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

**Échange des données de comptage de l'électricité – La suite DLMS/COSEM –
Partie 4-7: Couche transport DLMS/COSEM pour réseaux IP**

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ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 4-7: DLMS/COSEM transport layer for IP networks

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DLMS User Association
Zug/Switzerland
www.dlms.com

International Standard IEC 62056-4-7 has been prepared by IEC technical committee 13: Electrical energy measurement and control.

This first edition cancels and replaces IEC 62056-47 published in 2006. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) This standard is applicable now both for IP4 and IPv6 networks;
- b) Latest editions of the IEC 62056 suite are referenced.
- c) DLMS/COSEM IANA-registered port numbers added.

The text of this standard is based on the following documents:

CDV	Report on voting
13/1570/CDV	13/1595/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

This standard specifies the DLMS/COSEM transport layer for IP (IPv4 or IPv6) networks. It shall be read together with IEC 62056-9-7:2013, *Electricity metering data exchange – The DLMS/COSEM suite – Part 9-7: Communication profile for TCP-UDP/IP networks*.

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ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 4-7: DLMS/COSEM transport layer for IP networks

1 Scope

This part of IEC 62056 specifies a connection-less and a connection oriented transport layer (TL) for DLMS/COSEM communication profiles used on IP networks.

These TLs provide OSI-style services to the service user DLMS/COSEM AL. The connection-less TL is based on the Internet Standard User Datagram Protocol (UDP). The connection-oriented TL is based on the Internet Standard Transmission Control Protocol (TCP).

The DLMS/COSEM TL consists of the UDP or TCP transport layer TCP and an additional sublayer, called wrapper.

Annex A shows how the OSI-style TL services can be converted to and from UDP and TCP function calls.

2 Normative references

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The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-300:2001, *International Electrotechnical Vocabulary (IEV) – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

IEC TR 62051:1999, *Electricity metering – Glossary of terms*

IEC TR 62051-1:2004, *Electricity metering – Data exchange for meter reading, tariff and load control – Glossary of terms – Part 1: Terms related to data exchange with metering equipment using DLMS/COSEM*

IEC 62056-5-3:2013, *Electricity metering data exchange – The DLMS/COSEM suite – Part 5-3: DLMS/COSEM application layer*¹

IEC 62056-6-2:2013, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-2: COSEM interface classes*²

¹ Edition 2 of IEC 62056-5-3 to be published.

² Edition 2 of IEC 62056-6-2 to be published.

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

STD 0006, *User Datagram Protocol. Edited by Jon Postel, August 1980.* Available from: <http://www.faqs.org/rfcs/std/std6.html>

STD 0007, *Transmission Control Protocol. Edited by Jon Postel, September 1981.* Available from: <http://www.faqs.org/rfcs/std/std7.html>

NOTE See also Bibliography for other related Internet RFCs.

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-300, IEC TR 62051 and IEC TR 62051-1 apply as well as the following:

3.1.1

application process

an element within a real open system which performs the information processing for a particular application

[SOURCE: ISO/IEC 7498-1:1994, 4.1.4]

3.1.2

application entity

system-independent application activities that are made available as application services to the application agent, e.g., a set of application service elements that together perform all or part of the communication aspects of an application process

3.2 Abbreviations

APDU	Application Layer Protocol Data Unit
AL	Application Layer
AP	Application Process
AE	Application Entity
COSEM	COmpanion Specification for Energy Metering
DHCP	Dynamic Host Configuration Protocol
DLMS	Device Language Message Sepcification
COSEM_on_IP	The TCP-UDP/IP based COSEM communication profile
FTP	File Transfer Protocol
HTTP	HyperText Transfer Protocol
IANA	Internet Assigned Numbers Authority
IP	Internet Protocol
PDU	Protocol Data Unit
PAR	Positive Acknowledgement with Retransmission
SNMP	Simple Network Management Protocol
TCP	Transmission Control Protocol
TFTP	Trivial File Transfer Protocol
TL	Transport Layer
UDP	User Datagram Protocol

