



STRATEGIC PLATFORM FOR INNOVATION AND
RESEARCH IN INTELLIGENT POWER [IPOWER]

IPOWER - SMART METER CASE STUDY - DEVELCO PRODUCTS GATEWAY

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Abbreviations

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2 INTRODUCTION

Smart Grid technology has demonstrated the ability to generate business cases by transforming the electrical grid from coal plants to distributed renewable generation, by enabling consumer power savings, and by providing cost efficient operation of electrical grids.

iPower is a strategic platform where universities and industrial partners consolidates innovation and research activities for the purpose of developing intelligent control of decentralized power consumption. The iPower Platform develops and matures Smart Grid technologies for the electrical grid, industries and residential applications. The iPower platform links research, innovation and demonstration to actual product development by specifying technologies, requirements and methods for Smart Grid products.

In the iPower project several different cases on domestic demand were defined. One of those cases the “Smart Meter” case study was originally intended for controlling home appliances via the smart meter. During the course of the project, we have realized that this is no longer a feasible business case.

The pilot test sites in iPower have together with research and the business development on the smart home market made it clear that local intelligence is needed to control heat pumps, air condition, and other appliances. For controlling the load according to pricing, it is essential to have exactly the same tariff as the meter is operating with. This tariff can usually be requested via an internet connection, but in case the internet is non-functional, the system is not capable of running. By reading out tariffs as well as actual consumption from the meter, we assure the full alignment with the actual price.

On the basis of this, Develco Products has developed a new and improved platform for the operation of Home Area Networks intended for energy management and smart home.

3 SQUID.LINK GATEWAY – AN OPEN PLATFORM

This chapter presents the wireless platform for the operation of Home Area Networks, the Squid.link Gateway developed by Develco Products. Develco Products provides all hardware needed for smart home solutions. The key in smart home solutions is the Squid.link Gateway.

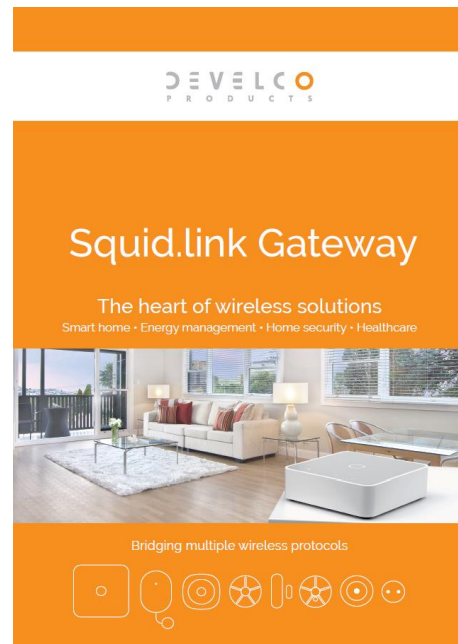


Figure 1 The Squid.link Gateway

3.1 AN OPEN PLATFORM

The Squid.link Gateway is an open Linux platform including multiple wireless networks for communication with smart meters, sensors, smart plugs, thermostats etc.

The Squid.link Gateway has options for ZigBee, Z-Wave, Wireless M-Bus and WiFi HAN networks. The gateway includes processor power to implement even very complex local intelligence. The configuration is determined when put into production.

The memory options leave room for data storage and logging. Communication with servers and e.g. smart phones can be established via WiFi, Ethernet (to local modem) or 2G/3G.

Modular platform

The Squid.link Gateway is a modular platform for bridging different wireless technologies. The gateway is modular and can handle many different wireless protocols at the same time.

Multiple protocols

Supported protocols are i.a. ZigBee, Z-Wave, Wireless M-Bus, Cellular 2G/3G, ethernet, and WLAN.

The price is extremely competitive since you will only pay for your selected modules.

Flexible solution

Squid.link Gateway is an extremely flexible solution for connecting networks based on different technologies.

You are no longer dependent on one vendor but can combine your Home Area network exactly the way you prefer.

