Author: Gyöző Kmety, President
Presenter: Paul Fuchs, General Secretary

DLMS User Association
Switzerland

28–30 September, 2010, Sao Paulo, BRAZIL
Frei Caneca Convention Centre, Sao Paulo, BRAZIL
Smart metering – Why, What and How

Presentation program

• Drivers for multi-energy smart metering systems
• European projects and harmonisation efforts
• Requirements, Use cases, Architectures, Technologies
• Data models, Protocols, Data security
• The role of the DLMS User Association

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Drivers for smart metering

**Political**
- energy efficiency
- energy saving
- supply security / sustainability
- EU energy market
- EU services market
- establish new technology culture
- economy stimulus

**Business**
- operation of the energy market
- customer choice
- efficient energy network operation
- defer capacity investments
- cost reduction
- market players need new revenue streams

**Technology**
- static meters
- ICT – Information and communication technologies grow together
Relevant European Directives

- **2004/22/EC, Measuring Instruments Directive (MID)**
  - Specifies essential requirements for metrology
  - Harmonised standards (OJ pub) give presumption of conformity
- **2006/32/EC, Energy end-use efficiency and energy services**
  - Article 13: Metering and informative billing of energy consumption
- **2009/72/EC, Common rules for the internal market in electricity**
  - Economic assessment of implementing smart metering by Sept 2012
  - Where positive, at least 80% of consumers shall be equipped with intelligent metering systems by 2020
  - 200,000,000 metering points, 40,000,000,000 € market
- **2009/73/EC, Common rules for the internal market in natural gas**
  - Economic assessment of implementing smart metering by Sept 2012
  - Subject to that assessment, prepare a timetable for the implementation of intelligent metering systems
EU smart metering projects / 1

- **France, Linky project, E-metering**
  - Pilot of 300,000, S-FSK PLC / Euridis + DLMS/COSEM
  - Go / No Go mid 2011
  - 35 M rollout 2013-2017, OFDM PLC / Euridis + DLMS/COSEM
  - 4,000 M € investment 10 years return

- **Germany, difficult to make a business case**
  - „Mühleim zählt” pilot with 14,000 meters
  - Multi Utility Controller (MUC) concept, local standards
  - Open Metering System (OMS) specification, M-Bus based

- **Italy: Telegestore project, E-metering**
  - 35 M meters installed, FSK / BPSK PLC
  - 2,100 € investment, 5 years return
  - MORE specification is made public now
  - Gas metering is starting now
EU smart metering projects / 2

- The Netherlands: 7 M E-meters, 6,5 M Gas meters
  - NTA 8130, Dutch Smart Metering Req Spec 3.0 (Soon)
  - DLMS/COSEM on S-FSK PLC, GPRS, web services
  - Rollout held back due to security / privacy concerns

- Spain: Total market 26 M E-meters
  - IBERDROLA, 54%: Prime OFDM PLC with DLMS/COSEM
  - ENDESA / ENEL, 46 %: MORE (like in Italy)

- Scandinavia
  - Various technologies: DLMS/COSEM with S-FSK PLC, GPRS
  - Echelon, Zigbee (Gothenburg)

- UK: 47 M meters 2010 - 2020
  - Trials and technology evaluation
  - HAN: ZigBee, Z-Wave, proprietary Low Power radio
  - Backhaul: GSM / GPRS / ZigBee, TV transmitters...
European harmonisation efforts

- OPEN meter collaborative research project
  - FP7: Seventh Framework Programme for research and technological development
  - Objective: specify a comprehensive set of open and public standards for AMI supporting multi commodities based on the agreement of the most relevant stakeholders
- M/441 smart metering standardization mandate
  - Objective: create European standards that will enable interoperability of utility meters (water, gas, electricity, heat)

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<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>USERS</th>
<th>POLICY MAKERS</th>
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</thead>
<tbody>
<tr>
<td>• Smart Meter Manufacturers</td>
<td>• Energy operators (retailers)</td>
<td>• Regulatory bodies</td>
</tr>
<tr>
<td>• Telecommunication industry</td>
<td>• Network operators</td>
<td>• Standardization bodies</td>
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<tr>
<td>• Silicon design &amp; manufacturing</td>
<td>• Metering operators</td>
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</table>

R&D, Technology centers
- Comm. protocols, data formats
- Integrated systems
- Compliance tests

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Work packages

- WP1: Functional Requirements & Regulatory Issues
- WP2: Identification of Knowledge & Technology Gaps
- WP3: Pre-Normative Research Activities
- WP4: Testing
- WP5: Specification & Proposal of a Standard
- WP6: Dissemination
- WP7: Coordination

