DEUTSCHE NORM *Entwurf* Februar 2008

# DIN IEC 61850-8-1

DIN

ICS 33.040.40

*Entwurf*

Einsprüche bis 2008-04-30
Vorgesehen als Ersatz für
DIN EN 61850-8-1:2005-11

## Kommunikationsnetze und -systeme für die Automatisierung der Energieversorgung – Teil 8-1: Spezifische Abbildung von Kommunikationsdiensten (SCSM) – Abbildungen auf MMS (nach ISO 9506-1 und ISO 9506-2) und ISO/IEC 8802-3 (IEC 57/903/CD:2007), Text Englisch

Communication networks and systems for power utility automation – Part 8-1: Specific Communication Service Mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3 (IEC 57/903/CD:2007), text English

### Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2008-02-18 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfes besonders zu vereinbaren.

Stellungnahmen werden erbeten

- vorzugsweise als Datei per E-Mail an dke@din.de in Form einer Tabelle. Die Vorlage dieser Tabelle kann im Internet unter www.dke.de/stellungnahme abgerufen werden;
- oder in Papierform an die DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (Hausanschrift: Stresemannallee 15, 60596 Frankfurt am Main).

Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevante Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 161 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

© DIN Deutsches Institut für Normung e.V. · Jede Art der Vervielfältigung, auch auszugsweise, nur mit Genehmigung des DIN Deutsches Institut für Normung e.V., Berlin, gestattet.
Alleinverkauf der Normen durch Beuth Verlag GmbH, 10772 Berlin

Documents
Document Sharing Hub

Full document details: E DIN IEC 61850-8-1:2008-02

# Nationales Vorwort

Die englische Originalfassung des internationalen Dokuments IEC 57/903/CD:2007 „Communication networks and systems for power utility automation – Part 8-1: Specific Communication Service Mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3“ (CD, en: Committee Draft) ist unverändert in diesen Norm-Entwurf übernommen worden.

Das internationale Dokument wurde vom TC 57 „Power systems management and associated information exchange“ der Internationalen Elektrotechnischen Kommission (IEC) erarbeitet und den nationalen Komitees zur Stellungnahme vorgelegt.

Die IEC und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Umfrage (CDV-Stadium) und Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dokumente, die bei CENELEC als Europäische Norm angenommen und ratifiziert werden, sind unverändert als Deutsche Normen zu übernehmen.

Es ist vorgesehen, auch bei der entsprechenden zukünftigen Deutschen Norm auf die deutsche Sprachfassung zu verzichten und diese in der englischsprachigen Fassung zu veröffentlichen.

Da der Abstimmungszeitraum für einen FDIS bzw. Schluss-Entwurf prEN nur 2 Monate beträgt, und dann keine sachlichen Stellungnahmen mehr abgegeben werden können, sondern nur noch eine „JA/NEIN“-Entscheidung möglich ist, wobei eine „NEIN“-Entscheidung fundiert begründet werden muss, wird bereits der CD als DIN-Norm-Entwurf veröffentlicht, um die Stellungnahmen aus der Öffentlichkeit frühzeitig berücksichtigen zu können.

Für diesen vorliegenden Norm-Entwurf ist das nationale Arbeitsgremium K 952 „Netzleittechnik“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (www.dke.de) zuständig.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf eine Norm ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils neueste gültige Ausgabe der in Bezug genommenen Norm.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe der Norm.

Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

**Änderungen**

Gegenüber DIN EN 61850-8-1:2005-11 wurden folgende Änderungen vorgenommen:

a) Klarstellung und Berichtigung

b) Anpassung an die ebenfalls überarbeiteten DIN EN 61850-7-2 und DIN EN 61850-7-4

c) Verweisung auf die IEC/TS 62351-6:2007



AVA Documents Document Sharing Hub

Full document details: E DIN IEC 61850-8-1:2008-02

CONTENTS

FOREWORD ..... 11
1 Scope ..... 14
2 Normative references ..... 14
3 Terms and definitions ..... 18
4 Abbreviations ..... 19
5 Overview ..... 21
5.1 General ..... 21
5.2 IEC 61850 server object ..... 22
5.3 MMS communication profiles ..... 23
5.4 Non-MMS communication profiles ..... 23
5.5 MMS objects being used ..... 23
6 Communication stack ..... 24
6.1 Overview of the protocol usage ..... 24
6.2 Client/server services and communication profiles ..... 25
6.2.1 Client/server services ..... 25
6.2.2 A-Profile ..... 26
6.2.3 TCP/IP T-Profile ..... 27
6.2.4 OSI T-Profile ..... 29
6.3 GSE management and GOOSE services communication profiles ..... 29
6.3.1 GSE mapping overview ..... 29
6.3.2 A-Profile ..... 30
6.3.3 T-Profile ..... 30
6.4 Time sync ..... 31
6.4.1 A-Profile ..... 31
6.4.2 T-Profile ..... 31
7 Objects of IEC 61850 ..... 32
7.1 Server ..... 32
7.2 Logical device (LD) ..... 32
7.3 Logical node (LN) ..... 32
7.3.1 General ..... 32
7.3.2 Mapping of LNReference to VariableAccessSpecifications ..... 34
7.3.3 Data ..... 34
7.3.4 Data Attributes (DataAttr) ..... 35
8 Mapping of IEC 61850-7-2 and IEC 61850-7-3 data attributes ..... 35
8.1 Mapping of Attributes specified in IEC 61850-7-2 ..... 35
8.1.1 Basic data attribute types ..... 35
8.1.2 Additional definitions of basic data type ..... 35
8.1.3 Common data types ..... 36
8.2 Mapping of quality common data attribute type specified in IEC 61850-7-3 ..... 39
9 Server class model ..... 40
9.1 Server mapping ..... 40
9.2 Server class attributes ..... 40
9.2.1 ServiceAccessPoint ..... 40
9.2.2 Logical devices ..... 41
9.2.3 Files ..... 41
9.2.4 Client associations ..... 41
9.3 Server class service GetServerDirectory ..... 41

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

10 Association model ..... 43
10.1 Association relation to communication profiles ..... 43
10.2 Two party association model for client/server communication profile ..... 43
10.2.1 Association mapping ..... 43
10.2.2 Association services ..... 43
10.3 Two party association model for GSE management communication profile ..... 44
10.4 Two party association model for time sync ..... 44
10.5 Multicast association model ..... 45
11 Logical device model ..... 45
12 Logical node model ..... 45
12.1 Logical node class ..... 45
12.2 Logical node class attributes ..... 45
12.3 Logical node class cervices ..... 46
12.3.1 GetLogicalNodeDirectory ..... 46
12.3.2 GetAllDataValues ..... 47
13 Data class model ..... 47
13.1 Data class ..... 47
13.2 Data class services ..... 48
13.2.1 GetDataValues ..... 48
13.2.2 SetDataValues ..... 48
13.2.3 GetDataDirectory ..... 48
13.2.4 GetDataDefinition ..... 49
14 Data set class model ..... 49
14.1 Data set class ..... 49
14.2 Data set attributes ..... 49
14.3 Data set services ..... 49
14.3.1 GetDataSetValues ..... 49
14.3.2 SetDataSetValues ..... 50
14.3.3 CreateDataSet ..... 50
14.3.4 DeleteDataSet ..... 51
14.3.5 GetDataSetDirectory ..... 52
15 Substitution model ..... 53
16 Setting group control class model ..... 53
16.1 Setting group control class definition ..... 53
16.2 Setting group control class services ..... 53
16.2.1 SelectActiveSG ..... 53
16.2.2 SelectEditSG ..... 53
16.2.3 SetSGValues ..... 53
16.2.4 ConfirmEditSGValues ..... 54
16.2.5 GetSGValues ..... 54
16.2.6 GetSGCBValues ..... 54
17 Reporting and logging class model ..... 54
17.1 Report model ..... 54
17.1.1 Report control blocks ..... 54
17.2 Reporting services ..... 56
17.2.1 Report service ..... 56
17.2.2 GetBRCBValues ..... 58
17.2.3 SetBRCBValues ..... 58
17.2.4 GetURCBValues ..... 58

AVA Documents Document Sharing Hub

Full document details: E DIN IEC 61850-8-1:2008-02

17.2.5 SetURCBValues ..... 58
17.3 Log model ..... 59
17.3.1 General ..... 59
17.3.2 Mapping of log control class ..... 59
17.3.3 Mapping of log class ..... 59
17.3.4 Mapping of log and log control services ..... 63
17.3.5 Conformance ..... 65
18 Mapping of the generic substation event model (GSE) ..... 65
18.1 Generic object oriented substation event (GOOSE) ..... 65
18.1.1 GOOSE control definition ..... 65
18.1.2 GOOSE services ..... 66
19 Transmission of sampled values class model ..... 75
20 Control class model ..... 75
20.1 Control service parameters ..... 75
20.2 Mapping of control objects ..... 76
20.3 Mapping of control services ..... 77
20.4 Select ..... 78
20.4.1 Select request ..... 78
20.4.2 Select response+ ..... 78
20.4.3 Select response– ..... 78
20.5 SelectwithValue ..... 78
20.5.1 SelectwithValue request ..... 78
20.5.2 SelectwithValue response+ ..... 78
20.5.3 SelectwithValue response– ..... 79
20.6 Cancel ..... 79
20.6.1 Cancel request ..... 79
20.6.2 Cancel response+ ..... 79
20.6.3 Cancel response– ..... 80
20.7 Operate ..... 80
20.7.1 Operate request ..... 80
20.7.2 Operate response+ ..... 81
20.7.3 Operate response– ..... 81
20.8 AdditionalCauseDiagnosis in negative control service responses ..... 81
20.9 CommandTermination ..... 83
21 Time and time synchronization model ..... 83
22 Naming conventions ..... 83
23 File transfer ..... 84
23.1 File transfer model ..... 84
23.2 File services ..... 86
23.2.1 GetFile ..... 86
23.2.2 SetFile ..... 87
23.2.3 DeleteFile ..... 88
23.2.4 GetFileAttributeValues ..... 88
24 Conformance ..... 89
24.1 Notation ..... 89
24.2 PICS ..... 89
24.2.1 Profile conformance ..... 89
24.2.2 MMS conformance ..... 91
24.3 PICS Statement ..... 102

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

24.3.1 Logical device ..... 102
24.3.2 GOOSE Services ..... 102
24.3.3 Substation configuration language ..... 103
25 Substation Configuration Language (SCL) ..... 103
25.1 SCL file and SCL extensions ..... 103
25.1.1 SCSM specific address element definitions ..... 103
25.1.2 Subnetwork protocol type ..... 104
Annex A (normative) Application protocol specification for GOOSE and GSE management ..... 105
Annex B (informative) Multicast address selection ..... 107
Annex C (normative) Overview of ISO/IEC 8802-3 frame structure for GSE management and GOOSE ..... 108
Annex D (informative) SCL conformance ..... 111
D.1 General ..... 111
D.2 SCL control block ..... 112
D.2.1 validate ..... 112
D.2.2 valState ..... 113
D.2.3 activate ..... 113
D.3 SCL support within devices ..... 113
D.3.1 File directory structure for SCL files ..... 113
D.3.2 Retrieval of an SCL file from an implementation ..... 113
D.3.3 Remote creation of a SCL file ..... 113
D.3.4 Local validation of an SCL file ..... 114
Annex E (normative) Specialized CDCs for control service mapping ..... 115
E.1 General ..... 115
E.2 Mapping specific logical device name space extension ..... 115
E.3 Mapping specific common data classes ..... 116
E.3.1 Extended common data class controllable single point (SPC) ..... 116
E.3.2 Extended common data class controllable double point (DPC) ..... 116
E.3.3 Extended common data class controllable integer status (INC) ..... 118
E.3.4 Extended common data class binary controlled step position information (BSC) ..... 118
E.3.5 Extended common data class integer controlled step position information (ISC) ..... 119
E.3.6 Extended common data class controllable analogue set point information (APC) ..... 119
E.4 Mapping specific common data attribute types ..... 120
E.4.1 SBOw ..... 120
E.4.2 Oper ..... 120
E.4.3 Cancel ..... 121
E.4.4 ctlVal ..... 121
E.5 Conditions for attribute inclusion ..... 121
E.6 Data attribute semantic ..... 122
Annex F (informative) Time scales and epochs ..... 123
F.1 General ..... 123
F.2 The MMS TimeOfDay epoch began at 0 hours on 1 January 1984 (MJD 40 587). Times measured are designated in this standard as MMS TimeOfDay mili-seconds GMT and TimeOfDay days GMT, and represent offets from the epoch. Standard time sources ..... 123

