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Communication networks and systems for power utility automation – Part 90-13: Deterministic networking technologies

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CONTENTS

FOREWORD 5
INTRODUCTION 7
1 Scope 8
2 Normative references 8
3 Terms and definitions, abbreviated terms and acronyms 9
3.1 Terms and definitions 9
3.2 Abbreviated terms and acronyms 11
4 Characteristics of determinism 13
4.1 Deterministic latency 13
4.2 Deterministic jitter 14
5 Problem Statement 15
5.1 Overview 15
5.2 Problems with existing technologies 16
5.3 Improvements in networking communication from using the capabilities of deterministic communication technologies 17
5.4 Drawbacks of deterministic networking 17
5.4.1 General 17
5.4.2 Change in network design 18
5.4.3 Changes to the network infrastructure 18
5.4.4 Change to the network tools 18
5.4.5 Hardware changes to the IEDs 18
5.4.6 Change to the IED applications 18
5.4.7 Change to the standard 18
5.4.8 Backward compatibility and transition phase 19
5.5 Survey about problem statement 19
6 Deterministic networking – support and improvements for existing use cases 19
6.1 Use cases for the LAN 19
6.1.1 Requirements 19
6.1.2 Substation automation 20
6.1.3 WAN-based use cases 23
6.1.4 Protection and control for Distributed Energy Resources (DER) 26
6.1.5 Use cases in which determinism supports non-functional requirements 28
6.2 New use cases (in substation automation and over the WAN) 29
6.2.1 Large control loops 29
6.2.2 Multi-service networks 30
7 Deterministic networking 31
7.1 Capabilities and improvements 31
7.1.1 General 31
7.1.2 Time synchronization 31
7.1.3 Quality of service (QoS) 31
7.1.4 Network configuration and management 32
7.2 Deterministic networking technologies 32
7.2.1 Deterministic HSR 32
7.2.2 IEEE 802.1 Time-sensitive networking (TSN) 34
7.2.3 IETF DetNet 41
7.2.4 Other technologies 42

8 Co-existence and interoperability with existing and emerging technologies (and how to address technology changes) 47
8.1 Relation of TSN to technologies such as SDN (Software Defined Networking) and NFV (Network Function Virtualization) 47
8.2 Relation and interoperability to existing architectures for high-availability and redundancy based on PRP/HSR 48
8.3 Relation and interoperability to existing WAN-architectures based on MPLS (IP/MPLS, MPLS-TP) 48
8.4 Brownfield deployment options 48
8.5 Migration path 49
9 Design consideration for a future utility profile using deterministic networking technologies 50
9.1 IEC 61850 traffic patterns and protocols 50
9.2 Non-IEC 61850 traffic patterns and protocols 52
9.3 High-availability and reliability 53
9.4 Deterministic traffic classification 53
9.5 Conceptual model 53
9.5.1 General 53
9.5.2 Utility profile considerations using 802.1 TSN technologies 54
9.5.3 Specific IEEE 802.1Q-2018 clauses and related amendments 54
9.5.4 Time synchronization 54
10 Harmonization of deterministic networking requirements 54
10.1 IEC 61850-5 54
10.2 IEC 61850-9-2 54
10.3 IEC/IEEE 61850-9-3 54
10.4 IEC TR 61850-90-1 55
10.5 IEC/TR 61850-90-2 55
10.6 IEC TR 61850-90-4 55
10.7 IEC TR 61850-90-12 55
11 Impact on application operation 55
11.1 Scope and dependencies 55
11.2 Impact on existing applications 56
11.3 Impact for new applications and application evolution 56
Annex A (informative) Related work and liaisons 57
A.1 IEC/IEEE 60802 TSN-Profile for industrial automation 57
A.2 IEEE 802.24.1 Smart Grid TG 58
A.3 IEC SEG8 58
A.4 Power utility automation and control applications using 5G technology 58
Bibliography 59

Figure 1 – Delay probability for hard- and soft-real-time system 14
Figure 2 – Low jitter – jitter deterministic delay 15
Figure 3 – Substation station bus, process bus and traffic example (IEC TR 61850-90-4, Figure 11) 20
Figure 4 – Substation with Deterministic Ethernet 21
Figure 5 – Current differential tele-protection system (IEC TR 61850-90-12:2015) 24
Figure 6 – Microgrid with renewable generation, storage and grid infeed 26
Figure 7 – Multi-Service Networks 30

Figure 8 – Precise sending in HSR 33
Figure 9 – TSN Components 34
Figure 10 – Fully Distributed Model 38
Figure 11 – Hybrid Model 39
Figure 12 – Central Model 40
Figure 13 – Topology of a WAN network using VSN 44
Figure 14 – Frame Structure 45
Figure 15 – Mapping data in a single EtherCAT DLPDU 46
Figure 16 – Brownfield configuration options 49
Figure 17 – GOOSE protocol time/space chart (Source IEC TR 61850-90-4) 52

