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Power systems management and associated information exchange – Data and communications security

Part 1: Communication network and system security – Introduction to security issues

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Part 1: Communication network and system security – Introduction to security issues

FOREWORD

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- The subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62351-1, which is a technical specification, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

Enquiry draft	Report on voting
57/802/DTS	57/850/RVC

Full information on the voting for the approval of this technical specification 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 parts of the IEC 62351 series, under the general title *Power systems management and associated information exchange – Data and communications security*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual edition of this document may be issued at a later date.

POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – DATA AND COMMUNICATIONS SECURITY

Part 1: Communication network and system security – Introduction to security issues

1 Scope and object

1.1 Scope

The scope of the IEC 62351 series is information security for power system control operations. The primary objective is to "*Undertake the development of standards for security of the communication protocols defined by IEC TC 57, specifically the IEC 60870-5 series, the IEC 60870-6 series, the IEC 61850 series, the IEC 61970 series, and the IEC 61968 series. Undertake the development of standards and/or technical reports on end-to-end security issues*."

1.2 Object

Specific objectives include:

- IEC 62351-1 provides an introduction to the remaining parts of the standard, primarily to introduce the reader to various aspects of information security as applied to power system operations.
- IEC 62351-3 to IEC 62351-6 specify security standards for the IEC TC 57 communication protocols. These can be used to provide various levels of protocol security, depending upon the protocol and the parameters selected for a specific implementation. They have also been design for backward compatibility and phased implementations.
- IEC 62351-7 addresses one area among many possible areas of end-to-end information security, namely the enhancement of overall management of the communications networks supporting power system operations.
- Other parts are expected to follow to address more areas of information security.

The justification for developing these information security standards is that safety, security, and reliability have always been important issues in the design and operation of systems in the power industry, and information security is becoming increasingly important in this industry as it relies more and more on an information infrastructure. The deregulated market has imposed new threats as knowledge of assets of a competitor and the operation of his system can be beneficial and acquisition of such information is a possible reality. In addition, inadvertent actions (e.g. carelessness and natural disasters) can be as damaging as deliberate actions. Recently, the additional threat of terrorism has become more visible.

Although many definitions of "end-to-end" security exist, one (multi-statement) standard definition is "*1. Safeguarding information in a secure telecommunication system by cryptographic or protected distribution system means from point of origin to point of destination. 2. Safeguarding information in an information system from point of origin to point of destination*"[1]. Using this definition as a basis, the first four standards address the security enhancements for IEC TC 57 communication profiles, since these were identified as the obvious first steps in securing power system control operations. However, these security enhancements can only address the security requirements between two systems, but does not address true "end-to-end" security that covers internal security requirements, including

[1] ATIS: an expansion of FS-1037C which is the US Federal Government standard glossary for telecommunications terms.

security policies, security enforcement, intrusion detection, internal system and application health, and all the broader security needs.

Therefore, the final sentence in the scope/purpose statement is very important: it is recognized that the addition of firewalls or just the simple use of encryption in protocols, for instance by adding "bump-in-the-wire" encryption boxes or even virtual private network (VPN) technologies would not be adequate for many situations. Security truly is an "end-to-end" requirement to ensure authenticated access to sensitive power system equipment, authorized access to sensitive market data, reliable and timely information on equipment functioning and failures, backup of critical systems, and audit capabilities that permit detection and reconstruction of crucial events.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this part of the IEC 62351 standard series.

IEC 60870-5 (all parts), *Telecontrol equipment and systems – Part 5: Transmission protocols*

IEC 60870-6 (all parts), *Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO standards and ITU-T recommendations* [2]

IEC 61850 (all parts), *Communication networks and systems in substations*[3]

3 Terms, definitions and abbreviations

For the purposes of this part of IEC 62351, the terms and definitions given in IEC 62351-2 apply.

4 Background for information security standards

4.1 Rationale for addressing information security in power system operations

Communication protocols are one of the most critical parts of power system operations, responsible for retrieving information from field equipment and, vice versa, for sending control commands. Despite their key function, to date, these communication protocols have rarely incorporated any security measures, including security against inadvertent errors, power system equipment malfunctions, communications equipment failures, or deliberate sabotage. Since these protocols were very specialized, "Security by Obscurity" has been the primary approach. After all, only operators are allowed to control breakers from highly protected control centres. Who could possibly care about the megawatts on a line, or have the knowledge of how to read the idiosyncratic bits and bytes of the appropriate one-out-of-a-hundred communication protocols. And why would anyone want to disrupt power systems?

However, security by obscurity is no longer a valid concept. In particular, the electricity market is pressuring market participants to gain any edge they can. A tiny amount of information can turn a losing bid into a winning bid – or withholding that information from your competitor can make their winning bid into a losing bid. And the desire to disrupt power

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[2] Also known as Inter-Control Centre Communications Protocol (ICCP) allows for data exchange over Wide Area Networks (WANs) between a utility control centre and other control centres, other utilities, power pools, regional control centres, and Non-Utility Generators.

[3] IEC 61850 which is used for protective relaying, substation automation, distribution automation, power quality, distributed energy resources, substation to control centre, and other power industry operational functions. It includes profiles to meet the ultra fast response times of protective relaying and for the sampling of measured values, as well as profiles focused on the monitoring and control of substation and field equipment.