

## DLMS User Association - Co-ordination between Applications and Channels

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### 1. INTRODUCTION

Standardisation is highly organised, world wide, by continents or by countries. Moreover, it is specialised, e.g. IEC for electrical belongings and ISO for all other business including data processing. This complexity calls for an easier way to do first steps in implementing the "Device Language Message Specification" standard for meter data exchange. The DLMS User Association co-ordinates the use of the "Device Language Message Specification" in a broad way, and takes care that all the different existing standards (including ISO/OSI) are considered. The first field of activities englobes Interface Objects describing features of energy meters, mapping them to DLMS, and transporting the data units via existing channels as e.g. the telephone network.



Figure 1: The trade marked DLMS Logo

DLMS in its original wording means "Distribution Line Message Specification". The outcome of the original inventors of DLMS is embedded into the standardisation work and is also supported by the DLMS User Association.

DLMS is a IEC standard (IEC 61334-4-41), so the common language is defined. The Communication Profile defined by the User Association bases to a great extent on ISO/IEC standards, e.g. HDLC for the Data Link Layer.

At the application side, metering objects use DLMS services to ensure interoperability and exchangeability. An object library (called Interface Objects) allows to build meters, which allow a manufacturer independent

external view to them, more precisely through the communication system.

A special concern is the way to reality. Practical examples of electricity meters for big consumers, for smaller industrial customers and for residential metering using DLMS are explained.

The advantages of an object oriented approach allows to handle customer requirements in a much more flexible way. This approach is a must for a deregulated and liberalised energy market. Especially important is the way how requirements that are not known yet can be included in this object oriented approach.

### 2. WHAT MEANS INTEROPERABILITY FOR END DEVICES?

In the early 1990th, many utilities introduced electronic end devices and meters, even for residential use. They immediately faced the problem of insufficient compatibility amongst products from different manufacturers, even having well defined and standardised parts like the optical port for automatic reading. Only countries with monopolistic structures could go around the problem, as their utilities were able to define the meter including communication channel in detail. The official standardisation of these systems was a stabilising act, more or less symbolic. Other utilities tried another way: they influenced the standard bodies to create standards for the data exchange for meters. This led to a lengthy exercise with not too much practical results yet.

DLMS was originally created as a standard for DLC (Distribution Line Carrier) systems. It is based on MMS, a messaging system created by General Motors to ease interoperability in car factories. DLMS can do more then just serve the distribution line channel, it can serve as Device Language Message Specification in general.

### 3. WHAT MEANS INTEROPERABILITY FOR SYSTEMS?

Once the first step is achieved and the devices speak the same language, the system aspects have to be considered. Of course, multiple communication channels must be supported. Each channel needs a specific interfacing link to adapt to its physical specialities. For the data collection centre, the channel for the transport of the information should not matter.

To support this request, first a common language is needed (DLMS). But even speaking the same language, it is necessary to formulate the content of the message in a common and standardised way. Information models for energy meters must be defined, so that the data collection centre gets the information in the same way, no matter who manufactured the meter and no matter which kind of measured media is expressed in the message.

### 4. WHAT MEANS INTEROPERABILITY FOR STANDARDISATION

DLMS started its life in IEC TC57 (power system control and associated communications), where WG9 (Distribution automation using distribution line carrier systems) defined a complete system for data exchange via distribution line carrier transmission. Soon after, IEC TC13 (Equipment for electrical energy measurements and load control) and its WG14 (Data exchange for meter reading, tariff and load control) took DLMS as a base for a telephone based system and for the modernisation of the twisted pair bus system. A SJWG 13/57 (Special Joint Working Group) paved the way for a good co-ordination. At the same time, CEN started with a new TC 294 (Communication systems for and remote reading of meters), and a co-ordination with CENELEC TC13 via a JWG RRM (Joint Working Group Remote Reading of Meters) was initiated. As CENELEC TC13 and IEC TC13 work in common (they have a common voting procedure), the link was established.