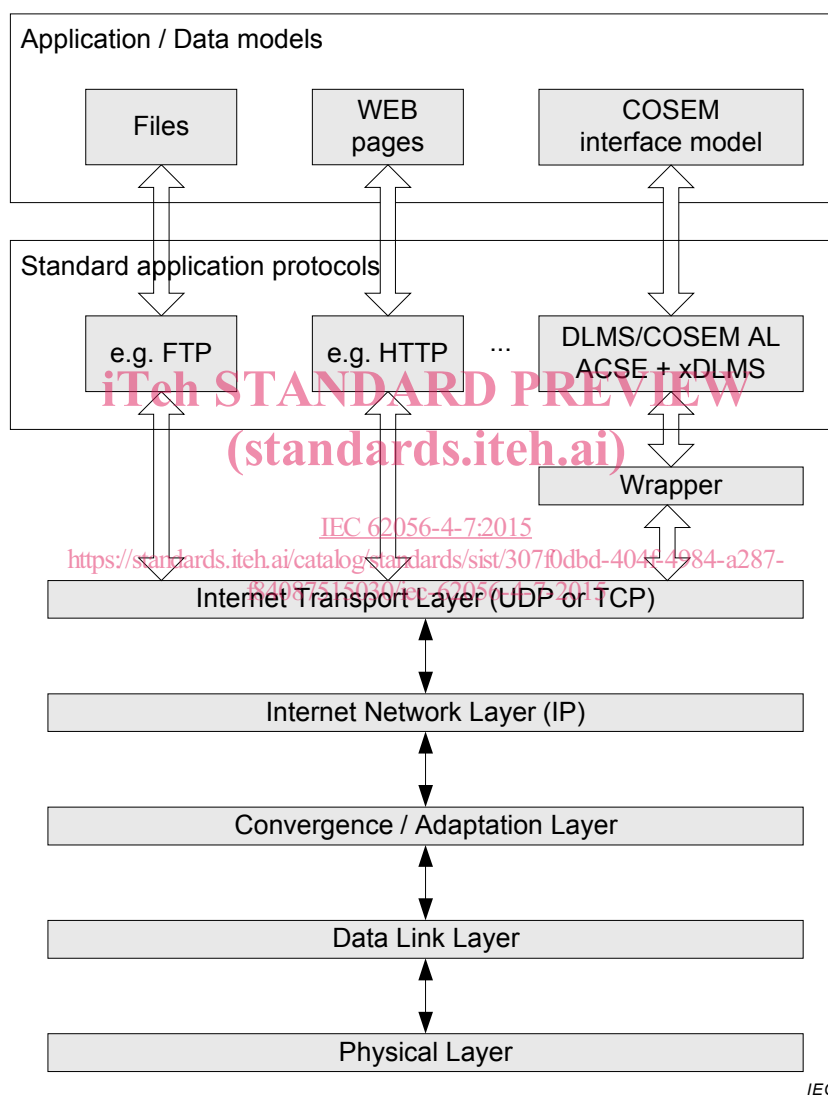
WPDU

Wrapper Protocol Data Unit

4 Overview

In the DLMS/COSEM_on_IP profiles, the DLMS/COSEM AL uses the services of one of these TLs, which use then the services of the Internet Protocol (IP) network layer to communicate with other nodes connected to the abstract IP network.

When used in these profiles, the DLMS/COSEM AL can be considered as an Internet standard application protocol (like the well-known HTTP, FTP or SNMP) and it may co-exist with other Internet application protocols, as it is shown in Figure 1.



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Figure 1 – DLMS/COSEM as a standard Internet application protocol

For DLMS/COSEM, the following port numbers have been registered by the IANA. See <http://www.iana.org/assignments/port-numbers>.

