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INTERNATIONAL STANDARD

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Electricity metering data exchange – The DLMS®/COSEM suite – Part 8-12: Communication profile for Low-Power Wide Area Networks (LPWANs)

Échange des données de comptage de l'électricité – La suite DLMS®/COSEM – Partie 8-12: Profil de communication pour réseaux étendus à basse consommation (LPWAN)

IEC 62056-8-12:2023-09(en-fr)

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ELECTRICITY METERING DATA EXCHANGE – THE DLMS®/COSEM SUITE –

Part 8-12: Communication profile for Low-Power Wide Area Networks (LPWANs)

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The text of this International Standard is based on the following documents:

Draft	Report on voting
13/1877/CDV	13/1901/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 62056 series, published under the general title *Electricity metering data exchange – The DLMS®/COSEM suite*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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ELECTRICITY METERING DATA EXCHANGE – THE DLMS®/COSEM SUITE –

Part 8-12: Communication profile for Low-Power Wide Area Networks (LPWANs)

1 Scope

This part of IEC 62056 describes the use of DLMS®/COSEM for Low-Power Wide Area Networks (LPWANs). It specifies how the COSEM data model and the DLMS®/COSEM application layer can be used over various LPWAN technologies using an adaptation layer based on IETF RFC 8724, and in particular over LoRaWAN.

This profile is intended to be used with LPWANs as defined in IETF RFC 8724, in particular LoRaWAN. Low-Power Wide Area Networks (LPWANs) are wireless technologies with characteristics such as large coverage areas, low bandwidth, possibly very small packet and application-layer data sizes, and long battery life operation. This document does not provide functionality to manage the lower layers of the LPWANs.

This part of the DLMS®/COSEM suite specifies the communication profile for Low-Power Wide Area Networks (LPWANs).

The DLMS®/COSEM LPWAN communication profiles use connection-less transport layer based on the Internet Standard User Datagram Protocol (UDP) and Internet Protocol (IPv6).

The adaptation layer is based on IETF RFC 8724 which provides both a header compression/decompression mechanism and an optional fragmentation/reassembly mechanism. SCHC compression is based on static context with small context identifier to represent full IPv6/UDP/COSEM wrapper headers. If required, SCHC fragmentation is used to support IPv6 MTU over the LPWAN technologies.

This document follows the rules defined in IEC 62056-5-3:2023, Annex A, and in IEC 62056-1-0, and IEC TS 62056-1-1:2016 for its structure. See also Annex A for examples.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62056-1-0, *Electricity metering data exchange – The DLMS®/COSEM suite – Part 1-0 Smart metering standardisation framework*

IEC TS 62056-1-1:2016, *Electricity metering data exchange – The DLMS®/COSEM suite – Part 1-1: Template for DLMS®/COSEM communication profile standards*

IEC 62056-4-7:2015, *Electricity metering data exchange – The DLMS®/COSEM suite – Part 4-7: DLMS®/COSEM transport layer for IP networks*

IEC 62056-5-3:2023, *Electricity metering data exchange – The DLMS®/COSEM suite – Part 5-3: DLMS®/COSEM application layer*

IEC 62056-6-1, Ed4[1], *Electricity metering data exchange – The DLMS®/COSEM suite – Part 6-1: Object Identification System (OBIS)*

IEC 62056-6-2:2023, *Electricity metering data exchange – The DLMS®/COSEM suite – Part 6-2: COSEM interface classes*

IEC 62056-9-7:2013, *Electricity metering data exchange – The DLMS®/COSEM suite – Part 9-7: Communication profile for TCP-UDP/IP networks*

IETF RFC 2460, *Internet Protocol*, Version 6 (IPv6) Specification. Edited by S. Deering, R. Hinden. December 1998. Available from http://www.ietf.org/RFC /RFC 2460.txt

IETF RFC 8376, *Low-Power Wide Area Network (LPWAN) Overview* (available from https://www.rfc-editor.org/rfc/pdfrfc/rfc8376.txt.pdf)

IETF RFC 8724, *SCHC – Generic Framework for Static Context Header Compression and Fragmentation* (available from https://www.rfc-editor.org/rfc/rfc8724.html)