AVA Documents Document Sharing Hub

Full document details: E DIN IEC 61850-8-1:2008-02

Annex G (normative) Type extensions to ISO 9506-1 (2003) and ISO 9506-2 (2003) ..... 126
G.1 General ..... 126
G.2 ISO 9506-1 (Service definitions) ..... 126
G.2.1 Add Reference for UTC time type definition ..... 126
G.2.2 Add UTC as a new time type ..... 126
G.2.3 Add, at the end of Subclause 14.2.2.4.1, the following new text: ..... 126
G.3 ISO 9506-2 (Protocol specification) ..... 127
G.3.1 Add UTC as a new time type ..... 127
G.3.2 Enlarge the MMS Identifier size ..... 127
G.3.3 Allow application-dependent use of MMSString data type ..... 127
Annex H (normative) Example SCL File ..... 129
Annex I (normative) Generic Substation State Event (GSSE) ..... 147
I.1 GSSE Service and communication profile ..... 147
I.1.1 GSSE mapping overview ..... 147
I.1.2 A-Profile ..... 147
I.1.3 T-Profile ..... 148
I.2 GSSE control definition ..... 149
I.3 GSSE services ..... 151
I.3.1 GetGsReference ..... 151
I.3.2 GetGSSEDataOffset ..... 154
I.3.3 GetGsCBValues ..... 155
I.3.4 SetGsCBValues ..... 155
I.3.5 SendGSSEMessage ..... 155
I.4 Conformance ..... 160
I.4.1 PICS Statement for GSSE services ..... 160
Figure 1 – Overview of functionality and profiles ..... 22
Figure 2 – OSI reference model and profiles ..... 24
Figure 3 –Ordered list of functional constraints ..... 33
Figure 4 – Relationship of LCB attributes to IEC 61850-7-2 log definitions ..... 59
Figure 5 – GetGoReference service primitives ..... 66
Figure 6 – GetGOOSEElementNumber service primitives ..... 69
Figure 7 – Transmission time for events ..... 71
Figure 8 – SendGooseMessage message service primitives ..... 71
Figure 9 – Publisher state machine for GOOSE service ..... 72
Figure 10 – Subscriber state machine for GOOSE service ..... 73
Figure 11 – Mapping of ACSI GetFile to MMS FileOpen, FileRead, FileClose ..... 86
Figure 12 – Mapping of ACSI SetFile service ..... 87
Figure C.1 – ISO/IEC 8802-3 frame format ..... 108
Figure C.2 – Virtual LAN tag ..... 109
Figure I.1 – GetGsReference service primitives ..... 152
Figure I.2 – GetGSSEDataOffset service primitives ..... 154
Figure I.3 – GSSE service primitives ..... 156
Figure I.4 – Client state machine for GSSE service ..... 157
Figure I.5 – Server state machine for GSSE service ..... 157
Table 1 – MMS objects and services in use within this SCSM ..... 24
Table 2 – Services requiring client/server Communication Profile ..... 25

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

Table 3 – Service and protocols for client/server communication A-Profile ..... 26
Table 4 – Service and protocols for client/server TCP/IP T-Profile ..... 27
Table 5 – Service and protocols for client/server OSI T-Profile ..... 29
Table 6 – Services requiring GSE Management and GOOSE communication profile ..... 30
Table 7 – Service and protocols for GSE Management and GOOSE communication A-Profile ..... 30
Table 8 – GOOSE/GSE T-Profile ..... 30
Table 9 – Time sync A-Profile ..... 31
Table 10 – Time sync T-Profile ..... 31
Table 11 – Mapping of ACSI data types ..... 35
Table 12 – Encoding of IEC 61850-7-2 TimeQuality ..... 38
Table 13 – Encoding of IEC 61850-7-3 quality ..... 40
Table 14 – ServiceError mapping for GetServerDirectory for non-files ..... 42
Table 15 – ServiceErrors mapping of ACSI GetServerDirectory for files ..... 42
Table 16 – Association model versus communication profiles ..... 43
Table 17 – Associate service error mappings ..... 44
Table 18 – Release service error mappings ..... 44
Table 19 – GetNameList classes for GetLogicalNodeDirectory service ..... 46
Table 20 – MMS AccessResult mapping to ASCI ServiceError ..... 47
Table 21 – Mapping of GetDataValues service parameters ..... 48
Table 22 – Mapping of SetDataValues service parameters ..... 48
Table 23 – Mapping of GetDataDirectory service parameters ..... 49
Table 24 – ServiceError Mappings for GetDataDirectory service ..... 49
Table 25 – Mapping of GetDataSetValues service parameters ..... 50
Table 26 – Mapping of SetDataSetValues service parameters ..... 50
Table 27 – Mapping of CreateDataSet service parameters ..... 51
Table 28 – ServiceError mapping for CreateDataSet ..... 51
Table 29 – Mapping of DeleteDataSet service parameters ..... 51
Table 30 – ServiceError mapping for DeleteDataSet ..... 52
Table 31 – Mapping of GetDataSetDirectory service parameters ..... 52
Table 32 – ServiceError mapping for GetDataSetDirectory ..... 52
Table 33 – Mapping of ACSI ServiceError for SelectActiveSG ..... 53
Table 34 – Mapping of BRCB to MMS type definition ..... 54
Table 35 – Mapping of OptFlds within Bitstring ..... 55
Table 36 – Mapping of URCB to MMS type definition ..... 55
Table 37 – Order of AccessResults for variableListName report ..... 56
Table 38 – Definition of an MMS log control block ..... 60
Table 39 – Mapping of values for LogEna ..... 60
Table 40 – Mapping of ACSI LogEntries ..... 61
Table 41 – General mappings of ACSI log model services ..... 63
Table 42 – Mapping of QueryLogByTime request parameters ..... 64
Table 43 – Mapping of response parameters ..... 64
Table 44 – ServiceError mappings for Log services ..... 64
Table 45 – Mapping of QueryLogAfter request parameters ..... 64

AVA Documents Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

Table 46 – Log conformance requirements ..... 65
Table 47 – MMS TypeDescription definition for GoCB MMS structure ..... 65
Table 48 – DstAddress structure ..... 66
Table 49 – Mapping of GetGoReference service ..... 67
Table 50 – GetGoReference ..... 67
Table 51 – Mapping of GetGOOSEElementNumber service ..... 69
Table 52 – GetGOOSEElementNumber ..... 70
Table 53 – GOOSE service parameter mapping ..... 73
Table 54 – Controllable service parameters ..... 75
Table 55 – Service parameters ..... 76
Table 56 – Mapping of IEC 61850-7-2 control model to MMS control components ..... 76
Table 57 – Mapping of control services ..... 77
Table 58 – Select service parameter mapping ..... 78
Table 59 – SelectwithValue service parameter mapping ..... 78
Table 60 – Select, Oper and Cancel AccessResult specification ..... 79
Table 61 – Cancel service parameter mapping ..... 79
Table 62 – Operate service parameter mapping ..... 80
Table 63 – Control with TimeActivation service parameter mapping ..... 81
Table 64 – Definition of LastApplError variable structure ..... 82
Table 65 – Mapping of ACSI AddCause values ..... 83
Table 66 – Mapping of ACSI file class to MMS file object ..... 84
Table 67 – Mappings of MMS File ServiceErrors to ACSI Service Errors ..... 85
Table 68 – Reserved file suffixes ..... 85
Table 69 – Mapping of ACSI GetFile service parameters ..... 87
Table 70 – Mapping of ACSI SetFile parameters ..... 88
Table 71 – Mapping of ACSI DeleteFile service ..... 88
Table 72 – Mapping of ACSI GetFileAttributeValues parameters ..... 89
Table 73 – Mapping of ACSI ListOfDirectoryEntry ..... 89
Table 74 – PICS for A-Profile support ..... 90
Table 75 – PICS for T-Profile support ..... 90
Table 76 – MMS InitiateRequest general parameters ..... 91
Table 77 – MMS InitiateResponse general parameters ..... 91
Table 78 – MMS service supported conformance table ..... 92
Table 79 – MMS Parameter CBB ..... 95
Table 80 – GetNameList conformance statement ..... 95
Table 81 – AlternateAccessSelection conformance statement ..... 96
Table 82 – VariableAccessSpecification conformance statement ..... 96
Table 83 – VariableSpecification conformance statement ..... 97
Table 84 – Read conformance statement ..... 97
Table 85 – Write conformance statement ..... 97
Table 86 – InformationReport conformance statement ..... 98
Table 87 – GetVariableAccessAttributes conformance statement ..... 98
Table 88 – DefineNamedVariableList conformance statement ..... 98
Table 89 –GetNamedVariableListAttributes conformance statement ..... 99

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

Table 90 – DeleteNamedVariableList conformance statement ..... 99
Table 91 – ReadJournal conformance statement ..... 100
Table 92 – JournalEntry conformance statement ..... 100
Table 93 – InitializeJournal conformance statement ..... 101
Table 94 – FileDirectory conformance statement ..... 101
Table 95 – FileOpen conformance statement ..... 101
Table 96 – FileRead conformance statement ..... 101
Table 97 – FileClose conformance statement ..... 102
Table 98 – GOOSE conformance statement ..... 102
Table 99 – Allowed P-Type definitions for client/server addressing ..... 103
Table 100 – Definitions for GSE SCL ..... 104
Table B.1 – Recommended multicast addressing example ..... 107
Table C.1 – Default virtual LAN IDs and priorities ..... 109
Table C.2 – Assigned Ethertype values ..... 110
Table D.1 – SCL conformance degrees ..... 111
Table D.2 – Supported ACSI services for SCL.2 and SCL.3 ..... 111
Table D.3 – Additional MMS services for SCL.2 and SCL.3 ..... 112
Table D.4 – Definition of SCL control block ..... 112
Table E.1 – Name space attributes ..... 115
Table E.2 – Extended common data class controllable single point ..... 116
Table E.3 – Extended common data class controllable double point ..... 117
Table E.4 – Extended common data class controllable integer status ..... 118
Table E.5 – Extended common data class binary controlled step position information ..... 118
Table E.6 – Extended common data class integer controlled step position information ..... 119
Table E.7 – Extended common data class controllable analogue set point information ..... 119
Table E.8 – SBOw ..... 120
Table E.9 – Oper ..... 120
Table E.10 – Cancel ..... 121
Table E.11 – ctlVal ..... 121
Table E.12 – Conditions for attribute inclusion ..... 121
Table E.13 – Semantics of data attributes ..... 122
Table F.1 – Relationships between timescales ..... 124
Table F.2 – Examples of timescale correspondence ..... 125
Table I.1 – Service requiring GSSE communication profile ..... 147
Table I.2 – Service and protocols for GSSE communication A-Profile ..... 147
Table I.3 – GSSE T-Profile ..... 148
Table I.4 – MMS TypeDescription Definition for GSSE control block MMS structure ..... 149
Table I.5 – Mapping of LSentData ..... 150
Table I.6 – Definition of integer values of PhsID ..... 151
Table I.7 – Definition of double-bit GSSE values ..... 151
Table I.8 – Mapping of GetGsReference service ..... 152
Table I.9 – GetGsReference ..... 153
Table I.10 – Mapping of GetGSEDataOffset service ..... 154
Table I.11 – GetGSSEDataOffset ..... 155

AVA Documents Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

Table I.12 – GSSE service ..... 158
Table I.13 – Mapping of test values to bit-pair values ..... 159
Table I.14 – GSSE conformance statement ..... 160

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

INTERNATIONAL ELECTROTECHNICAL COMMISSION

# 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

## FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61850-8-1 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

| FDIS | Report on voting |
|---|---|
| 57/692/FDIS | 57/712/RVD |

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

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

AVA Documents Document Sharing Hub

Full document details: E DIN IEC 61850-8-1:2008-02

IEC 61850 consists of the following parts, under the general title *Communication networks and systems in substations:*

Part 1: Introduction and overview

Part 2: Glossary

Part 3: General requirements

Part 4: System and project management

Part 5: Communication requirements for functions and device models

Part 6: Configuration description language for communication in electrical substations related to IEDs

Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models

Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)

Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes

Part 7-4: Basic communication structure for substation and feeder equipment – Compatible logical node classes and data classes

Part 8-1: Specific Communication Service Mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3

Part 9-1: Specific Communication Service Mapping (SCSM) – Sampled values over serial unidirectional multidrop point to point link

Part 9-2: Specific Communication Service Mapping (SCSM) – Sampled values over ISO/IEC 8802-3

Part 10: Conformance testing [1]

This document specifies in Annex E specialized CDCs (Common Data Classes) based on CDCs defined in IEC 61850-7-3:2003.

