Integrating a new smart meter gateway – a German case

- General requirements of the German regulatory framework
- Implement the security and privacy concept from the beginning
- How to minimize data transport to ensure privacy requirements

Metering, Billing/CRM Europe

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Brief portrait
EnBW Energie Baden-Württemberg AG

› One of the largest energy companies in Germany and Europe

› Business segments:
  electricity generation and trading, electricity grid and sales,
  gas, energy and environmental services

› Annual revenue 2011: in excess of € 18 billion

› Customers: some 5.5 million
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Topics

› General requirements of the German regulatory framework
› Implement the security and privacy concept from the beginning
› How to minimize data transport to ensure privacy requirements
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General requirements of the German regulatory framework
General requirements of the German regulatory framework

Actual requirements

**Metering and data acquisition**
Germany has a liberalized market for metering and data acquisition. The customer can choose his Meter Operator and Data Collector. By default these tasks are done by the DSO.

**Consolidating and distributing Meter Data**
The DSO consolidates the Meter Data
- checking plausibility
- building replacement values
and transfers them to the supplier.

establishing a unique basis for balance settlement purposes
General requirements of the German regulatory framework

Actual requirements

- Additional Meter Data, which are not used by the DSO, are directly transferred to the supplier, customer or third parties
- In case of automatic meter reading the Meter Operator also acts as Data Collector
General requirements of the German regulatory framework

New requirements by the energy law 2011

Installation of Meter Systems with Smart Meter Gateway

is obligatory especially for

- Customers with consumption over 6000 kWh/a
- New Buildings
- Producers of renewable energy over 7 kW peak

Until February 2013 Germany will build an economic efficiency calculation and decide, if the thresholds shall be changed and include additional customer groups.

Installation: Beginning in 2013/2014 after availability of certified Gateways
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Implement the security and privacy concept from the beginning
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The Netherlands and the problem with the privacy

The Netherlands stopped the roll out process of the smart meters after consumer protection and data protection organisations complained vehemently:

„SLIM METEN“ shows at GOOGLE 740.000 results!

„Security“ und „Privacy“ should be part of the process design right from the start!
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Smart Meter Gateway as a key component

The German energy law defines a new smart meter gateway as the key component of a metering system to ensure privacy and security for the customer data and security for the electrical network.

New Gas meters must be able to be connected to the gateway, if an electrical metering system is installed.

The Federal Office for Information Security (BSI) is developing

- A Protection Profile (PP) for the Smart Meter Gateway
  (Final draft version: https://www.bsi.bund.de/SmartMeter)
- Technical Guidelines for the Smart Meter Gateway
  - Minimum functionality
  - Requirements on interoperability
  - Requirements on cryptography
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Smart Meter Gateway as a key component

Gateway interface ports:
LMN Local Meter Network
WAN Wide Area Network
HAN Home Area Network
CLS Controllable local Systems

Embedding the Smart Meter Gateway in its operational environment

Source: draft paper
BSI TR-03109 Vers.0.20
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Smart Meter Gateway as a key component

**Privacy** – No tracing of customer behaviour
- Out of the house (WAN): Reduced data transfer by
  - Local data processing
  - Local tariff registers
- In house (HAN): Access to detailed local data
- Transparent data flows for the customer

**Security** – Secure transport of the necessary data
- Encrypted data transfer
  - Asymmetrical encryption
- Authenticated data flows
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De-centralized or centralized data communication?
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De-centralized data communication

- Every Party receives only the data which are needed for billing or operation purposes
- But: DSO and supplier need a lot of identical meter data for billing, for checking bills and for building a unique database for imbalance settlement

This is the favour configuration from the view of the data protection organisations.
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Centralized data communication

- The DSO consolidates all meter data, which are also needed by the supplier.
- This configuration would fit best to the existing market processes.

This is the favourite configuration of the association of energy companies (BDEW).

