

BS EN 61400-25-4: 2008



BSI British Standards

Wind turbines —

Part 25-4: Communications for monitoring
and control of wind power plants —
Mapping to communication profile

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National foreword

This British Standard is the UK implementation of EN 61400-25-4:2008. It is identical to IEC 61400-25-4:2008.

The UK participation in its preparation was entrusted to Technical Committee PEL/88, Wind turbines.

A list of organizations represented on this committee can be obtained on request to its secretary.

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ISBN 978 0 580 55687 6

ICS 27.180

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2009

Amendments issued since publication

Amd. No.	Date	Text affected
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**Wind turbines -
Part 25-4: Communications for monitoring and control
of wind power plants -
Mapping to communication profile
(IEC 61400-25-4:2008)**

Eoliennes -
Partie 25-4: Communications
pour la surveillance et la commande
des centrales éoliennes -
Mapping des profils de communication
(CEI 61400-25-4:2008)

Windenergieanlagen -
Teil 25-4: Kommunikation
für die Überwachung und Steuerung
von Windenergieanlagen -
Abbildung auf ein Kommunikationsprofil
(IEC 61400-25-4:2008)

This European Standard was approved by CENELEC on 2008-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 88/318/FDIS, future edition 1 of IEC 61400-25-4, prepared by IEC TC 88, Wind turbines, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61400-25-4 on 2008-10-01.

For the user's convenience, a file containing the text of Clause A.7 is included with this document.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2009-07-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2011-10-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61400-25-4:2008 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60870-5-104	2006	Telecontrol equipment and systems - Part 5-104: Transmission protocols - Network access for IEC 60870-5-101 using standard transport profiles	EN 60870-5-104	2006
IEC 61400-25	Series	Wind turbines - Part 25: Communications for monitoring and control of wind power plants	EN 61400-25	Series
IEC 61850-7-2	2003	Communication networks and systems in substations - Part 7-2: Basic communication structure for substation and feeder equipment - Abstract communication service interface (ACSI)	EN 61850-7-2	2003
IEC 61850-7-3	2003	Communication networks and systems in substations - Part 7-3: Basic communication structure for substation and feeder equipment - Common data classes	EN 61850-7-3	2003
IEC 61850-8-1	2004	Communication networks and systems in substations - Part 8-1: Specific Communication Service Mapping (SCSM) - Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3	EN 61850-8-1	2004
DNP3 Specification	2007	Volume 2 - Volume 8	-	-

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INTRODUCTION

The IEC 61400-25 series defines communications for monitoring and control of wind power plants. The architecture of the IEC 61400-25 series has been selected to provide an abstract definition of classes and services such that the specifications are independent of specific protocol stacks, implementations, and operating systems. This part of the IEC 61400-25 series specifies the mapping of these abstract classes and services to protocol stacks.

NOTE Performance of the IEC 61400-25 series implementations are application-specific. The IEC 61400-25 series does not guarantee a certain level of performance. This is beyond the scope of the IEC 61400-25 series. However there is no underlying limitation in the communications technology to prevent high-speed application (millisecond level responses).

WIND TURBINES –

Part 25-4: Communications for monitoring and control of wind power plants – Mapping to communication profile

1 Scope

The focus of the IEC 61400-25 series is on the communications between wind power plant components such as wind turbines and actors such as SCADA systems. Internal communication within wind power plant components is outside the scope of the IEC 61400-25 series.

The IEC 61400-25 series is designed for a communication environment supported by a client-server model. Three areas are defined, that are modelled separately to ensure the scalability of implementations:

- 1) wind power plant information model,
- 2) information exchange model, and
- 3) mapping of these two models to a standard communication profile.

The wind power plant information model and the information exchange model, viewed together, constitute an interface between client and server. In this conjunction, the wind power plant information model serves as an interpretation frame for available wind power plant information. The wind power plant information model is used by the server to offer the client a uniform, component-oriented view of the wind power plant data. The information exchange model reflects the whole active functionality of the server. The IEC 61400-25 series enables connectivity between a heterogeneous combination of client and servers from different manufacturers and suppliers.

As depicted in Figure 1, the IEC 61400-25 series defines a server with the following aspects:

- Information provided by a wind power plant component, for example, ‘wind turbine rotor speed’ or ‘total power production of a certain time interval’ is modelled and made available for access. The information modelled in the IEC 61400-25 series is defined in IEC 61400-25-2.
- Services to exchange values of the modelled information, defined in IEC 61400-25-3.
- Mapping to a communication profile, providing a protocol stack to carry the messages, i.e. the service requests and responses and the values from the modelled information (IEC 61400-25-4).

IEC 61400-25-5 defines test cases associated with information, services and protocol stacks for conformance testing of both servers and clients.

The IEC 61400-25 series only defines how to model the information, information exchange and mapping to specific communication protocols. The IEC 61400-25 series excludes a definition of how and where to implement the communication interface, the application program interface and implementation recommendations. However, the objective of the IEC 61400-25 series is that the information associated with a single wind power plant component (such as a wind turbine) is accessible through a corresponding logical device.

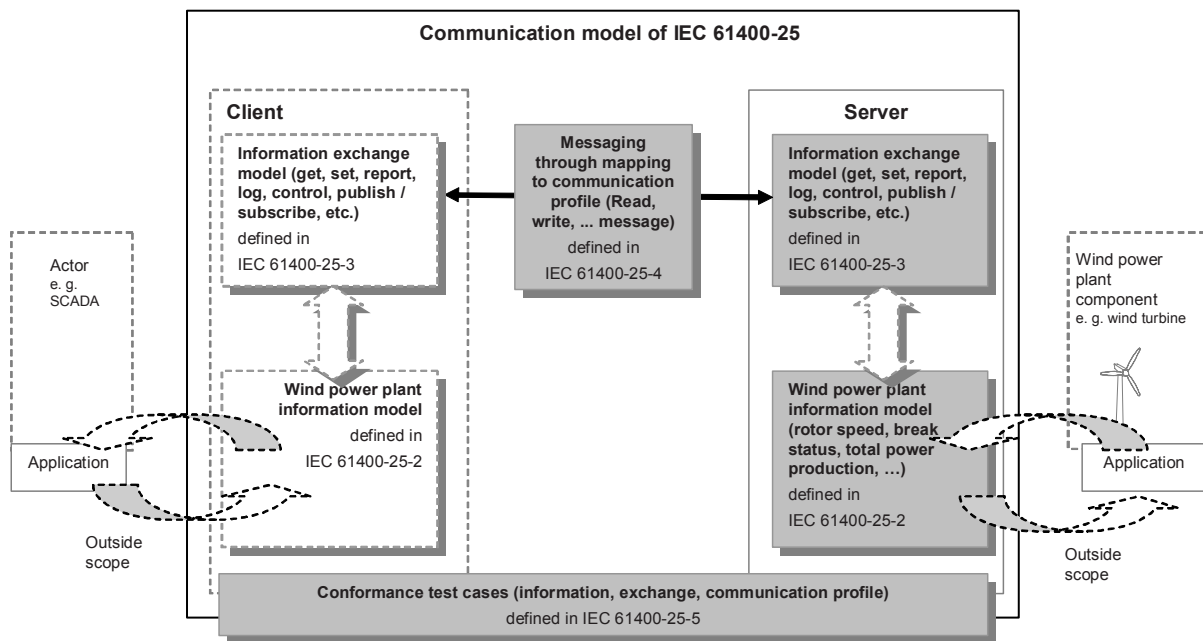
This part of the IEC 61400-25 series specifies the specific mappings to protocol stacks encoding the messages required for the information exchange between a client and a remote server for:

- data access and retrieval,
- device control,
- event reporting and logging,
- publisher/subscriber,
- self-description of devices (device data dictionary),
- data typing and discovery of data types.

The mappings specified in this part of IEC 61400-25 comprise:

- a mapping to SOAP-based web services,
- a mapping to OPC/XML-DA,
- a mapping to IEC 61850-8-1 MMS,
- a mapping to IEC 60870-5-104,
- a mapping to DNP3.

All mappings are optional, but at least one optional mapping shall be selected in order to be compliant with this part of IEC 61400-25.



IEC 1370/08

Figure 1 – Conceptual communication model of IEC 61400-25 series

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 60870-5-104:2006, *Telecontrol equipment and systems – Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles*

IEC 61400-25 (all parts), *Wind turbines – Part 25: Communications for monitoring and control of wind power plants*

IEC 61850-7-2:2003, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substations and feeder equipment – Abstract communication service interface (ACSI)*

IEC 61850-7-3:2003, *Communication networks and systems in substations – Part 7-3: Basic communication structure for substations and feeder equipment – Common data classes*

IEC 61850-8-1:2004, *Communication networks and systems in substations – Part 8-1: Specific Communication Service Mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3*

DNP3 Specification, Volume 2 – Volume 8:2007

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

actor

role a system plays in the context of monitoring and control, while it is not directly involved in wind power plant operation, such as Supervisory Control and Data Acquisition System (SCADA)

NOTE There are many other designations, for example, central management system, monitoring and control system, remote control system.

3.2

alarm

state information. Statement of safety intervention by the wind turbine control system (i.e on/off)

3.3

command

controllable data for system behaviour (enable/disable, active/deactivate, etc.)

3.4

communication function

used by an actor to configure, perform and monitor the information exchange with wind power plants, for example operational and management function

3.5

control

operational function used for changing and modifying, intervening, switching, controlling, parameterisation and optimising of wind power plants

3.6

data retrieval

operational function used for collecting of wind power plant data

3.7

diagnostics

management function used to set up and provide for self-monitoring of the communication system

3.8

electrical system

component of a wind power plant responsible for collecting and transmitting the energy produced in wind turbines

3.9

event

state transition (status, alarm, command)

3.10

function

task that is performed in the control centre or the wind power plant

NOTE Generally, a function consists of sub functions that exchange data with each other. Depending on the function definition, functions themselves exchange data with other functions.

3.11

Intelligent Electronic Device

IED

any device incorporating one or more processors, with the capability to receive data from an external sender or to send data to an external receiver

NOTE For example, wind turbine controller. An IED may have connections as a client, or as a server, or both, with other IED.

3.12

information

content of communication. Information is defined as data (often processed and derived data, and information describing other data). The basic element is raw data from the wind power plant component, which should be processed into specified information according to the IEC 61400-25 series

NOTE Wind power plant information categories: source information (analogue and state information), control information, derived information (statistical and historical information).

