

Smart Energy and Smart Grids

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1 DLMS/COSEM/OBIS/IDIS

The events are logged in the event log usually as objects.

The standard, how all the data (not only events) the data are organized in the smart meters provides the *DLMS/COSEM* set of standard. *DLMS* stands for **Device Language Message Specification** and *COSEM* for **COmpanion Specification for Energy Metering**.

The DLMS User Association maintains a set of four main specification documents:

- Blue Book - describes the COSEM meter object model and the *OBIS* (**OBject Identification System**) – which assigns logical names to the COSEM objects. OBIS is specified in the IEC 62056-61
- Green Book - describes the architecture and protocols
- Yellow Book – describes conformance testing
- White Book - contains the glossary of terms.

OBIS codes identify data using a hierarchical structure with dot notation and six value groups in the form: A-B:C.D.E*F. There are 4 different separators present (“-“, “:”, “.”, “*”) to support the group identification in case that only sub-identifier is preset.

Often this is three group sub identifier such as “1.8.0”, it maps to C.D.E). More detailed group descriptions are:

- A – defines media (energy type), e.g. 0=abstract, 1=electricity, 5=cooling, 6=heat, 7=gas, 8=cold water, 9=hot water, ...
- B – identifies the measurement channel by number
- C- identifies abstract or physical data, such as current, voltage, power, ... for given channel, e.g. 1= positive active power, 2= negative active power, 11=current, 12=voltage, 99=Abstract data profiles (if A=0), or Electricity data profile (if A=1)
- D – identifies the type of data processing result, e.g. 3=minimum, 6=maximum, 8=time integral
- E – identifies further processing, if A=1 then e.g. 0=total, 1=rate (tariff) 1, 2=rate (tariff) 2, but e.g. if C= 11 or 12 the meaning of E changes ot 0=total, 1=1st harmonics, 120=120th harmonics, 124=**Total Harmonic Distortion** (*THD*)
- F - identifies historical data

Example explanations of selected OBIS codes are presented in the table Tab. 1.

OBIS code	Explanation
1.8.0	Positive active energy (A+) total [kWh]
1.8.1	Positive active energy (A+) in tariff T1 [kWh]
2.8.0	Negative active energy (A-) total [kWh]
2.8.1	Negative active energy (A-) in tariff T1 [kWh]
99.98.x	Event log
99.1.x	Load profile with recording period 1
99.2.x	Load profile with recording period 2

Note: “x” means any value within the valid range 0-255

In the table we see more examples of profiles, that are objects that are used to hold series of measurements (objects) of one or similar quantities and/or to group various data. **For basic measurements the recording period is usually set to 15 min and DSO company fetches it once a day.**

In addition to mentioned standards describing DLMS/COSEM and OBIS, there is a great help of *IDIS* (**Interoperable Device Interface Specification**) Association, which aims to reach pan-European interoperability. Supports various use cases such as automatic meter registration, remote tariff programming, disconnection and reconnection of electricity supply, system wide clock synchronization, demand/load management, remote firmware update.

For example, IDIS specifies in more detail event code classification such as :

- event code 7: Replace battery - Battery has reached expected end of lifetime and must be replaced
- event code 40: Meter cover removed – Indicates, that meter cover has been removed.

2 Smart metering backend systems (HES, MDMS), interface and roles

As mentioned in previous lesson, the AMI ends on DSO side with the **AMI Head End System** (*HES*). The role of the HES in the Smart Metering system architecture is to acquire meter data automatically, manage the connectivity and data acquisition, enable secure access to meters, configuration, software updates and ad-hoc requests. This area can be seen as **Meter Data Collection** (*MDC*). After collection, the data are stored in the **Meter Data Management** (*MDM*) systems.

The scope of MDC / MDM systems is:

- **meter data collection** – from HES systems, legacy systems, manual data input, ...
- **data Validation, Estimation, and Editing (VEE)** – includes various data checks, provide estimation for the missing data, enable manual data editing, assign data quality evaluation, ...
- **data aggregation** – provide desired data aggregation, create and report statistics, ...

Optionally, MDM can serve as infrastructure mapping and asset management system especially for smaller DSO. The competencies of both, MDM and HES/MDC systems partially overlap, however MDM is more oriented to **metering data lifecycle** and HES focuses more on **infrastructure, devices, and communication**. However, cases as event management and functionality configuration of the smart meters are bound with both systems and must be coordinated by both. Moreover, specific events such as “last gasp” are important input for DSO’s **operational technology (OT) systems** such as Supervisory control and data acquisition (*SCADA*) system, Outage Management System (*OMS*) or Distribution Management System (*DMS*) which control the power grid.

On the HES-MDMS interface, the IEC 61698 is considered as the standard. IEC 61698-9 specifies the information content of a set of message types that can be used to support meter reading and control, events, customer data synchronization and customer switching. IEC 61698-11 specifies **common information model (CIM)** which supports the messages and extends the base CIM (IEC 61970) to the needs of distribution networks.

The overall architecture of Smart metering system including AMI and DSO metering-related back office systems is depicted on Fig. 1.

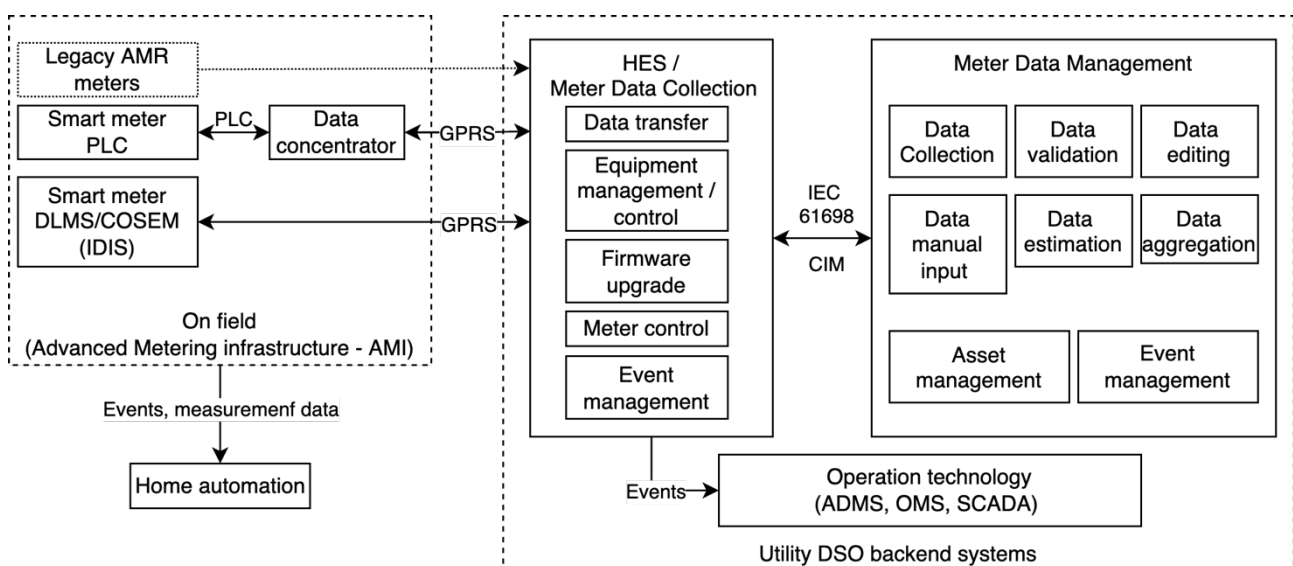


Fig. 1 Smart metering system - overview picture with AMI (left side) and DSO metering-related back office systems (right side)