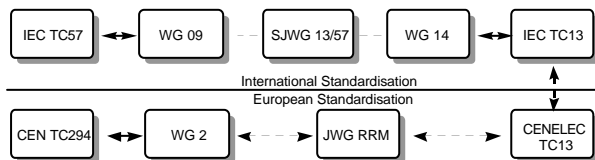


Figure 2: The main links between DLMS standards

The diversity of standardisation bodies working with DLMS has an obvious consequence: there are different ways to use DLMS depending on the different field of applications. It is one of the aims of the DLMS User

Association to offer help for all users of DLMS, without being dogmatic. The main aim is to find common ground for meter data exchange for all meters, not to create a "pure" standard.

### 5. THE APPROCHES TO AN INTEROPERABLE METER

#### 5.1 For gas, water and heat meters

These meters traditionally use simple tariff structures. The functionality of the meter differs very little from country to country. CEN TC294 has therefore used a straight forward approach towards an interoperable meter; i.e. they defined a complete meter model. This complete meter model consists of a set of DLMS variables which are accessed via the DLMS services "read" and "write". The result is published as draft N58 within CEN TC294.

#### 5.2 For electricity meters

Electricity metering and tariffing has a long history. Different countries use different tariff and rate models. The resulting metering products are matched to local markets.

The approach towards interoperability cannot be the same as for gas, water and heat meters. The DLMS User Association therefore decided not to specify THE meter but to define standardised building blocks from which a meter can be assembled. The complex functionality of the meter is divided into generic building blocks. The standardised building blocks form a library from which a customised meter can be built. When defining the building blocks the needs of different markets were considered. The concept of standardised building blocks offers the different manufacturers a maximum amount of *diversity* without giving up on *interoperability*.

### 6. WHAT MEANS INTEROPERABILITY FOR DIFFERENT CHANNELS

The co-ordination between applications and channels has one main aim: to avoid the re-engineering of an application in the case of a changing channel. The interface to the channel must therefore be flexible. Everybody is nowadays aware of the role of a modem in the

PC world. It is normally a little box between the application (e.g. an Internet browser) and the channel (e.g. the public telephone line or the connector of the cable TV). This box can also be integrated in the PC (freaks know, that the difference is marginal, it is just a board inside the machine).

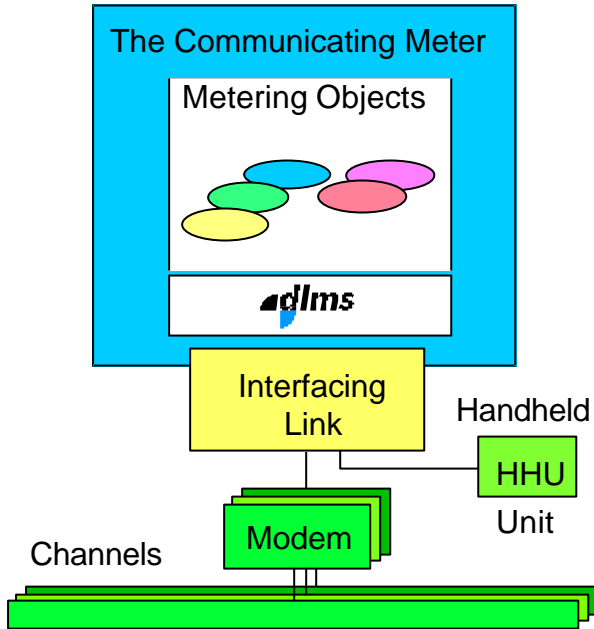


Figure 3: The role of the Interfacing Link

An end device (e.g. a meter) faces the same problem. It shall have a representation of the application which looks the same for equal applications of all different makes of the device, seen from the outside world. In old times, we were used to see the same presentation of mechanical registers on all meters of all makes. The DLMS User Association supports and proposes means which allow to have the same effect, seen through the communication channel. The adaptation to the channel specific peculiarities is done by a "modem". This modem is interchangeable, in the ideal case without dismantling the end device.