“

Programmable Linux gateway

”



Figure 2 The modular platform offers a whole range of possibilities for connection different devices from various brands.

3.2 SOFTWARE OPTIONS

Develco Products provides the Squid.link Gateway with Linux and optionally Java. For application of software, three options are available:

1. Squid.link Starter Kit: Complete hardware, software, development tools and documentation package for own software development
2. OSGi based middleware via partners, for own high level software development
3. Turnkey software solutions from partners

3.3 WIRELESS PLATFORM AND DEVELOPMENT TOOLS FOR A QUICK START

The Squid.link Gateway offers a fully open wireless platform based on open standards. Implementing your application in C, Python, Java or other language gives you full access to wireless networks based on multiple wireless standards.

The Squid.link platform is delivered with a demo application for a quick and easy start. Develco Products provides a PC based tool for generating, sending, receiving, and interpreting ZigBee telegrams and other messages.

Applications can access the hardware interfaces through an application API. This API is accessible directly from an application running on the gateway or from a server via the SmartAMM middleware.

3.3.1 LINUX, JAVA & OSGI

For development, several Linux build variants are available, e.g.:

- Linux for C and C++
- Linux with Oracle Java for JVM7 or JVM8
- Linux with Oracle Java, ProSyst Smart Home middleware, Eclipse SmartHome

Or you can modify the Linux platform yourself.

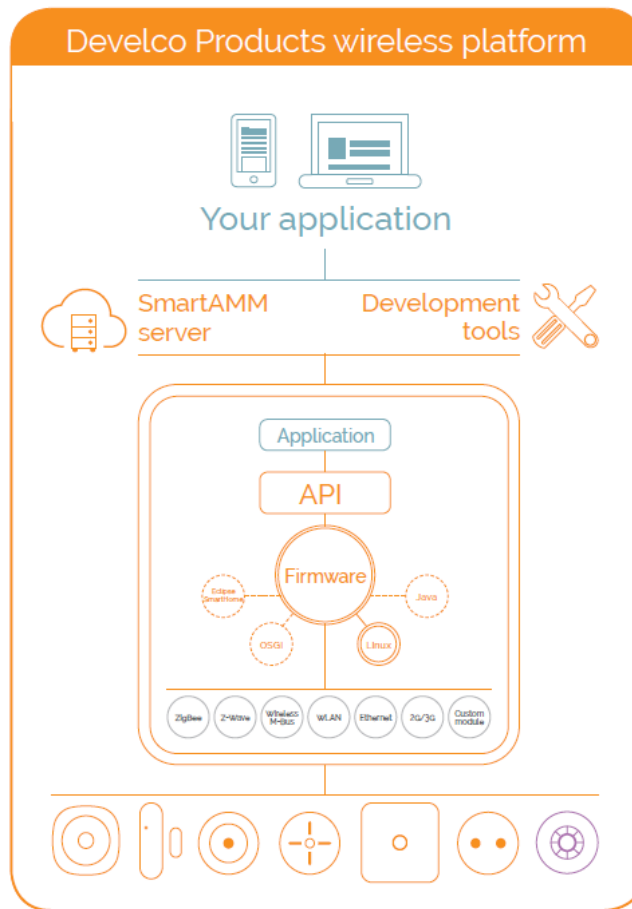


Figure 3 The Linux platform

Application API

The application API can be accessed from applications running on the gateway as well from a hosted application running remotely. The remote access runs through a separate channel established between the gateway and the server.

For easy access, a server middleware (SmartAMM server) is available through which you can debug the wireless communication with the development tool.

3rd party applications connect to the application API via a socket connection. The API supports:

IP settings

- DHCP/fixed IP (IPv4/IPv6)

System events

- MMI events

Wireless device access

- Access to ZB, ZW and WMB networks

Server settings (URL, port)

- SmartAMM server
- NTP server
- DNS server
- SSH Connect Home

Time sync

- UTC time
- Time zone
- Daylight saving

4 SMART METERS

By integrating wireless communication module in the meter, you add exploitation opportunities that – besides providing Demand Response opportunities - give economic benefits, and improve the level of comfort.

