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Functional reference architecture for communications in smart metering systems

Architecture fonctionnelle de référence pour les communications dans les systèmes de comptage intelligent

Funktionale Referenzarchitektur für die Kommunikation in intelligenten Messsystemen

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Foreword

This document (CEN/CLC/ETSI/TR 50572:2011) has been prepared by CEN/CENELEC/ETSI Smart Meters Coordination Group (SM-CG).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under Mandate M/441 given to CEN, CENELEC and ETSI by the European Commission and the European Free Trade Association.

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Introduction

This Technical Report identifies a functional reference architecture for communications relevant for smart metering systems and the standards relevant to meeting the technical / data communications requirements of Mandate M/441, in particular to assist the active participation of consumers in the energy markets. The architecture has been developed drawing on existing and planned implementations but its generic nature should enable it to support future different implementations.

Clause 1 sets out the scope of this Technical Report on communications in the context of the overall standardization work being undertaken in response to Mandate M/441, including that on additional functionalities.

Clause 2 gives the legislative framework and lists the references underpinning the smart metering work more generally. Clause 3 provides relevant extracts from the glossary of commonly used terms developed to support the M/441 Mandate work.

For the benefit of stakeholders including the European Commission, Clause 4 then sets the standardization work on communications in the context of the overall approach to the M/441 Mandate, with particular reference to the link between smart metering and smart grids.

Clause 5 considers privacy and data security.

Clause 6 ("Architecture") presents a functional reference architecture for smart metering systems, identifying the functional entities and interfaces that the communications standards should address. Clause 7 gives a general overview of the co-ordination between the ESOs for each of the specified interfaces.

Clause 8 ("Currently available communications standards and further standardization") provides a table setting out current and future communications standards which are considered to be relevant for smart metering in Europe.

The table (shown in 8.2) indicates the most relevant current standards together with the communications standards to be developed in the course of the mandate and the ESO technical committee responsible for co-ordinating the standardization work. It also identifies the smart metering interfaces addressed by the standards noted. The table is not meant to be an exhaustive list of standards; other alternative standards will be considered in the future and could be determined to be acceptable standards as well.

Clause 9 ("Interoperability and conformance") considers the nature of interoperability required under M/441 and responsibilities for conformance testing.

Annexes are included, to assist understanding of the use cases envisaged and terms used, give examples of practical implementations of the architecture described and to identify relevant product standards.

1 Scope

This Technical Report concerns the following communications deliverable within M/441:

A European standard comprising a software and hardware open architecture for utility meters that supports secure bidirectional communication upstream and downstream through standardized interfaces and data exchange formats and allows advanced information and management and control systems for consumers and service suppliers.

The architecture must be scalable to support from the simplest to the most complex applications.

Furthermore, the architecture must consider current relevant communications media and be adaptable for future communication media.

The communication standard of the open architecture must allow the secure interfacing for data exchanges with the protected metrological block.

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Since no single standard can cover all aspects for the full application range of smart metering systems, the deliverable takes the form of this Technical Report.

The Technical Report is the second document produced by the Smart Metering Co-ordination Group following acceptance of the Mandate 441 (M/441). The first - a response to the mandate - was issued in December 2009 and provided an overview of the current and future standardization activities, considering both the communications and the additional functionalities of smart meters.

Once the standardization activity undertaken in response to Mandate M/441 is complete for both the communications and additional functionality aspects, a final report will be produced providing a list of the finalized standards in both these areas.

2 Legislative framework

2.1 Directives

The Energy Services Directive (2006/32/EC) and the recently adopted electricity and gas directives (2009/72/EC and 2009/73/EC) are important elements in the background to the M/441 Mandate.

For electricity, the directive requires the implementation of *'intelligent metering systems that shall assist the active participation of consumers in the … market'.* Such systems must be in place for 80 % of electricity consumers by the end of 2020 (unless an economic assessment shows that a lower figure is appropriate).

For gas, there may be an economic assessment of such metering systems (by September 2012) but there is no specific target date by which they have to be installed, although this should be achieved within a reasonable period of time.

The number of electricity and gas meters potentially required to be replaced over the coming decade makes this standardization work urgent.

In the water sector, smart metering may contribute to meeting the goals of the Water Framework Directive (2000/60/EC), by allowing better control of water uses by consumers. It may also help implementation of the action plan being currently finalized against water scarcity and the impact of droughts, notably regarding "water performances of buildings".

2.2 Metrological considerations

The Measuring Instruments Directive 2004/22/EC (MID) covers the essential (metrological) requirements of meters and is currently being reviewed in the context of the adoption of the New Legislative Framework 765/2008/EC. The European Commission is now in the process of preparing a report on the implementation of the MID, for submission to the European Parliament and Council. See: http://ec.europa.eu/enterprise/sectors/legal-metrology-and-prepack/public-consultation/index_en.htm

Smart meter standardization undertaken in response to M/441 deals with additional functionalities not of a metrological nature which are not prohibited by the MID provided they do not affect the metrology required by the MID.

Consideration should be given at the design stage of any smart metering system to such functions as real-time clocks or tariff schedule registers which may need to be synchronized through external communication. This is to ensure that the metrological characteristics of the meter are not influenced in any inadmissible way by the connection to it of another device, by any feature of the connected device itself or by any remote device that communicates with the meter.

WELMEC has produced Guidelines which set out recommendations for the software used in or connected to the metrologically protected part of measuring instruments and its communications interface(s). The standards to be developed under M/441 should consider these recommendations, in particular concerning the functional requirement of upgrading software / firmware and specific provisions regarding the downloading of legally relevant and non-legally relevant software. Care should be taken at the design stage to ensure that any software / firmware upgrade process does not influence those parts of the meter that are under the control of the MID.

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