TC57, WG10 is currently preparing the second edition of IEC 61850. During the recent WG meeting, it was decided to circulate in a first step the following parts as CD: Part 6, 7-2, 7-3, 7-4, 8-1 and 9-2. The purpose of these CDs is, to give the national committees a first possibility to comment on the principle direction of Edition 2. There may still be some missing elements in these CDs.
It is intended, to circulate by the end of 2007 a CDV of Edition 2. For that CDV, other parts, in particular part 1, 5 and 7-1 will be prepared as well.

[1] Under consideration.

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

## INTRODUCTION

This document is part of a set of specifications which details layered substation communication architecture.

This part of IEC 61850 is intended to provide inter-device operation of a variety of substation and feeder devices to achieve interoperability providing detailed information on how to create and exchange concrete communication messages that implement abstract services and models specified in IEC 61850-7-4, IEC 61850-7-3, and IEC 61850-7-2.

The mapping allows for data exchange over ISO/IEC 8802-3 Local Area Networks between all kinds of substation devices. Some of the protocol stacks used within this document are routable. Therefore the actual communications path may not be restricted to the LAN. Data exchange consists of real-time monitoring and control data, including measured values, to name just a few.

NOTE This part of IEC 61850 does not provide tutorial material. It is recommended that IEC 61850-5 and IEC 61850-7-1 be read in conjunction with IEC 61850-7-2.

Editor's Note:
This document is based on the experiences made after the publication of the first Edition of this standard. The crucial changes made are according to the Tissues (Technical Issues) posted at the Tissue database (www.tissue.iec61850.com).

**The following tissues have been solved in this CD**
Tissues for clauses 1-6 – General, Communication stack:
122 235 290 292 299 430 459

Tissues for clause 7-8, 11-14 and Annex E (Data Model)
109 110 111 112 115 116 119 120 123 128 144 165 168 183 222 314 368 377 422 433

Tissues for clause 16 (Setting Group)
33 34 36 37 38 39 40 41 52 53 172 333 417

Tissues for clause 17 (Reporting model)
114 177 198 344 438

Tissues for clause 18-Annex A (GOOSE)
117 121 224 227 231 237 279 323 365 419

Tissues for clause 20 (Control model)
143 196 246 262 528

Tissues for clause 22 (File transfer)
118 260 576

Harmonization with 7-2 and 7-3
103 141 146 149 173 246 453 456 457

AVA Documents
Document Sharing Hub

Full document details: E DIN IEC 61850-8-1:2008-02

# 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

## 1 Scope

This part of IEC 61850 specifies a method of exchanging time-critical and non-time-critical data through local-area networks by mapping ACSI to MMS and ISO/IEC 8802-3 frames.

MMS services and protocol are specified to operate over full OSI and TCP compliant communications profiles. The use of MMS allows provisions for supporting both centralized and distributed architectures. This standard includes the exchange of real-time data indications, control operations, report notification.

This part of IEC 61850 specifies the mapping of the objects and services of the ACSI (Abstract Communication Service Interface, IEC 61850-7-2) to MMS (Manufacturing Message Specification, ISO 9506) and ISO/IEC 8802-3 frames.

This standard also specifies the mapping of time-critical information exchanges to non-MMS protocol. The protocol semantics are defined in IEC 61850-7-2. This standard contains the protocol syntax, definition, mapping to ISO/IEC 8802-3 frame formats, and any relevant procedures specific to the use of ISO/IEC 8802-3.

This mapping of ACSI to MMS defines how the concepts, objects, and services of the ACSI are to be implemented using MMS concepts, objects, and services. This mapping allows interoperability across functions implemented by different manufacturers.

This part of the standard defines a standardized method of using the ISO 9506 services to implement the exchange of data. For those ACSI services, defined in IEC 61850-7-2 that are not mapped to MMS, this part defines additional protocols. This standard describes real substation devices with respect to their external visible data and behaviour using an object oriented approach. The objects are abstract in nature and may be used to a wide variety of applications. The use of this mapping goes far beyond the application in the substation communications.

This part of IEC 61850 provides mappings for the services and objects specified within IEC 61850-7-2, IEC 61850-7-3, and IEC 61850-7-4.

## 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 60874-10-1:1997, *Connectors for optical fibres and cables – Part 10-1: Detail specification for fibre optic connector type BFOC/2,5 terminated to multimode fibre type A1*

IEC 60874-10-2:1997, *Connectors for optical fibres and cables – Part 10-2: Detail specification for fibre optic connector type BFOC/2,5 terminated to single-mode fibre type B1*

IEC 60874-10-3:1997, *Connectors for optical fibres and cables – Part 10-3: Detail specification for fibre optic connector type BFOC/2,5 for single and multimode fibre*

Documents
Document Sharing Hub

IEC 61850-2, *Communication networks and systems in substations – Part 2: Glossary*

IEC 61850-5, *Communication networks and systems in substations – Part 5: Communication requirements for functions and device models*

IEC 61850-7-1, *Communication networks and systems in substations – Part 7-1: Basic communication structure for substation and feeder equipment – Part 7-1: Principles and models*

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

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

IEC 61850-7-4, *Communication networks and systems in substations – Part 7-4: Basic communication structure for substation and feeder equipment – Compatible logical node classes and data classes*

IEC 61850-9-1, *Communication networks and systems in substations – Part 9-1: Specific Communication Service Mapping (SCSM) – Sampled values over serial unidirectional multidrop point to point link*

IEC 61850-9-2, *Communication networks and systems in substations – Part 9-2: Specific Communication Service Mapping (SCSM) – Sampled values over ISO/IEC 8802-3*

*IEC 62351-6, Data and Communication Security Part 6: Security for IEC 61850*

ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

ISO/IEC 7498-3:1997, *Information technology – Open Systems Interconnection – Basic Reference Model: Naming and addressing*

ISO/IEC 8072:1996, *Information technology – Open systems interconnection – Transport service*

ISO/IEC 8073:1997, *Information technology – Open Systems Interconnection – Protocol for providing the connection-mode transport service definition*

ISO/IEC 8326:1996, *Information processing system – Open Systems Interconnection – Session service definition*

ISO/IEC 8327-1:1997, *Information technology – Open Systems Interconnection – Connection-oriented session protocols: Protocol specification*

ISO/IEC 8348:2002, *Information technology – Open Systems Interconnection – Network service definition*

ISO/IEC 8473-1:1998, *Information technology – Protocol for providing the connectionless-mode network service: Protocol specification*

ISO/IEC 8473-2:1996, *Information technology – Protocol for providing the connectionless-mode network service – Part 2: Provision of the underlying service by an ISO/IEC 8802 subnetwork*

AVA Documents Document Sharing Hub

Full document details: E DIN IEC 61850-8-1:2008-02

ISO/IEC 8602:1995, *Information technology – Protocol for providing the OSI connectionless-mode transport service*

ISO/IEC 8649:1996, *Information technology – Open Systems Interconnection – Service definition for the Associated Control Service Element*

ISO/IEC 8650-1:1996, *Information technology – Open Systems Interconnection – Connection-oriented protocol for the Association Control Service Element: Protocol specification*

ISO/IEC 8802-2:1998, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control*

ISO/IEC 8802-3:2001, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ISO/IEC 8822:1994, *Information technology – Open Systems Interconnection – Presentation service definition*

ISO/IEC 8823-1:1994, *Information technology – Open Systems Interconnection – Connection-oriented presentation protocol: Protocol specification*

ISO/IEC 8824-1:1999, Information technology – Abstract Syntax Notation One (ASN. 1): Specification of basic notation
Amendment 1 (2000)
Amendment 2 (2000)

ISO/IEC 8825-1:2000, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO/IEC 8877:1992, *Information technology – Telecommunications and information exchange between systems – Interface connector and contact assignments for ISDN Basic Access Interface located at reference points S and T*

ISO/IEC 9542:1988, *Information processing systems – Telecommunications and information exchange between systems – End system to Intermediate system routeing exchange protocol for use in conjunction with the Protocol for providing the connectionless-mode network service (ISO 8473)*

ISO/IEC 9548-1:1996, *Information technology – Open Systems Interconnection – Connection-less Session protocol: Protocol specification*

ISO/IEC 9576-1:1995, *Information technology – Open Systems Interconnection – Connection-less Presentation protocol: Protocol specification*

ISO/IEC 10035-1:1995, *Information technology – Open Systems Interconnection – Connection-less protocol for the Association Control Service Element: Protocol specification*
Amendment 1 (1998)

ISO/IEC ISP 10608-1:1992, *Information technology – International Standardized Profile TAnnnn – Connection-mode Transport Service over Connectionless-mode Network Service – Part 1: General overview and subnetwork-independent requirements*

ISO/IEC ISP 10608-2:1992, *Information technology – International Standardized Profile TAnnnn – Connection-mode Transport Service over Connectionless-mode Network Service –*

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

*Part 2: TA51 profile including subnetwork-dependent requirements for CSMA/CD Local Area Networks (LANs)*

ISO/IEC ISP 11188-1:1995, *Information technology – International Standardized Profile – Common upper layer requirements – Part 1: Basic connection oriented requirements*

ISO/IEC ISP 11188-3:1996, *Information technology – International Standardized Profile – Common upper layer requirements – Part 3: Minimal OSI upper layer facilities*

ISO 9506-1:2003, *Industrial automation systems – Manufacturing Message Specification – Part 1: Service definition*

ISO 9506-2:2003, *Industrial automation systems – Manufacturing Message Specification – Part 2: Protocol specification*

ISO/ISP 14226-1:1996, *Industrial automation systems – International Standardized Profile AMM11: MMS General Applications Base Profile – Part 1: Specification of ACSE, Presentation and Session protocols for use by MMS*

ISO/ISP 14226-2:1996, *Industrial automation systems – International Standardized Profile AMM11: MMS General Applications Base Profile – Part 2: Common MMS requirements*

ISO/ISP 14226-3:1996, *Industrial automation systems – International Standardized Profile AMM11: MMS General Applications Base Profile – Part 3: Specific MMS requirements*

IEEE C37.111:1999, *IEEE Standard for Common Format for Transient Data Exchange (COMTRADE) for Power Systems*

IEEE 754:1985, *IEEE Standard for Binary Floating-Point Arithmetic*

IEEE 802.1Q:1998, *IEEE Standards for Local and Metropolitan Networks: Virtual Bridged Local Area Networks*

RFC 542, *File Transfer Protocol for the ARPA Network, IETF, available at <http://www.ietf.org>*

RFC 768, *User Datagram Protocol, IETF, available at <http://www.ietf.org>*

RFC 791, *Internet Protocol – DARPA Internet Program Protocol Specification, IETF, available at <http://www.ietf.org>*

RFC 792, *Internet Control Message Protocol – DARPA Internet Program Protocol Specification, IETF, available at <http://www.ietf.org>*

RFC 793, *Transmission Control Procedure – DARPA Internet Program Protocol Specification, IETF, available at <http://www.ietf.org>*

RFC 826, *An Ethernet Address Resolution Protocol or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware, IETF, available at <http://www.ietf.org>*

RFC 894, *A Standard for the Transmission of IP datagrams over Ethernet Networks, IETF, available at <http://www.ietf.org>*

RFC 919, *Broadcasting Internet Datagrams, IETF, available at <http://www.ietf.org>*

AVA Documents
Document Sharing Hub

Full document details: E DIN IEC 61850-8-1:2008-02

RFC 922 *Broadcasting Internet Datagrams in the presence of subnets, IETF, available at <http://www.ietf.org>*

RFC 950, *Internet Standard Subnetting Procedure, IETF, available at* <http://www.ietf.org>

RFC 959, *File Transfer Protocol (FTP), IETF, available at* <http://www.ietf.org>

RFC 1006 *ISO transport services on top of TCP: Version 3, IETF, available at <http://www.ietf.org>*

RFC 1112, *Host Extensions for IP Multicasting, IETF, available at <http://www.ietf.org>*

RFC 1122, *Requirements for Internet Hosts – Communication Layers, IETF, available at <http://www.ietf.org>*

RFC 1123, *Requirements for Internet Hosts – Application and Support, IETF, available at <http://www.ietf.org>*

RFC 2030, *Simple Network Time Protocol (SNTP) Version 4, IETF, available at <http://www.ietf.org>*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61850-2 as well as the following apply.