3.13

information exchange

communication process between two systems, such as wind power component and actor, with the goal to provide and to get relevant information. Requires specific communication functions, consisting of one or more services

3.14

information model

represents the knowledge concerning functions and devices in which the functions are implemented

NOTE This knowledge is made visible and accessible through the means of the IEC 61400-25 series. The model describes in an abstract way a communication oriented representation of a real function or device.

3.15

log

historical information. Chronological list of source information for a period of time

3.16

logging

operational function. The praxis of recording sequential data often chronologically. The result of the logging is a log

3.17

logical device

entity that represents a set of typical wind power plant functions

3.18

management function

function required for the administration of the information exchange in a certain level

NOTE Management functions are user/access management, time synchronisation, diagnostics, and configuration.

3.19

mandatory

defined content shall be provided in compliance with the IEC 61400-25 series

3.20

measured data

sampled value of a process quantity with associated data attributes such as time stamp and quality

3.21

meteorological system

component of a wind power plant responsible for the monitoring of the ambient conditions, for example the wind speed, wind direction, pressure, temperature, etc.

NOTE It supplies data for various purposes for example to correlate the meteorological data to the electrical energy output by individual wind turbines to the potentially usable wind energy.

3.22

monitoring

operational function used for local or remote observation of a system or a process for any changes which may occur over time. The term can also be used for observation of the behaviour of a data value or a group of data values

3.23

operational function

function to obtain information and to send instructions for the normal daily operation of wind power plants

NOTE Types: monitoring, logging and reporting, data retrieval, control.

3.24

optional

defined content can be optionally provided in compliance to the IEC 61400-25 series

3.25

parameter

controllable information intended for obtaining or correcting system behaviour

3.26

processed data

measured value, with the associated data attributes such as time stamp and quality, which has been processed according the calculation method attribute

3.27

profile(s)

format(s) used by a particular protocol to transmit data objects or commands, etc.

3.28

protocol stack

a particular software implementation of a computer networking protocol suite

NOTE The terms are often used interchangeably. Strictly speaking, the suite is the definition of the protocols and the stack is the software implementation of them.

3.29

report

actual information sent by the function reporting

3.30

reporting

operational function to transfer data from a server to a client, initiated by a server application process

3.31

Supervisory Control and Data Acquisition SCADA

system based on a processor unit which receives information from IEDs, determines the control requirements and sends commands to IEDs. A computer system that, for example, the dispatchers use to monitor the power distribution throughout a service or control area

3.32

status

state condition of a component or system (st1/st2/..stn)

3.33

statistical information

the result of applying a statistical algorithm to a set of data in order to get, for example, minimum, maximum, mean, average, standard deviation, etc.

3.34

timing data

time duration of a specific state

3.35

time synchronisation

the coordination of occurrences to operate in unison with respect to time. This process can be a premeditated arrangement set forth on a parallel time scape, or it can be an observable coincidence in eventuality

3.36

three phase data

measured value in a three phase electrical circuit with associated data attributes such as time stamp, quality and calculation method

3.37

user/access management

management function used for setting up, modifying, deleting users (administratively), assigning access rights (administratively) and monitoring access

3.38

wind power plant

complete system consisting of any number of technical subsystems referred to in the IEC 61400-25 series as wind power plant components, for example one or more wind turbines.

NOTE The main objective of a wind power plant is to generate electrical energy from the wind.

3.39

wind power plant analogue information

continuous information concerning the actual condition or behaviour of a component or system

NOTE Types are, for example, measured value, processed value, three phase value, setpoint, parameter.

3.40

wind power plant component

technical system employed in the operation of wind power plants, such as wind turbine, meteorological, electrical and wind power plant management system

3.41

wind power plant management system

component of a wind power plant, which is responsible to ensure that the complete system adapts itself to the static and dynamic conditions and requirements of the electrical power connection (i.e., interoperation of the wind turbines with substation and other power network related devices)

NOTE A wind power plant management system may include other functions (for example shadow control functionality, noise or sound reduction, ice warning, lightning protection) not modelled in the IEC 61400-25 series.

3.42

wind turbine

main component of a wind power plant. It is responsible for generating energy and meets the task of using the wind potential of a certain location that converts kinetic wind energy into electric energy

4 Abbreviated terms

ACSI	Abstract Communication Service Interface (defined for example in IEC 61850-7-2)
A-Profile	Application profile
HTTP	HyperText Transfer Protocol
ICMP	Internet Control Message Protocol
IED	Intelligent Electronic Device
IEM	Information Exchange Model
IM	Information Model
IP	Internet Protocol
LCB	Log Control Block
LD	Logical Device
LN	Logical Node
LOG	Log
LPHD	Logical Node Physical Device
RCB	Report Control Block
RFC	Request For Comments
SCADA	Supervisory Control and Data Acquisition
SCL	Substation (system) Configuration Language (defined in IEC 61850-6)
SCSM	Specific Communication Service Mapping (defined e.g. in IEC 61850-8-1)
SOAP	Simple Object Access Protocol
TCP	Transmission Control Protocol
T-Profile	Transport profile
UDP	User Datagram Protocol
UUID	Universally Unique Identifier
WPP	Wind Power Plant
WSDL	Web Services Description Language
WT	Wind Turbine
XML	Extensible Mark-up Language
XPATH	XML Path Language

5 General overview

5.1 General

The mapping of the information model defined in IEC 61400-25-2 and information exchange model, defined in IEC 61400-25-3, are specified in this part of IEC 61400-25 with specific mappings given in five Annexes

- A. The wind power plant information exchange model mapped to a set of web services that provide a mapping for the information exchange services defined and referenced in IEC 61400-25-3.
- B. The wind power plant information exchange model mapped to an OPC XML-DA protocol stack that provide a mapping for the information exchange services defined and referenced in IEC 61400-25-3.
- C. The wind power plant information exchange model mapped to an IEC 61850-8-1 MMS protocol stack that provide a mapping for the information exchange services defined and referenced in IEC 61400-25-3.
- D. The wind power plant information exchange model mapped to an IEC 60870-5-104 protocol stack that provide a mapping for the information exchange services defined and referenced in IEC 61400-25-3.
- E. The wind power plant information exchange model mapped to a DNP3 protocol stack that provide a mapping for the information exchange services defined and referenced in IEC 61400-25-3.

Subclause 5.2 provides an overview of the relation between the information model, the information exchange services and the mapping to protocol stacks.

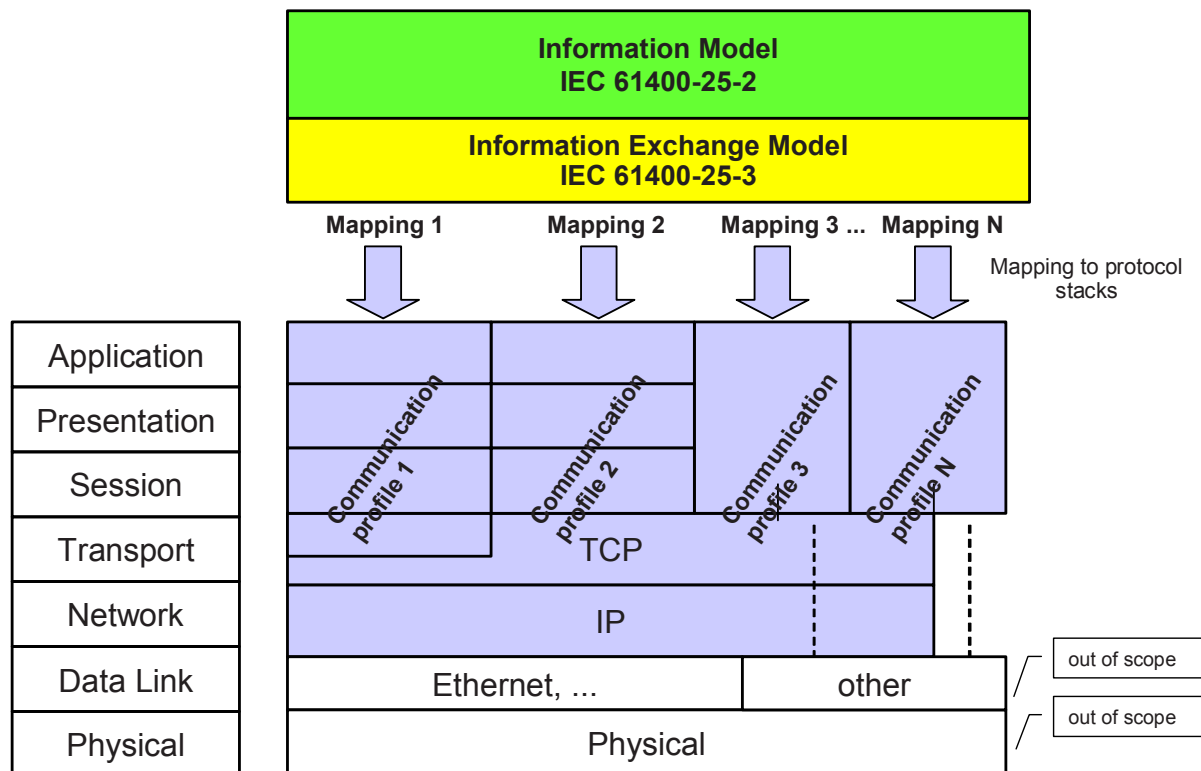
Subclause 5.3 provides an overview of the information exchange services specified in IEC 61400-25-3 and the capability of the mappings to protocol stacks.

Annex F provides a description of the time synchronization requirements to be implemented in order to be compliant with this part of the IEC 61400-25 series.

Annex G provides a readers guide to aid the understanding of the IEC 61400-25 series of standards. An example with a real system is used for explanation.

5.2 Mapping to protocol stacks

Multiple mappings are supported by IEC 61400-25-4, i.e. that more than one specific mapping are specified as normative. At least one mapping shall be selected in order to comply with this part of IEC 61400-25. The conceptual architecture of the multiple mapping is shown in Figure 2.



IEC 1371/08

Figure 2 – Communication profiles

5.3 Services of IEC 61400-25-3 mapped to protocol stacks

Table 1 provides an overview of the information exchange services specified in IEC 61400-25-3 and the degree of fulfillment provided by the specified mappings to protocol stacks. For each mapping a column is provided which describes the compliance to the services required. The M/O column indicates whether the service is defined in IEC 61400-25-3 as mandatory or optional. A “Y” in the column for a certain mapping stands for Yes, the service is supported, “N” means no support, and “P” means partial support, i.e. the service as defined in IEC 61400-25-3 is not completely supported.

