IEC TS 62056-8-20

Edition 1.0 2016-11

TECHNICAL SPECIFICATION

colour inside

Electricity metering data exchange – The DLMS/COSEM suite –
Part 8-20: Mesh communication profile for neighbourhood networks

IEC TS 62056-8-20:2016-11(en)

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ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 8-20: Mesh communication profile for neighbourhood networks

FOREWORD

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62056-8-20, which is a technical specification, has been prepared by technical committee 13: Electrical energy measurement and control.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
13/1673/DTS	13/1704/RVC

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

This document 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 website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

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INTRODUCTION

As defined in IEC 62056-1-0, the IEC 62056 DLMS/COSEM suite provides specific communication profile standards for communication media relevant for smart metering.

Such communication profile standards specify how the COSEM data model and the DLMS/COSEM application layer can be used on the lower communication media-specific protocol layers.

Communication profile standards refer to communication standards that are part of the IEC 62056 DLMS/COSEM suite or to any other open communication standard.

This Technical Specification specifies a DLMS/COSEM IPv6 based communication profile that can be used in large scale AMI deployments where the Neighbourhood Networks are mesh networks.

The communication profile specified in this Technical Specification can be used over various suitable technologies providing a Neighbourhood Network with mesh topology, as long as they are capable to carry IPv6 traffic.

This specification follows the rules defined in IEC 62056-5-3:2016, Annex A.

The communication profile specified in this specification addresses the specificities resulting from the properties of the mesh network and the large quantity of devices to be managed.

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

**Part 8-20: Mesh communication profile
for neighbourhood networks**

1 Scope

This part of IEC 62056 specifies a DLMS/COSEM communication profile that can be used in a smart metering system in which the Neighbourhood Networks (NN) are mesh networks.

This profile may be considered as an adaptation and extension of the UDP/IP communication profile specified in IEC 62056-9-7:2013. As in that standard, the PHY and MAC layers are out of the Scope.

This Technical Specification specifies a number of features essential to the efficient operation of a large scale AMI using mesh NNs. These features include:

- identification of the DLMS/COSEM client and server participating in an application association (AA) with their system title, so that this identification does not change when the IP address of the server changes, see Clause 6;
- a mechanism to inform the client of the binding between the server's system title and its current IP address(es), see 5.5.3;
- the use of the DLMS/COSEM UDP based transport layer, that allows keeping DLMS/COSEM AAs open for long periods, while the device may leave and join the mesh NN and/or its IP address may change, see 7.2.2;
- DLMS/COSEM application layer and application process level security features that can be used in a mesh environment, see 7.4.2;
- a mechanism to organize servers to one or more groups based on various conditions, so that the requests can be broadcasted to all devices attached to the mesh network, but only those servers belonging to the group carry out the request and respond, see 8.2;
- a mechanism that allows to send the response to a request in designated time windows and with a randomized delay, see 8.3.
- the use of a specific UDP port that allows efficient UDP header compression, see 6.3.3.

The Scope of this communication profile specification is restricted to aspects concerning the use of communication protocols in conjunction with the COSEM data model and the DLMS/COSEM application layer. Any project specific definitions of data structures and data contents may be provided in project specific companion specifications.

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 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at www.electropedia.org)

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

IEC TR 62051-1, *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 62056-1-0, *Electricity metering data exchange – The DLMS/COSEM suite – Part 1-0: Smart metering standardisation framework*

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

IEC 62056-5-3:2016, *Electricity metering data exchange – The DLMS/COSEM suite – Part 5-3: DLMS/COSEM application layer*

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

IEC 62056-6-2, *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*

RFC 768, User Datagram Protocol Edited by J. Postel. August 1980. Available from https://www.ietf.org/rfc/rfc768.txt

RFC 2460, Internet Protocol, Version 6 (Ipv6) Specification [online]. Edited by R. Hinden, S. Deering. December 1998. Available from http://tools.ietf.org/html/rfc2460

RFC 3315, Dynamic Host Configuration Protocol for IPv6 (DHCPv6) Edited by R. Droms, J. Bound, B. Volz, T. Lemon, C. Perkins, M. Carney. July 2003. Available from http://www.ietf.org/rfc/rfc3315.txt

RFC 4291, IP Version 6 Addressing Architecture [online]. Edited by R. Hinden, S. Deering. February 2006. Available from http://tools.ietf.org/html/rfc4291

RFC 4862, IPv6 Stateless Address Autoconfiguration. Edited by S. Thomson, T.Narten, T. Jinmei September 2007. Available from https://tools.ietf.org/html/rfc4862

RFC 4944, Transmission of IPv6 Packets over IEEE 802.15.4 Networks [online]. Edited by G. Montenegro, N. Kushalnagar, D. Culler. September 2007. Available from http://tools.ietf.org/html/rfc4944

RFC 6282, Compression Format for IPv6 Datagrams over IEEE 802.15.4-Based Networks. Available from http://tools.ietf.org/html/rfc6282

RFC 6550, IPv6 Routing Protocol for Low-Power and Lossy Networks, Edited by T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Lewis, K. Pister, R. Struik, JP. Vasseur, R. Alexander. March 2012. Available from https://tools.ietf.org/html/rfc6550

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the definitions given in IEC 60050, IEC 62051, IEC 62051-1 as well as the following apply.