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62056-5-3:2023, IETF RFC 8376 and IETF RFC 8724 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.2 Abbreviated terms

AA	Application Association
ABP	Activation by Personalization
APDU	Application Layer Protocol Data Unit
COSEM	Companion Specification for Energy Metering
C/D	Compression and Decompression
CSAP	Client Service Access Point
DevAddr	32-bit non-unique identifier assigned to an end-device statically or dynamically after a Join Procedure (depending on the activation mode)
DEVEUI	IEEE EUI-64 used to identify the device during the Join Procedure
DLMS	Device Language Message Specification
F/R	Fragmentation and Reassembly
HDLC	High-level Data Link Control
IP	Internet Protocol
LNAP	Local Network Access Point
NGW	Network Gateway
PAN	Personal Area Network

[1] Under preparation. Stage at the time of publication: IEC 13/1852/CDV

RG	Radio Gateway
SAP	Service Access Point
SSAP	Server Service Access Point
SCHC	Static Context Header Compression and fragmentation, a generic framework
TCP	Transmission Control Protocol
UDP	User Datagram Protocol

4 Targeted communication environments

4.1 General

4.1.1 Overview

The DLMS®/COSEM communication profiles for LPWAN networks are intended for remote data exchange on WAN between the HES and the end devices. From a DLMS® point of view, they are connected directly to the HES via the G1 interface. All dotted elements are out of the scope for this profile.

The functional smart metering reference architecture is shown in Figure 1.

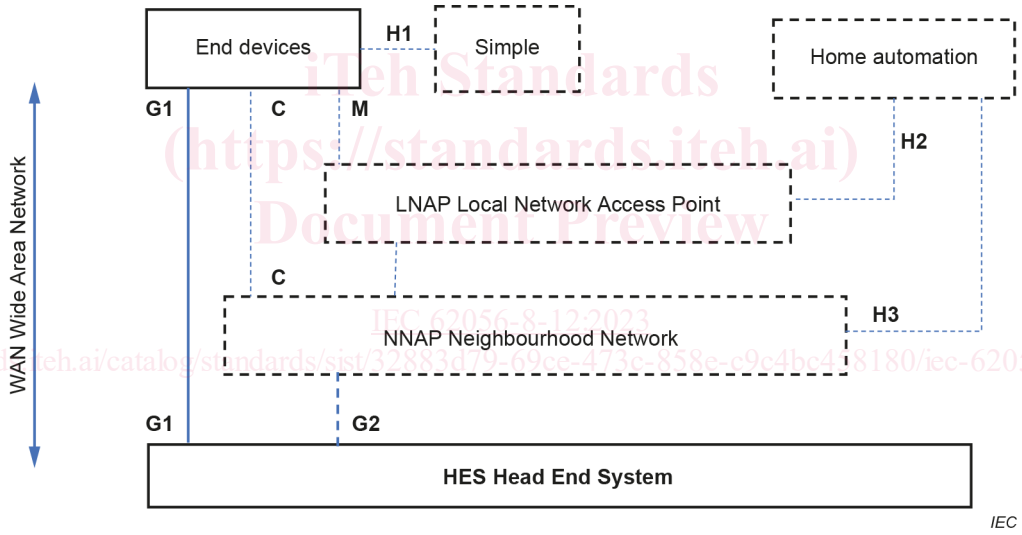

Figure 1 – Communication architecture

End devices comprise application functions and communication functions. They can be utility meters or any other kind of IoT devices. They use UDP/IPv6, SCHC compression/decompression and fragmentation/reassembly features as specified in IETF RFC 8724 and communicate with their related application server via the network gateway.

This profile maps to Figure 2.