Table 1 – Mapping overview of IEC 61400-25-3 services

Mapping capability overview						
IEC 61400-25-3 Services	M/O	Web-services	OPC XML-DA	IEC 61850-8-1 (MMS)	IEC 60870-5-104	DNP3
Associate	M	Y	Y	Y	Y	Y
Release	O	Y	Y	Y	Y	N
Abort	O	Y	Y	Y	N	N
GetServerDirectory	O	Y	Y	Y	N	Y
GetLogicalDeviceDirectory	O	Y	Y	Y	N	Y
GetLogicalNodeDirectory	O	Y	Y	Y	N	N
GetDataValues	M	Y	Y	Y	Y	Y
SetDataValues	M	Y	Y	Y	Y	Y
GetDataDirectory	O	Y	Y	Y	N	N
GetDataDefinition	O	Y	Y	Y	N	N
GetDataSetValues	M	Y	P ^a	Y	N	Y
SetDataSetValues	O	Y	N	Y	N	Y
CreateDataSet	O	Y	N	Y	N	N
DeleteDataSet	O	Y	N	Y	N	N
GetDataSetDirectory	O	Y	N	Y	N	N
Report	O	Y	Y	Y	Y	N
GetBRCBValues	O	Y	N	Y	N	N
SetBRCBValues	O	Y	N	Y	N	N
GetURCBValues	O	Y	N	Y	N	N
SetURCBValues	O	Y	N	Y	N	N
AddSubscription	O	Y	Y	Y	N	N
RemoveSubscription	O	Y	Y	Y	N	N
GetLCBValues	O	Y	N	Y	N	N
SetLCBValues	O	Y	N	Y	N	N
GetLogStatusValues	O	Y	N	Y	N	N
QueryLogByTime	O	Y	N	Y	N	N
QueryLogAfter	O	Y	N	Y	N	N
Select	O	Y	Y	Y	Y	Y
SelectWithValue	O	Y	Y	Y	Y	Y
Cancel	O	Y	Y	Y	Y	N
Operate	M	Y	Y	Y	Y	Y
CommandTermination	O	Y	Y	Y	Y	Y
TimeActivatedOperate	O	Y	Y	Y	N	N
^a The level of support is further described in B.5.7.3.5.						

Annex A (normative)

Specific communication service mapping – Definition and mapping to Web Services

A.1 General

A.1.1 Introduction to definition and mapping to Web Services

This Annex describes a solution including the definition and mapping of the IEC 61400-25-2 and IEC 61400-25-3 Information Model and Information Exchange Classes and Model services into objects and Web Services. The Annex describes a complete communication solution defined by a WSDL file applicable for implementation of communication with a wind power plant.

This Annex includes the following Clauses:

- Clause A.1 provides a general introduction to the mapping to WebServices.
- Clause A.2 provides the list of normative references for mapping to WebServices.
- Clause A.3 provides a list of abbreviated terms used in Annex A.
- Clause A.4 provides the mapping of the information model to WebServices.
- Clause A.5 provides the mapping of the information exchange model to WebServices.
- Clause A.6 provides the protocol stack details.
- Clause A.7 provides the WSDL specification for the mapping to WebServices. The binding style selected in the WSDL specification is the document/literal wrapped.

A.1.2 Scope of the definition and mapping to Web Services

The scope of the definition and mapping to Web Services is the exchange of process information required for operational purposes based on a client – server association.

The information model and the information exchange model constitutes the interface specification between a client and a server. The information model provides an interpretation frame for the exposed wind power plant data and is used by the server to offer the associated client a uniform and component-oriented view of the wind power plant data.

The amount of information provided by the server can vary, depending on the range of optional data offered by the various manufacturer.

Clients can be local, regional or placed in nationwide control centres that exchange information in order to monitor and control the wind power plant.

A.1.3 The mapping architecture

The mapping architecture consists of three parts:

- 1) Mapping of the information model.
- 2) Mapping of the data classes.
- 3) Mapping of the information exchange services.

The specified mapping for this Annex is based on using SOAP/XML to exchange the information modelled of the wind power plant components in a server – client based architecture.

The wind power plant information model defined in IEC 61400-25-2 shall be mapped to a hierarchical structure.

The conceptual mapping is depicted in Figure A.1. The wind power plant information model of IEC 61400-25-2 are intended to be preserved when mapped to Web Services. This especially means that:

- the server implements the hierarchical wind power plant information model of IEC 61400-25-2 (IM) that can be retrieved by the services according to Table A.1.
- the client implements the wind power plant information model by configuration.
- the client station accesses the hierarchical wind power plant information model of IEC 61400-25-2 through the services provided by Web Services mapping to exchange information.

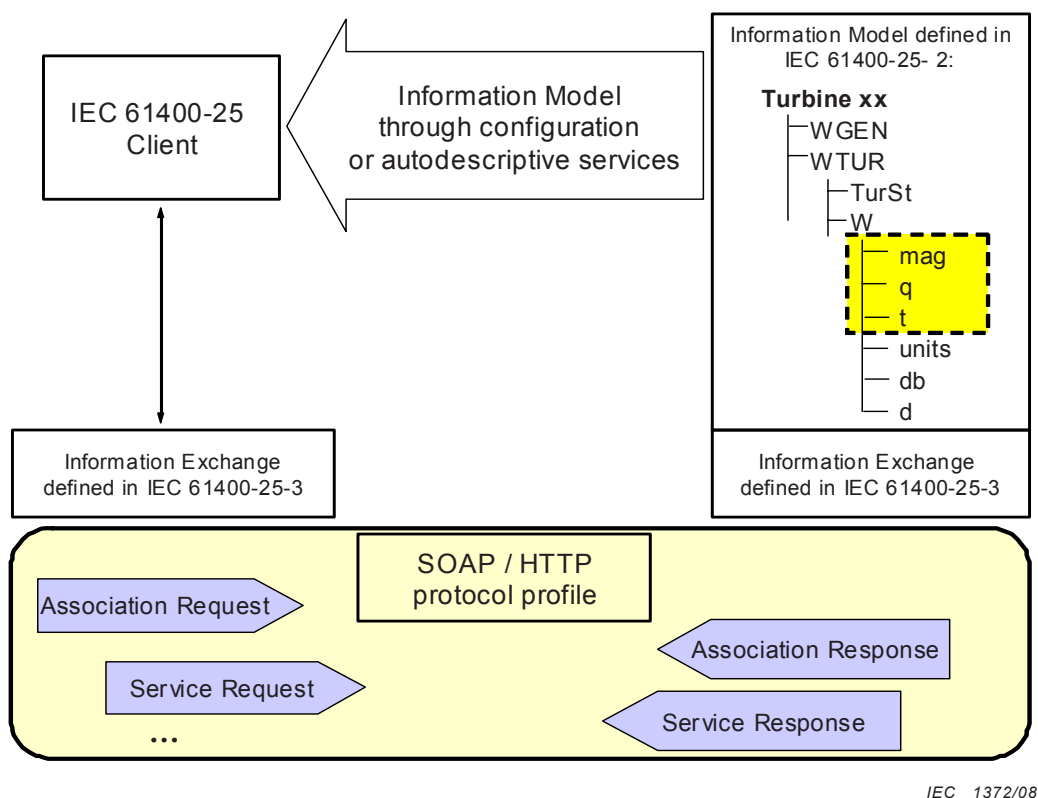


Figure A.1– Mapping architecture (conceptual)

Table A.1 – Web Services mapping overview of IEC 61400-25 IM and IEM

IEC 61400-25-2 IM Class IEC 61400-25-3 IEM Class	IEC 61400-25-3 IEM Services	M/O	Included in the mapping	Maps to objects and Web Services
SERVER			Y	tServer
	GetServerDirectory	O	Y	GetServerDirectory
ASSOCIATION				
	Associate	M	Y	Associate
	Release	O	Y	Release
	Abort	O	Y	Abort
LOGICAL-DEVICE			Y	tLD
	GetLogicalDeviceDirectory	O	Y	GetLogicalDeviceDirectory

IEC 61400-25-2 IM Class IEC 61400-25-3 IEM Class	IEC 61400-25-3 IEM Services	M/O	Included in the mapping	Maps to objects and Web Services
LOGICAL-NODE			Y	tLN
	GetLogicalNodeDirectory	O	Y	GetLogicalNodeDirectory
DATA			Y	tData
	GetDataValues	M	Y	GetDataValues
	SetDataValues	M	Y	SetDataValues
	GetDataDirectory	O	Y	GetDataDirectory
	GetDataDefinition	O	Y	GetDataDefinition
DATA-SET			Y	tDataSet
	GetDataSetValues	M	Y	GetDataSetValues
	SetDataSetValues	O	Y	SetDataSetValues
	CreateDataSet	O	Y	CreateDataSet
	DeleteDataSet	O	Y	DeleteDataSet
	GetDataSetDirectory	O	Y	GetDataSetDirectory
REPORTING				
	AddSubscription	O	Y	AddSubscription
	RemoveSubscription	O	Y	RemoveSubscription
	Report	O	Y	ReportRequest/Response
BRCB				tBRCB
	GetBRCBValues	O	Y	GetBRCBValues
	SetBRCBValues	O	Y	SetBRCBValues
URCB				tURCB
	GetURCBValues	O	Y	GetURCBValues
	SetURCBValues	O	Y	SetURCBValues
LOG			Y	tLOG
	GetLogStatusValues	O	Y	GetLogStatusValues
	QueryLogByTime	O	Y	QueryLogByTime
	QueryLogAfter	O	Y	QueryLogAfter
LCB				tLCB
	GetLCBValues	O	Y	GetLCBValues
	SetLCBValues	O	Y	SetLCBValues
CONTROL				
	Select	O	Y	Select
	SelectWithValue	O	Y	SelectWithValue
	Cancel	O	Y	Cancel
	Operate	M	Y	Operate
	CommandTermination	O	Y	CommandTermination
	TimeActivatedOperate	O	Y	TimeActivatedOperate
The M/O column in Table A.1 indicates whether the service is defined in IEC 61400-25-3 as mandatory or optional. A "Y" in the column stands for Yes, the service is supported, whereas an "N" means no support.				

