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Security for industrial automation and control systems – Part 4-1: Secure product development lifecycle requirements

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SECURITY FOR INDUSTRIAL AUTOMATION AND CONTROL SYSTEMS –

Part 4-1: Secure product development lifecycle requirements

FOREWORD

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The text of this International Standard is based on the following documents:

FDIS	Report on voting
65/685/FDIS	65/688/RVD

Full information on the voting for the approval of this International Standard 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 62443 series, published under the general title *Security for industrial automation and control systems*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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- withdrawn,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.

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document is part of a series of standards that addresses the issue of security for industrial automation and control systems (IACS). This document describes product development life-cycle requirements related to cyber security for products intended for use in the industrial automation and control systems environment and provides guidance on how to meet the requirements described for each element.

This document has been developed in large part from the Secure Development Life-cycle Assessment (SDLA) Certification Requirements [26] [1] from the ISA Security Compliance Institute (ISCI). Note that the SDLA procedure was based on the following sources:

– ISO/IEC 15408-3 (Common Criteria) [18];

– Open Web Application Security Project (OWASP) Comprehensive, Lightweight Application Security Process (CLASP) [36];

– The Security Development Life-cycle by Michael Howard and Steve Lipner [43];

– IEC 61508 Functional safety of electrical/electronic/ programmable electronic safety-related systems [24], and

– RCTA DO-178B Software Considerations in Airborne Systems and Equipment Certification [28].

Therefore, all these sources can be considered contributing sources to this document.

This document is the part of the IEC 62443 series that contains security requirements for developers of any automation and control products where security is a concern.

Figure 1 illustrates the relationship of the different parts of IEC 62443 that were in existence or planned as of the date of circulation of this document. Those that are normatively referenced are included in the list of normative references in Clause 2, and those that are referenced for informational purposes or that are in development are listed in the Bibliography.

[1] Figures in square brackets refer to the bibliography.