NOTE Where there is a difference between the definitions in the glossary and those contained in product standards produced by TC 13, then the latter take precedence in applications of the relevant standard.

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

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

3.1.1
mesh network
functional unit for the transfer of data between several participants for data processing, via one or a number of redundant transmission paths, whereby each participant is able to pass on data that do not concern themselves to one or more neighbours

3.1.2
Head End System
HES
Central Data System exchanging data via the AMI of various meters in its service area

Note 1 to entry: The HES may communicate via WAN directly to the end devices or via NNAPs and LNAPs.

3.2 Abbreviated terms

AA	Application Association
ACSE	Association Control Service Element
AL	Application Layer
AMI	Advanced Metering Infrastructure
AP	Application Process
ASE	Application Service Element
COSEM	Companion Specification for Energy Metering
DCS	Data Collection System
DHCPv6	Dynamic Host Configuration Protocol for IPv6
DLMS	Device Language Message Specification
DNS	Domain Name System
IP	Internet Protocol
HES	Head End System
HLS	High Level Security mechanism
IANA	Internet Assigned Numbers Authority
LAN	Local Area Network
LN	Local Network
LNAP	Local Network Access Point
MAC	Media Access Control sublayer of the Data Link Layer as specified in the OSI Open Systems Interconnection Model
NN	Neighbourhood Network
NNAP	Neighbourhood Network Access Point
PHY	Physical Layer as specified in the OSI Open Systems Interconnection Model
RF	Radio Frequency
RPL	Routing Protocol for Low-Power and Lossy Networks
SAP	Service Access Point
TCP	Transmission Control Protocol

UDP User Datagram Protocol

WAN Wide Area Network

xDLMS Extended DLMS

4 Targeted communication environments – Overview

The objectives of defining a DLMS/COSEM communication profile for mesh neighbourhood networks are the following:

a) centralized management of a large number of end devices by a single central Head End System (HES) hosting a (set of) DLMS/COSEM client(s);

b) efficient end-to-end communication between DLMS/COSEM clients and different kind of devices over Neighbourhood Networks using mesh topology;

c) reliability and efficiency of accessing devices via the mesh network;

d) management of adding, removing and relocating devices using existing open standards.

A segment of an AMI network with devices communicating over a mesh network is shown in Figure 1.