A.2 References specific to Web Services

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 61400-25 (all parts), *Wind turbines – Part 25: Communications for monitoring and control of wind power plants*

IEC 61850-6:2004, *Communication networks and systems in substations – Part 7-2: Configuration description language for communication in electrical substations related to IEDs*

ISO/IEC 10646:2003, *Information technology – Universal Multiple-Octet Coded Character Set (UCS)*

ISO 639-2, *Codes for the representation of names of languages – Part 2: Alpha-3 code*

W3C, *Web Services Architecture*, <http://www.w3.org/TR/2002/WD-ws-arch-20021114/>

W3C, *Extensible Markup Language (XML) 1.0*, <http://www.w3.org/TR/2000/REC-xml-20001006>

W3C, *Name spaces in XML*, <http://www.w3.org/TR/REC-xml-names>

W3C, *XML Schema Part 0: Primer*, <http://www.w3.org/TR/xmlschema-0>

W3C, *XML Schema Part 1: Structures*, <http://www.w3.org/TR/xmlschema-1>

W3C, *XML Schema Part 2: Data Types*, <http://www.w3.org/TR/xmlschema-2>

SOAP ver. 1.1, W3C Note "*Simple Object Access Protocol (SOAP) 1.1*", 8 May 2000.
<http://www.w3.org/TR/2006/NOTE-soap11-ror-httpbinding-20060321/#reqoptrespbinding> and
<http://www.w3.org/TR/2000/NOTE-SOAP-20000508/>

RFC 791, *Internet Protocol specification (IP)*

RFC 792, *Internet Control Message Protocol (ICMP)*

RFC 793, *Transmission Control Protocol (TCP)*

RFC 826, *Ethernet Address Resolution Protocol*

RFC 919, *Broadcasting internet datagrams*

RFC 922, *Broadcasting internet datagrams in presence of subnets*

RFC 950, *Internet Standard Subnetting Procedure*

RFC 1112, *Host Extensions for IP Multicasting*

RFC 2616, *Hypertext Transfer Protocol – HTTP/1.1*

RFC 2817, *Upgrading to TLS Within HTTP/1.1*

RFC 2246, *Transport Layer Security (TLS) protocol*

RFC 4122, *Universally Unique Identifier (UUID) URN Namespace*

A.3 Abbreviated terms

DA	Data Attribute
HTTP	Hyper Text Transfer Protocol
ICMP	Internet Control Message Protocol
IED	Intelligent Electronic Device
IEM	Information Exchange Model
IM	Information Model
IP	Internet Protocol
LCB	Log Control Block
LD	Logical Device
LN	Logical Node
LOG	Log
LPHD	Logical Node Physical Device
RCB	Report Control Block
SCADA	Supervisory Control and Data Acquisition
SCSM	Specific Communication Service Mapping (defined in IEC 61850-8-1)
SOAP	Simple Object Access Protocol
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UUID	Universally Unique Identifier
WPP	Wind Power Plant
WSDL	Web Services Description Language. Litteral/wrapped
WT	Wind Turbine
XML	Extensible Mark-up Language
XPATH	XML Path Language

A.4 Mapping of the IEC 61400-25 Information Model to Web Services

A.4.1 General introduction to Annex A

The main characteristics of the classes defined in IEC 61400-25-2 mapped to web services are listed in Table A.2.

Table A.2 – Mapping the IEC 61400-25 IM to Web Services

IEC 61400-25-2 IM Classes	Mapping to objects and Web Services
SERVER	tServer
LOGICAL-DEVICE	tLD
LOGICAL-NODE	tLN
DATA classes	tDATA
COMMON-DATA classes	tCDC
DATA-ATTRIBUTE type	tDataAttribute
DA-COMPONENT type	tDAType

The mapping of the basic data types attributes are depicted in Table A.3.

Table A.3 – Mapping of IEC 61400-25 data attribute basic types

IEC 61400-25 name	Value Range/explanation	Mapping to objects and Web Services
BOOLEAN	True False	according to tBasicType
INT8	–128 to +127	according to tBasicType
INT16	–32 768 to +32 767	according to tBasicType
INT24	–8 388 608 to 8 388 607	according to tBasicType
INT32	-2^{32} to $(2^{32})-1$	according to tBasicType
INT128	-2^{127} to $(2^{127})-1$	according to tBasicType
INT8U	0 to 255	according to tBasicType
INT16U	0 to 65 535	according to tBasicType
INT24U	0 to 16 777 215	according to tBasicType
INT32U	0 to 4 294 967 295	according to tBasicType
FLOAT32	Single precision floating point	according to tBasicType
FLOAT64	Double precision floating point	according to tBasicType
ENUMERATED	Ordered set of values defined as integers and text	according to tBasicType
CODED ENUM	Order set of values defined as integer with an explicit defined number of bits	according to tBasicType
OCTET STRING	Hexadecimal binary	according to tBasicType
VISIBLE STRING	A string of characters encoded as a UNICODE string	according to tBasicType
UNICODE STRING	Unicode strings are non-null-terminated octet sequences that are based on the UTF-8 transformation format of ISO/IEC 10646 which encodes character that can be up to six octets	according to tBasicType

The wind power plant information model specified in IEC 61400-25-2 is defined by LOGICAL-NODES classes, DATA classes, COMMON-DATA classes, DATA-ATTRIBUTE types, and DA-COMPONENT types.

Objects in the information model are named according to the methods defined in IEC 61400-25-2:2006, Clause 5 and 6.

The first part of an object name is a user-defined Logical Device (LD) name of 64 characters maximum length, followed by a slash ("/") used as a separator.

Figure A.2 illustrates the construction of the portion of the name following the slash that is composed of standardized components. There are three sets of tables involved in constructing the name:

- Logical Node (LN) definitions found in IEC 61400-25-2:2006, Clause 6.
- Common Data Class definitions (DATA) found in IEC 61400-25-2:2006, Subclause 7.3.
- Common Data Attribute definitions (DA) found in IEC 61400-25-2:2006, Subclause 7.2.

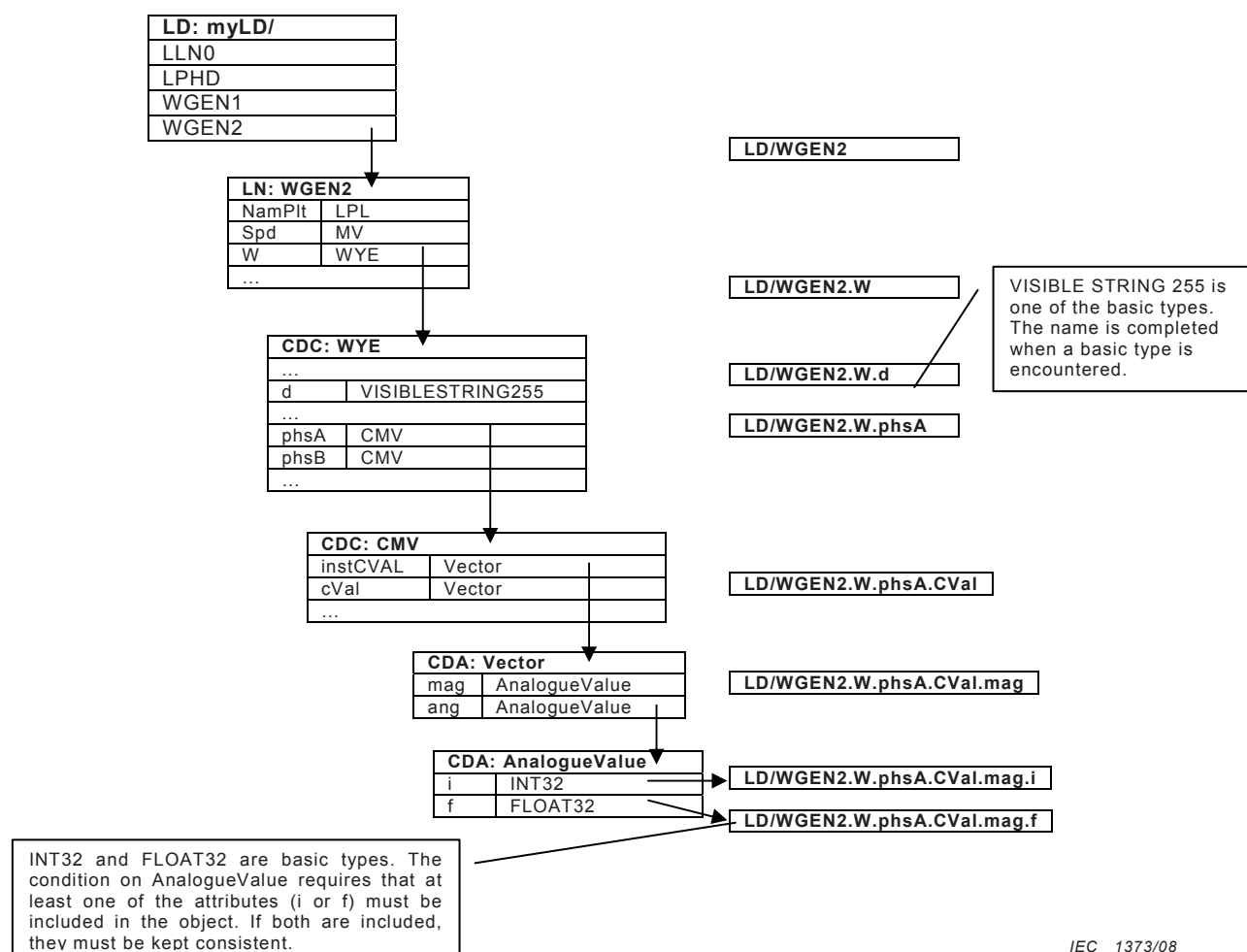


Figure A.2 – Naming structure applied in the IEC 61400-25 series (conceptual)

In addition to the defined components there are a set of basic data types defined in IEC 61400-25-2:2006, Table 42. The final component of a name will be a data attribute that has a basic data type.

The logical node (LN) definitions have lists of components that are DATA. The DATA definitions have lists of components that may be either DA (known as "Simple" CDC) or other DATA (known as "Composite" CDC). An example of a case in which one DATA uses a component consisting of another DATA is that for wye-connected electrical objects (WYE) where the components are each of class Complex Measured Value (CMV) that is also a DATA class.

