INTERNATIONAL STANDARD

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**Electricity metering –
Data exchange for meter reading, tariff and load control –**

**Part 47:
COSEM transport layers for IPv4 networks**

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ELECTRICITY METERING – DATA EXCHANGE FOR METER READING, TARIFF AND LOAD CONTROL –

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DLMS[1] User Association

Geneva / Switzerland

www.dlms.ch

International Standard IEC 62056-47 has been prepared by IEC technical committee 13: Equipment for electrical energy measurement and load control.

[1] Device Language Message Specification

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

FDIS	Report on voting
13/1386/FDIS	13/1397/RVD

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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A list of all parts of IEC 62056 series, published under the general title *Electricity metering – Data exchange for meter reading, tariff and load control*, can be found on the IEC website.

A bilingual version of the publication may be issued at a later date.

ELECTRICITY METERING – DATA EXCHANGE FOR METER READING, TARIFF AND LOAD CONTROL –

Part 47: COSEM transport layers for IPv4 networks

1 Scope

This part of IEC 62056 specifies the transport layers for COSEM communication profiles for use on IPv4 networks.

These communication profiles contain a connection-less and a connection-oriented transport layer, providing OSI-style services to the service user COSEM application layer. The connection-less transport layer is based on the Internet standard User Datagram Protocol. The connection-oriented transport layer is based on the Internet standard Transmission Control Protocol.

Although the major part of the COSEM transport layers is the UDP and TCP as they are specified in the relevant Internet standards, they include an additional sub-layer, called wrapper.

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

2 Normative references

The following referenced documents are indispensable for the application 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 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 62051:1999, *Electricity metering – Glossary of terms*

IEC 62051-1:2004, Ed.1., *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 62056-53, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 53: COSEM application layer* [3]

IEC 62056-62, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 62: Interface classes* [3]

STD0005 – *Internet Protocol*
Author: J. Postel
Date: September 1981
Also: RFC0791, RFC0792, RFC0919, RFC0922, RFC0950, RFC1112

STD0006 – *User Datagram Protocol*
Author: J. Postel
Date: 28 August 1980
Also: RFC0768

STD0007 – *Transmission Control Protocol*
Author: J. Postel
Date: September 1981
Also: RFC0793

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 definitions given in IEC 60050-300, IEC 62051 and IEC 62051-1 apply.

3.2 Abbreviations

APDU	Application Layer Protocol Data Unit
COSEM	COmpanion Specification for Energy Metering
COSEM_on_IP	The TCP-UDP/IP based COSEM communication profile
IP	Internet Protocol
PDU	Protocol Data Unit
PAR	Positive Acknowledgement with Retransmission
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
WPDU	Wrapper Protocol Data Unit

4 Overview

This standard specifies two transport layers for the COSEM_on_IP communication profiles: a connection-less transport layer, based on UDP, Internet standard STD0006 and a connection-oriented transport layer, based on TCP, Internet standard STD0007.

In these profiles, the COSEM application layer uses the services of one of these transport layers, which use then the services of the Internet Protocol (IPv4) network layer to communicate with other nodes connected to the abstract IPv4 network.

When used in these profiles, the COSEM application layer can be considered as another Internet standard application protocol (like the well-known HTTP, FTP or SNMP) and it may co-exist with other Internet application protocols, as shown in

Figure 1.

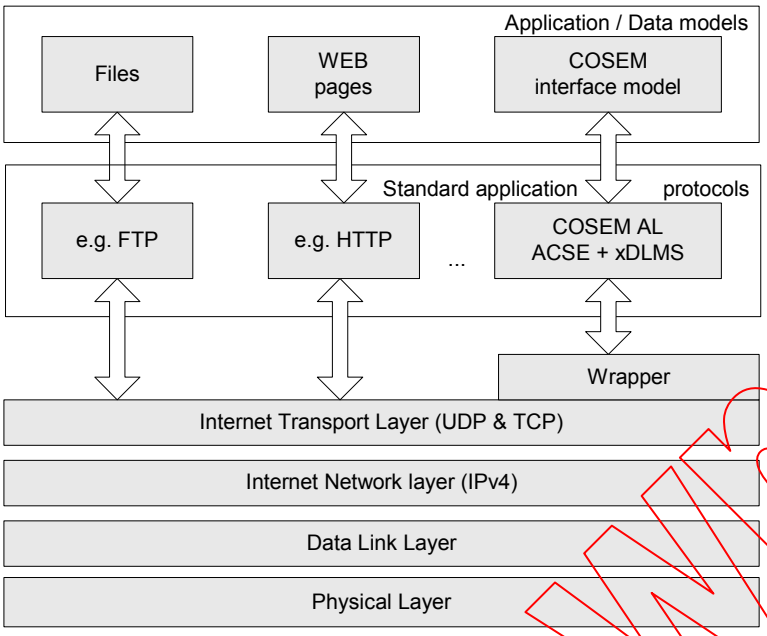


Figure 1 – COSEM as a standard Internet application protocol

As the COSEM application layer specified in IEC 62056-53 uses and provides OSI-style services, a wrapper has been introduced between the UDP/TCP layers and the COSEM application layer.