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Deliverables to date

- D 1.1 Requirements, use cases
- D 1.2 Regulatory requirements
- D 2.1 State-of-the art of technologies and protocols
- D 2.2 Assessment of technologies
- D 2.3 Identification of gaps
- D 3.1. System architecture

- Deliverables available at www.openmeter.com
OPEN meter
Open Public Extended Network metering

System components and interfaces

Architecture

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<table>
<thead>
<tr>
<th>System requirements / Processes (Minimum)</th>
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<tbody>
<tr>
<td>OM-SR1 Meter registration</td>
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<td>OM-SR2 Remote tariff programming</td>
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<td>OM-SR3 Meter reading – on demand</td>
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<td>OM-SR4 Meter reading – for billing</td>
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<td>OM-SR5 Remote disconnection and reconnection</td>
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<td>OM-SR6 Power control</td>
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<td>OM-SR7 Clock synchronization</td>
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<td>OM-SR8 Remote firmware update</td>
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<td>OM-SR9 Alarm and event management</td>
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<td>OM-SR10 Interruption information</td>
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<td>OM-SR11 Fraud detection</td>
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<td>OM-SR12 Remote concentrator access</td>
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<td>OM-SR13 Load profile management</td>
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<td>System requirements / Processes (Advanced)</td>
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<td>OM-SR14</td>
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<td>OM-SR15</td>
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<th>System requirements / Processes (Optional)</th>
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<td>OM-SR16</td>
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<td>OM-SR17</td>
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<td>OM-SR18</td>
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<td>OM-SR19</td>
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<td>OM-SR20</td>
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Selected technologies

System components and interfaces

DLMS/COSEM over local ports

DLMS/COSEM over GPRS

COSEM over web technologies

DLMS/COSEM over M-Bus, Euridis

DLMS/COSEM over S-FSK / OFDM PLC

IEC 62056 DLMS/COSEM selected as data model and application layer protocol

Media: S-FSK PLC, OFDM PLC, M-Bus, Euridis, GPRS / UMTS...

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M/441 Mandate: Overview

• In view of the various Smart Metering projects there is an urgent need for harmonisation to avoid uncontrolled growth of specifications

• Mandate M/441 of the EC from 12th March 2009:
  – *Draft standardisation mandate to CEN, CENELEC and ETSI in the field of measuring instruments for the development of an open architecture for utility meters involving communication protocols enabling interoperability*

• Objectives:
  – to create European standards that will enable interoperability of utility meters (water, gas, electricity, heat), providing a means to raise customers’ awareness of actual consumption in order to allow timely adaptation to their demands (commonly referred to as “smart metering”)
M/441 Mandate: Tasks

• Communication: 9 months
  – Develop European standards for an open software and hardware architecture for utility meters that:
    – Support secure bi-directional communication
    – Allow advanced information, management and control systems
    – Scalable and adaptable for future needs
    – Provide secure interface to protected metrology block

• Harmonised solutions for additional functions: 30 months
  – Develop European standards for additional functions within an interoperable environment

• Permit innovation
• Permit fully integrated modular and multi-part solutions
• Consider existing international, EN and national standards
M/441 mandate org and responsibilities

European Commission
DG Enterprise and Industry
M mandate issued 3/09

M mandate accepted 6/09

M mandate 2011-2012

CEN TC 294
CLC TC 13
CLC TC 205
ETSI M2M

Smart Metering standards

M mandate approved

European Commission
DG Enterprise and Industry
M mandate issued 3/09

M mandate accepted 6/09

Approve reports
Publish standards

CEN CENELEC ETSI

CLC TC 13
CLC TC 205
ETSI M2M

Smart Meter Coord. Group

CEN CENELEC ETSI
WELMEC
CEER / ERGEG OPEN meter

EURELECTRIC MARCOGAZ ESMIG
FACOGAZ
Consumers Assn. Installers Assn.

Prepares reports

Assigns responsibilities / Coordinates work programs

Develops Glossary
Develops Use cases
Develops architecture

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M/441 Mandate: Application

- Only MID has essential requirements
  - Smart metering standards will not be „harmonised” by publishing them in the OJ – no presumption of conformity

- Solutions of member states may differ
  - Standardization in the context of the mandate does not necessarily mean completely identical solutions in the member states

- Standards must cover all solutions
  - As a target smart meter solutions of the member states must be covered by suitable standards

- Country solutions to be standards based
  - The member states can set their own priorities and treat the various consumption types differently, but the selected solution must be taken from the one and only smart meter standard pool