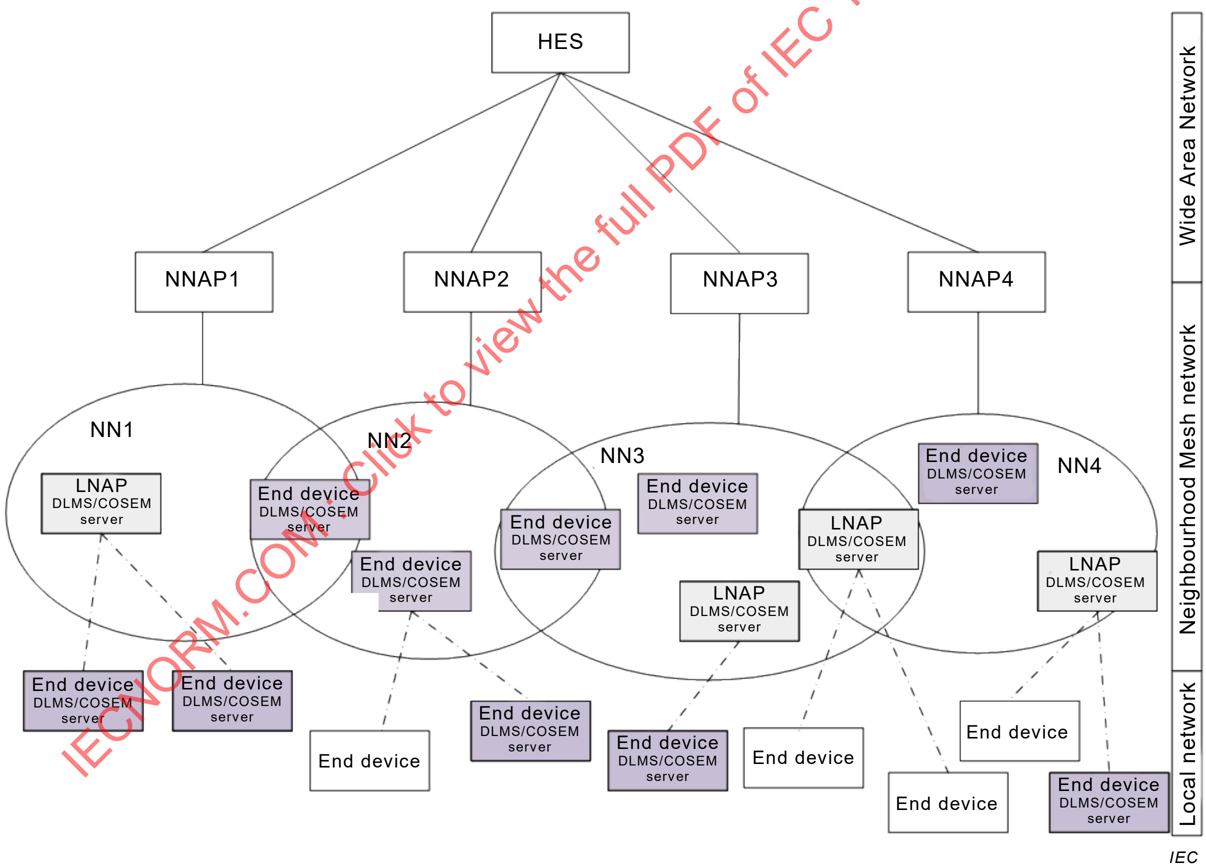


Figure 1 – Mesh neighbourhood network within an AMI environment

Figure 1 depicts a centralized meter data collection and management system.

NOTE 1 It may be managed by a Utility or some other 3rd party entity but this aspect is out of the Scope of this document.

There may be many NNs with a single NNAP each. The NNAP provides access for the HES to the mesh NN. On the one hand, an NNAP has an interface towards the WAN and the NN. On the other hand, it acts as the coordinator of the NN, managing the discovery and registration of devices on the mesh network. Concerning DLMS/COSEM data exchange, the NNAP provides only a routing function.

End devices may be:

- various kind of utility meters e.g. electricity, gas, heat, water meters or other devices with smart metering and control functions;
- DLMS/COSEM servers, or they may implement another application protocol (e.g. M-Bus or ZigBee®[1]);
- mains powered or battery powered (electricity meters are always mains powered);
- directly connected to the mesh network, or connected via LNAPs;
- IP capable or not.

The functionality of LNAPs depends on the kind of end devices connected to them:

- when the end devices are mains powered and IP capable DLMS/COSEM servers that are not directly connected to the mesh network, the LNAP is simply a router;
- when the end devices are mains powered not IP capable DLMS/COSEM servers that therefore cannot be directly connected to the mesh network, the LNAP acts as a DLMS/COSEM gateway and as a master of the LN;
- when the end devices are battery powered DLMS/COSEM servers that cannot be directly connected to the mesh network, the LNAP acts as a proxy that exchanges data with the end devices when they are awake and that can store requests to and responses from the DLMS/COSEM servers. The LNAP also acts as a master of the LN;
- when the end devices are not DLMS/COSEM servers, then the LNAP acts as a master for those end devices and acts as an application protocol converter.

NOTE 2 The router / gateway / proxy functions of LNAPs are out of the Scope of this document.

LNAPs are always connected directly to the mesh NN and they shall be mains powered.

Some LNAPs and end devices may provide routing functionality, ensuring an optimal path to reach each device and ensuring network resilience.

LNAPs and end devices can be connected to zero or one mesh NN at any time. They may leave the mesh NN and join the same or a neighbouring and overlapping mesh NN any time; this may imply a change of their IP address.

Figure 2 shows the entities and interfaces of a smart metering system as depicted in IEC 62056-1-0. This document covers the "C" interface concerning DLMS/COSEM data exchange. The "L" interface forms part of the mesh network, providing routing functionality, but no application data transport.

1 ZigBee® is a trademark owned by ZigBee corporation. This information is given for the convenience of users of this document and does not constitute an endorsement by the IEC of the product named.

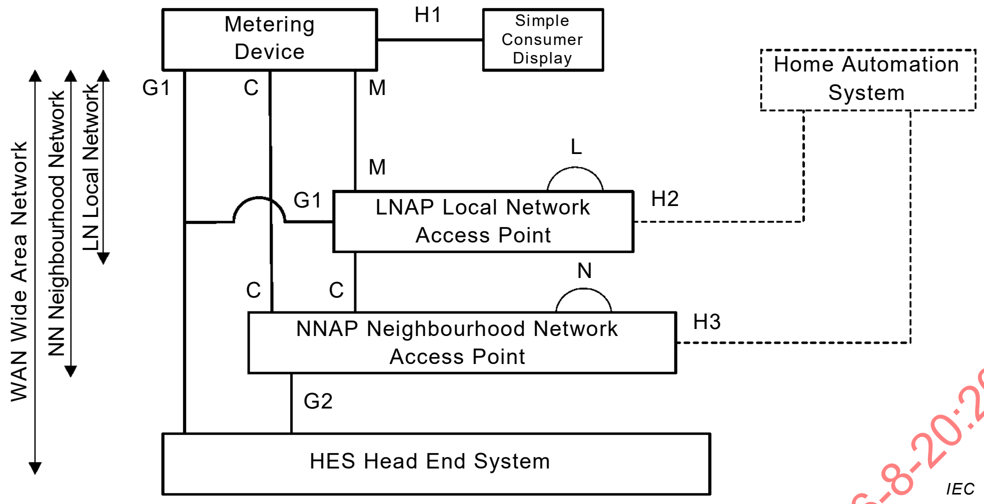


Figure 2 – Entities and interfaces of a smart metering system

The components of the communication environment of the Figure 2, meaning the HES, NNAP, LNAP and the end devices are already defined above.