Therefore, the COSEM transport layers consist of a wrapper sub-layer and the UDP or TCP transport layer.

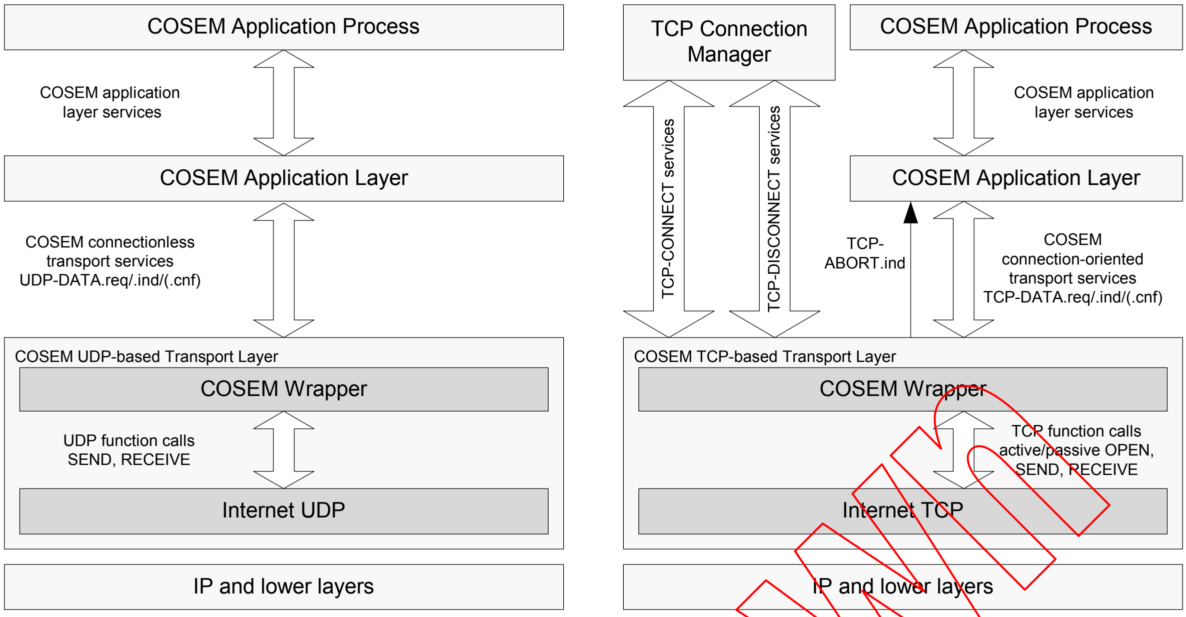
The wrapper sub-layer is a lightweight, nearly state-less entity: its main function is to adapt the OSI-style service set, provided by the COSEM transport layer, to UDP or TCP function calls and vice versa.

In addition, the wrapper sub-layer 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 62056-53, B.3.3, the COSEM application layer is listening only on one UDP or TCP port. On the other hand, as defined in IEC 62056-62, a COSEM physical device may host several client application processes or server logical devices. The additional addressing capability provided by the wrapper sub-layer allows identifying these application processes.

The structure of the COSEM transport layer and their place in COSEM-on_IP is shown in Figure 2.



a) the UDP-based profile b) the TCP-based profile

Figure 2 – Transport layers of the COSEM_on_IP profile

The service user of the UDP-DATA and the TCP-DATA services is the COSEM application layer. On the other hand, the service user of the TCP-CONNECT and TCP-DISCONNECT services is the TCP Connection Manager Process. The COSEM TCP-based transport layer also provides a TCP-ABORT.indication service to the service user COSEM application layer.

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

5.1 General

The COSEM connection-less transport layer is based on the User Datagram Protocol (UDP) as specified in STD0006.

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 COSEM UDP-based transport layer, then invoking confirmed COSEM data communication 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 application processes, hosted in the same physical device and identified by its IPv4 address[2].

[2] The addressing/identification scheme for the COSEM_on_IP profiles is defined in IEC 62056-53, B.3.3.

As already mentioned in Clause 4, the COSEM application layer is listening only on one UDP port. On the other hand, as defined in IEC 62056-62, a COSEM physical device may host several client application processes or server logical devices. The additional addressing capability provided by the wrapper sub-layer, using the wrapper port (wPort) numbers on top of the UDP/TCP port numbers allows identifying these application processes.

The wrapper also adds length information to the APDU to be transported.

5.2 Service specification for the COSEM UDP-based transport layer

5.2.1 General

The COSEM UDP-based transport layer provides the same set of services both at the Client and at the Server sides, as shown in Figure 3.

