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TECHNICAL REPORT

colour inside

Communication networks and systems for power utility automation – Part 90-2: Using IEC 61850 for communication between substations and control centres

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-2: Using IEC 61850 for communication between substations and control centres

FOREWORD

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IEC TR 61850-90-2, which is a technical report, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

DTR	Report on voting
57/1578/DTR	57/1641/RVC

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

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

A list of all the parts in the IEC 61850 series, published under the general title *Communication networks and systems for power utility automation*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

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

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INTRODUCTION

Following the publication of IEC 61850, substations using IEC 61850 technologies have been implemented. The concepts of IEC 61850 are also used in applications outside of the substation such as distributed energy resources, hydro power plants and wind power plants. Therefore, IEC 61850 forms the foundation for a globally standardized utility communication network.

The object models and configuration language introduced by IEC 61850 provide new possibilities for the management of the automation system. A direct and seamless access from the control and maintenance centres to the IEDs of the substation automation system allows efficient data management of the overall control system.

The possibility of using IEC 61850 for communication between substations and control systems is mentioned in IEC TR 62357-1:2012 without any specification of how it will be used. The issue was evaluated in 2002 by a task force. The conclusion was that IEC 61850 is suitable, but may eventually require the following extensions:

- A new mapping of the communication services on a protocol suitable for wide area communication;
- Extensions of the data model to provide a control centre view of the substation. A further important benefit to users is the possibility of entering configuration information only once.

Currently, substation configuration information is available in the SCL and control centre configuration information is available in the CIM. The models have been harmonized, so that an automatic transfer of the information from one model to the other should be possible. New work will describe how that configuration information can be transferred between CIM and SCL. However, this document does not address the overall topic of CIM/IEC 61850 harmonisation. That will be addressed separately in the future technical report IEC TR 62361-102.

IEC 61850 was initially prepared for information exchange between the devices of a substation automation system. The concepts are now also used in other power system application domains.

This technical report provides a comprehensive overview of the matters that need to be considered in order to use IEC 61850 for information exchange between substations and control or maintenance systems. Areas that require extension of specific parts of the existing IEC 61850 standards will be incorporated in future editions of the affected part of IEC 61850.

A similar report discussing the use of IEC 61850 for communication between substations has been issued as IEC TR 61850-90-1.

The namespace of this technical report is “(Tr)IEC 61850-90-2:2015A”.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-2: Using IEC 61850 for communication between substations and control centres

1 Scope

This part of IEC 61850, which is a technical report, provides a comprehensive overview of the different aspects that need to be considered while using IEC 61850 for information exchange between substations and control or maintenance centres or other system level applications. In particular, this technical report:

- defines use cases and communication requirements that require an information exchange between substations and control or maintenance centres
- describes the usage of the configuration language of IEC 61850-6
- gives guidelines for the selection of communication services and architectures compatible with IEC 61850
- describes the engineering workflow
- introduces the use of a Proxy/Gateway concept
- describes the links regarding the Specific Communication Service Mapping (SCSM)

This technical report does not define constraints or limitations for specific device implementations. There is no specific chapter for cyber security which is tackled when it is necessary. The model, for IEC TR 61850-90-2, provides security functions based upon the security threats and security functions found in IEC TS 62351-1 and IEC TS 62351-2. This technical report touches several security aspects with the following basic assumptions:

- Information authentication and integrity (e.g. the ability to provide tamper detection) is needed
- Confidentiality is optional

It shall be possible to provide information authentication and integrity in an end-to-end method, regardless of information hierarchies. The typical method to provide this security function is through some type of information/message authentication code. IEC 62351-4:2007 and IEC 62351-9[1] describe how authentication and integrity is achieved for IEC 61850-8-1. A later version of IEC 62351-4 will provide means to ensure end-to-end data integrity through Proxy/Gateways.

Beneath information authentication and integrity, information availability is an important aspect for telecontrol. This technical report provides redundancy architectures to enhance the availability of information in control and maintenance centres.

