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

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-13: Deterministic networking technologies

FOREWORD

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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- withdrawn,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*