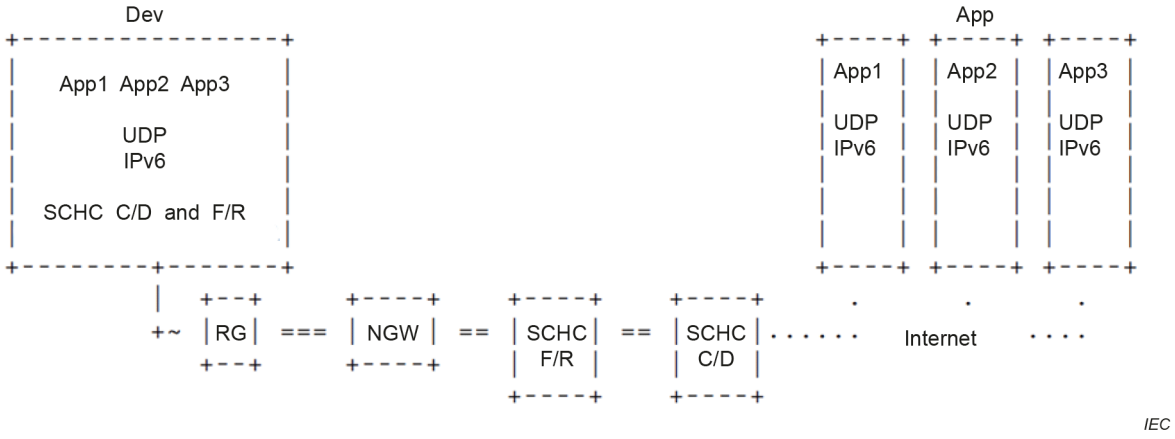

Figure 2 – LPWAN (SCHC) architecture outline

4.1.2 Security

LPWAN technologies provide various lower layer security features. The application security features provided by DLMS®/COSEM can be used over any of them.

4.2 Use of the communications layers for this profile

4.2.1 Information related to the use of the standard specifying the lower layers (IEC TS 62056-1-1:2016, 5.1)

IETF RFC 8724 can be considered as an adaptation layer between UDP/IPv6 and the underlying LPWAN technology. SCHC comprises two sublayers, compression and fragmentation that are independent of the specific LPWAN technology. IETF RFC 8724 supports UDP/IPv6 and as such supports the DLMS®/COSEM UDP/IP profile. No adaptations or limitations to IETF RFC 8724 or DLMS®/COSEM are expected to be required when using SCHC to transport COSEM APDUs.

4.2.2 Structure of the communication profiles (IEC TS 62056-1-1:2016, 5.2)

See Figure 3.