The scheme shown in Figure 1 gives an overview of the connectivity and the communication paths. In particular it indicates the principle to access directly or indirectly – via the Proxy/Gateway – to an IED. An application of security controls for substation to control centre communication can be found in IEC 62351-10:2012, 6.4.3. Thus, the substation automation system has to be considered inside a perimeter of cyber security. The access is totally checked by security access points (this document does not describe such a security access

[1] Under consideration.

point). The boundary of the electronic security perimeter is defined by the point, where the communication line leaves the perimeter of the substation over public ground. There might be more than one security access point, where separation of applications (e.g. control centre and maintenance centre) is required. When more than one client needs access to the same security access point information level access control, e.g. according to IEC TS 62351-8:2011, may be added. IEC TS 62351-8:2011 may also be used in other cases, where different access rights are required.

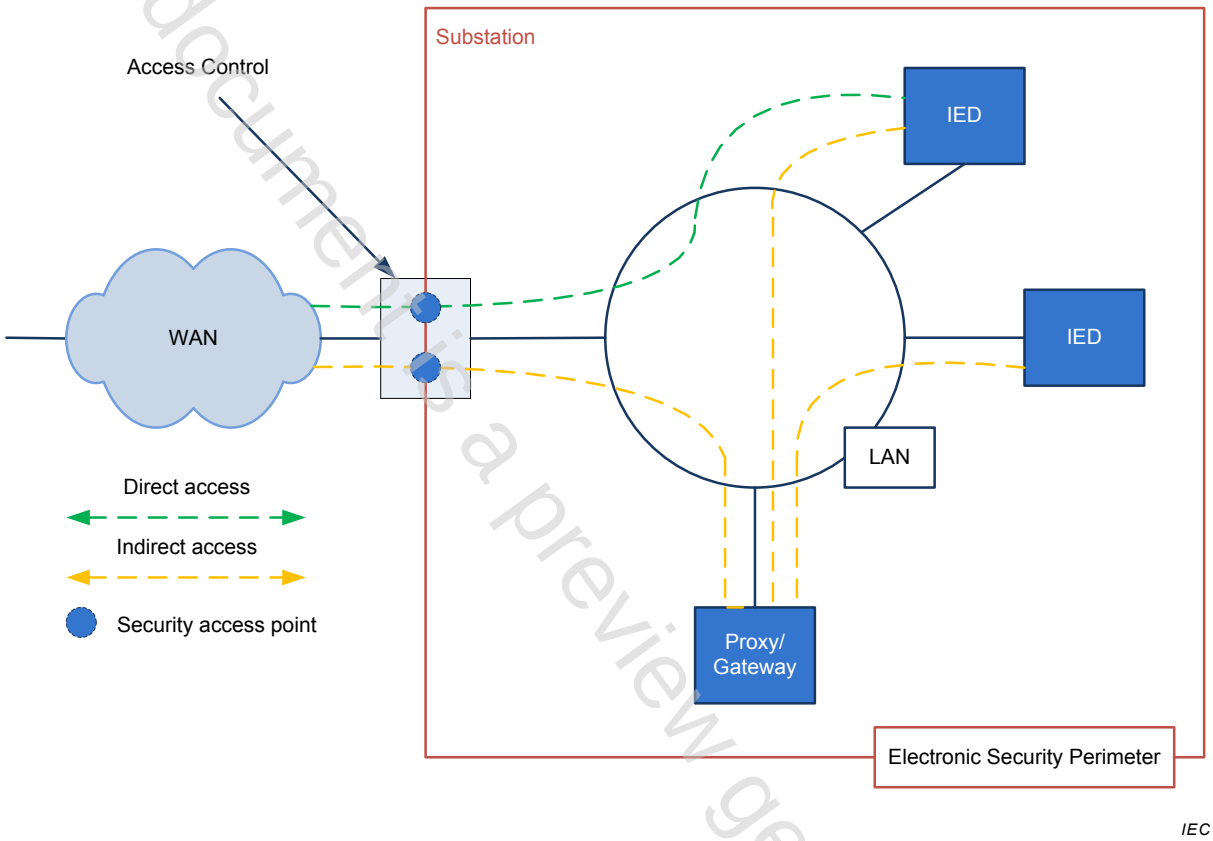

Figure 1 – Connectivity and communication paths of a substation

The majority of applications for which this technical report is applicable will use the services of MMS (ISO 9506) mapped to ISO/IEC 8802-3 frame formats, as described in IEC 61850-8-1:2011.