NOTE 3 In the remaining part of this document the term “device” means either the LNAP or the Metering End Device.

5 Use of the communication layers for this profile

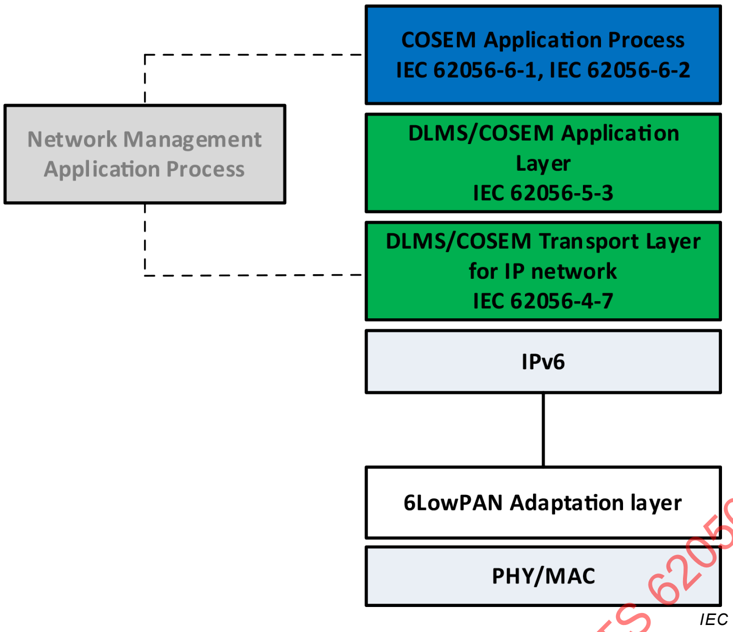
5.1 Information related to the use of the specification specifying the lower layers

This document specifies how this profile can be used over any PHY and MAC layers.

The network layer shall be IPv6 based. The transport layer shall be UDP.

5.2 The structure of the profile supporting network meshed communications

The structure of a DLMS/COSEM mesh network communication profile is shown in Figure 3. The transport layer is as specified in IEC 62056-9-7:2013 except that – as specified in 5.1 – only UDP can be used. The specific configuration of the Network layer and the Transport layer are specified in 5.3.5 and 5.3.6 respectively.



NOTE The Network Management Application Process is out of the Scope of this document.

Figure 3 – The DLMS/COSEM mesh communication profile

5.3 Lower protocol layers and their use

5.3.1 Overview

A DLMS/COSEM based mesh network communication profile is a connectionless communication profile which does not need connection establishment, maintenance and release of the layers below the DLMS/COSEM application layer. The network layer interfaces the PHY and MAC layers with the means of an adaptation layer specified in 5.3.4.

5.3.2 Physical layer

The physical layer is out of Scope of this document. Any mesh based physical layer can be used.

5.3.3 MAC layer

The MAC layer is out of Scope of this document. Any mesh based MAC layer that is compatible with the physical layer chosen can be used.

5.3.4 Service mapping and adaptation layers

5.3.4.1 General

The adaptation layer shall be chosen according to the physical and MAC layers selected. 6LoWPAN may be used according to RFC 4944 and RFC 6282.

5.3.4.2 Segmentation and reassembly

The adaptation layer of all devices complying with this specification may support segmentation and reassembly feature as specified in RFC 4944, 5.3.

5.3.4.3 IPv6 header compression

All devices complying with this specification may support IPv6 header compression as specified in RFC 6282, Clause 3.

5.3.4.4 IPv6 address configuration

5.3.4.4.1 Unicast address configuration

An IPv6 address prefix is used for stateless auto configuration. This prefix is obtained by the devices from the NNAP via router advertisement messages as specified in RFC 4862, 5.5.

NOTE The IPv6 address assignment concerns devices inside the NN and also those eventually on the LN. For the devices inside LNs, those on the NN act as a router. It is the scope of the devices on the NN to have knowledge of the nature of the LN lower layers and manage it consequently. The LN is out of the Scope of this document.

The IPv6 address can alternatively be configured using DHCPv6 as described in RFC 3315. DHCPv6 can provide a device with an IPv6 address assigned by DHCPv6 server and with other configuration information which are carried in options.

5.3.4.4.2 Multicast address configuration

Devices inside the NN shall support multicast IPv6 addressing as described in RFC 4291, 2.7.

5.3.5 Network layer

Inside the mesh network, the network layer shall be IPv6 as defined in RFC 2460.

NOTE 1 Devices in the LN which are IP capable are preferably IPv6 devices, but the LN is out of the Scope of this document.

If the routing protocol is not specified in the lower layers or in a project specific companion specification then the RPL specified in RFC 6550 shall be used.

NOTE 2 The WAN can be based on IPv4 or IPv6. When it is based on IPv4, the compatibility is accomplished by traditional techniques such as tunnelling and/or dual stack implementations in the NNAP. However, the WAN is out of the Scope of this document.