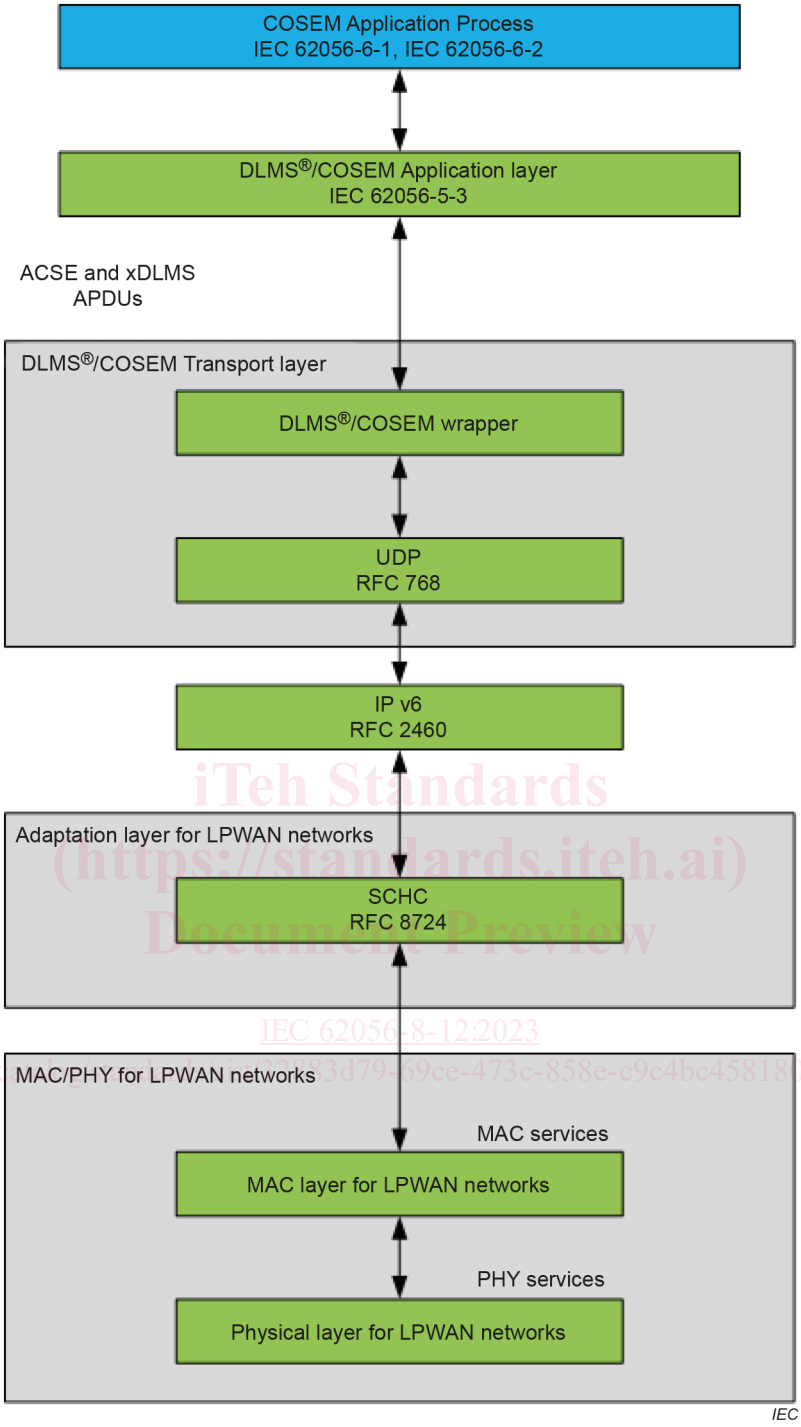

Figure 3 – DLMS®/COSEM LPWAN communication profile

4.2.3 Lower protocol layers and their use (IEC TS 62056-1-1:2016, 5.3)

4.2.3.1 Overview (IEC TS 62056-1-1:2016, 5.3.1)

Lower layers are any LPWAN lower layers that can transport SCHC packets as specified in IETF RFC 8724.

NOTE IETF RFC 8376 provides an overview of LPWAN technologies that can be used for running IP in LPWANs.

ABP is not permitted when the LoRaWAN network is being applied. See also IEC 62056-6-2:2023, 4.16.

4.2.3.2 Physical layer (IEC TS 62056-1-1:2016, 5.3.2)

The physical layer is out of the scope of this document; it is specific to the LPWAN technology used.

4.2.3.3 MAC layer (IEC TS 62056-1-1:2016, 5.3.3)

The MAC layer is out of the scope of this document; it is specific to the LPWAN technology used.

4.2.3.4 Adaptation layer (IEC TS 62056-1-1:2016, 5.3.4)

The adaptation layer is in accordance with IETF RFC 8724. It interfaces at the upper layer IPv6 as specified in IETF RFC 2460.

4.2.4 Service mapping and adaptation layers (IEC TS 62056-1-1:2016, 5.4)

The DLMS®/COSEM transport layer for IP networks performs the necessary binding of the COSEM object model and the DLMS®/COSEM application layer in one part and the communication lower layers in the other part. The service mapping is fully specified in the UDP-DATA service, see IEC 62056-4-7:2015, 5.2.2.

4.2.5 Registration and connection management (IEC TS 62056-1-1:2016, 5.5)

Registration and connection management are specific to each LPWAN technology and network. Details can be found in IEC 62056-6-2:2023, 4.16.

4.3 Identification and addressing schemes (IEC TS 62056-1-1:2016, Clause 6)

The identification and addressing of SAPs is as described in Table 1.

Table 1 – Client and server SAPs

Client SAPs	
Client Management Process	0x01
Public Client	0x10
Open for client SAP assignment	0x02 ...0x0F
	0x11... 0xFF
Server SAPs	
Management Logical Device	0x01
Reserved for future use	0x02…0x0F
Open for server SAP assignment	0x10…0x7E
All-station (broadcast)	0xFF

4.4 Specific considerations for the application layer service (IEC TS 62056-1-1:2016, Clause 7)

4.4.1 Overview (IEC TS 62056-1-1:2016, 7.1)

The constraints and options available to AL services are those dictated by any UDP-based DLMS® approach.