The components of DATA are DA, that can be either an attribute that has a basic data type (known as a "Simple" component, that thereby becomes the final component in the name) or is another DA (known as a "Composite" component).

Construction of a name begins by entering the collection of LN tables and finding the LN Name, which is appended to the name just following the slash separator. The LN Name can start with an optional LN prefix followed by the standardized LN class name and it ends with a mandatory LN instance ID (for example, the second WGEN in an LD is denoted WGEN2). The LN instance ID is followed by a dot (".") separator.

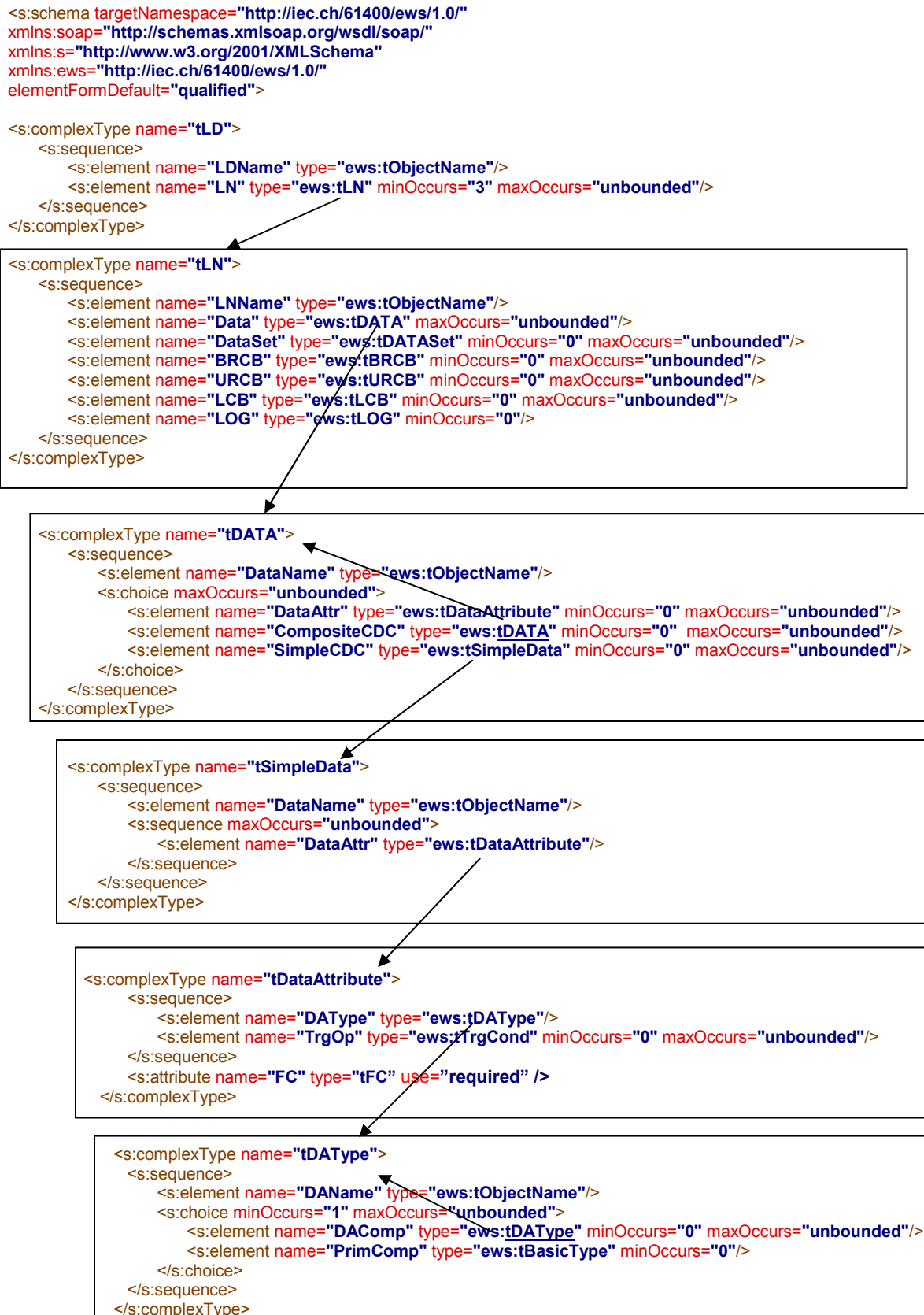
Having found the appropriate LN table, the next relevant component on the list is selected. The component name is appended after the dot separator and is followed by another dot separator. The LN table will indicate the DATA class of that component. The proper table among the DATA definitions is then selected and the next relevant component on the list for that DATA definition is selected. The name of that component is appended after the last dot separator.

If the component is a DA and is primitive, the name is completed. Otherwise, the component may be another DATA or a DA with a definition in the DA tables. In either of the latter cases, the appropriate table is re-entered and the next relevant component selected from the list. If that component is not a primitive DA, the appropriate tables are re-entered, appending names and dot separators until a primitive component is reached.

The schema shall be used for all services that carry structure and/or data values of a given instance of the wind power plant information model derived from the classes defined in this part of IEC 61400-25.

The WSDL structures shown in Table A.4 are to facilitate understanding of the specification. The exact WSDL specifications are given in A.7, which shall be implemented in order to comply with this part of IEC 61400-25.

Table A.4 – XML schema for wind power information model



A.4.2 SERVER class

The SERVER class shall be mapped as defined in the following text.

```
<s:complexType name="tServer">
  <s:annotation>
    <s:documentation>Container for Server object</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="ServerAccessPoint" type="s:string" maxOccurs="unbounded"/>
    <s:element name="LD" type="ews:tLD" maxOccurs="unbounded"/>
  </s:sequence>
</s:complexType>
```

All elements shall be as defined and referenced in 9.3 of IEC 61400-25-3:2006.

A.4.3 LOGICAL-DEVICE class

The LOGICAL-DEVICE class shall be mapped as defined in the following text.

```
<s:complexType name="tLD">
  <s:annotation>
    <s:documentation>Container for Logical Device object</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="LDName" type="ews:tObjectName"/>
    <s:element name="LN" type="ews:tLN" minOccurs="3" maxOccurs="unbounded"/>
  </s:sequence>
</s:complexType>
```

All elements shall be as defined and referenced in 9.4 of IEC 61400-25-3:2006.

A.4.4 LOGICAL-NODE class

The LOGICAL-NODE class shall be mapped as defined in the following text.

```
<s:complexType name="tLN">
  <s:annotation>
    <s:documentation>Container for Logical Node object</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="LNName" type="ews:tObjectName"/>
    <s:element name="Data" type="ews:tDATA" maxOccurs="unbounded"/>
    <s:element name="DataSet" type="ews:tDATASet" minOccurs="0" maxOccurs="unbounded"/>
    <s:element name="BRCB" type="ews:tBRCB" minOccurs="0" maxOccurs="unbounded"/>
    <s:element name="URCB" type="ews:tURCB" minOccurs="0" maxOccurs="unbounded"/>
    <s:element name="LCB" type="ews:tLCB" minOccurs="0" maxOccurs="unbounded"/>
    <s:element name="LOG" type="ews:tLOG" minOccurs="0"/>
  </s:sequence>
</s:complexType>
```

All elements shall be as defined and referenced in 9.5 of IEC 61400-25-3:2006.

A.4.5 DATA class

The DATA class shall be mapped as defined in the following text.

```
<s:complexType name="tDATA">
  <s:annotation>
    <s:documentation>Container for DATA object</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="DataName" type="ews:tObjectName"/>
    <s:choice maxOccurs="unbounded">
      <s:element name="DataAttr" type="ews:tDataAttribute" minOccurs="0" maxOccurs="unbounded"/>
      <s:element name="CompositeCDC" type="ews:tDATA" minOccurs="0" maxOccurs="unbounded"/>
      <s:element name="SimpleCDC" type="ews:tSimpleData" minOccurs="0" maxOccurs="unbounded"/>
    </s:choice>
  </s:sequence>
</s:complexType>
```

The CompositeCDC and the SimpleCDC is a specialization of the DATA class for this part of IEC 61400-25, all other elements shall be as defined in 9.6 of IEC 61400-25-3:2006.

A.4.6 DATA-SET class

The DATA-SET class shall be mapped as defined in the following text.

```
<s:complexType name="tDATASet">
  <s:annotation>
    <s:documentation>Container for DATA-SET object</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="DSName" type="ews:tObjectName"/>
    <s:element name="DSMemberRef" type="ews:tFcdFcdaType" maxOccurs="unbounded"/>
  </s:sequence>
</s:complexType>
```

All elements shall be as defined and referenced in 9.7 of IEC 61400-25-3:2006.

A.4.7 DATA ATTRIBUTE definition

The DATA ATTRIBUTE definition shall be mapped as defined in the following text.

```
<s:complexType name="tDataAttribute">
  <s:annotation>
    <s:documentation>Container for DataAttributes</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="DAType" type="ews:tDAType"/>
    <s:element name="TrgOp" type="ews:tTrgCond" minOccurs="0" maxOccurs="1"/>
  </s:sequence>
  <s:attribute name="FC" type="ews:tFC" use="required" />
</s:complexType>
```

All elements shall be as defined and referenced in 9.6 of IEC 61400-25-3:2006.

A.4.8 DAType class

The DAType class shall be mapped as defined in the following text.

```
<s:complexType name="tDAType">
  <s:annotation>
    <s:documentation>Container for DAType</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:choice minOccurs="1" maxOccurs="unbounded">
      <s:element name="DAComp" type="ews:tDAType" minOccurs="0" maxOccurs="unbounded"/>
      <s:element name="PrimComp" type="ews:tBasicType" minOccurs="0"/>
    </s:choice>
    <!-- Specialisation of DAType-->
  </s:sequence>
  <s:attribute name="DAName" type="ews:tObjectName" use="required"/>
  <s:attribute name="ix" type="s:integer" use="optional"/><!-- Index of Array of Composite Data Attribute as ARRAY of AnalogueValue-->
</s:complexType>
```

DAComp and PrimComp is a specialization of the DAType class for this part of IEC 61400-25, all elements shall be as defined in 9.6 of IEC 61400-25-3:2006.

A.4.9 REPORT-CONTROL-BLOCK class

Report control block provides the mechanism of spontaneously reporting of data values on specific criteria (e.g., on change of value, on change of quality information, or simply periodically). The behaviour of a report control is determined by the values of the attributes of the corresponding control block instances (e.g., enable/disable reporting, use of sequence number). A report control block references an instance of a data set to specify the data values to be monitored and reported spontaneously.