5.3.6 Transport layer

The DLMS/COSEM Transport layer shall apply as described in IEC 62056-4-7. In the Scope of the present document, it includes the COSEM Wrapper and UDP. For mesh networks, UDP as specified in RFC 768 shall be the applicable transport protocol. TCP shall not be used.

5.4 Service mapping and adaptation layers

5.4.1 Service mapping

See IEC 62056-9-7:2013, Clause 7, where only UDP part applies.

5.4.2 Protocol_Connection_Parameters of the COSEM-OPEN service

See IEC 62056-9-7:2013, Clause 8.

5.5 Registration and connection management

5.5.1 Overview

The present subclause is related to the connectivity management and registration. At the COSEM application level, the device registration function – see 5.5.3.2 – allows changes at the network level to be communicated to client applications.

5.5.2 Connectivity management

Devices can join or leave the mesh network and the network management system can automatically configure them. Before DLMS/COSEM data exchange can take place, the devices shall have a valid IP address obtained from the network infrastructure. This comprises the complete enrolment process through discovery, authentication, IPv6 address assignment, configuration, and proper attachment to the routing infrastructure. The details of this process are out of the Scope of this document.

The following are required by the DLMS/COSEM mesh profile:

- when the IP address changes, it shall not affect the client and server connectivity;
- the client shall update its connectivity parameters before any message exchange with the servers.

At the top of these protocols, a management information base (MIB) may be available and may require configuration COSEM interface classes to be defined in the future.

5.5.3 Registration

5.5.3.1 Overview

The present subclause specifies the means for making the server IP address available to the client in real time in order to allow the client to send and receive COSEM APDUs to and from the servers.

As specified in 5.3.4.4, IPv6 address registration may be achieved by the means of a DHCP client and/or DNS.

When a DHCP or DNS is not available, in order to achieve inter-operability, the registration may be achieved as described in 5.5.3.2. The role of the registration process is to update the HES about any IP address change. This application process makes the necessary link between the network management part and the DLMS/COSEM data communication part. This link is made at the AP level in order to avoid as much as possible any interaction between the network management part which is out of the Scope of this document, and the DLMS/COSEM application entity.

The purpose of this AP is to provide all the elements from the network part which are needed by DLMS/COSEM part for performing the data exchange. It resolves the IPv6 address by mapping the system title to the current IPv6 addresses of the device hosting the server.

NOTE Each physical device has a single system title that is shared by all logical devices hosted.

5.5.3.2 IPv6 address registration and update operation

5.5.3.2.1 Overview

This subclause specifies a DLMS/COSEM mechanism for IPv6 address registration and update that can be used if no other mechanism is available.

5.5.3.2.2 General

All devices connected to the NN report their initial IP address assignment and any subsequent changes to the registration client. See 5.5.3.3.

NOTE The registration concerns the devices on the LN also. However, this link is out of the Scope of this document.

The device uses two operations for the registration management: IP address registration and IP address update. Address registration is used every time the device wants to register a new IPv6 address. Address update is used when the server wants to register a new IPv6 address replacing an old one.

The registration operations are performed by the devices using “Push setup” objects and the “DataNotification” xDLMS service. Initially, devices are configured with the registration client

IP address and UDP port number in the *send_destination_and_method* (attribute 3 as defined in Table 1) of a “Push setup” object instance prior to network connection as follows:

Table 1 – Send_destination_and_method attribute

Parameter	Value
transport_service_type	UDP
destination	Registration-client IPv6 address, port 0xF0B0
message_type	A-XDR encoded xDLMS APDU

5.5.3.2.3 Address registration

Table 2 provides the content and format of the data needed during the IP address registration operation.

Table 2 – Address registration data

Name	Length (bits)	Data type	Description
Id	8	unsigned	Identifier of the operation “0x01”
System title	64	octet-string	End device system title
IPv6 address	128	octet-string	Assigned IPv6 address
Lifetime	32	double-long-unsigned	Lifetime of the assigned IPv6 address

The device obtains an IPv6 address from the mesh network as specified in 5.3.4.4. The Address Registration Data is then sent by the device to the registration client during installation.

The lifetime is the duration (in seconds) for which the related registration is deemed to be valid by the registration client. Before the lifetime elapses, the device has to renew its registration.

The Notification_Body parameter of the DataNotification service is constructed from the *push_object_list* attribute of a “Push setup” object which points to the *value* attribute of the “Data” object that holds the information specified in Table 2 as a structure of 4 elements. The contents of the “Data” object is managed by the server and it shall not be modified by the client.

Every time the device obtains an additional IPv6 address, it performs this operation.

5.5.3.2.4 Address update

Table 3 provides the content of the data carried during an address update operation:

Table 3 – Address update data

Name	Length (bits)	Data type	Description
Id	8	unsigned	Identifier of the operation “2”
System title	64	octet-string	End device system title
IPv6 address	128	octet-string	Previous IPv6 address of the device
IPv6 address	128	octet-string	Current assigned IPv6 address of the device
Lifetime	32	double-long-unsigned	Lifetime of the assigned IPv6 address

An address update takes place when a device is already registered on the mesh network and obtains a new IP address. For every address change, the Address Update Data (identified in Table 3) shall be sent by the end device to the registration client.

