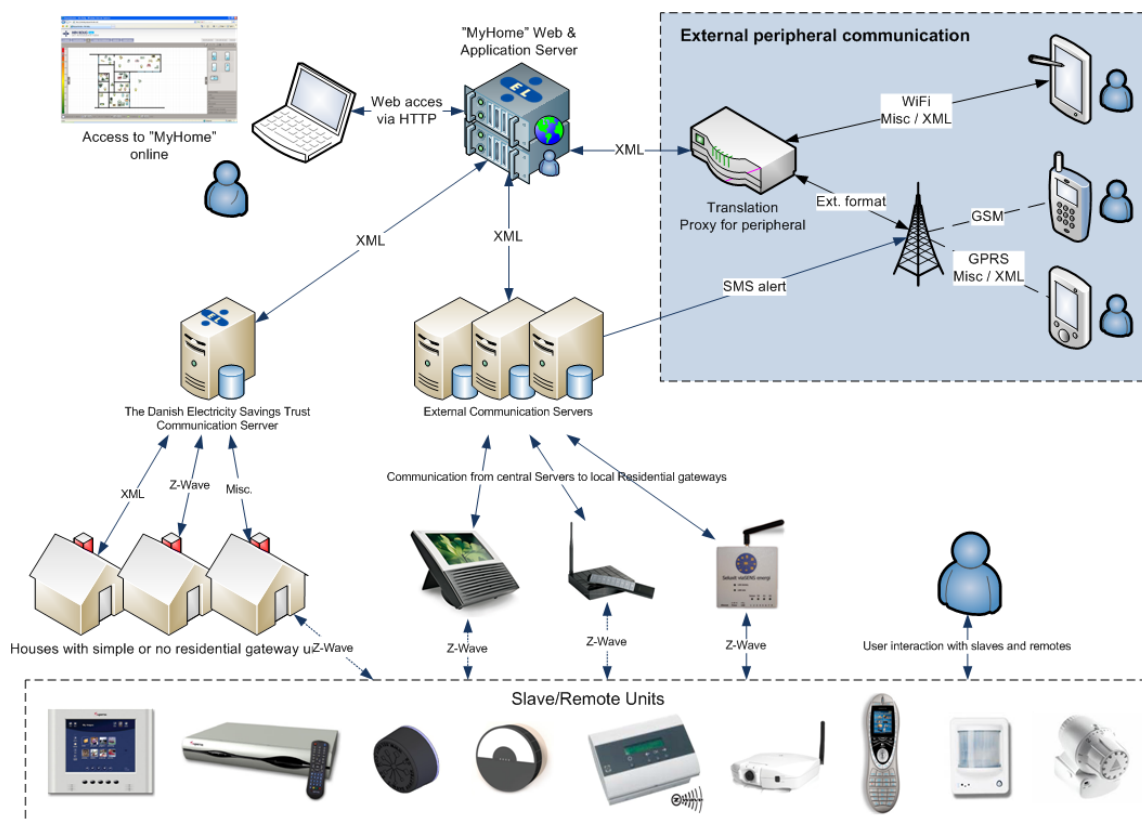


Device management and monitoring – the technical set-up

This document describes the technical set-up for device management and monitoring in more detail. It also explains the structure of The Danish Electricity Saving Trust's concept for home automation, device management and monitoring from a technical angle, based on the diagram below.



The diagram illustrates the multiple communication layers from online user access to access via residential gateways and remote controls, and the communication to and from external units such as mobile devices.