## 7. WHAT MEANS INTEROPERABILITY FOR THE DEFINITION PROCESS

A channel was normally the first item which attracted organisations to create a new standard. The whole rest was then built around the channel. How can this concept be generalised in order to use a multi-channel architecture and to co-ordinate between applications and channels? Of course, the ISO/OSI model was created for that purpose.

The seven layer OSI model proves soon as rather complex. Therefore simpler implementations concatenate functions of several layers into one layer, e.g., the application layer serves also for transport and presentation. Such a simplified model is already standardised, and the DLMS UA recommendation bases on this model. The three layer model is often called "Enhanced Performance Architecture" EPA.

What is this all about? The comparison with the good old postal services are still valid: If a letter is written, no matter what it contains, it is put into an envelope, it is addressed and stamped. The content is the comparable with the application, the paper with the application layer. Once the letter is thrown into a letterbox, the sender is no longer interested in technical details. He or she just wants the letter to arrive safely at the destination. The transport is comparable with the channel. The logistics is the link layer, the transportation means (automobile, train, aeroplane) is the physical layer. The methods of packing and unpacking is typical for a layered transport: The envelope stays unchanged, if many letters fill a postal bag, and many postal bags will fill a container which fits in the cargo department of the plane. If the "channel" is a train, the container will not be the same, it must be adapted to the other conditions. But the postal bags will stay the same. If however an express parcel service transports the letter, it will be put in a separate plastic bag and use fast transport means.

For the communication channels, similar elements become true. It might be possible to use the same link layer for the optical and for the telephone communication, whereas a DLC channel needs another link layer. Important is the fact, that the application (the letter) is well defined, so that it is even possible to change the channel during the transport without unpacking and repackaging of the message.

## 8. ENERGY METERS AND THEIR INTEROPERABLE BUILDING BLOCKS

The DLMS User Association created a set of object oriented application definitions as "Companion Specification for Energy Metering". These interface objects are open to all members of the DLMS User Association. It is the clear aim to open them to standardisation also. They are a complete set of specifications defining a library of metering objects.

The purpose is to be capable to address the same things in the same way. Furthermore, it shall be possible to create more complex objects in using adequate sim-

pler objects as building blocks in inheriting their properties.

To formally pack the information, a language shall be used, which is generally understood, the Device Language Message Specification DLMS.

Back to the application: It is necessary to find a common way to describe them. This is not sufficient, it must be impossible to misunderstand the description. This fact is true for many fields of the information technology, and the answer is to define objects.

The drawing above shows the different objects and their relations. One example shall be detailed: The Interface Class "Register":

A Register object stores a process value **or** a status value with its associated unit. The Register object knows the nature of the process value or of the status value. The nature of the value is described by the attribute "logical name" (e.g. using the identification system EDIS where applicable). EDIS means Energy Data Identification System, it is a work item of IEC TC13 WG14.

## **9. COSEM DEFINITIONS FOR MORE INTEROPERABILITY**

The Management Committee of the DLMS User Association sanctioned the founding of a new Working Group "Value Added Services" (WG VAS). This WG will define objects in conformance with COSEM Interface Objects. The needs will be investigated and clarified by the WG, but the general direction is clear. VAS are customer oriented services which can be provided by utilities in using the existing infrastructure, e.g. the meter for providing customer information about energy consumed, power and load control, tariff switching etc. Another possibility is to use the communication channel for customer information, e.g. pre-warnings about dynamic peak tariffs, service information etc. This is one next step on the application side.

There are also next steps on the channel side. The M-Bus User Group and the DLMS User Association have signed an agreement, they give each other the membership rights in order to make best use of their mutual interests.