The Notification_Body parameter of the DataNotification service is constructed from the *push_object_list* attribute of a "Push setup" object which points to the *value* attribute of the "Data" object that holds the information specified in Table 3 as a structure of 5 elements. The contents of the "Data" object is managed by the server and it shall not be modified by the client.

NOTE The previous IP address is not available any more after the address update.

5.5.3.3 Registration client

When the mechanism pushing the IPv6 address as described in 5.5.3.2 is implemented, the devices use a pre-established application AA between the Management Logical Device and the registration client.

The value of the registration client SAP shall be 0xFF. See Table 4.

The security related to the registration client is addressed by DLMS/COSEM security as defined by the security policy of the "Security Setup" object linked to this AA.

If the registration client is implemented, the conformance block in the pre-established AA between the registration client and the management logical device shall support at least the following xDLMS services/capabilities:

- general-protection -- bit 1;
- data-notification -- bit 16.

6 Identification and addressing scheme

6.1 Overview

Along the mesh profile, three addressing levels are needed:

- IP addressing;
- UDP addressing;
- wrapper port addressing.

The following rules apply specifically for the identification and addressing in the mesh profile:

- within a physical device, DLMS/COSEM clients and Logical Devices shall be identified by wPort assignments as specified IEC 62056-4-7;
- a fixed UDP port shall be reserved as a DLMS/COSEM listening port at the transport layer level, see 6.3.3;
- the combination of IPv6 address / UDP port shall address the DLMS/COSEM application within a physical device;
- system titles shall be the only unique, non-ambiguous identifiers of the server physical devices. The system title is used for the device identification and not the IP address because of node migration. This is discussed further in 7.2.3.

Figure 4 shows an example of a mesh communication profile identification and addressing scheme between two client APs and two server logical devices (i.e. server APs). Client_AP_01 and Logical Device LD_01 in Host_Device_01 are associated by AA 1. Likewise, Client_AP_02 and Logical Device LD_02 in Host_Device_02 are associated by AA 2.

As described in IEC 62056-9-7:2013, Clause 6, DLMS/COSEM AAs are identified using client and server end-point identifiers. The devices involved in the AA contain addresses for both the client and server sides. The descriptor for each side consists of the following elements:

IP address,

UDP port address (N for client, M for server),

Wrapper port address.