**3.1**
**(*n*)-layer**
any specific layer

[ISO/IEC 7498-1, 3.1]

**3.2**
**(*n*)-protocol data unit**
unit of data specified in an ($n$)-protocol and consisting of ($n$)-protocol-control-information and possibly ($n$)-user-data

[ISO/IEC 7498-1, 5.6.1.3]

**3.3**
**(*n*)-protocol**
set of rules and formats (semantic and syntactic) which determines the communication behavior of (N)-entities in the performance of ($n$)-functions

[ISO/IEC 7498-1, 5.2.1.9]

**3.4**
**class**
description of a set of objects that share the same attributes, services, relationships, and semantics

[IEC 61850-7-2, 3.1]

**3.5**
**client**
entity that requests a service from a server and that receives unsolicited messages from a server

[IEC 61850-7-2, 3.2]

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

**3.6**
**device**
entity that performs control, actuating and/or sensing functions and interfaces to other such entities within an automation system

[IEC 61850-7-2, 3.3]

NOTE Devices alone do not perform energy transport functions.

**3.7**
**logical device**
entity that represents a set of typical substation functions

[IEC 61850-7-2, 3.6]

**3.8**
**logical node**
entity that represents a typical substation function

[IEC 61850-7-2, 3.7]

**3.9**
**physical device**
entity that represents the physical parts of a device (hardware and operating system, etc.)

[IEC 61850-7-2, 3.8]

NOTE Physical devices host logical devices.

**3.10**
**Application and Transport Profiles (A-Profile and T-Profile)**
set of protocols for a specific purpose

**3.11**
**attribute**
named element of data which has a specific type

**3.12**
**data**
meaningful structured information of applications located in an automation device which can be read or written.

NOTE This definition is in accordance with the Data definition of IEC 61850-7-2. The MMS use of Data refers to data types and potential instantiations of MMS variables. The reader of this part of IEC 61850 shall be careful of the context in which “data” is being used.

**3.13**
**ISO/IEC 8802-3**
communication technology according to ISO/IEC 8802-3

**3.14**
**server**
entity that provides services to clients or issues unsolicited messages

## 4 Abbreviations

| | |
|---|---|
| A | Application |
| ACSE | Association Control Service Element |
| ACSI | Abstract Communication Service Interface |
| APPID or AppID | Application Identification |

AVA Documents
Document Sharing Hub

| | |
|---|---|
| BRBC | Buffered Report Control Block |
| CBB | Conformance Building Block |
| CDC | Common Data class |
| CL | Connectionless |
| Client-CR | Client Conformance Requirement |
| CO | Connection Oriented |
| DNA | Dynamic Namespace Attribute |
| F/S | Functional Standard. |
| FC | Functional Constraint |
| FCD | Functionally Constrained Data |
| GPS | Global Positioning System |
| GOOSE | Generic Object Oriented Substation Event |
| GSE | Generic Substation Event |
| GSSE | Generic Substation Status Event |
| IEEE | Institute of Electrical and Electronics Engineers |
| IETF | Internet Engineering Task Force |
| IP | Internet Protocol |
| ISO | International Standardization Organization |
| LAN | Local Area Network |
| LCB | Log Control Block |
| LD | Logical Device |
| LLC | Logical Link Control |
| LN | Logical Node |
| LPDU | Link Protocol Data Unit |
| M or m | Mandatory. Indicates that the service, parameter, or attribute shall be supported within an implementation |
| M= or m= | Mandatory information that shall be equal the original information supplied in the request |
| MAC | Media Access Control |
| MJD | Modified Julian Day |
| MMS | Manufacturing Message Specification (ISO 9506) |
| o | Optional: Indicates that the service, parameter, or attribute may be supported within an implementation |
| OSI | Open Systems Interconnection |
| PDU | Protocol Data Unit |
| PICS | Protocol Implementation Conformance Statement |
| PIXIT | Protocol Implementation Extra Information |
| r | Mandates that the item is readable. The ability to write the item is a local issue. |
| RFC | Request for Comments |
| rw | Mandates that the item is both readable and writeable. |
| S | Server specified parameter |
| SAP | Service Access Point. The Service Access Point represents a logical |

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

| | |
|---|---|
| | construct through which a peer selects a communication protocol or access to an applications. The selection of the entire seven layers of SAPs represents a communication profile |
| SBO | Select Before Operate |
| SCL | substation automation System Configuration Language (IEC 61850-6) |
| SNTP | Simple Network Time Protocol |
| SCSM | Specific Communication Service Mapping |
| Server-CR | Server Conformance Requirement |
| SG | Setting Group |
| SNTP | Simple Network Time Protocol |
| SV | Sampled Values |
| Sync | Synchronization |
| T | Transport or Timestamp |
| TAI | Temps Atomique International |
| TCP | Transmission Control Protocol |
| TPID | Priority Tagging Identification (for IEEE 802.1Q networks) = 0x8100 |
| UCA | Utility Communication Architecture |
| u or U | User-specific: Indicates that the service, parameter, or attribute can be defined by an implementation |
| u= or U= | User-specific information that shall be equal the original information supplied in the request |
| UTC | coordinated universal time |
| VARSPEC | Variable Specification |
| V-GET | Virtual Get Function. Defined in ISO 9506-1 |
| VID | VLAN Identificator |
| VLAN | Virtual LAN |
| VMD | Virtual Manufacturing Device |
| V-PUT | Virtual Put Function. Defined in ISO 9506-1 |
| w | Mandates that the item is writeable. The ability to read the item is a local issue. |

# 5 Overview

## 5.1 General

The purpose of IEC 61850-8-1 is to provide detailed instructions/specification as to the mechanisms and rules required to implement the services, objects, and algorithms specified in IEC 61850-7-2, IEC 61850-7-3, and IEC 61850-7-4 while making use of ISO 9506 (all parts) (Manufacturing Message Specification), SNTP, and other application protocols (see Figure 1). This Clause is intended to provide an overview of the methodology to provide the mapping from IEC 61850-7-2, IEC 61850-7-3, and IEC 61850-7-4 into MMS.

The communication requirements for substations (listed in IEC 61850-5) are met by the profiles shown in Figure 1.

The message types and performance classes specified in IEC 61850-5 are mapped as shown in Figure 1:

AVA Documents
Document Sharing Hub

Type 1 (Fast messages)

Type 1A (Trip)

Type 2 (Medium speed messages)

Type 3 (Low speed messages)

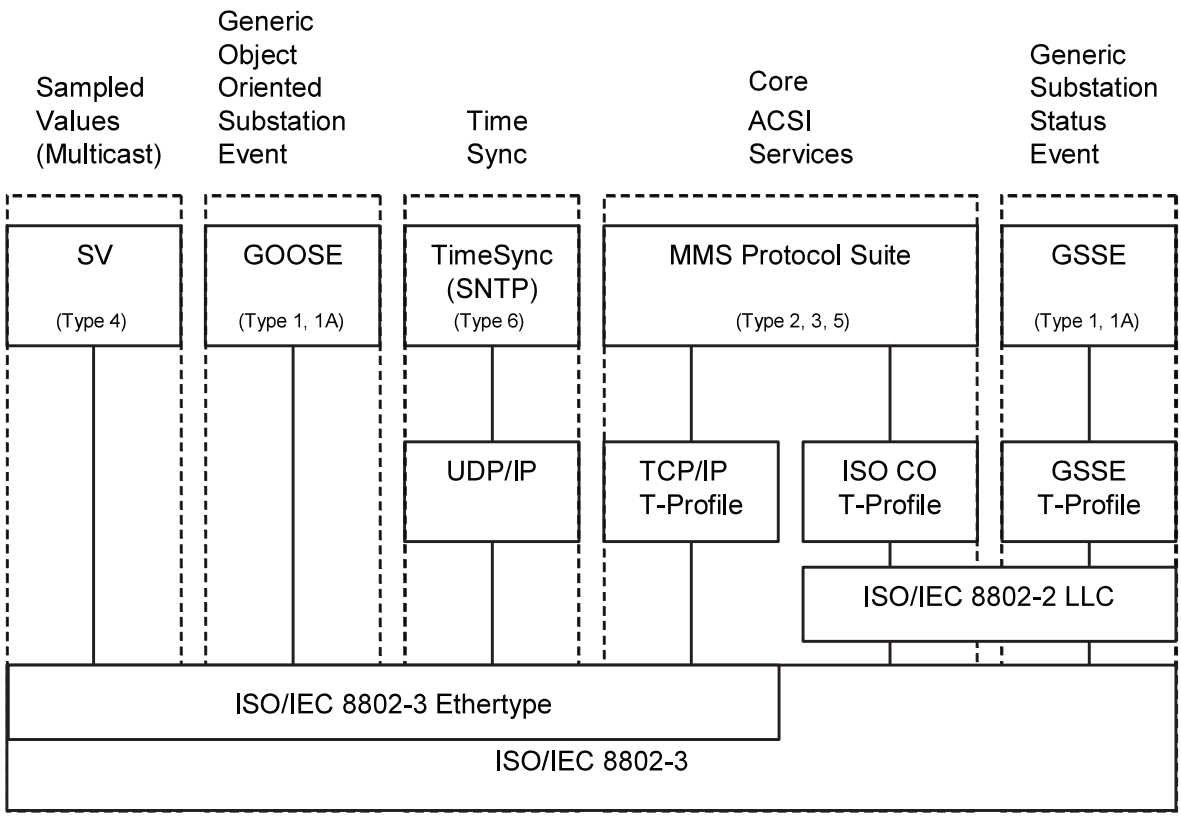
Type 4 (Raw data messages)

Type 5 (File transfer functions)

Type 6 (Time synchronisation messages)

Messages of Type 1 and Type 1A are mapped to distinct Ethertypes to optimise decoding of received messages.

Messages of Type 2, 3, and 5 require message oriented services. The MMS standard provides exactly the information modelling methods and services required by the ACSI.




(Type x) is the Message type and performance class defined in IEC 61850-5

**Figure 1 – Overview of functionality and profiles**

Further details pertaining to the use and actual specification of each profile may be found in Clause 6.

## 5.2 IEC 61850 server object

An instance of an IEC 61850-7-2 Server class is mapped one-to-one to an MMS Virtual Manufacturing Device (VMD) object. The MMS VMD is that portion of an application task that makes available (for control, monitoring, or both) a set of resources and functionality associated with one or more devices. Each VMD is assigned one or more communication addresses that create Service Access Points (SAPs) through which MMS services can be exchanged. The format of the address is determined by the communication profile that is

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

being used. It is through MMS services that MMS objects can be manipulated. Within this mapping to MMS, a VMD represents the capabilities provided by an IEC 61850-7-2 server on the network.

The server also is specified to contain other objects. These objects are:

– files
– client associations

### 5.3 MMS communication profiles

The VMD's service address format is determined through the communication profile being used. However, ISO has recognized the existence of Application Profiles (A-Profiles) and Transport Profiles (T-Profiles). A-Profiles represent the protocols and agreements in regards to the upper 3 layers of the OSI Reference Model (ISO/IEC 7498-1). The T-Profiles represent the protocols and agreements in regards to the lower 4 layers of the OSI reference model.

For the purpose of this document, there are 2 A-Profiles: Connection Oriented OSI and Connectionless OSI. Additionally, there are 3 T-Profiles: Connection Oriented TCP, Connection Oriented OSI, and Connectionless OSI. The ConnectionOriented A-Profile shall only be used over the connection oriented T-Profiles.

### 5.4 Non-MMS communication profiles

There are several services, specified in IEC 61850-7-2, that have been intentionally mapped to application protocols and communication profiles that do not make use of ISO 9506 as the application layer protocol. Other communication profiles are used to accomplish time synchronization, via IETF Simple Network Time Protocol (SNTP), sampled values, and GOOSE/GSSE messages.

### 5.5 MMS objects being used

ISO 9506 (MMS) specifies several MMS objects that could be used as part of this SCSM. However, all objects are not required in order to perform the mapping of IEC 61850-7-2, IEC 61850-7-3, and IEC 61850-7-4. Table 1 shows the MMS objects and services that shall be used within this SCSM.