- dlms/cosem 4059/TCP DLMS/COSEM
- dlms/cosem 4059/UDP DLMS/COSEM

As the DLMS/COSEM AL specified in IEC 62056-5-3 uses and provides OSI-style services, a wrapper has been introduced between the UDP/TCP layers and the DLMS/COSEM AL. Therefore, the DLMS/COSEM TLs consist of a wrapper sublayer and the UDP or TCP TL. The

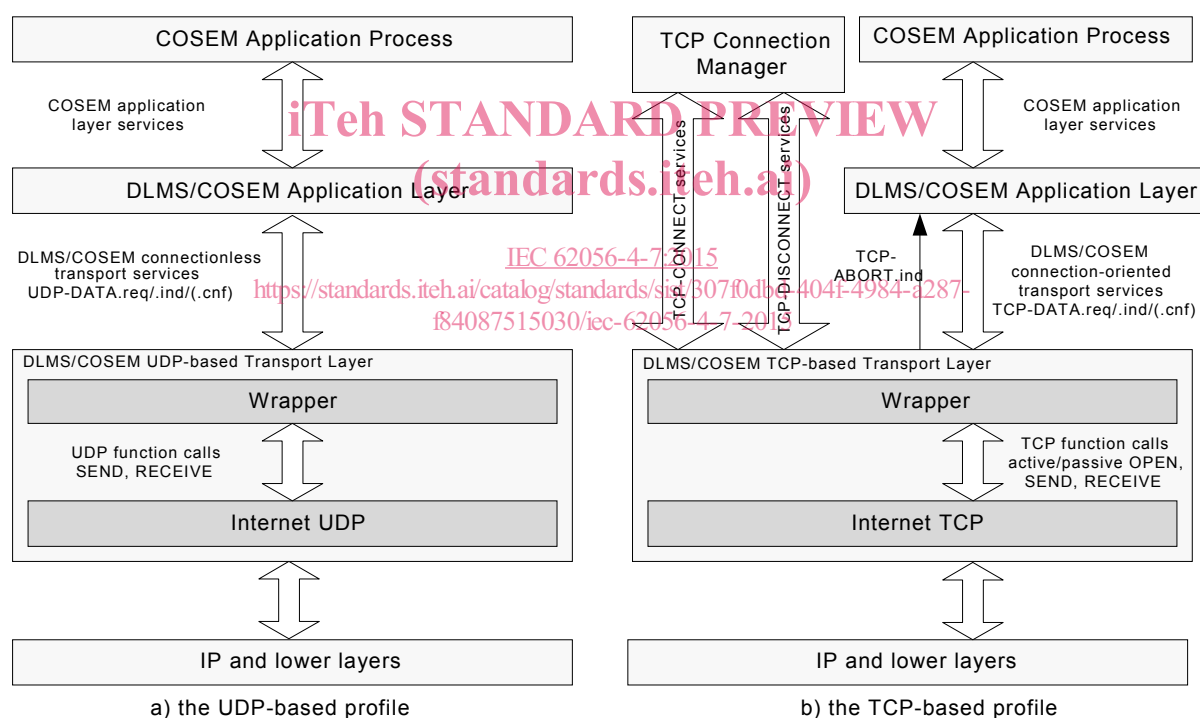
wrapper sublayer is a lightweight, nearly state-less entity: its main function is to adapt the OSI-style service set, provided by the DLMS/COSEM TL, to UDP or TCP function calls and vice versa.

In addition, the wrapper sublayer has the following functions:

- it provides an additional addressing capability (wPort) on top of the UDP/TCP port;
- it provides information about the length of the data transported. This feature helps the sender to send and the receiver to recognize the reception of a complete APDU, which may be sent and received in multiple TCP packets.

As specified in IEC 62056-9-7:2013, Clause 6, the DLMS/COSEM AL is listening only on one UDP or TCP port. On the other hand, as defined in IEC 62056-6-2:2013, 4.7, a DLMS/COSEM physical device may host several client APs or server logical devices. The additional addressing capability provided by the wrapper sublayer allows identifying these APs.

The structure of the DLMS/COSEM TL and their place in COSEM_on_IP is shown in Figure 2.



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Figure 2 – Transport layers of the DLMS/COSEM_on_IP profile

The service user of both the UDP-DATA and the TCP-DATA services is the DLMS/COSEM AL. On the other hand, the service user of the TCP-CONNECT and TCP-DISCONNECT services is the TCP Connection Manager Process. The DLMS/COSEM TCP-based TL also provides a TCP-ABORT service to the service user DLMS/COSEM AL.