AA 1: { (::163.187.32.10, N, 31) (::163.187.45.36, M, 527) }

AA 2: { (::163.187.32.10, N, 34) (::163.187.45.78, M, 3013) }

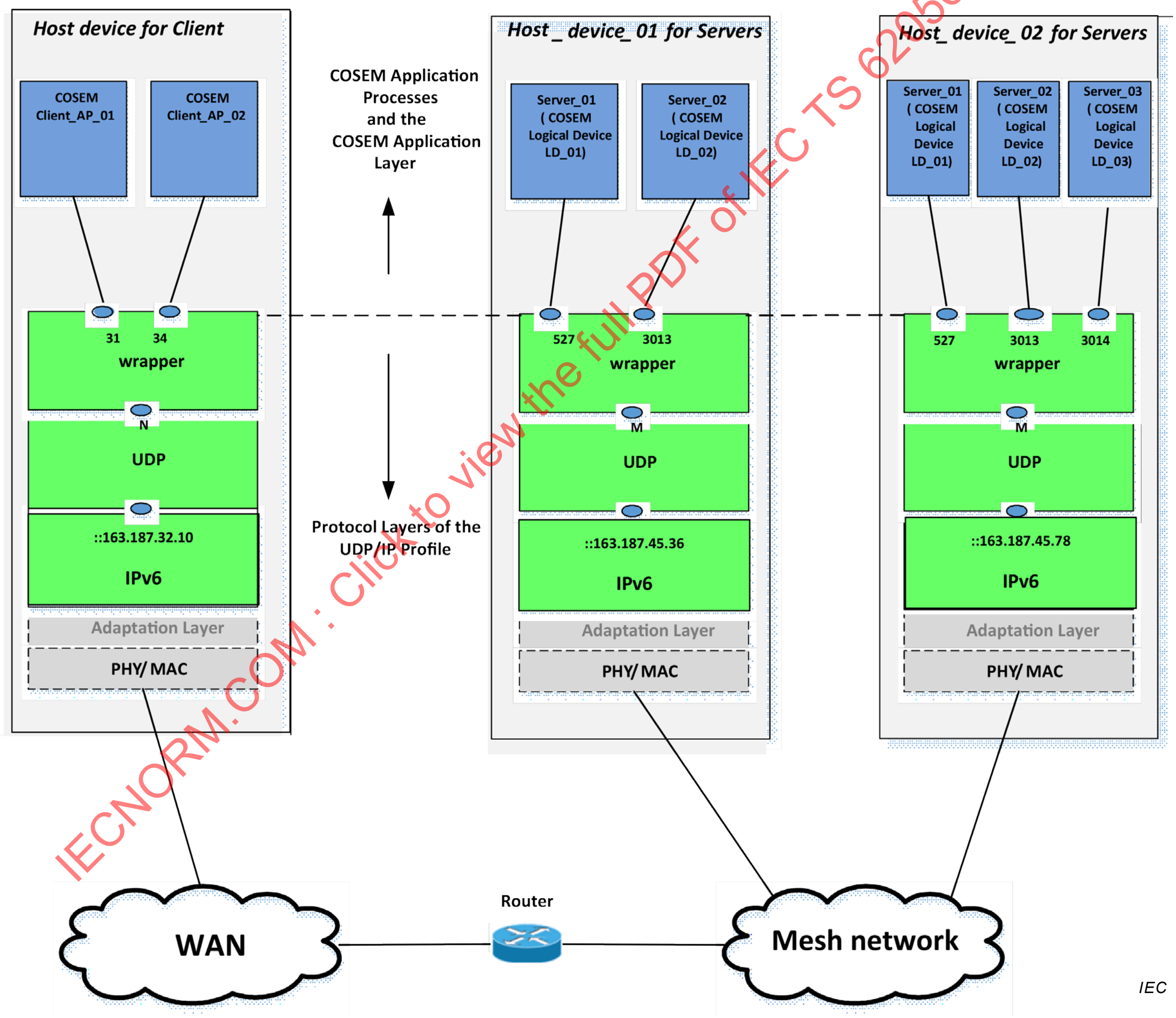


Figure 4 – Identification and addressing scheme

6.2 Network addressing

6.2.1 General

IPv6 addressing is used as defined in RFC 4291.

6.2.2 Node migration

The devices in a mesh network are capable of changing their routing information to establish and maintain optimal communication paths whether or not they are migrating between networks. In this respect mesh networks are self-healing, i.e. able to recover from blocked or lost nodes.

As a result of the self-healing characteristics of these networks, the IPv6 address of a specific device may change depending on which sub-network the related device is attached to at a given time; see 7.2.2.

6.3 Transport addressing

6.3.1 Overview

In the DLMS/COSEM mesh profile, UDP port is used for addressing the DLMS/COSEM application layer at the transport layer.

6.3.2 UDP port

A fixed UDP port is used as a listening port by the DLMS/COSEM AL. All DLMS/COSEM client and server applications exchange messages over this port.

6.3.3 Default UDP ports

The default UDP port assigned for DLMS/COSEM by IANA is [0x0FDB (4059)].

When 6LoWPAN UDP Header Compression is used, this port cannot be used.

UDP shall be used together with 6LoWPAN UDP Header according to RFC 6282, 4.3.1. The server uses 0xF0B0 (61 616) and client uses range 0xF0B1 (61 617) to 0xF0BF (61 631).

6.4 Wrapper addressing

The wrapper ports provide the client and the server SAPs; see Table 4.

Table 4 – Client and server SAPs

Client SAPs	
Client Management Process	0x01
Public Client	0x10
Open for client SAP assignment	0x02 ...0x0F
	0x11... 0xFE
Registration client	0xFF
Server SAPs	
No-station	0x0000
Management Logical Device	0x0001
Reserved for future use	0x0002...0x000F
Open for server SAP assignment	0x0010...0xFFFE
All-station (Broadcast)	0xFFFF

7 Specific considerations for the application layer services

7.1 Overview

Concerning the use of confirmed and unconfirmed ACSE and xDLMS services IEC 62056-9-7:2013, 9.1, 9.2 and Table 1 apply.

7.2 Application association establishment and release: ACSE services

7.2.1 Application associations

The HES and the devices may use pre-established AAs or explicitly established AAs. Both pre-established and explicitly established AAs may use confirmed or unconfirmed services. (Refer to IEC 62056-9-7:2013, Table 1.)

Using explicitly established AAs allows the negotiation of the application context, the authentication mechanism and the xDLMS context and also transferring dedicated keys. Explicitly established AAs can be released when needed for example when the client wants to propose a different context or when it wants to use a new dedicated key.

As the UDP-IPv6 stack is connectionless, AAs are not released when the IPv6 address changes or when the device leaves the network. Whenever the device is attached to a network and has an IPv6 address, it can exchange DLMS/COSEM messages in the scope of the already established AA.

7.2.2 Application association life time

In a large-scale AMI deployment – due to a large number of mesh networks and devices attached to them – the process of establishing AAs before each transaction, releasing them at the end of the transaction and re-establishing them again for the next transaction would cause unnecessary overhead and may prove to be too costly.

Choosing UDP as the transport layer allows keeping AAs open, once established, until they are explicitly released by the client.

Explicitly established AAs shall maintain their “established” state even when an IPv6 address changes or a power failure occurs. As soon as the new IPv6 address is assigned and the registration server is informed or when power is restored, it shall be possible to resume exchanging COSEM APDUs.