4.4.2 Application Association establishment and release: ACSE services (IEC TS 62056-1-1:2016, 7.2)

In accordance with IEC 62056-9-7:2013, 9.1 and 9.2.

4.4.3 xDLMS services (IEC TS 62056-1-1:2016, 7.3)

According to IEC 62056-9-7:2013, 9.4 and 9.5.

4.4.4 Security mechanisms (IEC TS 62056-1-1:2016, 7.4)

4.4.4.1 DLMS®/COSEM security

DLMS/COSEM security applies at the application layer and model level. As a consequence, application security does not depend on the structure of this communication profile. All the security mechanisms as defined in the IEC 62056-5-3:2023, IEC 62056-6-1, Ed4 and IEC 62056-6-2:2023 are applicable without any restrictions. The security suites and the security policies chosen and the PKI to use are project specific. They depend on the project specific companion specification.

4.4.4.2 Lower layers security

In addition to the DLMS®/COSEM security, the lower layers can also provide security features addressing confidentiality, data authenticity and integrity. These security features are out of the scope of this standard.

4.4.4.3 Registration and deregistration of lower layers security

Registration and deregistration security are specific to the LPWAN technology used (see IEC 62056-6-2:2023).

4.4.5 Transferring long application messages (IEC TS 62056-1-1:2016, 7.5)

For transporting long messages, either the service specific block transfer or the general block transfer (GBT) DLMS®/COSEM application layer mechanisms can be used (the latter is preferred).

4.4.6 Media access, bandwidth and timing consideration (IEC TS 62056-1-1:2016, 7.6)

Out of the scope of this document; these aspects are specific to the LPWAN technology used (see IEC 62056-6-2:2023).

4.5 Communication configuration and management (IEC TS 62056-1-1:2016, Clause 8)

The parameters allowing the configuration of the adaptation layer and the LPWAN lower layers are mapped to attributes and methods of DLMS®/COSEM interface classes:

- a setup and a diagnostic IC for SCHC-LPWAN are specified in IEC 62056-6-2:2023;
- a setup and a diagnostic IC should be specified for each specific LPWAN technology. For LoRaWAN they are specified in IEC 62056-6-2:2023, 4.16.

4.6 The COSEM application process (IEC TS 62056-1-1:2016, Clause 9)

All the features defined in IEC 62056-6-1, Ed4, IEC 62056-6-2:2023 and IEC 62056-5-3:2023 are applicable without any restrictions.

Annex A
(informative)

Examples

A.1 Example 1: DLMS®/COSEM GET Service transported through LPWAN using LoRaWAN technology

See Table A.1 and Figure A.1.

Table A.1 – Get Service example

Message elements	Contents	LEN (Bytes)
Get-Request	C0	1
get-request-normal	01	1
invoke-id-and-priority	40	1
cosem-attribute-descriptor		0
class-id	0001	2
instance-id	0000600100FF	6
attr-id	02	1
access-selection	00	1
Get-Request (encoded)	C001400001000600100FF0200	13
IPv6		
IPv6 Header	60045604001E1180	8
IPv6 Source Address	FE8000000000000745500FFFE000100	16
IPv6 Destination Address	FE8000000000000745500FFFE000101	16
UDP		
UDP Header	0FDB0FDB001E3A86	8
COSEM Wrapper		
COSEM Wrapper Header	000100010001000D	8
get-request	C001400001000600100FF0200	13
IPv6 (encoded)	60045604001E1180FE8000000000000745500FFFE000100FE8000000000000745500FFFE0001010FDB0FDB001E3A8600010001000DC0014000010000600100FF0200	69
SCHC Packet		
Rule ID=0x02|CompressionResidue=|SCHC Payload | Padding=	02C001400001000600100FF0200	14
SCHC (encoded)	02C001400001000600100FF0200	14
LoRaWAN (Downlink)		