5 The DLMS/COSEM connection-less, UDP-based transport layer

5.1 General

The DLMS/COSEM connection-less TL is based on the User Datagram Protocol (UDP) as specified in STD 0006.

UDP provides a procedure for application programs to send messages to other programs with a minimum of protocol mechanism. On the one hand, the protocol is transaction oriented, and delivery and duplicate protection are not guaranteed. On the other hand, UDP is simple, it adds a minimum of overhead, it is efficient and easy to use. Several well-known Internet applications, like SNMP, DHCP, TFTP, etc., take advantage of these performance benefits, either because some datagram applications do not need to be reliable or because the required reliability mechanism is ensured by the application itself. Request/response type applications, like a confirmed COSEM application association established on the DLMS/COSEM UDP-based TL, then invoking confirmed xDLMS data transfer services is a good example for this second category. Another advantage of UDP is that being connection-less, it is easily capable of multi- and broadcasting.

UDP basically provides an upper interface to the IP layer, with an additional identification capability, the UDP port number. This allows distinguishing between APs, hosted in the same physical device and identified by its IP address.

NOTE The addressing/identification scheme for the COSEM_on_IP profiles is defined in IEC 62056-9-7:2013, Clause 6.

5.2 Service specification for the DLMS/COSEM UDP-based transport layer

5.2.1 General

The DLMS/COSEM UDP-based TL provides only a data transfer service: the connection-less UDP-DATA service. Consequently, the service specification for this service is the same for both the client and server TLs, as it is shown in Figure 3.

The .request and .indication service primitives are mandatory. The implementation of the local .confirm service primitive is optional.

The xDLMS APDU pre-fixed with the wrapper header shall fit in a single UDP datagram.

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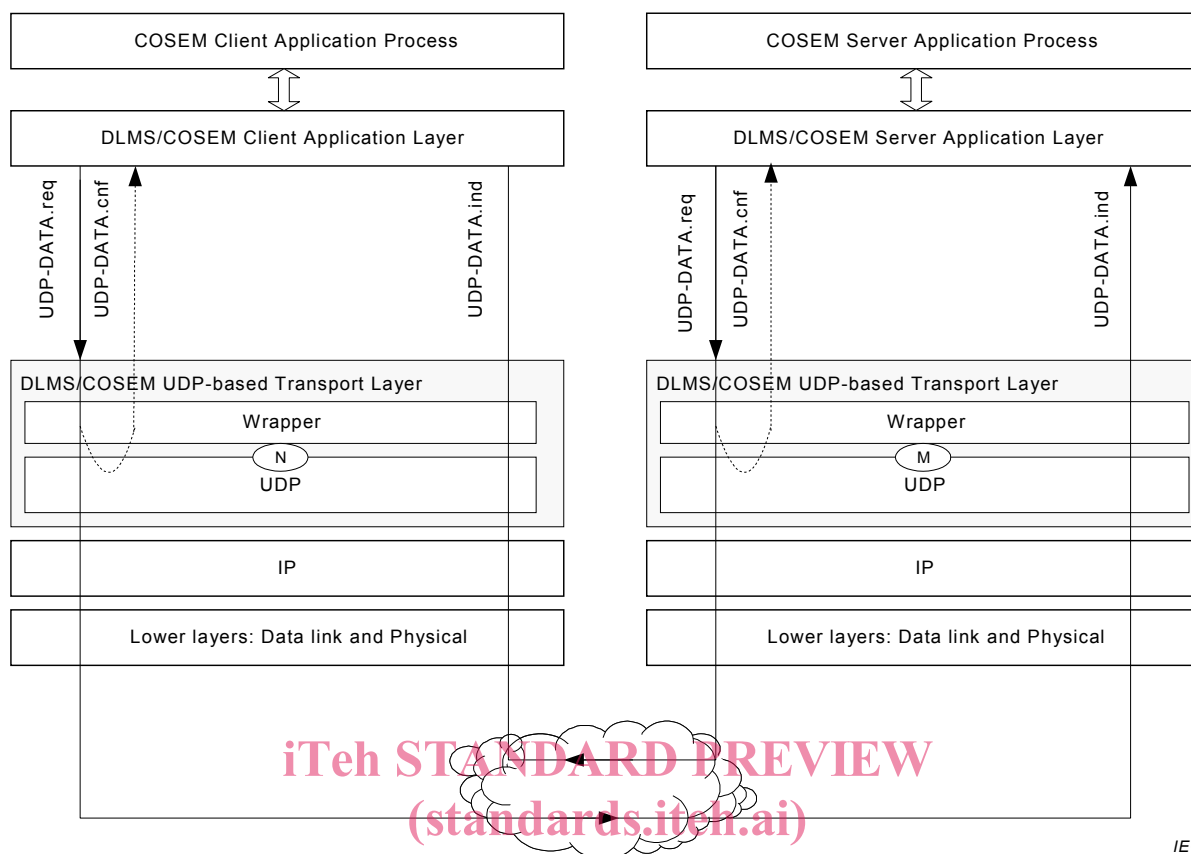