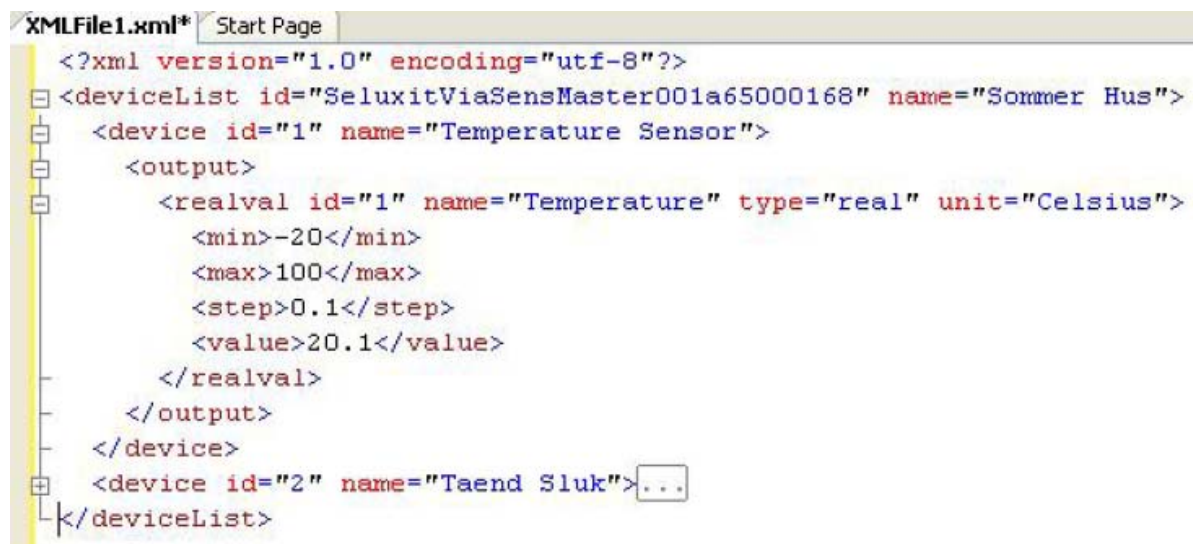
XML standard

The Danish Electricity Saving Trust has opted to use XML as the standard for data exchange between servers and units in the network. XML is a recognized open standard supported by many different platforms and systems. The Trust has chosen the XML format because it is well-suited for sharing structured data across various systems and platforms while allowing users to define their own elements and tags.

The Trust has developed a set of standard tags to deal with the challenges of data exchange between sensors, actuators, remote controls, residential gateways and the master servers on the Internet. This standardized XML format opens up opportunities for many new players to enter the market. By using the format as a communication standard for external systems and platforms, including residential gateways, sensors, actuators and remote controls, these new players will easily be able to develop services and units for consumers. Examples are mobile services and wireless niche products.

Creating the XML file

In the case of households with a residential gateway and a number of units in the home, the XML file is created on the residential gateway. A list of all known connected devices in the wireless Z-Wave network is created here. The residential gateway either names each unit or uses a name already keyed in by the user via the residential gateway display, 'lamp over coffee table', for example. This identification makes it easier for the user to recognize the device later. The XML document now contains a complete list of all devices in the wireless network.



```
XMLFile1.xml* | Start Page
<?xml version="1.0" encoding="utf-8"?>
<deviceList id="SeluxitViaSensMaster001a65000168" name="Sommer Hus">
  <device id="1" name="Temperature Sensor">
    <output>
      <realval id="1" name="Temperature" type="real" unit="Celsius">
        <min>-20</min>
        <max>100</max>
        <step>0.1</step>
        <value>20.1</value>
      </realval>
    </output>
  </device>
  <device id="2" name="Taend Sluk">...
</deviceList>
```

The XML document contains a complete list of all devices in the wireless network, along with their status and current values.

If the residential gateway registers a change in device status, the XML document is updated with the new status. Thus the XML document will always contain complete information about all known devices in the network. At set intervals or on direct request, the XML document is sent from the residential gateway to a communication server on the Internet. This communication server may be the manufacturer's own server, which is constantly or periodically linked to the connected gateways, or it may be the Trust's communication server. These servers relay the XML document to the My Home application server, which can now display the devices in a graphic user interface when the user is logged into My Home application.

In My Home users can drag icons representing the individual devices into a plan of their own home, a technique that gives them an intuitive and easily accessible interface with the devices. Conditions, relationships and calendar functions, etc., can subsequently be set up for the device in a practical way using a regular large PC screen. The established rules, relationships and groups are translated to the XML document according to the applicable format and relayed via the same route down to the individual residential gateways, which can then use the new sets of rules to manage the units.

Logging

One element of the XML standard is the logging of current measurement values over time. This enables the system to log a unit's quarterly values, for example, thus ensuring that the temperature or electricity consumption over time is saved on a central server. In the long term, the logged electricity and energy consumption forms a data basis for analyzing the consumer's energy needs. This helps consumers to optimize their energy consumption and reduce their needs, for the benefit of consumer and environment alike.