The BUFFERED-REPORT-CONTROL-BLOCK (BRCB) provides the functionality to ensure that a server sends a sequence-of-events even if the communication is temporarily interrupted. With the UNBUFFERED-REPORT-CONTROL-BLOCK (URCB) a server does not need to buffer events in case of communication interruption.

All attributes and behaviour of the report control block classes (BRCB and URCB) as defined in 9.8 of IEC 61400-25-3:2006 shall be mapped as follows.

A.4.10 BUFFERED-REPORT-CONTROL-BLOCK Class (BRCB)

The BRCB class shall be mapped as defined in the following text.

```
<s:complexType name="tBRCB">
  <s:annotation>
    <s:documentation>Container for BRCB object</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="BRCBName" type="ews:tObjectName"/>
    <s:element name="RptID" type="ews:tstring65"/>
    <s:element name="RptEna" type="s:boolean"/>
    <s:element name="DataSet" type="ews:tDataSetReference"/>
    <s:element name="ConfRev" type="s:unsignedInt"/>
    <s:element name="OptFlds" type="s:tOptFldsBRCB"/>
    <s:element name="BufTm" type="s:unsignedInt"/>
    <s:element name="SqNum" type="s:unsignedShort"/>
    <s:element name="TrgOp" type="ews:tTrgCond"/>
    <s:element name="IntgPd" type="ews:unsignedInt"/>
    <s:element name="GI" type="s:boolean"/>
    <s:element name="PurgeBuf" type="s:boolean"/>
    <s:element name="EntryID" type="ews:tEntryID"/>
    <s:element name="TimeOfEntry" type="ews:tTimeStamp"/>
  </s:sequence>
</s:complexType>
<!--
-->
<s:complexType name="tOptFldsBRCB">
  <s:annotation>
    <s:documentation>Optional fields for BRCB</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="seqNum" type="s:boolean" />
    <s:element name="timeStamp" type="s:boolean" />
    <s:element name="reasonCode" type="s:boolean" />
    <s:element name="dataSet" type="s:boolean" />
    <s:element name="dataRef" type="s:boolean" />
    <s:element name="bufOvfl" type="s:boolean" />
    <s:element name="entryID" type="s:boolean" />
    <s:element name="configRef" type="s:boolean" />
  </s:sequence>
</s:complexType>
```

All elements shall be as defined and referenced in 9.8 of IEC 61400-25-3:2006.

A.4.11 UNBUFFERED REPORT CONTROL BLOCK Class (URCB)

The URCB class shall be mapped as defined in the following text.

```
<s:complexType name="tURCB">
  <s:annotation>
    <s:documentation>Container for UNBUFFERED REPORT CONTROL BLOCK object</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="URCBName" type="ews:tObjectName"/>
    <s:element name="RptID" type="ews:tstring65"/>
    <s:element name="RptEna" type="s:boolean"/>
    <s:element name="Resv" type="s:boolean"/>
    <s:element name="DatSet" type="ews:tDataSetReference"/>
    <s:element name="ConfRev" type="s:unsignedInt"/>
    <s:element name="OptFlds" type="ews:tOptFldsURCB"/>
    <s:element name="BufTm" type="s:unsignedInt"/>
    <s:element name="SqNum" type="s:unsignedShort"/>
    <s:element name="TrgOp" type="ews:tTrgCond"/>
    <s:element name="IntgPd" type="s:unsignedInt"/>
    <s:element name="GI" type="s:boolean"/>
  </s:sequence>
</s:complexType>
<!--
-->
<s:complexType name="tOptFldsURCB">
  <s:annotation>
    <s:documentation>Optional fields for URCB</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="seqNum" type="s:boolean" />
    <s:element name="timeStamp" type="s:boolean" />
    <s:element name="reasonCode" type="s:boolean" />
    <s:element name="dataSet" type="s:boolean" />
    <s:element name="dataRef" type="s:boolean" />
    <s:element name="reserved" type="s:boolean" />
    <s:element name="configRev" type="s:boolean" />
  </s:sequence>
</s:complexType>
```

All elements shall be as defined and referenced in 9.8 of IEC 61400-25-3:2006.

A.4.12 LOG-CONTROL-BLOCK class (LCB)

LOG-CONTROL-BLOCK class shall be mapped as defined in the following text.

```
<s:complexType name="tLCB">
  <s:annotation>
    <s:documentation>Container for LOG-CONTROL-BLOCK object</s:documentation>
  </s:annotation>
  <s:sequence>
    <s:element name="LCBName" type="ews:tObjectName"/>
    <s:element name="LogEna" type="s:boolean"/>
    <s:element name="DatSet" type="ews:tDataSetReference"/>
    <s:element name="OptFlds" type="ews:tOptFldsLCB"/>
    <s:element name="TrgOp" type="ews:tTrgCond"/>
    <s:element name="IntgPd" type="s:unsignedInt"/>
    <s:element name="LogRef" type="ews:tObjectReference"/>
  </s:sequence>
</s:complexType>
```

All elements shall be as defined and referenced in 9.9 of IEC 61400-25-3:2006.

A.4.13 LOG class

the LOG class shall mapped as defined in the following text.

```
<s:complexType name="tLOG">
  <s:annotation>
    <s:documentation>Container for LOG object</s:documentation>
```

```

</s:annotation>
<s:sequence>
  <s:element name="LogName" type="ews:tObjectName"/>
  <s:element name="OldEntrTm" type="ews:tTimeStamp"/>
  <s:element name="NewEntrTm" type="ews:tTimeStamp"/>
  <s:element name="OldEntr" type="s:unsignedInt"/>
  <s:element name="NewEntr" type="s:unsignedInt"/>
  <s:sequence maxOccurs="unbounded">
    <s:element name="LogEntry" type="ews:tLOGEntry"/>
  </s:sequence>
</s:sequence>
</s:complexType>

```

All elements shall be as defined and referenced in 9.9 of IEC 61400-25-3:2006.

A.5 Mapping of the Information Exchange Model to Web Services

A.5.1 General

The wind power plant information exchange services specified in the IEC 61400-25-3 IEM shall be mapped to the services defined in this clause.

All service names and definitions given in Clause A.5 have been inherited from IEC 61850-7-2 except for the services AddSubscription defined in A.5.7.2 and RemoveSubscription defined in A.5.7.3.

All definitions given in this clause using CODED ENUM shall begin with 1, except where the values are explicitly defined in IEC 61400-25-2.

A.5.2 SERVER class service mapping

A.5.2.1 General

The SERVER class services shall be mapped to Web Services as depicted in Table A.5.

Table A.5 – Server class services mapped to Web Services

IEC 61400-25-2 IM Class IEC 61400-25-3 IEM Class	IEC 61400-25-3 IEM Services	Maps to objects and Web Services
SERVER		tServer
	GetServerDirectory	GetServerDirectory
ASSOCIATION		
	Associate	Associate
	Release	Release
	Abort	Abort

A.5.2.2 GetServerDirectory

A.5.2.2.1 General

A client shall use the GetServerDirectory services to retrieve the namespace of LOGICAL-DEVICES exposed and thus accessible to a client addressing the SERVER.

A.5.2.2.2 GetServerDirectoryRequest

The GetServerDirectoryRequest service shall be defined as follows:

```
<s:element name="GetServerDirectoryRequest">
  <s:complexType>
    <s:sequence>
      <s:element name="ObjClass" type="ews:tObjectClass"/>
    </s:sequence>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.6.

Table A.6 – GetServerDirectoryRequest

Tag Name	Description
GetServerDirectoryRequest	A service for a client to request a list of the names of all Logical device made visible and thus accessible to the requesting client.
ObjClass	A reference to a LOGICAL-DEVICE or a FILE reference.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.2.2.3 GetServerDirectoryResponse

The GetServerDirectoryResponse service shall be defined as follows:

```
<s:element name="GetServerDirectoryResponse">
  <s:complexType>
    <s:choice>
      <s:element name="LDRef" type="ews:tLogicalDeviceReference" minOccurs="0"
maxOccurs="unbounded"/>
      <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0" maxOccurs="1"/>
    </s:choice>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.7.

Table A.7 – GetServerDirectoryResponse

Tag Name	Description
GetServerDirectoryResponse	A server response to a client request on the list of logical devices hosted by the server.
LDRef	Logical Device object reference. The element shall be a unique path-name of a logical device.
ServiceError	An embedded error. The server shall use the element to indicate that the service requested was not successful. When this element is present in the response message, the client shall assume that the request is rejected by the server.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122. The Server shall mirror the UUID value received in the request message and return the same value in the response message.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.2.3 ASSOCIATION services mapping

The process of creating an association with a server shall be the step taking place before the data exchange takes place. The client shall identify itself to the server. The server shall approve the parameter values provided in the association request before a session between client and server shall continue.

A client and a server might have multiple associations, this is only limited by the implementation and accordingly beyond the scope of this part of IEC 61400-25.

The final step in a communication session shall be the release of the association. It enables the client to notify the server about its intention to release the association, so the server is able to de-allocate resources related to the association.

The server shall keep a time-out linked to each association established. If this timeout is exceeded without any service request from the client, it shall be considered that the communication is over and release any resource allocated. Any service request received with an invalid (not in use) association identifier shall return the "connection-lost" service error.

```
<s:enumeration value="connection-lost"/>
```

On the client side, the reception of the "connection-lost" service error shall be considered a communication lost so a new association shall be requested in order to exchange services with the server side.

If the client detects an abnormal situation that discontinues interchanging of services or if the server refuses the release of an association, the client may abort the association using the "AbortRequest" service.

The server cannot refuse this service. The only service error allowed in the AbortResponse is the "connection-lost" that means that the server considers the association to be released.