In order to integrate data from meters, there are different options.

4.1 EXTERNAL METER INTERFACE

If the electronic meter has no built-in communication, it is easy to mount an external meter interface with ZigBee communication – see figure 4. The external meter interface serves as a ZigBee interface for the electronic meter at home. It collects readings and information from existing and already installed meters, and send data via the ZigBee communication to appliances in the building. So, with this solution, you can follow your energy consumption through a display, your computer or your mobile phone.



Figure 4 The External Meter Interface with ZigBee communication provides wireless intelligence for meters without integrated communication.

4.2 INTEGRATED WIRELESS COMMUNICATION

An integrated meter interface equips meters with wireless communication. Develco Products has developed modules among others for Kamstrup and NES meters.

4.2.1 KAMSTRUP INTERFACE

The meter interface equips Kamstrup meters with wireless communication. The module is compatible with both single and poly phase meters. In addition to the standard ZigBee metering functionality, the device supports the complete KMP protocol via ZigBee tunnel cluster, hence providing expanded meter functionality.

Key features

- LED and Switch MMI
- Over the air update (OTA)
- Serial interface - KMP protocol
- ZigBee SE and HA protocols
- Proved functionality supporting numerous meters

Kamstrup Meter Interface is available as slide-in module or under-cover module for both ZigBee Smart Energy and ZigBee Home Automation applications. Moreover, Kamstrup Meter Interface is compatible with OMNIPower and generation K and L electricity meters.

4.2.2 NES INTERFACE

The ZigBee and/or Wireless M-Bus module serves as a gateway between the wireless network and the NES electricity meter powerline communication. The NES Interface is capable of collecting meter readings from up to 16 different meter units in one system.

Key features:

- Fits into NES IEC-type electricity meters
- Provides ZigBee SE 1.2 HAN
- Provides Wireless M-Bus
- Collects data from ZigBee and Wireless M-Bus meters
- Smart solution for metering

The NES Meter Interface is based on a DevCom module with a data flash for firmware update via Power Line Communication. The NES Meter Interface can be used to interfere with different kinds of meters e.g. water, gas and heating meters connected to the wireless network for data storage and management.

5 CONCLUSIONS

As previously stated, the iPower Smart Meter case study was originally intended for controlling home appliances via the smart meter. During the course of the project, we have realized that this is no longer a feasible business case.

The pilot test sites in iPower (Jensen et al, 2016) have together with research and the business development on the smart home market made it clear that local intelligence is needed to control building appliances. In (Jensen et al, 2016) it was found that:

- if the internet connection is lost there is a need for local intelligence to secure a proper operation of the heat pump. This local intelligence may further be used for other services like optimization of the operation of the energy service systems in the house, security in the house, better comfort, etc. This bundling of services may improve the business case of introducing remote control of heat pumps in order to obtain energy flexibility
- when only controlling the heat pump, only “half” the possible flexibility is obtainable. The switch off time of the heat pump can be extended if the house is excess preheated (within the comfort band) before a switch off, of the heating system. In order to be able to excess heat the house it is necessary to be able to control the thermostats of the heat emitting system, - to increase the set point of the thermostats. The control of the thermostats may be carried out by the above mentioned local intelligence
- when controlling the heat pump, set points and measured values should be manipulated allowing the internal control of the heat pump to control the heat pump instead of hard cut of the power to the heat pump. The former leads to less wear on the heat pump and allows for more sophisticated control of the heat pump. Also her local intelligence in the house is needed

Develco Products has, therefore, developed a new and improved platform for the operation of Home Area Networks intended for energy management and smart home, the Squid.link Gateway. There are high market expectations for the platform, and the iPower project has been a valuable contribution to the shaping and tailoring of this platform both with regards to the user perspective and to the technical development.

6 REFERENCES

Jensen, S.Ø., Christiansen, C.H., Jørgensen, D.M and Huet, J., 2016. Smart Meter Case Study. iPower Report. Danish Technological Institute.