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

**Table 1 – MMS objects and services in use within this SCSM**

| MMS OBJECT | IEC 61850 OBJECT | MMS SERVICES IN USE |
|---|---|---|
| Application Process VMD | Server | Initiate<br>Conclude<br>Abort<br>Reject<br>Cancel<br>Identify[1] |
| Named Variable Objects | Logical Nodes and Data | Read<br>Write<br>InformationReport<br>GetVariableAccessAttribute<br>GetNameList |
| Named Variable List Objects | Data Sets | GetNamedVariableListAttributes<br>GetNameList<br>DefineNamedVariableList<br>DeleteNamedVariableList<br>GetNameList<br>Read<br>Write<br>InformationReport |
| Journal Objects | Logs | ReadJournal<br>InitializeJournal<br>GetNameList |
| Domain Objects | Logical Devices | GetNameList<br>GetDomainAttributes<br>StoreDomainContents |
| Files | Files | FileOpen<br>FileRead<br>ObtainFile<br>FileClose<br>FileDirectory<br>FileDelete |
| [1] Required by ISO 9506 for conformance. | | |

# 6 Communication stack

## 6.1 Overview of the protocol usage

The OSI Reference Model (ISO/IEC 7498-1) details a model based upon the concept of layering of communication functionality. The model details 7 layers and details the functional requirements, for each layer, in order to achieve a robust communication system. The model does not specify the protocols to be used to achieve the functionality, nor does it restrict the solution to be a single set of protocols.

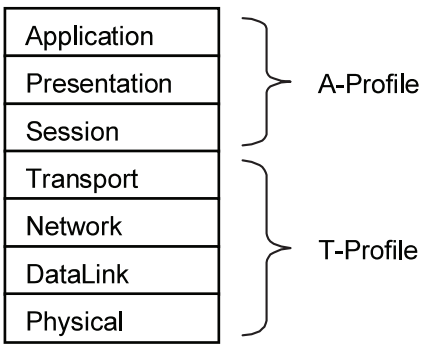



**Figure 2 – OSI reference model and profiles**

The use of ISO Application (A-Profile) and Transport (T-Profile) Profiles (see Figure 2) describes the various stack profiles. An ISO A-Profile is the set of specifications and

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

agreements relating to the upper 3 layers of the ISO OSI reference model (e.g. the layers of application, presentation, and session). An ISO T-Profile is the set of specifications and agreements relating to the lower 4 layers of the ISO OSI reference model (e.g. the layers of transport, network, DataLink and physical).

Various combinations of A-Profiles and T-Profiles can be combined in order to allow certain types of information/services to be exchanged. The services, as specified in IEC 61850-7-2, are mapped into 4 different combinations of A- and T- profiles. The four different combinations are used for:

– Client/server services (see Figure 1 Core ACSI Services). See 6.2 for further details.
– GOOSE/GSE Management Services. See 6.3 for further details.
– GSSE Services. See Annex I.3 for further details.
– Time Sync. See 6.4 for further details.

## 6.2 Client/server services and communication profiles

### 6.2.1 Client/server services

The client/server communication profile shall be used for any implementation claiming conformance to this standard and declaring support for one of the IEC 61850-7-2 services shown in Table 2.

**Table 2 – Services requiring client/server Communication Profile**

| IEC 61850-7-2 model | IEC 61850-7-2 service |
|---|---|
| Server | GetServerDirectory |
| Association | Associate |
| | Abort |
| | Release |
| Logical Device | GetLogicalDeviceDirectory |
| Logical Node | GetLogicalNodeDirectory |
| | GetAllDataValues |
| Data | GetDataValues |
| | SetDataValues |
| | GetDataDirectory |
| | GetDataDefinition |
| Data Set | GetDataSetValues |
| | SetDataSetValues |
| | CreateDataSet |
| | DeleteDataSet |
| | GetDataSetDirectory |
| Substitution | GetDataValues |
| | SetDataValues |
| Setting Group Control Block | SelectActiveSG |
| | SelectEditSG |
| | SetSGValues |
| | ConfirmEditSGValues |
| | GetSGValues |
| | GetSGCBValues |

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

| IEC 61850-7-2 Model | IEC 61850-7-2 Service |
|---|---|
| Report Control Block | Report |
| | GetBRCBValues |
| | SetBRCBValues |
| | GetURCBValues |
| | SetURCBValues |
| LOG Control Block | GetLCBValues |
| | SetLCBValues |
| | GetLogStatusValues |
| | QueryLogByTime |
| | QueryLogAfter |
| GOOSE | GetGoCBValues |
| | SetGoCBValues |
| GSSE | GetGsCBValues |
| | SetGsCBValues |
| Control | Select |
| | SelectWithValue |
| | Cancel |
| | Operate |
| | CommandTermination |
| | TimeActivatedOperate |
| FILE transfer | GetFile |
| | SetFile |
| | DeleteFile |
| | GetFileAttributeValues |

### 6.2.2 A-Profile

Services and protocols of the A-Profile client/server shall be as shown in Table 3.

**Table 3 – Service and protocols for client/server communication A-Profile**

| OSI model layer | Specification | | | m/o |
|---|---|---|---|---|
| | Name | Service specification | Protocol specification | |
| Application | Manufacturing Message Specification | ISO 9506-1:2003 | ISO 9506-2:2003 | m |
| | Association Control Service Element | ISO/IEC 8649:1996 | ISO/IEC 8650:1996 | m |
| Presentation | Connection Oriented Presentation | ISO/IEC 8822:1994 | ISO/IEC 8823-1:1994 | m |
| | Abstract Syntax | ISO/IEC 8824-1:1999 | ISO/IEC 8825-1 | m |
| Session | Connection Oriented Session | ISO/IEC 8326:1996 | ISO/IEC 8327-1:1997 | m |

There are 2 T-Profiles that may be used by the client/server A-Profile: TCP/IP or OSI. An implementation that claims conformance to this standard shall implement the TCP/IP profile as a minimum.

**Implementation agreements**

This A-Profile shall conform to the agreements specified in ISO/ISP 14226-1, ISO/ISP 14226-2, ISO/ISP 14226-3, ISO/IEC ISP 11188-1and ISO/IEC ISP 11188-3.

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

### 6.2.3 TCP/IP T-Profile

Table 4 shows services and protocols of the TCP/IP T-Profile client/server.

**Table 4 – Service and protocols for client/server TCP/IP T-Profile**

| OSI Model Layer | Specification | | | m/o |
|---|---|---|---|---|
| | Name | Service specification | Protocol specification | |
| Communication | Requirement for internet host | RFC 1122 | | m |
| Transport | ISO Transport on top of TCP | RFC 1006 | | m |
| | Internet Control Message Protocol (ICMP) | RFC 792 | | m |
| | Transmission Control Protocol (TCP) | RFC 793 | | m |
| Network | Internet Protocol | RFC 791 | | m |
| | An Ethernet Address Resolution Protocol (ARP) | RFC 826 | | m |
| DataLink | Standard for the transmission of IP datagrams over Ethernet networks | RFC 894 | | m |
| | Carrier Sense Multiple Access with collision detection (CSMA/CD) | ISO/IEC 8802-3:2001 | | m |
| Physical (option 1) | 10Base-T/100Base-T | ISO/IEC 8802-3:2001 | | c1 |
| | Interface connector and contact assignments for ISDN Basic Access Interface. [a] | ISO/IEC 8877:1992 | | |
| Physical (option 2) | Fibre optic transmission system 100Base-FX | ISO/IEC 8802-3:2001 | | c1 |
| | Basic Optical Fibre Connector. [b] | IEC 60874-10-1, IEC 60874-10-2 and IEC 60874-10-3 | | |

[a] This is the specification for the 10BaseT connector.

[b] This is the specification for the ST connector.

c1 It is recommended to implement at least one of the two Physical interfaces. Additional or future technologies may be used.

**Implementation agreements**

**TCP_KEEPALIVE**

The TCP_KEEPALIVE function according to RFC 1122 shall be implemented. The value of the TCP KEEPALIVE shall be configurable. The range of allowed values shall be specified in the PIXIT declaration of the implementation. The value of the TCP shall be specified in seconds.

NOTE It is recommended that the minimum-maximum value of the allowable range should be no greater than 20 s. It is also recommended that the TCP_KEEPALIVE be configurable to a minimum of 1 s. This results in a recommended range of 1 to 20. The value of the TCP_KEEPALIVE is not intended to be changed via SCL since the impact of the parameter is IED wide. Additionally, the PIXIT shall declare if the TCP_KEEPALIVE can be used to indicate Application functionality[2].

[2] There are implementation strategy where the MMS/stack user is a separate process from the MMS provider/TCP stack. In such implementations, the use of TCP_KEEPALIVE may not yield an appropriate indication that the MMS User is still executing.

AVA Documents Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

**Transport selector**

The Transport Selector size shall be limited to a maximum of 4 octets.

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

### 6.2.4 OSI T-Profile

Table 5 shows services and protocols of the OSI T-Profile client/server.

**Table 5 – Service and protocols for client/server OSI T-Profile**

| OSI Model Layer | Specification | | | m/o |
|---|---|---|---|---|
| | Name | Service specification | Protocol specification | |
| Transport | Connection Oriented Transport | ISO/IEC 8072:1996 | ISO/IEC 8073:1997 | m |
| Network | Connectionless Network | ISO/IEC 8348:2002 | ISO/IEC 8473-1:1998<br>ISO/IEC 8473-2:1996 | m |
| | End System to Intermediate System (ES/IS) | ISO/IEC 9542:1988 | | m |
| DataLink | Logical Link Control | ISO/IEC 8802-2:1998 | | m |
| | Carrier Sense Multiple Access with collision detection (CSMA/CD) | ISO/IEC 8802-3:2001 | | m |
| Physical (option 1) | 10Base-T/100Base-T | ISO/IEC 8802-3:2001 | | c1 |
| | Interface connector and contact assignments for ISDN Basic Access Interface. [a] | ISO/IEC 8877:1992 | | |
| Physical (option 2) | Fibre optic transmission system 100Base-FX | ISO/IEC 8802-3:2001 | | c1 |
| | Basic Optical Fibre Connector. [b] | IEC 60874-10-1, IEC 60874-10-2 and IEC 60874-10-3 | | |

[a] This is the specification for the 10BaseT connector.

[b] This is the specification for the ST connector.

c1 It is recommended to implement at least one of the two Physical interfaces. Additional or future technologies may be used.

**Implementation agreements**

The OSI T-Profile shall conform to the agreements as specified in ISO/IEC ISP 10608-1 and ISO/IEC ISP 10608-2.

**Naming and addressing**

The naming and addressing, of this profile, shall be as specified in ISO/IEC 7498-3. The addressing shall be further constrained to support, at a minimum, the ISO DCC (39 hexadecimal) and Local (49 hexadecimal) AFI values found in ISO/IEC 7498-3.

**Transport selector**

The Transport Selector size shall be limited to a maximum of 4 octets.

**LLC type**

This profile shall use Class 1 LLC as specified in ISO/IEC 8802-2.

## 6.3 GSE management and GOOSE services communication profiles

### 6.3.1 GSE mapping overview

The GSE communication profile shall be used for any implementation claiming conformance to this standard and declaring support for one of the IEC 61850-7-2 services shown in Table 6.

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

**Table 6 – Services requiring GSE Management and GOOSE communication profile**

| Model | IEC 61850-7-2 service |
|---|---|
| Generic Substation Event | GetReference<br>GetGOOSEElementNumber<br>SendGOOSEMessage |

### 6.3.2 A-Profile

Table 7 shows services and protocols of the A-Profile GSE Management and GOOSE services.

**Table 7 – Service and protocols for GSE Management and GOOSE communication A-Profile**

| OSI model layer | Specification | | | m/o |
|---|---|---|---|---|
| | Name | Service specification | Protocol specification | |
| Application | GSE/GOOSE protocol | See Annex A | | m |
| Presentation | Abstract Syntax | NULL | | m |
| Session | | | | |

The presentation layer encoding shall be Basic Encoding Rules as defined in ISO/IEC 8824-1 and ISO/IEC 8825-1 to encode the grammar referenced.

### 6.3.3 T-Profile

The T-Profile for GSE and GOOSE Services shall be as shown in Table 8.

**Table 8 – GOOSE/GSE T-Profile**

| OSI model layer | Specification | | | m/o |
|---|---|---|---|---|
| | Name | Service specification | Protocol specification | |
| Transport | | | | |
| Network | | | | |
| DataLink | Priority Tagging/ VLAN | IEEE 802.1Q | | m |
| | Carrier Sense Multiple Access with collision detection (CSMA/CD). | ISO/IEC 8802-3:2001 | | m |
| Physical (option 1) | 10Base-T/100Base-T | ISO/IEC 8802-3:2001 | | c1 |
| | Interface connector and contact assignments for ISDN Basic Access Interface. [a] | ISO/IEC 8877:1992 | | |
| Physical (option 2) | Fibre optic transmission system 100Base-FX | ISO/IEC 8802-3:2001 | | c1 |
| | Basic Optical Fibre Connector. [b] | IEC 60874-10-1, IEC 60874-10-2 and IEC 60874-10-3 | | |

[a] This is the specification for the 10BaseT connector.