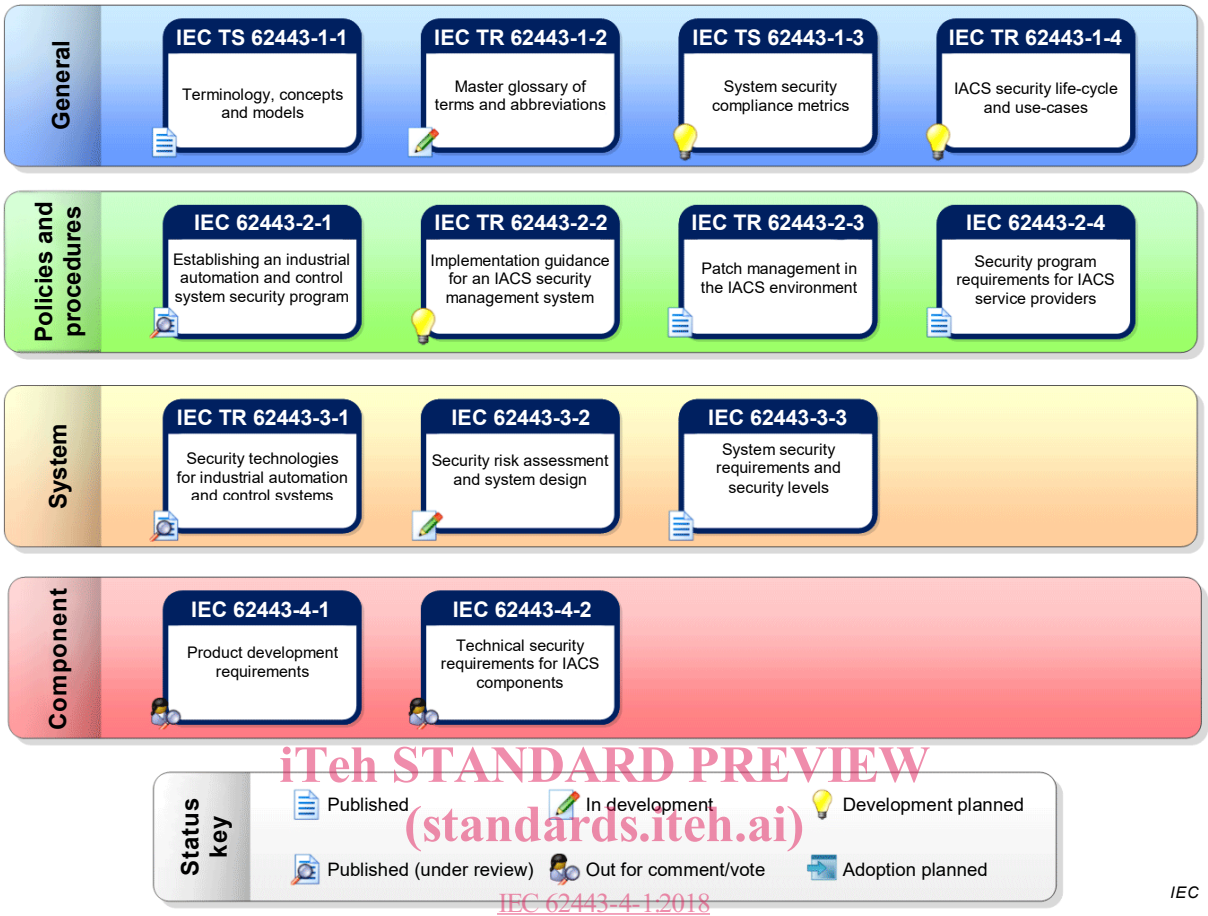

Figure 1 – Parts of the IEC 62443 series

Figure 2 illustrates how the developed product relates to maintenance and integration capabilities defined in IEC 62443-2-4 and to its operation by the asset owner. The product supplier develops products using a process compliant with this document. Those products may be a single component, such as an embedded controller, or a group of components working together as a system or subsystem. The products are then integrated together, usually by a system integrator, into an Automation Solution using a process compliant with IEC 62443-2-4. The Automation Solution is then installed at a particular site and becomes part of the industrial automation and control system (IACS). Some of these capabilities reference security measures defined in IEC 62443-3-3 [10] that the service provider ensures are supported in the Automation Solution (either as product features or compensating mechanisms). This document only addresses the process used for the development of the product; it does not address design, installation or operation of the Automation Solution or IACS.

In Figure 2, the Automation Solution is illustrated to contain one or more subsystems and optional supporting components such as advanced control. The dashed boxes indicate that these components are “optional”.

NOTE 1 Automation Solutions typically have a single product, but they are not restricted to do so. In some industries, there may be a hierarchical product structure. In general, the Automation Solution is the set of hardware and software, independent of product packaging, that is used to control a physical process (for example, continuous or manufacturing) as defined by the asset owner.

NOTE 2 If a service provider provides products used in the Automation Solution, then the service provider is fulfilling the role of product supplier in this diagram.

NOTE 3 If a service provider provides products used in the Automation Solution, then the service provider is fulfilling the role of product supplier in this diagram.