## **10. THE DLMS USER ASSOCIATION AND THE STEPS TO INTEROPERABILITY**

The DLMS User Association was founded by three major meter manufacturers in 1997, after a successful presentation of DLMS at MATES 1996 at a common booth of the founding members. During its existence, the DLMS UA presented itself at DA/DSM Europe '97, CIFACES '98 and DA/DSM '98. Each time, more members had joined the Association, and the exhibits became more practical.

Members of the DLMS User Associations are (status at December 1998):

- ABB Netzleittechnik
- CHAUVIN ARNOUX
- Delta Software Engineering
- Deutsche Zählergesellschaft
- ELECTRICITE DE FRANCE
- Elster Produktion
- EMH Elektrizitätszähler
- Enermet
- GAZ DE FRANCE
- Görlitz Computerbau
- HYDROMETER
- ISKRAEMECO
- ITRON
- KAMSTRUP
- KEMA Nederland
- M-Bus User Group
- RWE Energie
- Santel
- Schlumberger Industries
- Siemens Metering
- Spanner Pollux

## **11. INTEROPERABLE COSEM METERS**

The meters shown are partly taken from pre-series, partly advanced prototypes. They fulfil the COSEM description DLMS UA 1000-1 and ..-2, revision 1. Their functionality is still limited mainly to residential use. This is intended, as the first DLMS meters on the market will be mass products for the residential use.

The co-ordination between applications and channels is clearly visible: The meters can serve partially more than one channel, e.g. the use PSTN (telephone) and the optical link (IEC 1107), but they speak DLMS and they exchange the same COSEM objects over both channels. This is the most important step towards a co-ordinated handling of applications and channels. Of course, there is still a backward compatibility to the classical data

formats, the meter finds out automatically if the hand terminal speaks DLMS or not.

The new generation of meters is clearly directed towards the liberalised market. The installation (or the meter exchange) is supported by built-in software, a pulsing output can be used e.g. to inform local load controllers about the actual load, and last but not least, the meter is built in a modular way, which allows to add or change modules with different functionalities (e.g. supporting different channels) without interfering with the measuring device "electricity meter" itself.

## 12. DLMS USED IN INTEROPERABLE COMPLEX METERING

In IEC TC13 WG14, DLMS Standards are working items. Close to publication are the following Technical Reports or Standards:

IEC 62056-31 (... using local area networks with carrier signalling)

IEC 62056-41 (... using wide area networks: PSTN with LINK+ protocol)

IEC 62056-51 (Application layer protocols)

IEC 62056-52 (Management DLMS server)

The already mentioned activities in the field of gas, heat, and water meters of CEN TC294 base on these reports. Also possible is the use of DLMS for downloading executable code, a possibility used by Electricité de France.

The first service offered by EDF using these standards is called Emeraude Service. Its concept is to offer a tariff contract for large-scale industry including a commitment to the level of quality of electrical supply. DLMS is used to download applications and to exchange meter, service and customer data.

The range of services designed for major industrial companies comprises 9 points:

- Emeraude : Electricité de France guarantees a quality supply level. It commits itself on precise criteria, such as the limitation of the number of long or short power cuts. If these criteria are not complied with, the Company will compensate the customer according to the damage suffered. The customer will

make sure that his facilities do not create disturbances on the network.

- Programming of voltage interruptions (optimisation of dates, times and duration decided on with the customer).
- Customer information (systematic information concerning long power cuts).
- Monthly payment
- Tariff advice (optimisation)
- Annual and monthly report (a full report on the management of the supply contract for the past year is sent and, on request, a monthly load curve)
- Information on Peak Day Demand Reduction (EJP)
- Electricity applications (information and, on request, a techno-economic study of a process)

## 13. CONCLUSION

Concluding can be said, that DLMS is a tool to make meters interoperable, which in turn is a precondition for a liberalised energy market. Real products are on the market, and the DLMS User Association will help to coordinate the implementations, as well on the application side as on the channel side.

The DLMS User Association is not a standardising body, but it closely works together with national and international bodies, in order to bridge the gap of official standardising work to real implementations.