7.2.3 COSEM-OPEN and COSEM-RELEASE service parameters

The Protocol_Connection_Parameters parameters of the COSEM-OPEN service – see IEC 62056-5-3:2016, 6.2 – shall be as shown below, according to IEC 62056-9-7:2013, Clause 8 specified for UDP:

- Protocol (Profile) Identifier UDP/IP;
- Server_IP_Address Replaced by the system title of the server;
- Server_UDP_Port See 6.3.3;
- Server_wrapper_Port COSEM Logical Device Address SAP;
- Client_IP_Address Replaced by the system title of the client;
- Client_UDP_Port, 0xF0B1 (61617) to 0xF0BF (61631);
- Client_wrapper_Port COSEM client application process (type) identifier

For interoperability reasons the client and server UDP ports are specifically defined. The client and server IP addresses are replaced by the respective system titles. The link between the system title and the valid IP addresses is provided by an IP address server which is handled by a specific application process that is out of the Scope of this document. The address information for the IP servers is provided by procedures described in 5.5.3.

The User_Information service parameter of the COSEM_OPEN service is not used.

The Service_Class parameter of the COSEM-OPEN service shall be used as follows:

- the Service_Class parameter is linked to the response-allowed parameter of the xDLMS InitiateRequest APDU;
- if the COSEM-OPEN service is invoked with Service_Class == Confirmed, the response-allowed parameter shall be set to TRUE. The server is expected to respond;
- if it is invoked with Service_Class == Unconfirmed, the response-allowed parameter shall be set to FALSE. The server shall not send back a response;
- unconfirmed AA-s between a client and a group of logical devices are established using a COSEM-OPEN service with Service_Class == Unconfirmed and a group of logical device addresses (for example multicast address).

As the lower layers are connectionless, the Use_RLRQ_RLRE service parameter of the COSEM-RELEASE service shall be set to TRUE. See IEC 62056-5-3:2016, 6.3.

7.3 xDLMS services

This document does not preclude the use of any xDLMS services specified in IEC 62056-5-3:2016, belonging either to the Short Name referencing or Logical Name referencing application contexts. However, to benefit from the optional data exchange strategies as specified in 8.2 and 8.3, the following features shall be supported:

- the application context using Logical Name referencing;
- the General Block Transfer mechanism.

These features may be used together with the appropriate COSEM object attribute and method related xDLMS services.

7.4 Security mechanisms

7.4.1 General

For DLMS/COSEM application layer and application process level security, see IEC 62056-5-3 and IEC 62056-6-2. Security suites 0, 1 or 2 may be used.

7.4.2 Broadcast

Broadcast messages (xDLMS APDUs) may be protected using the Global Broadcast Encryption Key GBEK and the Authentication Key GAK.

The servers and the clients could be provisioned with the keys OUT OF BAND. Replacing the keys can be performed server-by-server using the AES key wrap or the key agreement algorithms specified in IEC 62056-5-3 and IEC 62056-6-2.

7.4.3 Lower layers security

Lower layers security, meaning the security provided at MAC layer level, device authentication during device enrolment, network and transport layer security are out of the Scope of the document.

7.5 Transferring long application messages

For transferring long application messages, preferably the General Block Transfer mechanism as specified in IEC 62056-5-3:2016, 4.2.3.13 shall be used as this mechanism allows the use of streaming, i.e. sending several blocks without the need of confirming their reception by the client. xDLMS service specific block transfer – see IEC 62056-5-3:2016, 4.2.3.12 a) – may be used in the scope of point to point communication.

The lower layers may provide segmentation and reassembly capability.

7.6 Media access, bandwidth and timing considerations

<void>

7.7 Other considerations

<void>

8 Communication configuration and management

8.1 Overview

Mesh networks offer the capability to multicast requests / commands to all devices within a given area. It may be useful then organizing DLMS/COSEM servers – i.e. logical devices within physical devices – in groups so that only servers that belong to (a) given groups(s) respond / execute the commands.

Along with group management, a randomized delay mechanism for the responses may be required to avoid collision and congestion.

8.2 Group management

A group is defined as a collection of servers which share the same properties or operations in regard to the client, such as performing specific read types, group functional testing, pilot run testing, etc. Servers may be grouped at the AP level through a means of group definition and identification. The functional groups may be identified with specific group identifiers; e.g. a device may be assigned to group xx for “data collection”. A device may belong to one or several functional groups.

Group assignments and identification may be made as part of the registration and configuration process.

Instead of having point to point communication with each device forming the related group, the client may perform a point to multipoint communication with the entire group. Managing the groups of devices does not require any knowledge as to which NN the device is currently attached. All the group identifiers use the same multicast address.

8.3 Delayed and randomized response

When a request is sent to a group of servers and a response is expected from them, the servers may be configured to provide the responses in designated time windows and with a randomized delay to prevent network congestion.

A typical use case is the “periodic group read” procedure as described below.

Such periodic reads are performed regularly by the client to collect meter readings related to specific time intervals. All meters capture meter readings for the same time intervals, but the client can collect those readings over an extended period from designated groups of meters in