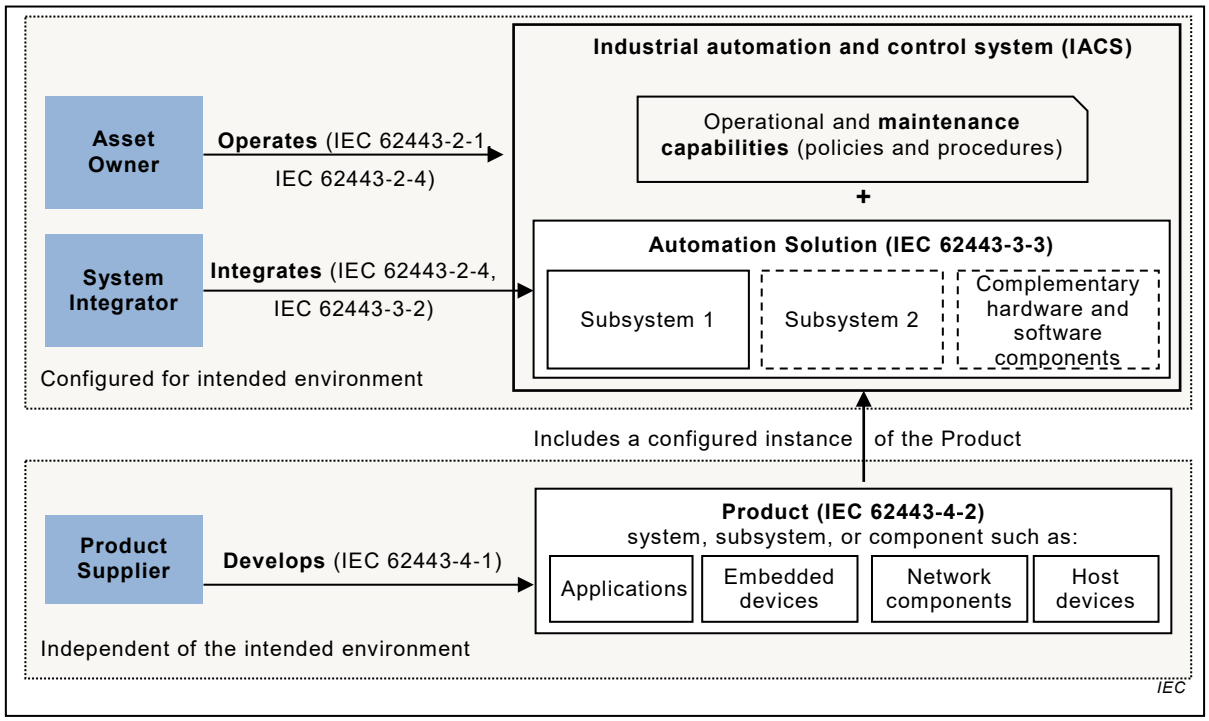

Figure 2 – Example scope of product life-cycle

SECURITY FOR INDUSTRIAL AUTOMATION AND CONTROL SYSTEMS –

Part 4-1: Secure product development lifecycle requirements

1 Scope

This part of IEC 62443 specifies process requirements for the secure development of products used in industrial automation and control systems. It defines a secure development life-cycle (SDL) for the purpose of developing and maintaining secure products. This life-cycle includes security requirements definition, secure design, secure implementation (including coding guidelines), verification and validation, defect management, patch management and product end-of-life. These requirements can be applied to new or existing processes for developing, maintaining and retiring hardware, software or firmware for new or existing products. These requirements apply to the developer and maintainer of the product, but not to the integrator or user of the product. A summary list of the requirements in this document can be found in Annex B.

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 62443-2-4:2015, *Security for industrial automation and control systems – Part 2-4: Security program requirements for IACS service providers*
IEC 62443-2-4:2015/AMD1:2017

3 Terms, definitions, abbreviated terms, acronyms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TR 62443-1-2[2] and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
abuse case
test case used to perform negative operations of a use case

Note 1 to entry: Abuse case tests are simulated attacks often based on the threat model. An abuse case is a type of complete interaction between a system and one or more actors where the results of the interaction are intentionally intended to be harmful to the system, one of the actors or one of the stakeholders in the system.

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2 Under consideration.

3.1.2
access control <protection>
protection of system resources against unauthorized access

3.1.3
access control <process>
process by which use of system resources is regulated according to a security policy and is permitted by only authorized users according to that policy

Note 1 to entry: Access control includes identification and authentication requirements specified in other parts of the IEC 62443 series.

3.1.4
administrator
user who has been authorized to manage security policies/capabilities for a product or system

3.1.5
asset
physical or logical object owned by or under the custodial duties of an organization, having either a perceived or actual value to the organization

Note 1 to entry: In this specific case, an asset is an object that is part of an IACS.

3.1.6
asset owner
individual or organization responsible for one or more IACSs

3.1.7
attack surface
physical and functional interfaces of a system that can be accessed and, therefore, potentially exploited by an attacker

3.1.8
audit log
event log that requires a higher level of integrity protection than provided by typical event logs

Note 1 to entry: Audit logs are used to protect against claims that repudiate responsibility for an action.

3.1.9
authentication
provision of assurance that a claimed characteristic of an identity is correct

Note 1 to entry: Not all credentials used to authenticate an identity are created equally. The trustworthiness of the credential is determined by the configured authentication mechanism. Hardware or software-based mechanisms can force users to prove their identity before accessing data on a device. A typical example is proving the identity of a user usually through an identity provider.

Note 2 to entry: Authentication includes verifying human users as well as non-human users such as devices or processes.

3.1.10
automation solution
control system and any complementary hardware and software components that have been installed and configured to operate in an IACS

Note 1 to entry: Automation Solution is used as a proper noun in this part of the IEC 62443 series.

Note 2 to entry: The difference between the control system and the Automation Solution is that the control system is incorporated into the Automation Solution design (for example, a specific number of workstations, controllers and devices in a specific configuration), which is then implemented. The resulting configuration is referred to as the Automation Solution.

Note 3 to entry: The Automation Solution can be comprised of components from multiple suppliers including the product supplier of the control system.

3.1.11
banned function
software method that is no longer recommended to be used in software because more secure versions exist with less propensity for misuse

Note 1 to entry: Banned functions are sometimes called banned methods or banned Application Programming Interfaces (APIs).

3.1.12
best practices
guidelines for securely designing, developing, testing, maintaining or retiring products that the supplier has determined are commonly recommended by both the security and industrial automation communities

EXAMPLE Least privilege, economy of mechanism and least common mechanism.

3.1.13
component
one of the parts that make up a product or system

Note 1 to entry: A component may be hardware or software and may be subdivided into other components.

3.1.14
configuration management
discipline of identifying the components of an evolving system for the purposes of controlling changes to those components and maintaining continuity and traceability throughout the life-cycle

3.1.15
defense in depth
approach to defend the system against any particular attack using several independent methods

Note 1 to entry: Defense in depth implies layers of security and detection, even on single systems, and provides the following features:

- is based on the idea that any one layer of protection, may and probably will be defeated;
- attackers are faced with breaking through or bypassing each layer without being detected;
- a flaw in one layer can be mitigated by capabilities in other layers;
- system security becomes a set of layers within the overall network security; and
- each layer should be autonomous and not rely on the same functionality nor have the same failure modes as the other layers.

3.1.16
dependent component
component external to the product on which the product depends

EXAMPLE Java run time environment or a driver

Note 1 to entry: This includes both hardware and software.

3.1.17
deprecated function
software method that is supported but whose use is no longer recommended

Note 1 to entry: Methods are generally deprecated before becoming obsolete (deleted from the set of functions provided by the supplier of the function). Deprecated functions are sometimes called deprecated methods or deprecated APIs.