- Back office systems and industrial metering are out of scope
  - Industry solutions or back office solutions will not be regulated by the mandate, knowing that there will be a significant impact on these areas
M/441 mandate: ESO TC responsibilities
M/441 Mandate: High level additional functions

Additional function is what goes beyond the MID

- F.1 Meter reading for billing, export / import
- F.2 Two-way comms for PQ, tamper, firmware update, customer info
- F.3 Prepayment, TOU
- F.4 Remote disablement / enablement / limitation of supply
- F.5 Communication with in-home devices: load control, customer info, HA
- F.6 Provide info via web portal / gateway
M/441 Mandate: technologies/standards

IEC 62056-62 / IEC 62056-61 EN 13757-1
COSEM / OBIS model

IEC 62056-53
DLMS/COSEM Application layer

M-Bus Application layer
EN 13757-3

IEC 62056-46
HDL

IEC 62056-42
Phy layer

Phy + MAC

IP support layers e.g. GPRS, ADSL, Ethernet, OFDM PLC

IEC 61334-5-1
S-FSK PLC

IEC 62056-31
Euridis
Phy + Link

EN 13757-2
M-Bus
Phy + Link

EN 13757-4
w-less M-Bus
Phy + Link

NextGen
w-less
Phy + Link

IP SSAL

SSAL

ETSI M2M

CLC TC 13

CEN TC 294

Public WAN

Acces LAN

In-House (HAN)

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CENELEC TC 13 WG02 Road map

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<td>Task 1: Use cases</td>
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<td>Task 2: Func. architectures and service requirements</td>
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<td>Task 4: Legal metro requirements</td>
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<td>Task 5: Security requirements</td>
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<td>Task 6: Map additional functions to object models</td>
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<td>Meeting 7</td>
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<td>Task 7: Multi-part installations</td>
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<td>Task 8: Further communication technologies (Pass 2 of Task 3)</td>
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<td>Task 9: Interoperability requirements and test processes</td>
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Meeting 1: 28–30 September, 2010, Sao Paulo, BRAZIL
IEC – CENELEC TC 13 co-operation

• CENELEC TC 13 develops technical reports, describing how to use existing standards for smart metering
• Identifies need for new standards – these will be developed by IEC TC 13
• IEC standards become EN standards through parallel voting
A few words on data security

- Data security and privacy are major concerns
  - May fail a project
- DLMS/COSEM provides tools for:
  - role based access
  - peer authentication
  - message confidentiality
  - message integrity /authenticity
- It is up to the project to use them properly
- Guidance:
  - Customer should own data and
  - Make available for the purposes of the services required
• Formed in 1997
• 182 members (July 2010)
• 5 continents - 40 countries
• from all branches of the industry
• 145 Product Certificates
DLMS UA in smart metering standardization

M / 441
EC Smart Metering
Standardization Mandate

TC 57, Power systems management
• IEC 61334 PLC

TC 13, Metering
• WG 14 - IEC 62056

TC 13, Metering
• WG02, Smart metering

TC 294, Communication systems for meters – EN 13757-1

ETSI
• TC M2M

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## Status of the DLMS/COSEM specification

<table>
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<tr>
<th>Blue Book Ed. 10</th>
<th>Green Book Ed. 7</th>
<th>Yellow Book Edition 3</th>
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<tr>
<td>• energy&amp;demand</td>
<td>• 3-layer HDLC</td>
<td>• All objects</td>
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<td>• gas volume conversion</td>
<td>• TCP-UDP/IP</td>
<td>• 3-layer HDLC</td>
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<td>• load profiles</td>
<td>• S-FSK PLC</td>
<td>• TCP-UDP/IP</td>
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<td>• Euridis</td>
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<td>• instantaneous, PQ</td>
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<tr>
<td>• value monitoring</td>
<td>• and in the near future</td>
<td></td>
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<tr>
<td>• load management</td>
<td>• OFDM PLC</td>
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<td>• connect / disconnect</td>
<td>• M-Bus</td>
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<td>• events and tamper mgmt.</td>
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<td>• firmware upgrade</td>
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<td>• comm. channel setup</td>
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<tr>
<td>• data security</td>
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Summary

• Many national smart metering projects
• Standards are seen as key to interoperability
• EU pushes for harmonised standards
  – OPEN meter project
  – M/441 standardisation mandate
• IEC 62056 / EN 13757-1 DLMS/COSEM is core standard
  – Data model for all energies
  – Advanced security
  – GPRS, Internet, PLC ... Media
• DLMS UA works with all TCs involved

Smart meters have new talents: how do we benefit?
Many thanks for your kind attention!

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paul.fuchs@dlms.com