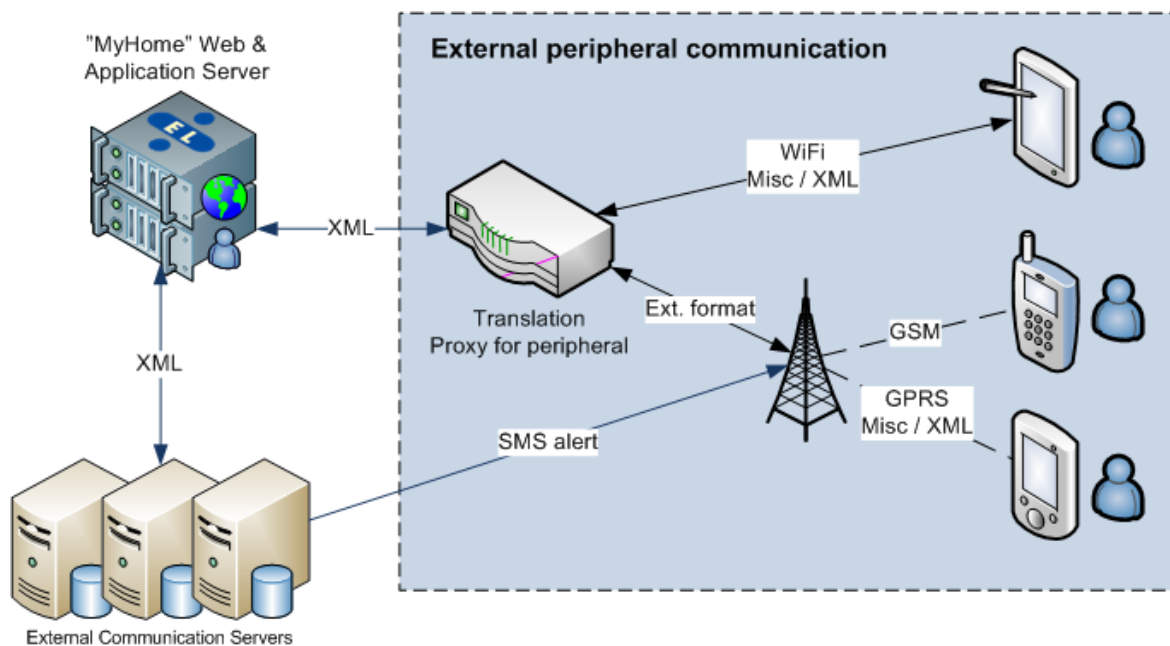
At My Home, The Danish Electricity Saving Trust will provide consumers with analytical tools in the form of the Energy Signatures service. Energy signatures are a way of describing the energy demand and increasing the level of information provided by time series measurements uploaded to My Home. Quarterly or hourly time series of measured energy demands are automatically processed using advanced statistical tools, and the information embedded in the time series is condensed into one or more figures describing the demand.

External peripheral communication

For the Danish Electricity Saving Trust, access to the home via external devices such as PDAs, cell phones and smart devices is a key element of home control and monitoring. Users must be able to control simple operations, turning off all the lights, for example, and checking that the front door is locked. However, they must also be able to access alarms in the case of unforeseen emergencies such as flooding, break-ins and frost damage.

The idea is not to use these external devices for programming and configuring sensors, actuators, remote controls and residential gateways, but to use them to turn established control rules on and off. Users should also be able to view the status of the devices in the network, enabling them to check from a distance whether the lights are turned off and the doors locked and, if this is not the case, to lock their home and switch the lights to the automatic light system.

The cell phone and PDA markets feature a wide variety of standards and platforms that have to be taken into account. The Trust is currently developing descriptions for a concept as well as examples of user interfaces that mobile clients can use to control and monitor the units in their home. In time, as manufacturers decide to support the concept, they can be connected via a translation proxy that translates the standardized XML format into the format and platform they use.



Push information is another important aspect of mobile technology. This can either take the form of ordinary information such as status reports or alarms warning users about such emergencies as damp, break-in or frost damage. Some push information will be sent direct from the external communication servers to the mobile devices while other types of information will be relayed via XML through translation proxies and out to the various devices either as text messages or PUSH GPRS, or possibly via http through Wi-Fi.

The Trust provides

- A warranty label with the energy saving recommendation logo that will be widely accepted by consumers as quality insurance
- An open XML standard that can be used as communication between residential gateways, online servers and external devices
- C code library with convention functions between Z-wave and XML, that allows manufactures to translate a list of devices in the Z-wave network to the standardized XML format and send controlling rules from the XML document to the Z-Wave network
- C# code library for online servers to interpret the XML to a graphical user interface

The Danish Electricity Saving Trust

The Danish Electricity Saving Trust is a governmental, not-for profit organization, whose mandate is to help consumers and public sector institutions save electricity. The Trust has an annual budget of around EUR 12 million. The funds are spent on the development of a market for energy efficient products, and campaigns offering sound and broadly based information to consumers about potential savings. Moreover, the Trust negotiates with manufacturers of power consuming appliances with a view to entering into product-related voluntary agreements. The Trust publicly recommends products covered by these agreements with the intention of encouraging consumers and public sector institutions to choose products on the recommended lists.

One aspect of the present initiative is that the Trust plans to encourage consumers to purchase energy saving devices covered by the Trust's energy saving recommended label.

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More information about Z-Wave:

<http://www.zen-sys.com/>

<http://www.z-wavealliance.org/content/modules/Start/>

More information about the Trust:

<http://www.elsparefonden.org>