A.5.2.4 Associate

A.5.2.4.1 AssociateRequest

The AssociateRequest service shall be defined as follows:

```
<s:element name="AssociateRequest">
  <s:complexType>
    <s:sequence>
      <s:element name="UserName" type="s:string"/>
      <s:element name="Password" type="s:string"/>
      <s:element name="LocalID" type="s:string" minOccurs="0"/>
      <s:element name="MaxMessageSize" type="s:unsignedInt"/>
    </s:sequence>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.8.

Table A.8 – AssociateRequest

Tag Name	Description
AssociateRequest	AssociateRequest shall be the first message sent when establishing a connection to a server. This allows the client to set up properties for the session and the server to verify that these properties are set to a proper value. If a client tries to send any messages prior to an AssociateRequest, the response shall be a SOAP Fault with the fault code: Client.MustAssociate, but without any restrictions on the specific wording of the fault string. If the client is already logged on to the server and sends a AssociateRequest, the AssociateResponse shall contain a ServiceError.
UserName	The server shall use the UserName to identify the client as a registered user and if this is not possible, the server shall return an error in the AssociateResponse.
Password	The Password attribute shall be used by the server to verify that the requesting client is allowed to associate with the system. If the password verification is rejected, the server shall return an error in the AssociateResponse.
LocalID	The LocalID attribute shall be optional and could be used by the server to respond to a client request to select e.g. which language shall be used for display of the information requested. If no LocalID is supplied, the default selections defined in the nameplate shall be used. If this attribute is set to an invalid value, the server shall respond with an error. Valid range of LocalID shall be a three letter code according to ISO 639-2.
MaxMessageSize	Max number of octets the client are able to receive in one SOAP reply message from the server.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122.

EXAMPLE Body of the corresponding SOAP message for an AssociateRequest:

```
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:SOAP-ENC="http://schemas.xmlsoap.org/soap/encoding/">
  <SOAP-ENV:Body>
    <m:AssociateRequest xmlns:m="http://iec.ch/61400/ews/1.0/">
      <m:UserName>MyName</m:UserName>
      <m>Password>MyPassword</m>Password>
      <m:LocalID>ger</m:LocalID>
      <m:MaxMessageSize>MaxMessageSize</m:MaxMessageSize>
    </m:AssociateRequest>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

The LocalID specifies that the German language shall be applied in the association. The MaxMessageSize specify by the client gives the maximum number of octets that the client are be able to receive in one SOAP reply message.

A.5.2.4.2 AssociateResponse

The AssociateResponse shall be defined as follows:

```
<s:element name="AssociateResponse">
  <s:complexType>
    <s:choice>
      <s:sequence>
        <s:element name="MaxMessageSize" type="s:unsignedInt minOccurs="0"/>
        <s:element name="AssocID" type="ews:tAssocID" />
      </s:sequence>
      <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0" maxOccurs="1"/>
    </s:choice>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.9.

Table A.9 – AssociateResponse

Tag Name	Description
AssociateResponse	AssociateResponse shall be the response message by the server upon receiving a AssociateRequest. This message shall contain only an optional error and an optional ClientRequestHandle. The Client shall use the AssociateResponse to verify that the AssociateRequest has been successfully executed.
ServiceError	An embedded error. The server shall use the element to indicate that the service requested was not successful. When this element is present in the response message, the client shall assume that the request is rejected by the server.
MaxMessageSize	The MaxNumber of octet send in any message between the client and server.The maximum message size shall be less than or equal to the MaxMessageSize specified in the client AssociateRequest.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122. The Server shall mirror the UUID value received in the request message and return the same value in the response message.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

EXAMPLE Body of the corresponding SOAP message for AssociateResponse:

```
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:SOAP-ENC="http://schemas.xmlsoap.org/soap/encoding/">
  <SOAP-ENV:Body>
    <m:AssociateResponse xmlns:m="http://iec.ch/61400/ews/1.0/" UUID="xxxxxx">
      <m:MaxMessageSize>??</m:MaxMessageSize>
      <m:AssocID>??</m:AssocID>
    </m:AssociateResponse>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

A.5.2.5 Release

A.5.2.5.1 ReleaseRequest

The ReleaseRequest shall be defined as follows:

```
<s:element name="ReleaseRequest">
  <s:complexType>
    <s:annotation>
      <s:documentation>ReleaseRequest is the message used when releasing an
        association</s:documentation>
    </s:annotation>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.10.

Table A.10 – ReleaseRequest

Tag Name	Description
ReleaseRequest	ReleaseRequest shall be the last message sent when terminating the session. This allows the client to prepare the server for the closing of the session. If one or more client subscriptions is running on the server at the time ReleaseRequest is accepted, the identifier AssocID is used for identification of the subscription owner.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.2.5.2 ReleaseResponse

The ReleaseResponse shall be defined as follows:

```
<s:element name="ReleaseResponse">
  <s:complexType>
    <s:annotation>
      <s:documentation>ReleaseResponse is the message returned from a server when receiving a
      ReleaseRequest</s:documentation>
    </s:annotation>
    <s:sequence>
      <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0" maxOccurs="1"/>
    </s:sequence>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.11.

Table A.11 – ReleaseResponse

Tag Name	Description
ReleaseResponse	ReleaseResponse shall be the response message by the server upon receiving a ReleaseRequest. The Client shall use the ReleaseResponse to verify that the ReleaseRequest has been successfully executed.
ServiceError	An embedded error. The server shall use the element to indicate that the service requested was not successful. When this element is present in the response message, the client shall assume that the request is rejected by the server.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122. The Server shall mirror the UUID value received in the request message and return the same value in the response message.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.2.6 Abort

A.5.2.6.1 AbortRequest

The AbortRequest shall be defined as follows:

```
<s:element name="AbortRequest">
  <s:complexType>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.12.

Table A.12 – AbortRequest

Tag Name	Description
AbortRequest	If the client detects an anormal situation that discontinues interchanging of services or in the case where the server refuses the release of an association, the client may abort the association using the "AbortRequest" service. The server cannot refuse this service. The only service error allowed in the AbortResponse is "connection-lost" which means that the association is considered over from the server point of view.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.2.6.2 AbortResponse

The AbortResponse shall be defined as follows:

```
<s:element name="AbortResponse">
  <s:complexType>
    <s:choice>
      <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0" maxOccurs="unbounded"/>
    </s:choice>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.13.

Table A.13 – AbortResponse

Tag Name	Description
AbortResponse	Any service request which receives an invalid (not in use) association identifier shall return the "connection-lost" service error: <s:enumeration value="connection-lost"/> On the client side, the reception of the "connection-lost" service error shall be considered a communication lost, so a new association shall be requested in order to exchange services with the server side.
ServiceError	An embedded error. The server shall use the element to indicate that the service requested was not successful. When this element is present in the response message, the client shall assume that the request is rejected by the server.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122. The Server shall mirror the UUID value received in the request message and return the same value in the response message.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.3 LOGICAL-DEVICE class service mapping

A.5.3.1 General

The LOGICAL-DEVICE class service shall be mapped to web services as given in Table A.14.

Table A.14 – LOGICAL-DEVICE service mapping

IEC 61400-25-2 IM Class IEC 61400-25-3 IEM Class	IEC 61400-25-3 IEM Services	Maps to objects and Web Services
LOGICAL-DEVICE		tLD
	GetLogicalDeviceDirectory	GetLogicalDeviceDirectory

A.5.3.2 GetLogicalDeviceDirectory

A.5.3.2.1 General

A client shall use the GetLogicalDeviceDirectory service to retrieve the LD namespace with all LOGICAL-NODEs exposed, and thus accessible to a client addressing the Logical Device.

A.5.3.2.2 GetLogicalDeviceDirectoryRequest

The GetLogicalDeviceDirectoryRequest service shall be defined as follows:

```
<s:element name="GetLogicalDeviceDirectoryRequest">
  <s:complexType>
    <s:sequence>
      <s:element name="LDRef" type="ews:tLogicalDeviceReference"/>
    </s:sequence>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.15.

Table A.15 – GetLogicalDeviceDirectoryRequest

Tag Name	Description
GetLogicalDeviceDirectoryRequest	A service for a client to request a list of object references of all logical devices made visible and thus accessible to the requesting client.
LDRef	Logical Device object reference. The element shall be a unique path-name of a logical device.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.3.2.3 GetLogicalDeviceDirectoryResponse

The GetLogicalDeviceDirectoryResponse service shall be defined as follows:

```
<s:element name="GetLogicalDeviceDirectoryResponse">
  <s:complexType>
    <s:choice>
      <s:element name="LNRef" type="ews:tLogicalNodeReference" minOccurs="3"
maxOccurs="unbounded"/>
      <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0" maxOccurs="unbounded"/>
    </s:choice>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.16.

Table A.16 – GetLogicalDeviceDirectoryResponse

Tag Name	Description
GetLogicalDeviceDirectoryResponse	A server response to a client request on the list of object references contained in the logical devices.
LNRef	Logical Node object reference. The element shall be a unique path-name of a logical node.
ServiceError	An embedded error. The server shall use the element to indicate that the service requested was not successful. When this element is present in the response message, the client shall assume that the request is rejected by the server.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122. The Server shall mirror the UUID value received in the request message and return the same value in the response message.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.4 LOGICAL-NODE class services mapping

A.5.4.1 General

The LOGICAL-NODE class services shall be mapped to web services as defined in Table A.17.

Table A.17 – LOGICAL-NODE mapping

IEC 61400-25-2 IM Class IEC 61400-25-3 IEM Class	IEC 61400-25-3 IEM Services	Maps to objects and Web Services
LOGICAL-NODE		tLN
	GetLogicalNodeDirectory	GetLogicalNodeDirectory

A.5.4.2 GetLogicalNodeDirectory

A.5.4.2.1 General

A client shall use the GetLogicalNodeDirectory service to retrieve the LN namespace with all DATA and Control Blocks (e.g. RCB or LCB) exposed, and thus accessible to a client addressing the Logical Node.