Table 1 – Transfer time requirements of IEC 61850-5 19
Table 2 – Station bus communication specifics in today's substations and possible benefits / improvements with TSN 23
Table 3 – Process bus communication specifics in today's substations and possible benefits / improvements with TSN 23
Table 4 – Latency requirements for protection schemes 25
Table 5 – IEEE 802.1 Qcc Configuration Models 36
Table 6 – DetNet documents 42
Table 7 – Traffic type characteristics of IEC 61850 protocols 51
Table 8 – Traffic type characteristics of non-IEC 61850 protocols 53

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-13: Deterministic networking technologies

FOREWORD

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The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 61850-90-13, 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:

Draft TR	Report on voting
57/2236/DTR	57/2301/RVDTR

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

A list of all 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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

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INTRODUCTION

Deterministic networking technologies enable applications that require bounded communication delays regardless of network load or reconfiguration. They allow traffic of different time-criticality to share the same physical medium. Deterministic network technologies are based on the pre-allocation of resources using for example scheduling, traffic shaping and the pre-emption of low priority messages to guarantee the timely delivery of high-priority traffic.

Power automation and control is an industry domain where deterministic networking is needed to support existing use cases and applications (requiring real-time communication), and to enable new developments. This networking is currently being provided by SDH networks or dedicated (for protection communications) Ethernet networks; however significant drives (economic and political) are now emerging to use "converged" Ethernet networks.

In this document the term WAN is used for the inter-substation communication networks, with the driving force usually being the desire of a utility to use the same network infrastructure for IT as well as for operational tasks such as inter-substation protection communications.

The term LAN is used for the intra-substation communication networks. Converged networks are those supporting mixed traffic (e.g. process data, configuration management, voice and video surveillance data) in the same network being used for critical power automation applications. In the same way that using public transportation to get from A to B in a timely (deterministic) manner requires the ability to be guaranteed a seat at a particular time, using a communication network for the deterministic delivery of data also requires the guarantee of access at a particular time. This document identifies, describes, and discusses the known technologies to address this determinism issue.

Summary:

Clause 5 describes the problem (with non-deterministic networks);

Clause 6 provides use cases;

Clause 7 lists deterministic networking technologies;

Clause 8 discusses interoperability issues;

Clause 9 suggests changes to the IEC 61850 standards needed to support determinism;

Annex A lists some related works and liaisons.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-13: Deterministic Networking Technologies

1 Scope

This part of IEC 61850, which is a Technical Report, provides information, use cases, and guidance on whether and how to use deterministic networking technologies. Furthermore, this document comprises technology descriptions, provides guidance how to achieve compatibility and interoperability with existing technologies, and lays out migration paths. It will separate the problem statement from the possible solutions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60834-1:1999, *Teleprotection equipment of power systems – Performance and testing – Part 1: Command systems*

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/IEEE 61588:2009*, Precision clock synchronization protocol for networked measurement and control systems*

IEC 61850 (all parts), *Communication networks and systems for power utility automation*

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

IEC/IEEE 60802, *Time-sensitive networking profile for industrial automation*

IEC/IEEE 61850-9-3-2016, *IEC/IEEE International Standard – Communication networks and systems for power utility automation – Part 9-3: Precision time protocol profile for power utility automation*

IEC TR 61850-90-1:2010, *Communication networks and systems for power utility automation – Part 90-1: Use of IEC 61850 for the communication between substations*

IEC TR 61850-90-2:2016, *Communication networks and systems for power utility automation – Part 90-2: Using IEC 61850 for communication between substations and control centres*

IEC TR 61850-90-4:2020, *Communication networks and systems for power utility automation – Part 90-4: Network engineering guidelines*

IEC TR 61850-90-5:2012, *Communication networks and systems for power utility automation – Part 90-5: Use of* IEC 6*1850 to transmit synchrophasor information according to* IEEE *C37.118*

IEC TR 61850-90-12:2020, *Communication networks and systems for power utility automation – Part 90-12: Wide area network engineering guidelines*

IEC 62351-7:2017, *Power systems management and associated information exchange – Data and communications security – Part 7: Network and System Management (NSM) data object models*

IEC 62439-3:2016, *Industrial communication networks – High availability automation networks – Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)*

IEEE 802.1AS, *IEEE Standard for Local and Metropolitan Area Networks – Timing and Synchronization for Time-Sensitive Applications*, available at http://www.ieee.org

IEEE 802.1Q, *IEEE Standard for Local and metropolitan area networks – Bridges and Bridged Networks;* available at <http://www.ieee.org>

IEEE 802.1Qcc-2018, *IEEE Standard for Local and Metropolitan Area Networks – Bridges and Bridged Networks – Amendment 31: Stream Reservation Protocol (SRP) Enhancements and Performance Improvements*

IEEE 802.3-2018, *IEEE Standard for Ethernet*

IEEE C37.94-2017, *IEEE Standard for N times 64 kbps Optical Fiber Interfaces between Teleprotection and Multiplexer Equipment*

IEEE C37.118.1-2011, *IEEE Standard for Synchrophasor Measurements for Power Systems*