[b] This is the specification for the ST connector.

c1 It is recommended to implement at least one of the two physical interfaces. Additional or future technologies may be used.

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

**Implementation agreements**

**T-DATA service**

The T-DATA service shall be mapped directly to the M_UNITDATA service of the DataLink.

**Link layer: MAC – sublayer**

See Annex C for definitions.

The T-DATA destination address for a GOOSE message shall contain a multicast MAC address. The T-DATA source address for a GOOSE message shall contain a unicast MAC address.

The T-DATA destination address for a GSE management messages shall contain a unicast MAC address. The T-DATA source address for a GSE Management messages shall contain a unicast MAC address.

**Link Layer: Priority tagging/Virtual LAN**

See Annex C.

### 6.4 Time sync

This communication profile shall be used for any implementation claiming conformance to this standard and declaring support for objects containing an attribute of type TIMESTAMP.

#### 6.4.1 A-Profile

The A-Profile for Time Sync Services shall be as shown in Table 9.

**Table 9 – Time sync A-Profile**

| OSI model layer | Specification | | | m/o |
|---|---|---|---|---|
| | Name | Service specification | Protocol specification | |
| Application | Simple Network Time Protocol | RFC 2030 | | m |
| Presentation | | | | |
| Session | | | | |

**Implementation agreements**

This A-Profile shall conform to the agreements specified in RFC 1122 and RFC 1123.

Mode 3, 4 of SNTP time synchronization shall be supported.

#### 6.4.2 T-Profile

The T-Profile for Time Sync Services shall be as shown in Table 10.

**Table 10 – Time sync T-Profile**

| OSI model layer | Specification | | | m/o |
|---|---|---|---|---|
| | Name | Service specification | Protocol specification | |
| Transport | Internet Control Message Protocol (ICMP) | RFC 792 | | m |
| | User Datagram Protocol (UDP) | RFC 768 | | m |
| Network | Internet Protocol | RFC 791 | | m |

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

| OSI model layer | Specification | | | m/o |
|---|---|---|---|---|
| | Name | Service specification | Protocol specification | |
| | An Ethernet Address Resolution Protocol (ARP) | RFC 826 | | m |
| | Broadcasting Internet Datagrams | RFC 922<br>RFC 950<br>RFC 919 | | m |
| | Host Extensions for IP Multicasting | RFC 1112 | | m |
| DataLink | Standard for the transmission of IP datagrams over Ethernet networks | RFC 894 | | m |
| | Carrier Sense Multiple Access with collision detection (CSMA/CD) | ISO/IEC 8802-3:2001 | | m |
| Physical (option 1) | 10Base-T/100Base-T | ISO/IEC 8802-3:2001 | | c1 |
| | Interface connector and contact assignments for ISDN Basic Access Interface. [a] | ISO/IEC 8877:1992 | | |
| Physical (option 2) | Fibre optic transmission system 100Base-FX | ISO/IEC 8802-3:2001 | | c1 |
| | Basic Optical Fibre Connector. [b] | IEC 60874-10-1, IEC 60874-10-2 and IEC 60874-10-3 | | |
| [a] This is the specification for the 10BaseT connector.<br>[b] This is the specification for the ST connector.<br>c1 – It is recommended to implement at least one of the two Physical interfaces. | | | | |

# 7 Objects of IEC 61850

## 7.1 Server

For details, see 5.2.

## 7.2 Logical device (LD)

An instance of a IEC 61850-7-2 logical device class shall be represented by an MMS domain object. The IEC 61850-7-2 server object shall contain one or more MMS domain objects. An MMS domain represents a collection of information associated with a specific name. The domain object provides both an unambiguous name space for its subordinate objects (they need only be uniquely named within the scope of the domain). Within this mapping to MMS, the domain is used to represent the collection of objects and services that constitute a logical device.

Each physical device shall have one domain that represents the physical resources of the MMS VMD. This domain shall contain at least a LLN0 and a LPHD logical node.

Example IEC 61850-7-1 shows an example of a physical device that proxies other physical devices. This example can be extended to a single physical device with slotted CPU capability. Each CPU, and its associated Logical Devices, would have their own LPHD information. The entire box needs a set of independent LPHD and LLNO.

## 7.3 Logical node (LN)

### 7.3.1 General

The construction of the contents of a logical node, that need mapping, are defined in IEC 61850-7-2, IEC 61850-7-3, and IEC 61850-7-4.

Each instance of a IEC 61850 Logical node maps to a single MMS NamedVariable. The MMS NamedVariable name is a local issue, but shall be named in accordance with the naming conventions set forth in IEC 61850-7-2, IEC 61850-7-3, and IEC 61850-7-4.

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

The MMS NamedVariable shall have a hierarchical MMS complex MMS type description. The general hierarchy of the MMS TypeDescription consists of multiple levels of components. The algorithm for the creation of the TypeDescription is specified in Equation 1.

For each functional constraint ( c ) found in Figure 3[3]

For each DATA ( d ) in the LN

If the FCD generated from d,c is not empty, then add a component of ComponentName ( d ) of the ComponentType determined by the FCD to structure ( s ).

End For

If the structure ( s ) is not empty then add a component of ComponentName ( c ) of the ComponentType ( s ) to the TypeDescription being generated.

End For

**Equation 1: Algorithm for logical node mapping**

The order of the resulted components is recommended to be as shown in Figure 1.

**Figure 3 –Ordered list of functional constraints**

NOTE FCs are defined as follows: RP – unbuffered report control blocks; LG – log control blocks; BR – buffered report control blocks; GO – GOOSE control blocks; GS – GSSE control blocks; SV – substituted values; SE- Setting group editing; MS – Multicast Sampled Values control block (from IEC 61850-9-2); US – Unicast Sampled Values control block (from IEC 61850-9-1); and EX – extension.

[3] The recommended ordering provides compatibility with existing UCA 2.0 implementations.

Documents
Document Sharing Hub

Full document details: E DIN IEC 61850-8-1:2008-02

If there is no DATA (d) that instantiates a specific functional constraint, that functional constraint shall not appear as part of the NamedVariable TypeDescription.

Within a MMS component, representing a functional constraint, the order of the MMS components is determined by the order of the names of the compatible data classes (see IEC 61850-7-4) whose data attributes have the specific functional constraint.

Within a MMS component, representing IEC 61850-7-4 DATA, the order of MMS components is determined by the order of the names of the common data classes as defined in IEC 61850-7-3 or IEC extensions of it (e.g. Annex E.3). For private CDCs, or private Extensions,the order of attributes within the MMS component shall be identical to the order within the SCL ICD file describing the data model.

Common data classes, which have a single attribute, shall be mapped to a MMS primitive data type, unless otherwise specified. The component name shall be the attribute name from IEC 61850-7-3 unless otherwise specified.

Custom or proprietary extensions to data or data attributes shall be added to the end of the MMS TypeDescription structures. These components shall be named according to the data or data attribute names in the order given by the extended name space document.

This algorithm and mapping produces a MMS NamedVariable whose components are accessible through the use of MMS variable specification of an alternate access type. Additionally, there shall be a mapping to a set of flattened MMS named variables. The names of the flattened MMS named variables shall be created through the concatenation of the MMS named variable component names separated by “$”. The nesting of the concatenation shall be constrained by the maximum MMS NamedVariable identifier size.

These two methods of creating a MMS variable specification shall be referred to as a 8-1 VARSPEC.

### 7.3.2 Mapping of LNReference to VariableAccessSpecifications

An ACSI LNRef may be mapped to a MMS VariableAccessSpecification, when appropriate. The VariableSpecification of such a mapping shall be of type name (e.g. an MMS ObjectName). The scope of the ObjectName is determined by the ACSI LNReference parameter. If a LogicalDevice name is present within the LNReference, the scope of the MMS request shall be Domain-Specific. If an “@” is present, the scope shall be AA-Specific. If neither is present, the scope shall be VMD-Specific.

For a domain-specific scoped request, then the name of the ObjectName’s DomainID shall be the name of the LogicalDevice specified within the LNRef.

The ObjectName identifier for the MMS NamedVariable shall be the name of the LogicalNode contained within the LNRef.

An alternate specification shall be supported. This specification references the MMS named variable that has been mapped into a NamedVariable substituting the “$” character for the ASCII “.” character.

### 7.3.3 Data

Logical Nodes, according to IEC 61850-7-2, consist of one or more data. The names of data will be based upon the hierarchically named component of the data found within the MMS named variable. Each level of hierarchy will be delimited through the use of a “$” within the MMS named variable that represents the data.

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

The data of an instance of LOGICAL-NODE shall be decomposed into multiple MMS NamedComponents

Example <LNVariableName>$<FC>$<LNDataName1> (e.g. XCBR$ST$Pos).

### 7.3.4 Data Attributes (DataAttr)

The logical node data attributes DataAttr map in a similar manner to the Data. However, the attribute name is also included within the hierarchy.

Example <LNVariableName>$<FC>$<LNDataName1>$<AttributeName1>
(e.g. XCBR$ST$Pos$ctlVal).

## 8 Mapping of IEC 61850-7-2 and IEC 61850-7-3 data attributes

### 8.1 Mapping of Attributes specified in IEC 61850-7-2

### 8.1.1 Basic data attribute types

The mapping of basic types of IEC 61850-7-2 shall be as defined in Table 11.

**Table 11 – Mapping of ACSI data types**

| IEC 61850-7-2 type name | MMS data type | MMS value range | Comment |
|---|---|---|---|
| BOOLEAN | Boolean | | |
| INT8 | Integer | –128 to 127 | |
| INT16 | Integer | –32 768 to 32 767 | |
| INT32 | Integer | –2 147 483 648 to 2 147 483 647 | |
| INT128 | Integer | –2**127 to (2**127)–1 | |
| INT8U | Unsigned | 0 to 255 | |
| INT16U | Unsigned | 0 to 65 535 | |
| INT32U | Unsigned | 0 to 4 294 967 295 | |
| FLOAT32 | Floating-point | Range of values and precision as specified by IEEE 754 single precision floating point | |
| FLOAT64 | Floating-point | Range of values and precision as specified by IEEE 754 double precision floating point | |
| ENUMERATED | Integer | Ordered set of values, defined where type is used | See 8.1.2.2 |
| CODED ENUM | Bit-string | Ordered set of values, defined where type is used | See 8.1.2.3 |
| OCTET STRING | Octet-string | Max length shall be defined where type is used | See 8.1.2.4 |
| VISIBLE STRING | Visible-string | Max length shall be defined where type is used | See 8.1.2.5 |
| UNICODE STRING | MMS string | Max length shall be defined where type is used | See 8.1.3.10 |

### 8.1.2 Additional definitions of basic data type

#### 8.1.2.1 General

For the purposes of this standard, the reference to bitstring shall indicate the use of an MMS bitstring type. According to this definition, Bit(0) is mapped to the most significant bit of the value.

AVA Documents Document Sharing Hub

The amount of bits conveyed by a sent variable length bit-string shall always be equal to the maximum length of the defined variable length bit-string at the sender side.

NOTE The attempt to write in an attribute a value that is not supported by the application will lead to a write negative response with a DataAccessError=object-value-invalid (for instance: writing a not supported Enumerated, writing a longer VisibleString/bitString than defined, etc.).

#### 8.1.2.2 ENUMERATED

The IEC 61850-7-2 ENUMERATED shall map to a value represented by a MMS integer value. Values that are 0 or greater shall be reserved for values standardized within IEC 61850. Values that are less than 0 shall be considered private values. The range of allowed values are specified in IEC 61850-7-2 and IEC 61850-7-3. The size of the MMS data type shall be the minimum size required to contain the maximum standardized value.

The first ordered value, of the standardized enumerated values, shall be assigned the value of zero(0).

Enumerated values outside the standardized range of values but within the MMS integer size, shall be assumed to be value extensions and shall not cause a protocol error.

NOTE For IEC 61850 enumerated values, where the actual numeric values are specified, the integer values within the context of IEC 61850-8-1 shall be the same as the numeric values specified.

#### 8.1.2.3 CODED ENUM

The IEC 61850-7-2 CODED ENUM is represented by a bit-string. The size of the bit-string shall be the number of bits required to represent the maximum enumerate value defined in IEC 61850-7-2 and IEC 61850-7-3. The value of a particular bit-string shall be the unsigned integer encoding of the enumerated values in the order specified in IEC 61850-7-2 and IEC 61850-7-3.

For the purposes of IEC 61850-8-1, CODED ENUMs that appear within a PACKED LIST or an array of other CODED ENUMs are treated as special cases.