A.5.4.2.2 GetLogicalNodeDirectoryRequest

The GetLogicalNodeDirectoryRequest service shall be defined as follows:

```
<s:element name="GetLogicalNodeDirectoryRequest">
  <s:complexType>
    <s:sequence>
      <s:element name="LNRef" type="ews:tLogicalNodeReference"/>
      <s:element name="IEMcls" type="ews:tIEMcls"/>
    </s:sequence>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.18.

Table A.18 – GetLogicalNodeDirectoryRequest

Tag Name	Description
GetLogicalNodeDirectoryRequest	A service for a client to request a list of the object references of all instances of a requested class made visible and thus accessible to the requesting client.
LNRef	Logical Node object reference. The element shall be a unique path-name of a logical node.
IEMcls	Enumeration ("DATA", "DATASET", "BRCB", "URCB", "LCB", "LOG")
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.4.2.3 GetLogicalNodeDirectoryResponse

The GetLogicalNodeDirectoryResponse service shall be defined as follows:

```
<s:element name="GetLogicalNodeDirectoryResponse">
  <s:complexType>
    <s:choice>
      <s:sequence>
        <s:element name="DATAname" type="ews:tObjectName" minOccurs="0"
maxOccurs="unbounded"/>
        <s:element name="DSname" type="ews:tObjectName" minOccurs="0" maxOccurs="unbounded"/>
        <s:element name="BRCBname" type="ews:tObjectName" minOccurs="0"
maxOccurs="unbounded"/>
        <s:element name="URCBname" type="ews:tObjectName" minOccurs="0"
maxOccurs="unbounded"/>
        <s:element name="LCBname" type="ews:tObjectName" minOccurs="0" maxOccurs="unbounded"/>
        <s:element name="LOGname" type="ews:tObjectName" minOccurs="0" maxOccurs="unbounded"/>
      </s:sequence>
      <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0" maxOccurs="1"/>
    </s:choice>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.19.

Table A.19 – GetLogicalNodeDirectoryResponse

Tag Name	Description
GetLogicalNodeDirectoryResponse	A server response to a client request for the list of object references to all instances of a class contained in the logical node addressed.
DATAname	An element that unambiguously identifies a DATA within the scope of a logical node.
DSname	An element that unambiguously identifies a Data-Set within the scope of a logical node or within a client-server association.
BRCBname	An element name that unambiguously identifies the BRCB within the scope of a logical node.
URCBname	An element name that unambiguously identifies the URCB within the scope of a logical node.
LCBname	An element name that unambiguously identifies the LCB within the scope of a logical node.
LOGname	An element name that unambiguously identifies the LOG within the scope of the LLN0 logical node. LOGname shall be the name of the Logical-Device.
ServiceError	An embedded error. The server shall use the element to indicate that the service requested was not successful. When this element is present in the response message, the client shall assume that the request is rejected by the server.

Tag Name	Description
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122. The Server shall mirror the UUID value received in the request message and return the same value in the response message.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.5 DATA class services mapping

A.5.5.1 General

The DATA class services shall be mapped to web services as defined in Table A.20.

Table A.20 – Data mapping

IEC 61400-25-2 IM Class IEC 61400-25-3 IEM Class	IEC 61400-25-3 IEM Services	Maps to objects and Web Services
DATA		tDATA
	GetDataValues	GetDataValues
	SetDataValues	SetDataValues
	GetDataDirectory	GetDataDirectory
	GetDataDefinition	GetDataDefinition

A.5.5.2 GetDataValues

A.5.5.2.1 GetDataValuesRequest

The GetDataValuesRequest service shall be defined as follows:

```
<s:element name="GetDataValuesRequest">
  <s:complexType>
    <s:sequence>
      <s:element name="Ref" type="ews:tFcdFcdaType" />
    </s:sequence>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.21.

Table A.21 – GetDataValuesRequest

Tag Name	Description
GetDataValuesRequest	Retrieve values of DataAttributes of the referenced DATA made visible and thus accessible to a client by the referenced Logical-Node.
Ref	The parameter Reference shall define the functional constrained data (FCD) or functional constrained data attributes (FCDA) of the DATA whose DataAttribute value is to be written. The Reference shall be FCD or FCDA.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.5.2.2 GetDataValuesResponse

The GetDataValuesResponse service shall be defined as follows:

```
<s:element name="GetDataValuesResponse">
  <s:complexType>
    <s:choice>
      <s:sequence>
        <s:element name="DataAttrVal" type="ews:tDataAttributeValue" minOccurs="0"
maxOccurs="unbounded"/>
      </s:sequence>
      <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0" maxOccurs="unbounded"/>
    </s:choice>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.22.

Table A.22 – GetDataValuesResponse

Tag Name	Description
GetDataValuesResponse	A client shall use the GetDataValue service to retrieve value of DataAttributes of the referenced DATA made visible and thus accessible to the requesting client by the referenced LOGICAL-NODE.
DataAttrVal	Type referencing Value from DataRef contained in tDataAttributeValue type.
ServiceError	An embedded error. The server shall use the element to indicate that the service requested was not successful. When this element is present in the response message, the client shall assume that the request is rejected by the server.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122. The Server shall mirror the UUID value received in the request message and return the same value in the response message.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.5.3 SetDataValues

A.5.5.3.1 SetDataValuesRequest

The SetDataValuesRequest service shall be defined as follows:

```
<s:element name="SetDataValuesRequest">
  <s:complexType>
    <s:sequence>
      <s:element name="Ref" type="ews:tFcdFcdaType" />
      <s:element name="DataAttrVal" type="ews:tDataAttributeValue" maxOccurs="unbounded"/>
    </s:sequence>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.23.

Table A.23 – SetDataValuesRequest

Tag Name	Description
SetDataValuesRequest	A client shall use the SetDataValues service to set value of DataAttributes of the referenced DATA made visible and thus accessible to the requesting client by the referenced LOGICAL-NODE.

Tag Name	Description
Ref	The parameter Reference shall define the functional constrained data (FCD) or functional constrained data attributes (FCDA) of the DATA whose DataAttribute value is to be written. The Reference shall be FCD or FCDA.
DataAttrVal	Type referencing Value from DataRef contained in tDataAttributeValue type.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.5.3.2 SetDataValuesResponse

The SetDataValuesResponse service shall be defined as follows:

```
<s:element name="SetDataValuesResponse">
  <s:complexType>
    <s:sequence>
      <s:choice>
        <s:element name="Result" type="ews:tResult" minOccurs="0"/>
        <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0"
maxOccurs="unbounded"/>
      </s:choice>
    </s:sequence>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.24.

Table A.24 – SetDataValuesResponse

Tag Name	Description
SetDataValuesResponse	A server response to the client requesting the SetDataValues service to set value of DataAttributes of the referenced DATA made visible and thus accessible to the requesting client by the referenced LOGICAL-NODE.
Result	Simple result string "Ok" stating the SetDataValues request was accepted.
ServiceError	An embedded error. The server shall use the element to indicate that the service requested was not successful. When this element is present in the response message, the client shall assume that the request is rejected by the server.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122. The Server shall mirror the UUID value received in the request message and return the same value in the response message.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.5.4 GetDataDirectory

A.5.5.4.1 General

A client shall use the GetDataDirectory service to retrieve the namespace of all DATA-ATTRIBUTES exposed and thus accessible to a client addressing the DATA class.

A.5.5.4.2 GetDataDirectoryRequest

The GetDataDirectoryRequest service shall be defined as follows:

```
<s:element name="GetDataDirectoryRequest">
```

```
<s:complexType>
  <s:sequence>
    <s:element name="DataRef" type="ews:tDAReference"/>
  </s:sequence>
  <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
  <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
</s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.25.

Table A.25 – GetDataDirectoryRequest

Tag Name	Description
GetDataDirectoryRequest	A client shall use the GetDataDirectory service to retrieve the list of all DataAttributeName of the referenced DATA made visible and thus accessible to the requesting client by the referenced LOGICAL-NODE.
DataRef	The parameter DataReference shall contain the ObjectReference of the DATA. The ObjectReference shall be DataRef.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.5.4.3 GetDataDirectoryResponse

The GetDataDirectoryResponse service shall be defined as follows:

```
<s:element name="GetDataDirectoryResponse">
  <s:complexType>
    <s:choice>
      <s:sequence>
        <s:element name="DataName" type="ews:tObjectName" minOccurs="0" maxOccurs="unbounded"/>
        <s:element name="DataAttrName" type="ews:tObjectName" minOccurs="0"
maxOccurs="unbounded"/>
maxOccurs="unbounded"/>
      </s:sequence>
      <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0"
/>
    </s:choice>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.26.

Table A.26 – GetDataDirectoryResponse

Tag Name	Description
GetDataDirectoryResponse	A server response to the client requesting the GetDataDirectory service to retrieve the list of all DataAttributeName of the referenced DATA made visible and thus accessible to the requesting client by the referenced LOGICAL-NODE.
DataName	The attribute DataName shall unambiguously identify a DATA within the scope of a LOGICAL-NODE.
DataAttrName	The parameter DataAttributeName shall contain a DataAttrName of the highest level of a DataAttribute of the DATA.
ServiceError	An embedded error. The server shall use the element to indicate that the service requested was not successful. When this element is present in the response message, the client shall assume that the request is rejected by the server.

Tag Name	Description
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122. The Server shall mirror the UUID value received in the request message and return the same value in the response message.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.5.5 GetDataDefinition

A.5.5.5.1 General

A client shall use the GetDataDefinition service to retrieve the definitions of all DATA-ATTRIBUTES exposed and thus accessible to a client addressing the DATA class.

A.5.5.5.2 GetDataDefinitionRequest

The GetDataDefinitionRequest service shall be defined as follows:

```
<s:element name="GetDataDefinitionRequest">
  <s:complexType>
    <s:sequence>
      <s:element name="DataRef" type="ews:tDAResponse"/>
    </s:sequence>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```

The Tag Names shall be defined according to Table A.27.

Table A.27 – GetDataDefinitionRequest

Tag Name	Description
GetDataDefinitionRequest	A client shall use the GetDataDefinition service to retrieve the complete list of all DataAttribute definitions of the referenced DATA made visible and thus accessible to the requesting client by the referenced LOGICAL-NODE.
DataRef	The parameter DataReference shall contain the ObjectReference of the DATA. The ObjectReference shall be DataRef.
UUID	Universal Unique ID is used as a unique service identification for a request/response relationship. The UUID details shall be as specified in RFC 4122.
AssocID	AssocID is used to identify the association originator – the specific client. The AssocID shall be used to identify e.g. established subscriptions and loggings on the server.

A.5.5.5.3 GetDataDefinitionResponse

The GetDataDefinitionResponse shall be defined as follows:

```
<s:element name="GetDataDefinitionResponse">
  <s:complexType>
    <s:choice>
      <s:element name="DataAttrDef" type="ews:tDataAttributeDefinition" minOccurs="1"
maxOccurs="unbounded"/>
      <s:element name="ServiceError" type="ews:tServiceError" minOccurs="0" maxOccurs="1"/>
    </s:choice>
    <s:attribute name="UUID" type="ews:tstring36" use="optional"/>
    <s:attribute name="AssocID" type="ews:tAssocID" use="required"/>
  </s:complexType>
</s:element>
```