The final configuration is still in discussion.
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How to minimize data transport to ensure privacy requirements

Local or central tariff processing?
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Options for tariff processing in the Gateway concept

The German Energy Law requires:
- **Variable tariffs**: e.g. time dependent and demand dependent variable tariffs
- **Privacy**: Only the necessary data for billing purposes shall be transferred

The Gateway concept takes these requirements into account:

**Option 1: Local tariff registers and local tariff processing**
- As default option for tariffs which are realizable using tariff registers

**Option 2: Central tariff processing using time series data**
- Used for complex tariffs (e.g. tariffs with indexed prices, …), which are not realizable using local tariff processing
- Used if the customer has agreed to the use of his time series data (“personal data”) for central tariff processing

Both options are necessary: Local **and** central tariff processing!
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Local tariff processing and profiling for the balancing process
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Local tariff processing and profiling for the balancing process

Local tariff processing

Following the need of privacy the BSI-concept designed a smart meter gateway that can hold tariff registers to minimize the data transport for billing purposes.

That implicates that the tariff information has to be transferred to the metering system. In the future static tariffs do not fit with the times of volatile energy production (e.g. green energy by wind and sun). Therefore we have the need to change the tariff times in a dynamic way.
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Local tariff processing and profiling for the balancing process

Profiling for the balancing process

For the imbalance settlement we need time series data with \( \frac{1}{4} \) h values. In the past we used fixed profiles (normalized time series) for households and small business. In the future this will not be possible in the case of tariff registers, which are filled on fixed different times for each supplier or on flexible tariff times.

Therefore we need flexible tariff based profiles for the balancing process. EnBW has developed a concept of dynamic profiling for households and small business.

In this concept we need tariff rated consumption data and the tariff information. The tariff information (tariff-ID, tariff changing time) is used to generate in sections the necessary \( \frac{1}{4} \) h values for a flexible profile.
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Building flexible tariff based profiles (example)
Step 1: Acquisition of register values and tariff time series

The acquisition is based on reading the **register values** (e.g. monthly):

<table>
<thead>
<tr>
<th>Register</th>
<th>Date / Time</th>
<th>Meter value</th>
<th>Used Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>01.06.2012 00:00</td>
<td>1230000</td>
<td>Tariff Register T1</td>
</tr>
<tr>
<td></td>
<td>01.07.2012 00:00</td>
<td>1236000</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>01.06.2012 00:00</td>
<td>0990000</td>
<td>Tariff Register T2</td>
</tr>
<tr>
<td></td>
<td>01.07.2012 00:00</td>
<td>0994500</td>
<td></td>
</tr>
</tbody>
</table>

and the **tariff time series** („Time series of tariff changing points“),
used for partitioning of the energy quantities for balancing purposes:

<table>
<thead>
<tr>
<th>Date / Time</th>
<th>Used Register</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.06.2012 22:00</td>
<td>T2</td>
<td>i.e. from 22:00 o‘clock Register T2 is filled</td>
</tr>
<tr>
<td>12.06.2012 07:00</td>
<td>T1</td>
<td>i.e. from 07:00 o‘clock Register T1 is filled</td>
</tr>
<tr>
<td>12.06.2012 12:00</td>
<td>T2</td>
<td>i.e. from 12:00 o‘clock Register T2 is filled</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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Building flexible tariff based profiles (example)

Step 2: Generating the tariff based profile

Register readings and calculation of tariff rated quantities: Tariff time series:

<table>
<thead>
<tr>
<th>Register</th>
<th>Date/Time</th>
<th>Meter reading</th>
<th>Monthly quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>01.06.2012 00:00</td>
<td>123000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>01.07.2012 00:00</td>
<td>123450</td>
<td>450</td>
</tr>
<tr>
<td>T2</td>
<td>01.06.2012 00:00</td>
<td>099000</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>01.07.2012 00:00</td>
<td>099600</td>
<td></td>
</tr>
</tbody>
</table>

Date / Time Used Register

... 11.06.2012 22:00 T2
12.06.2012 07:00 T1
12.06.2012 12:00 T2
... 11.06.2012 22:00 T2
12.06.2012 07:00 T1
12.06.2012 12:00 T2
...

Based on the relevant tariff time series points and the tariff rated energy quantities the tariff based profile is generated, which represents the load curve of the customer:

(simplified diagram with linear / smoothed partitioning of the energy amounts)
Conclusion
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Conclusion

• Germany starts a partial rollout
• Privacy and security are design criteria
• A new smart meter gateway is the key component
• Local tariff processing shall minimize the transferred data to ensure privacy requirements
• Additional concepts are necessary to build dynamic tariff based profiles for households and small business for the imbalance settlement
• EnBW has developed a concept of dynamic profiling for that purpose
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Thanks for your attention!

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