attributes of a HAN Standard

The Utility HAN standard should be;

- Open and non-proprietary
- Available royalty free and provide sufficient information to allow manufacturers to produce a fully compliant solution
- Interoperable.

An independent, verifiable, certification process testing compliance to the standard, including testing for device interoperability should be supported.

The standard should support the ability for the Smart Electricity Meter to manage access and activity on the HAN.

Devices used on the HAN must be simple to install preferably offering plug-and-play device commissioning.

The HAN standard should support secure two-way communications with the meter.

The standard should address future proofing through a defined means of upgrading device firmware. Preferably this should be possible remotely with the utility able to issue upgrades.

There is a requirement to support the collection and display of multi-utility information, specifically gas meters. Transmitters for gas meter reading typically use battery powered radio frequency transmitters so the HAN standard may be required to provide additional functionality to extend the battery life (for example storing information in a powered device for collection by the battery powered device during the short periods that the transmitter is turned on).
7 Timing of Standard Definition and Selection

Benefits of defining the standard early

There are several benefits to be derived from defining the HAN standard at an early stage of the project. This is especially so when there are multiple bodies effected by the technology decision. An early decision allows for certainty between the parties in terms of interfacing and conformance. It aids the integration process through out the technical architecture especially at the interface points. It will speed up the design process as it will allow parallel design and testing for the various contributors to the infrastructure.

Cost benefits should also be derived from a timely technology decision as it will allow vendors to develop, design and incorporate the technology into their offerings with the certainty that the technology choice is compatible.

Impact of not defining the standard early

Uncertainty
Uncertainty will lead to increased time for development, less effective proposals, additional cost and sub-optimal solutions.

Coordination and Program Dependencies
Work on specification, integration and procurement of connecting equipment, such as the Gas Meter and the IHD will not be able to commence until after the e-Meter procurement process has been completed as there will not be sufficient certainty to allow them to proceed until after the HAN technology selection has been finalised.

Cost Implications
It is possible that delayed selection of the HAN technology could add to integration and development costs for all components of the HAN.

Avoidable complexity
Uncertainty around the HAN standard to be used for the rollout complicates the procurement processes of all the interested parties. Third parties may have to be involved in the selection process for the electricity meters or the HAN component thereof. Bord Gais Networks, Suppliers and IHD manufacturers may require access to possibly confidential information from the ESBN procurement process. This will severely complicate and possibly compromise, both the RFP process and the selection process.
8 HAN Technology Strategy in Other Jurisdictions

In other jurisdictions such as the UK, Holland, the US and Australia, where the HAN forms a significant component of the respective rollouts, significant work has been done to define a HAN standard at an early stage of the respective processes. This is especially the case where there are multiple contributors to the rollout. This is done to ensure conformity with standards, common understanding of the technical landscape, minimize costs and simplify integration.

9 Strategy for determining a HAN standard for the full roll out

The strategy to select an appropriate HAN technology will be centred around the need to solve key performance criteria. The selected standard and technology must;

- Deliver the functionality required at the performance levels specified
- Function in all environments, property types, sizes and construction types
- Be standards based, open and non proprietary
- Be secure.
- Be supported by a significant number of product vendors

In order to select a technology which meets these criteria it is proposed to carry out the following key tasks.

- Required Functionality Definition
- Technology Questionnaire
- Meter Proximity Study (Gas Meter to Electricity Meter)
- Propagation Study

10 HAN Standards bodies survey

The objective of this survey is to determine suitability of available HAN technologies to meet the known and possible future requirements for a full roll out.

In order to evaluate the suitability of the various available standards a questionnaire has been devised to obtain the necessary information from the various industry bodies promoting these different technologies.

The questionnaire will attempt to determine from the various proposers, associations and vendors the capabilities of the respective standards in the areas of;

- Technology and Standards Governance
- Application Layer
• Product Ecosystem
• Indicative cost per point (licencing, once off costs etc.)
• Comparisons with other competing HAN standards
• Physical architecture
• Testing/Certification requirements
• Customer Device Commissioning
• Security
• Battery Powered Devices

Relevant standards bodies have already been invited to fill in the questionnaire.

11 Meter Proximity Survey

In order to develop an understanding of the conditions under which the dual fuel element of the HAN will be required to operate it is proposed to carry out a Meter Proximity Study. This study will establish a list of the key scenarios for the Dual Fuel set up. The key elements of this study will be

• Identify and list the major dwelling categories
• Establish location for e-Meters in all main dwelling categories
• Establish location for g-Meter in all main dwelling categories
• Determine typical figures for distances between meters in major dwelling categories

12 Propagation Study

Many HAN technologies use radio transmissions to communicate between the SMI meter and devices in the HAN. Radio based protocols are subject to inherent radio characteristics such as range, coverage and interference. The Irish AMI environment presents a number of challenges for the HAN that may not have been encountered in other deployments of similar technologies in other countries.

As such it is prudent to evaluate the effectiveness of the available and most frequently employed frequencies for HAN technologies. As it is likely that wireless systems will form a significant component of the HAN solution it is proposed to conduct a series of RF Propagation trials to assess the likely coverage of possible short range radio solutions in the main unlicensed radio bands, including 2.4GHz, 868MHz, 434MHz and 169MHz.

Initially it is proposed to carry out an evaluation of the results of tests carried out in other jurisdictions with similar conditions and requirements. We will estimate their relevance to the Irish context and environment. This may be sufficient for many of the cases to be encountered in Ireland.

For those cases where the results of existing studies are not sufficient it is proposed to carry out a series of field tests and measurements in the Irish SMI environment to determine the capability of the various technologies in the various conditions.