#### 8.1.2.4 OCTET-STRING

The IEC 61850-7-2 OCTET-STRING shall map to a value represented by a MMS variable length octet-string. The maximum size of the MMS octet-string shall be the size as specified in IEC 61850-7-2 and IEC 61850-7-3.

#### 8.1.2.5 VISIBLE-STRING

The IEC 61850-7-2 VISIBLE-STRING shall map to a value represented by a MMS variable length MMSString. The maximum size of the MMS visible-string shall be the size as specified in IEC 61850-7-2 and IEC 61850-7-3.

The character set, of MMSString, shall be constrained to ISO646String.

### 8.1.3 Common data types

#### 8.1.3.1 OBJECTNAME

This type never appears within the context of IEC 61850-8-1. Therefore it is not mapped.

#### 8.1.3.2 OBJECTREFERENCE

The IEC 61850-7-2 ObjectReference maps to a variable length MMS visible-string. The maximum size of the visible-string shall be 129 octets. The value is the fully MMS scope qualified name of the MMS object. The value shall be constructed as:

– AA-specific scope objects: @<MMS Object Name>

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

– Domain specific: <MMS Domain Name>/<MMS Object Name>

– VMD-specific: /<MMS Object Name>

The maximum MMS Object Name and Domain Name size shall be constrained by the MMS maxidentifier size of 64 (see Annex G) clause G.3.2.

The construction of MMS object names from IEC 61850 names is defined in 7.3.

The allowed character set is defined as the MMS Identifier and the "/" and "@" characters.

#### 8.1.3.3 ServiceError

The ServiceError encoding is specified in the description of the individual services. Default mapping of a SCSI error is ACSI service error "failed-due-to-communications-constraint".

#### 8.1.3.4 EntryID

The ACSI EntryID type shall be mapped to an 8 octet fixed length MMS OCTETSTRING. The contents of the OCTETSTRING are IEC 61850 server specific. It is suggested that the format of the contents be documented as part of the implementation's PIXIT statement.

The reserved value for EntryID is zero (0) is the MMS OCTETSTRING "00000000", where all octect have a value (0).

#### 8.1.3.5 PACKED LIST

A PACKED LIST type shall be mapped to a variable length MMS Bit-string. The minimum size of the bit-string shall be determined by the number of bits required to encode the members of the PACKED LIST. The order of the bits, in the bit-string, shall be that the first member of the PACKED LIST shall be mapped to Bit(0). The other members shall be mapped in consecutive bits in the order specified by IEC 61850-7-2 and IEC 61850-7-3.

Bitstrings shall support at least the number of bits required to represent the maximum enumerated value defined. Bits that are returned in excess of that number of bits may be ignored.

Bit 0 shall be the leftmost (most significant) bit of the first octet. Bit 7 shall be the rightmost (least significant) bit of the first octet. Bit 8 shall be the leftmost (most significant) bit of the second octet. Bit 15 shall be the rightmost (least significant) bit of the second octet. This shall be continued in that way in further octets.

There are special cases that are individually mapped and do not conform to the general rule. These are the timestamp type and quality type. For detailed mapping information, see 8.2 and 8.1.3.6.

#### 8.1.3.6 TIMESTAMP

Extensions to the Data syntax of ISO 9506-2 are given in Annex G.

The quality flags are located in the eighth octet. These flags are defined in Table 12.

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

**Table 12 – Encoding of IEC 61850-7-2 TimeQuality**

| Bit | Value | Meaning |
|---|---|---|
| 0 | | Leap Second Known |
| 1 | | ClockFailure |
| 2 | | Clock not synchronized |
| 3-7 | | Time accuracy of fractions of second |
| | 00000 | 0 bit of accuracy |
| | 00001 | 1 bit of accuracy |
| | 00010 | 2 bits of accuracy |
| | 00011 | 3 bits of accuracy |
| | 00100 - 11000 | Integer value of number of bits of accuracy |
| | 11000- 11110 | Invalid |
| | 11111 | unspecified |

Bit 0 shall be the most significant bit of octet 7. Bit 7 shall be the least significant bit of octet 7.

The octet format shall be (using ASN.1 bstring notation):

'sssssssssssssssssssssssssssssssfffffffffffffffffffffffqqqqqqqq'B

### 8.1.3.7 EntryTime

EntryTime shall be mapped to the MMS DataType of BINARY-TIME. The size of the BINARY-TIME value shall be six (6) octets.

The MMS TimeOfDay epoch began at 0 hours on 1 January 1984 (MJD 40 587). Times measured are designated in this standard as MMS TimeOfDay milli-seconds GMT and TimeOfDay days GMT, and represent offets from the epoch. It should be noted that exceptions to this mapping do occur. One such example is the T attribute of the GOOSE message (see 18.1.2.5).

### 8.1.3.8 TriggerConditions

The values for TriggerConditions encoded as a PACKED_LIST, however Bit(0) is reserved. Therefore, the mapping of TriggerConditions to MMS is a variable length BITSTRING. The minimum size of the BITSTRING shall be six(6) bits. Additional bits are reserved for future versions of the standard. The bits are assigned as follows:

Bit 0 Reserved (reserved to provide backward compatibility with UCA 2.0)
Bit 1 data-change
Bit 2 quality-change
Bit 3 data-update
Bit 4 integrity
Bit 5 general-interrogation

### 8.1.3.9 ExtendedTriggerConditions

The values for ExtendedTriggerConditions encoded as a PACKED_LIST, however Bit(0) is reserved. Therefore, the mapping of ExtendedTriggerConditions to MMS is a variable length BITSTRING. The minimum size of the BITSTRING shall be six(8) bits. Additional bits are reserved for future versions of the standard. The bits are assigned as follows:

Bit 0 Reserved (reserved to provide backward compatibility with UCA 2.0)
Bit 1 data-change

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

Bit 2 quality-change
Bit 3 data-update
Bit 4 integrity
Bit 5 general-interrogation
Bit 6 includeAll
Bit 7 Reserved (reserved for future use – as long as the bit is reserved, the application shall ignore it).

#### 8.1.3.10 UNICODE-STRING

Extensions to the Data syntax of ISO 9506-2 are given in Annex G.

#### 8.1.3.11 Array

The IEC 61850-7-2 Array maps to a MMS array.

### 8.2 Mapping of quality common data attribute type specified in IEC 61850-7-3

The definition, found in IEC 61850-7-3 of the Quality common data attribute, specifies a combination of PACKED LISTs, CODED ENUMs, and BOOLEAN values. The mapping of this data attribute shall be as prescribed in this Clause.

An IEC 61850-7-3 value of the type quality, shall be represented by an MMS DataType of BIT-STRING. The BIT-STRING shall be encoded as variable length bit-string. Bits that are not conveyed shall assume a DEFAULT value as specified in this Subclause.

The bit-string bit values shall be as defined in Table 13.

Future versions of the standard may add additional bits. The maximum allowed bit number shall be 15.

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

**Table 13 – Encoding of IEC 61850-7-3 quality**

| Bit(s) | IEC 61850-7-3 | | Bit-String | |
|---|---|---|---|---|
| | Attribute name | Attribute value | Value | Default |
| 0-1 | Validity | Good | 0 0 | 0 0 |
| | | Invalid | 0 1 | |
| | | Reserved | 1 0 | |
| | | Questionable | 1 1 | |
| 2 | Overflow | | TRUE | FALSE |
| 3 | OutofRange | | TRUE | FALSE |
| 4 | BadReference | | TRUE | FALSE |
| 5 | Oscillatory | | TRUE | FALSE |
| 6 | Failure | | TRUE | FALSE |
| 7 | OldData | | TRUE | FALSE |
| 8 | Inconsistent | | TRUE | FALSE |
| 9 | Inaccurate | | TRUE | FALSE |
| 10 | Source | Process | 0 | 0 |
| | | Substituted | 1 | |
| 11 | Test | | TRUE | FALSE |
| 12 | OperatorBlocked | | TRUE | FALSE |

# 9 Server class model

## 9.1 Server mapping

The ACSI Server, specified in IEC 61850-7-2, shall be mapped to at least one MMS VMD.

## 9.2 Server class attributes

### 9.2.1 ServiceAccessPoint

There are 5 ServiceAccessPoints (e.g. communication interfaces) that may be supported by an IEC 61850-8-1 implementation. The access points/communication interfaces that shall be supported are determined by the service support declared by the implementation.

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

1) Client/server profile

   Implementations that use the client/server profile shall support at least one Presentation Address that makes use of the TCP/IP T-Profile. More than one PresentationAddress may be supported.

   Additionally, one or more PresentationAddresses that uses the OSI T-Profile may also be supported.

2) GSE management

   Implementations that support the GSE management profile shall support as least one ServiceAccessPoint for the GSE management services. An access point shall be defined as an L-Address. The L-Address shall be the combination of the physical MAC address, ETHERTYPE, and APPID specified by the profile for GSE management (see 6.3.3).

   The destination ServiceAccessPoint shall be another L-Address specifying the same ETHERTYPE.

3) GOOSE services

   Implementations that support the GOOSE profile shall support as least one ServiceAccessPoint for transmitting GOOSE services. The access point shall be defined as an L-Address. The L-Address shall be the combination of the physical MAC address, ETHERTYPE, and APPID specified by the profile for GOOSE (see 6.3.3).

   The destination ServiceAccessPoint shall be another L-Address specifying the same ETHERTYPE. The destination MAC address shall be an address that has the multicast bit set.

4) GSSE services

   Implementations that support the GSSE profile shall support at least ServiceAccessPoint for transmitting GSSE services. The access point shall be a PresentationAddress. (see I.1)

   The destination ServiceAccessPoint shall be another PresentationAddress, as constrained by the profile. The destination ServiceAccessPoint shall be another L-Address specifying the same LLC. The destination MAC address shall be an address that has the multicast bit set.

5) Transmission of sampled values services

   Shall be as specified in IEC 61850-9-1 and IEC 61850-9-2.

#### 9.2.2 Logical devices

Logical devices are mapped to MMS domain objects. For each logical device instance there shall be a single MMS domain. The domain name shall be the name of the logical device instance.

Further mapping information regarding logical devices is found in Clause 11.

#### 9.2.3 Files

Files are mapped to MMS file objects. Further mapping information regarding files is found in Clause 23.

#### 9.2.4 Client associations

See Clause 10.

### 9.3 Server class service GetServerDirectory

The GetServerDirectory service shall be mapped based upon the ACSI class being requested within the ServerDirectory service. There are 2 ACSI classes allowed: LOGICAL-DEVICE and FILE.

AVA Documents
Document Sharing Hub

### LOGICAL-DEVICE class

The ACSI request maps to an MMS GetNameList request. The GetNameList object class shall have a value of domain. The MMS GetNameList service, if constrained by the negotiated mmsPDU size limitation, may segment the process by returning a subset of file names and a flag (moreFollows) indicating the need to request the next subset. The client shall then post another request, this time specifying the position in the list at which the server should continue with name retrieval. Due to this constraint, the mapping of the ACSI service is actually a sequence of GetNameList services (until moreFollows=FALSE).

The ACSI ServiceErrors "failed-due-to-server-constraint" shall map to the Reject Code as detailed in Table 14. The ACSI ServiceErrors are mapped to MMS reject reasons. ACSI ServiceError values that do not appear in the table are not mapped.

**Table 14 – ServiceError mapping for GetServerDirectory for non-files**

| ACSI service error | MMS reject | |
|---|---|---|
| | Reject reason | Reject code |
| failed-due-to-server-constraint | confirmed-requestPDU | other,<br>unrecognized-service,<br>max-serv-oustanding-exceeded |

### FILE class

The ACSI request maps to an MMS FileDirectory request. The MMS FileDirectory service, if constrained by the negotiated mmsPDU size limitation, may segment the process by returning a subset of file names and a flag (moreFollows) indicating the need to request the next subset. The Client shall then post another request, this time specifying the position in the list at which the server should continue with name retrieval. Due to this constraint, the mapping of the ACSI service is actually a sequence of FileDirectory services (until moreFollows=FALSE).

The ACSI ServiceErrors shall map to Error Class/Error Code or Reject Code as detailed in Table 15. The ACSI ServiceErrors are mapped to either MMS ServiceErrors or MMS Reject reasons. ACSI ServiceError values that do not appear in the table are not mapped.

If the Filename (for instance MMS FileSpecification) is not present in the FileDirectory.request, then the responding server shall return the Filenames present in the root directory. For servers that have logical devices, 23.1 specifies the root directory. The names of the files returned shall be the filenames of the files present in the LD directory. For servers that have no logical devices (for instance possibly a file server), the root directory shall be a local issue.