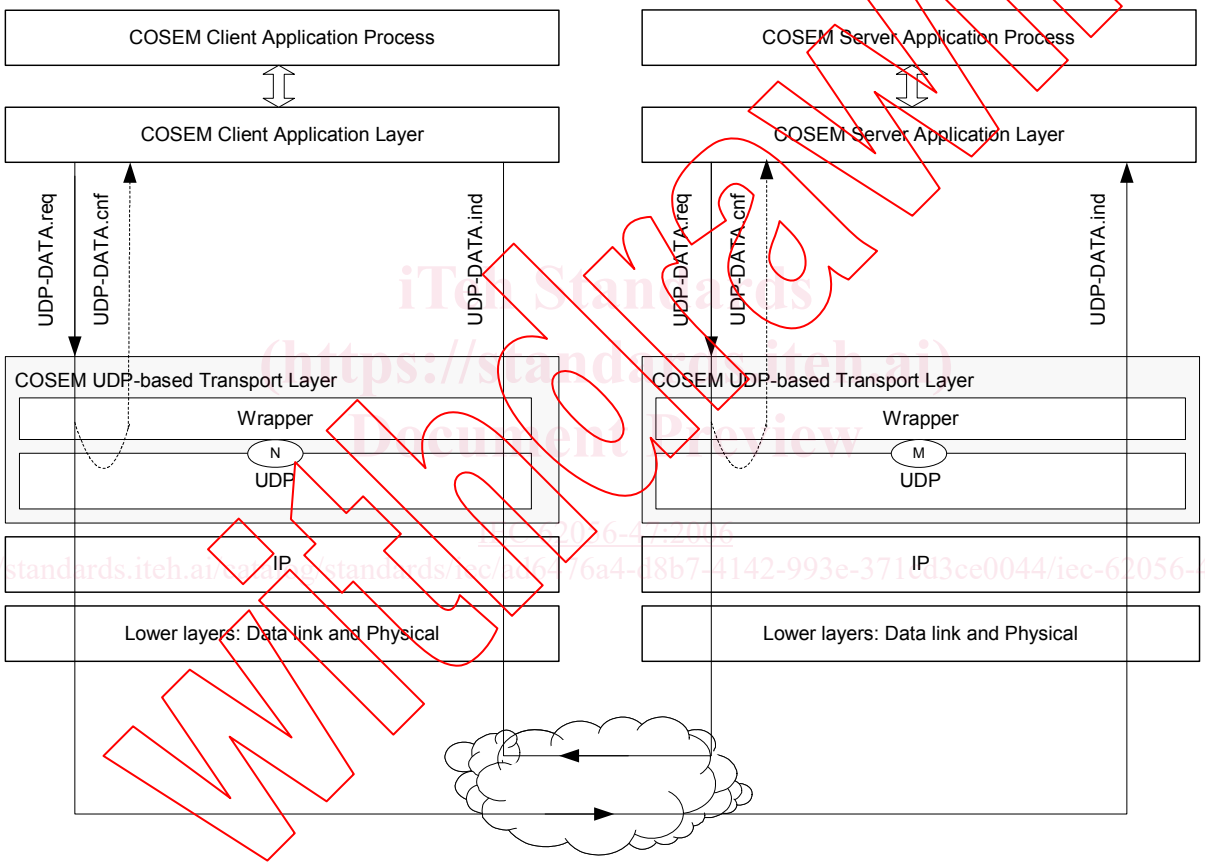


Figure 3 – Services of the COSEM connection-less, UDP-based transport layer

The COSEM UDP-based transport layer provides only data communication services: the connection-less UDP-DATA services. The service set for the UDP-DATA services is the same at both the client and server sides: consequently, the service specification for these services is the same for both the client and server transport layers.

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

NOTE The APDU pre-fixed with the header by the wrapper sub-layer must fit in a single UDP datagram.

5.2.2 The UDP-DATA services

5.2.2.1 UDP-DATA.request

Function

This service primitive is invoked by the service user COSEM application layer to request the transmission of an APDU to the peer COSEM application layer.

Service parameters

The semantics of the primitive is 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/application process 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/application process to which the Data is to be transmitted.

The Local_UDP_Port and Remote_UDP_Port parameters identify the local and remote UDP ports respectively. Note, that as no well-known port number is reserved for COSEM communications, the value of these parameters must be in the non-privileged range (above 1024).

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

The Data parameter contains the COSEM APDU to be transferred to the peer application layer.

Use

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

The reception of this service primitive shall cause the wrapper sub-layer to pre-fix the wrapper header to the APDU received, and then to call the SEND() function of the UDP sub-layer with the properly formed WPDU, see at 5.3.2, as DATA. The UDP sub-layer shall transmit the WPDU to the peer wrapper sub-layer as described in STD0006.