The primary application for the use of indirect access, as described in this technical report, will be for telecontrol applications. Nevertheless this technical report does not imply that the use of a Proxy/Gateway is required for telecontrol applications. Direct access may also be used for telecontrol applications where applicable and accepted by the customer.

2 Normative references

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

IEC 60870-4:1990, *Telecontrol equipment and systems – Part 4: Performance requirements*

IEC 60870-5-103:1997, *Telecontrol equipment and systems – Part 5-103: Transmission protocols – Companion standard for the informative interface of protection equipment*

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

IEC 61158-6, *Industrial communication networks – Fieldbus specifications*

IEC TS 61850-2:2003, *Communication networks and systems in substations – Part 2: Glossary*

IEC 61850-4:2011, *Communication networks and systems for power utility automation – Part 4: System and project management*

IEC 61850-5:2013, *Communication networks and systems for power utility automation – Part 5: Communication requirements for functions and device models*

IEC 61850-6:2009, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substations related to IEDs*

IEC 61850-7-1:2011, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure – Principles and models*

IEC 61850-7-2:2010, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

IEC 61850-7-3:2010, *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure – Common data classes*

IEC 61850-7-4:2010, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

IEC 61850-8-1:2011, *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 61850-9-2:2011, *Communication networks and systems for power utility automation – Part 9-2: Specific communication service mapping (SCSM) – Sampled values over ISO/IEC 8802-3*

IEC TS 61850-80-4, *Communication networks and systems for power utility automation – Part 80-4: Translation from COSEM object model (IEC 62056) to the IEC 61850 data model*[2]

IEC TR 61850-90-3, *Communication networks and systems for power utility automation – Part 90-3: Using IEC 61850 for condition monitoring diagnosis and analysis*[2]

IEC TR 61850-90-5:2012, *Communication networks and systems for power utility automation – Part 90-5: Use of IEC 61850 to transmit synchrophasor information according to IEEE C37.118*

IEC TR 61850-90-12:2015, *Communication networks and systems for power utility automation – Part 90-12: Wide area network engineering guidelines*

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2 To be published.

IEC 62056-6, *Electricity metering data exchange – The DLMS/COSEM suite*

IEC TS 62351-4:2007, *Power systems management and associated information exchange – Data and communications security – Part 4: Profiles including MMS*

IEC TS 62351-8:2011, *Power systems management and associated information exchange – Data and communications security – Part 8: Role-based access control*

IEC 62351-9, *Power systems management and associated information exchange – Data and communications security – Part 9: Cyber security key management for power system equipment*[2]

IEC TR 62351-10:2012, *Power systems management and associated information exchange – Data and communications security – Part 10: Security architecture guidelines*

IEC 62351-11, *Power systems management and associated information exchange – Data and communications security – Part 11: Security for XML Files*[3]

IEC 81346-1:2009, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 1: Basic rules*

IEC 81346-2:2009, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 2: Classification of objects and codes for classes*

IEEE 1815-2012, *IEEE Standard for Electric Power Systems Communications-Distributed Network Protocol (DNP3)*

RFC 1122:1989, *Requirements for Internet Hosts – Communication Layers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61850-2:2003 and IEC 61850-7-2:2010, as well as the following, apply.

3.1
control centre
place where a master station (SCADA, EMS, DMS, GMS, grid operator) receives and processes data coming from substations

Note 1 to entry: The control centre may also perform the functions of a maintenance centre.

3.2
maintenance centre
place from where maintenance, management of asset, disturbance analysis and metering are managed

3.3
Proxy/Gateway
IED containing an IEC 61850 server which services requests of its clients by forwarding requests to other servers through its IEC 61850 client

Note 1 to entry: A Proxy/Gateway optionally alters the client requests or the server's response and sometimes it may serve the request without contacting the specified server, e.g. by maintaining a process data image. In some

[3] To be published.