Figure 3 – Services of the DLMS/COSEM connection-less, UDP-based transport layer

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5.2.2 The UDP-DATA service

5.2.2.1 UDP-DATA.request

Function

This primitive is the service request primitive for the connection-less mode data transfer service.

Semantics of the service primitive

The primitive shall provide parameters as follows:

```

UDP-DATA.request (
    Local_wPort,
    Remote_wPort,
    Local_UDP_Port,
    Remote_UDP_Port,
    Local_IP_Address,
    Remote_IP_Address,
    Data_Length,
    Data
)
    
```

The Local_wPort, Local_UDP_Port and Local_IP_Address parameters indicate wrapper Port number, UDP Port number and IP Address parameters belonging to the device / DLMS/COSEM AE requesting to send the Data. The Remote_wPort, Remote_UDP_Port and Remote_IP_Address parameters indicate the wrapper Port number, UDP Port number and IP Address parameters belonging to the device / DLMS/COSEM AE to which the Data is to be transmitted.

The Data_Length parameter indicates the length of the Data parameter in bytes.

The Data parameter contains the xDLMS APDU to be transferred to the peer AL.

Use

The UDP-DATA.request primitive is invoked by either the client or the server DLMS/COSEM AL to request sending an APDU to a single peer AL, or, in the case of multi- or broadcasting, to multiple peer ALs.

The reception of this service primitive shall cause the wrapper sublayer to pre-fix the wrapper header to the APDU received, and then to call the SEND() function of the UDP sublayer with the properly formed WPDU, see at 5.3.2, as DATA. The UDP sublayer shall transmit the WPDU to the peer wrapper sublayer as described in STD 0006.

5.2.2.2 UDP-DATA.indication

Function

This primitive is the service indication primitive for the connection-less mode data transfer service.

Semantics of the service primitive

The primitive shall provide parameters as follows:

UDP-DATA.indication (

Local_wPort,
Remote_wPort,
Local_UDP_Port,
Remote_UDP_Port,
Local_IP_Address,
Remote_IP_Address,
Data_Length,
Data

)

The Local_wPort, Local_UDP_Port and Local_IP_Address parameters indicate wrapper Port number, UDP Port number and IP Address parameters belonging to the device / DLMS/COSEM AE receiving the Data. The Remote_wPort, Remote_UDP_Port and Remote_IP_Address parameters indicate the wrapper Port number, UDP Port number and IP Address parameters belonging to the device / AE which has sent the data.

The Data_Length parameter indicates the length of the Data parameter in bytes.

The Data parameter contains the xDLMS APDU received from the peer AL.

Use

The UDP-DATA.indication primitive is generated by the DLMS/COSEM UDP based TL to indicate to the service user DLMS/COSEM AL that an APDU from the peer layer entity has been received.

The primitive is generated following the reception of an UDP Datagram by the UDP sublayer, if both the Local_UDP_Port and Local_wPort parameters of the message received contain valid port numbers, meaning that there is a DLMS/COSEM AE in the receiving device bound to the given port numbers. Otherwise, the message received shall simply be discarded.