**Table 15 – ServiceErrors mapping of ACSI GetServerDirectory for files**

| ACSI service error | MMS ServiceError | |
|---|---|---|
| | Error class | Error code |
| parameter-value-inappropriate | file | filename-syntax-error |
| parameter-value-inconsistent | file | filename-ambiguous |
| | MMS reject | |
| | Reject reason | Reject code |
| failed-due-to-server-constraint | confirmed-requestPDU | other,<br>unrecognized-service,<br>max-serv-oustanding-exceeded |

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

# 10 Association model

## 10.1 Association relation to communication profiles

There are two types of application associations specified in IEC 61850-7-2. These are:

– two-party associations;
– multicast associations.

There are several communication profiles specified in this document. An implementation-claiming conformance to any one of the given profiles shall implement the association model required for that profile, as defined in Table 16.

**Table 16 – Association model versus communication profiles**

| Communication profile | ACSI association model(s) supported |
|---|---|
| Client/server | Two party |
| GSE Management | Two party |
| GOOSE | Multicast |
| GSSE | Multicast |
| Time Sync | Two party or multicast |

## 10.2 Two party association model for client/server communication profile

### 10.2.1 Association mapping

The client/server profile shall map the ACSI two party association model to the MMS environment as specified in ISO 9506-1.

NOTE The MMS environment, as specified in ISO 9506-1, is brought into existence through the establishment of a single application-to-application association that is created and maintained via a connection-oriented communication profile. The addressing and procedures for this may be found in ISO 9506-1. However, the MMS environment consists, additionally, of the negotiation of application capabilities through the exchange of the MMS initiate service.

**AssociationID**

The AssociationID shall be a local issue. However, there shall be a one-to-one correspondence between an AssociationID and an MMS environment, including negotiated parameters.

NOTE Security, authentication is a future work item and is pending the development of a common IEC Technical Committee 57 security mechanism. This mechanism may restrict the visibility of objects within the MMS Environment. These efforts are underway within IEC Technical Committee 57 Working Groups 7 and 15.

### 10.2.2 Association services

#### 10.2.2.1 Associate

The ACSI associate request service shall map directly to the MMS initiate request service.

The ACSI associate response service shall map directly to the MMS initiate response service.

The ACSI associate response– service shall map to the MMS initiate service result(–).

The ACSI ServiceErrors shall map to Error Class/Error Code as detailed in Table 17. ACSI ServiceError values that do not appear in the table are not mapped.

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

**Table 17 – Associate service error mappings**

| ACSI service error | MMS Serviceerror | | ACSE AARE |
|---|---|---|---|
| | Error class | Error code | Parameter Values |
| instance-not-available | application-reference | application-unreachable | |
| parameter-value-inappropriate | application-reference | application-reference-invalid, context-unsupported | |
| parameter-value-inconsistent | initiate | max-services-outstanding-calling-insufficient<br>max-services-outstanding-called-insufficient | |
| failed-due-to-communications-constraint | initiate | parameter-CBB-insufficient<br>nesting-level-insufficient | |
| failed-due-to-server-constraint | initiate | other | Result::=Failure |

Any other MMS ServiceErrors shall be mapped to failed-due-to-server-constraint.

#### 10.2.2.2 Abort

The ACSI abort request service shall map directly to the MMS abort request service.

The ACSI Abort Indication service shall map directly to the MMS abort indication. The reason code values shall be as defined in ISO 9506 (all parts).

#### 10.2.2.3 Release

The ACSI release request service shall map directly to the MMS conclude request service.

The ACSI release response+ shall map directly to the MMS conclude response.

The ACSI release response– shall map directly to the MMS conclude error. The ACSI ServiceErrors shall map to Error Class/Error Code as detailed in Table 18. ACSI ServiceError values that do not appear in the table are not mapped.

**Table 18 – Release service error mappings**

| ACSI service error | MMS ServiceError | |
|---|---|---|
| | Error class | Error code |
| instance-in-use | conclude | further-communication-required |
| failed-due-to-server-constraint | conclude | other |

Any other MMS ServiceErrors shall be mapped to failed-due-to-server-constraint.

### 10.3 Two party association model for GSE management communication profile

Although the GSE Management communication profile does not make use of multicast, the association model shall be implemented consistent with the multicast association model.

### 10.4 Two party association model for time sync

Although the SNTP protocol does not make use of MMS, it does behave as if it were a two party association model. Please refer to RFC 2030 for the specifics.

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

### 10.5 Multicast association model

The association model is specified as part of the various communication profiles.

## 11 Logical device model

The ACSI request GetLogicalDeviceDirectory maps to an MMS GetNameList request. The GetNameList object class shall have a value of NamedVariable within the scope of a particular domain. The MMS GetNameList service, if constrained by the negotiated mmsPDU size limitation, may segment the process by returning a subset of object names and a flag (moreFollows) indicating the need to request the next subset. The client shall then post another request, this time specifying the position in the list at which the server should continue with name retrieval. Due to this constraint, the mapping of the ACSI service is actually a sequence of GetNameList services (until moreFollows=FALSE).

If the LDReference (e.g. the MMS Domain), in the GetLogicalDeviceDirectory does not exist within the scope of the Server, then a MMS Confirmed-ErrorPDU shall be returned. The MMS ServiceError, within the Confirmed-ErrorPDU shall be an access error whose value is “object-non-existent”.

If the requested Domain exists, but there are no objects of the requested ObjectClass, then a GetNameList-Response shall be sent. The GetNameList-Response shall indicate MoreFollows=FALSE and shall contain a NULL listOfIdentifier.

The NamedVariable objects returned may contain more objects than solely logical nodes. Therefore, the MMS ObjectName will need to be filtered based upon the naming standards within this document (e.g. a NamedVariable that has no ‘$’ character).

## 12 Logical node model

### 12.1 Logical node class

An instance of an ACSI LogicalNode shall be mapped to a single MMS NamedVariable. The mapping algorithm shall be as specified in 7.3.

### 12.2 Logical node class attributes

**Data**

The ACSI data, associated with an instance of a logical node, shall appear as MMS named components within the NamedVariable’s MMS TypeDescription.

**DataSets**

The ACSI DataSet shall be mapped to a MMS NamedVariableList object. If the DataSet is within a logical node, then the name of the NamedVariableList object shall be constructed by concatenating logical node name and DataSet name separated by a “$” character. A DataSetRef appearing within an IEC 61850-7-2 data object shall be mapped to a MMS variable length VISIBLE-STRING. The value of the VISIBLE-STRING shall be an OBJECT-REFERENCE as specified in 8.1.3.2.

**BufferedReportControlBlocks**

See 17.1.1.1.

**UnbufferedReportControlBlocks**

See 17.1.1.2.

**LogControlBlocks**

See 17.3.2.

AVA Documents
Document Sharing Hub

**SettingGroupControlBlock**

See 16.

**Log**

The mapping of the IEC 61850-7-2 Log class shall be specified in 17.3.3.

**GOOSEControlBlock**

See 18.1.1.

**GSSEControlBlock**

See Annex I.2.

**MulticastSampledValueControlBlock**

MulticastSampledValueControlBlock shall map as per the data mapping rules.

**UnicastSampledValueControlBlock**

UnicastSampledValueControlBlock shall map as per the data mapping rules.

## 12.3 Logical node class cervices

### 12.3.1 GetLogicalNodeDirectory

The GetLogicalNodeDirectory service shall map directly to the GetNameList MMS service (see Table 19).

**Table 19 – GetNameList classes for GetLogicalNodeDirectory service**

| ACSI class being requested in GetLogicalNodeDirectory | GetNameList service constraints |
|---|---|
| Data | NamedVariable |
| DataSet | NamedVariableList |
| BufferedReportControlBlock | NamedVariable |
| UnbufferedReportControlBlock | NamedVariable |
| LogControlBlock | NamedVariable |
| SettingGroupControlBlock | NamedVariable |
| Log | Journal |
| GooseControlBlock | NamedVariable |
| GSSEControlBlock | NamedVariable |
| MulticastSampledValueControlBlock | NamedVariable |
| UnicastSampledValueControlBlock | NamedVariable |

The ACSI request maps to an MMS GetNameList request. The GetNameList object class shall have a value as specified in Table 19. The scope of the request shall be the scope of the LogicalNode (typically within the scope of a particular domain). The MMS GetNameList service, if constrained by the negotiated mmsPDU size limitation, may segment the process by returning a subset of object names and a flag (moreFollows) indicating the need to request the next subset. The client shall then post another request, this time specifying the position in the list at which the server should continue with name retrieval. Due to this constraint, the mapping of the ACSI service is actually a sequence of GetNameList services (until moreFollows=FALSE).

The ACSI Response– maps onto the MMS ServiceError as specified in Table 14.

Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

### 12.3.2 GetAllDataValues

#### 12.3.2.1 Request

The ACSI request shall map to an MMS read request. The mapping of the ACSI LNReference parameter shall be as per 7.3.2.

If the ACSI request contains a functional constraint parameter, the read request Variable AccessSpecification shall specify alternateAccess. The accessSelection of the alternate access specification shall specify component. The value of the component shall be the value of the functional constraint being specified.

NOTE The access to all values of a particular logical node may also be obtained through the use of a single MMS named variable, with no alternate access. The name of the variable would be <LogicalNodeName>.

#### 12.3.2.2 Response+

The ACSI GetAllDataValues response+ maps to a MMS ReadResponse where the AccessResult returns MMS data.

The ACSI GetAllDataValues response+ parameter of DataAttributeReference is not mapped nor supported within this SCSM.

The DataAttributeValue(s) shall be mapped to the MMS AccessResult of the MMS read response. There shall be only 1 AccessResult returned.

#### 12.3.2.3 Response–

The ACSI GetAllDataValues response– shall map to a MMS read response where AccessResult indicates failure. Table 20 defines the mappings.

**Table 20 – MMS AccessResult mapping to ASCI ServiceError**

| ACSI service error | AccessResult Codes (DataAccessError) |
|---|---|
| instance-not-available | object-non-existent |
| access-violation | object-access-denied |
| parameter-value-inconsistent | invalid-address |
| instance-locked-by-other-client | temporarily-unavailable |
| type-conflict | type-inconsistent |
| failed-due-to-server-constraint | hardware-failure |

NOTE An out of range access will result in an MMS DataAccessError “object-value-invalid”.

## 13 Data class model

### 13.1 Data class

Instances of IEC 61850-7-2 data shall be mapped to a IEC 61850-8-1 VARSPEC as specified in 7.3.1 data class attributes.

**Functionally Constrained Data (FCD)**

An ACSI FCD is mapped as specified in 7.3.1.

**Functionally Constrained Data Attribute (FCDA)**

An ACSI FCDA is a special case of the mapping specified in 7.3.1. The differentiation between an FCD and a FCDA is that a FCDA is specified as nesting one level below the FCD

AVA Documents Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02

Once mapped to MMS, the FCDA is identical and has the same IEC 61850-8-1 VARSPEC as a data attribute access.

## 13.2 Data class services

### 13.2.1 GetDataValues

The ACSI GetDataValues service shall be mapped to the MMS read service. The mapping of the ACSI service parameters shall be as defined in Table 21.

**Table 21 – Mapping of GetDataValues service parameters**

| GetDataValues parameters | MMS service or parameter | Constraint |
|---|---|---|
| Request | Read request service | |
| Reference | variableAccessSpecification | Maps to a 8-1VARSPEC |
| | | |
| Response+ | Read response service | |
| DataAttributeValue[1..n] | listOfAccessResult | |
| | | |
| Response– | Read response service | |
| ServiceError | listOfAccessResult | See Table 20 |

### 13.2.2 SetDataValues

The ACSI SetDataValues service shall be mapped to the MMS Write service. The mapping of the ACSI service parameters shall be as defined in Table 22.

**Table 22 – Mapping of SetDataValues service parameters**

| SetDataValues service parameters | MMS service or parameter | Constraint |
|---|---|---|
| Request | Write request service | |
| Reference | variableAccessSpecification | Mapped to 8-1VARSPEC |
| DataAttributeValue[1..n] | listOfData | |
| | | |
| Response+ | Write response service | |
| | success | |
| | | |
| Response– | Write response service | |
| ServiceError | failure | See Table 20 |

### 13.2.3 GetDataDirectory

The ACSI GetDataDirectory service shall be mapped to the MMS GetVariableAccessAttributes service. The mapping of the ACSI service parameters shall be as defined in Table 23.

AVA Documents
Document Sharing Hub
Full document details: E DIN IEC 61850-8-1:2008-02