ISASecure webinar

Address Smart Building Cybersecurity with IEC 62443

Presented by Jon Williamson

June 29, 2022

ISASecure®

Johnson Controls

Smart Buildings

Power	HVAC	BMS	Security	Fire	Lighting / Other
Substations	Ventilation	Temperature Control	Video	Panels	Lighting
Microgrid	Chillers	Thermostats	Access Control	Detectors	Shade / Blind
Generators	Air Handlers	Analytics	Intrusion	Suppression	Roof
Power distribution	Purification	Air Quality / Health	Loss Prevention	Smoke	Digital Signage
Arc flash technology			Monitoring	Safety	Conference
Metering			Parking		Emergency
			Elevator / Lift		
			Occupant Health		

Monitoring (Workstations, Mobile, Alerts)

Analytics (Logging, Optimization, AI)

Connectivity (IT networks, Wireless, Mobile, Intranet, Cloud)

Smart Building Benefits

- Efficiency
- Comfort
- Experience
- Health

OT Attacks are on the rise

Industry reports

Gartner (2017)

- by 2020, more than 25% of all identified attacks in enterprises will involve IoT
- IoT will account for less than 10% of IT security budgets'.
- buildings will account for 81% of all connected things in 2020

Kaspersky (2019)

- 40,000 smart buildings worldwide running Kaspersky, nearly 4 in 10 (37.8%) of these buildings had been affected by a malicious cyber attack.

Building incidents

- Target, USA (2013)
- DHS, USA (2013)
- St. Regis Hotel, China – (2014)
- Google Sydney HQ (2014)
- Hollywood Presbyterian Hospital LA (2017)
- Erie County Medical Center, NY (2017)
- Norsk Hydro Aluminium (2019)

Critical incidents

- SolarWinds – Federal Hack (2020)
- Colonial Pipeline - (2021)
- Florida Water Plant - (2021)
- Kemuri Water Company (2016)

Malware

- Lockergog
- Shamoon
- Wannacry
- Garmarue
- Stuxnet
- Havex/Dragonfly

Case study

December 2013: Target Corporation

- Up to 40 million financial and personal records of Target customers exfiltrated
- Hackers stole credentials from an HVAC and refrigeration company, gained remote access to the network, installed malware on Point-of-Sales (POS) and other nodes, send data (via FTP) to Russian server

Game changers

Attacks increasingly disrupt people and businesses

December, 2020

SolarWinds Software Supply Chain Attack: United States Federal Government data breach –cyber attack by a group backed by a foreign government penetrated thousands of organizations, including the US Federal Government. The impact of the 'Sunburst' malware to power providers is still unknown.

May, 2021

Ransomware paralyzed the Colonial Pipeline Co., prompting a shutdown of the 5,500-mile pipeline that carries 45% of the fuel used on the East Coast—quickly followed by a rise in gasoline prices, panic buying of gas across the Southeast, and closures of thousands of gas stations.

Impacts

- A heightened need for secure remote access
- Real physical implications
- Increased government regulation forthcoming
- Concern from constituents not previously engaging in the discussion

Smart Buildings need cybersecurity across all systems

Power	HVAC	BMS	Security	Fire	Lighting / Other
Substations	Ventilation	Temperature Control	Video	Panels	Lighting
Microgrid	Chillers	Thermostats	Access Control	Detectors	Shade / Blind
Generators	Air Handlers	Analytics	Intrusion	Monitoring	Digital Signage
Power distribution	Purification	Air Quality / Health	Loss Prevention	Suppression	Conference
Arc flash technology			Monitoring	Smoke	Emergency
Metering			Parking	Safety	
			Elevator / Lift		
			Occupant Health		

BACnet · Microsoft AD · Modbus · ONVIF · MQTT · DALI · LoRa · SIP · zigbee · Z-WAVE · Proprietary · SNMP · KNX · OSDP · M-Bus · http:// · DMX

ASHRAE BACnet® evolution

- 1995 – Initial release
- 2010 – Network Security “addendum G”
- 2019 – BACnet/SC “secure connect”

… regardless of protocol

Building systems utilize a layered architecture

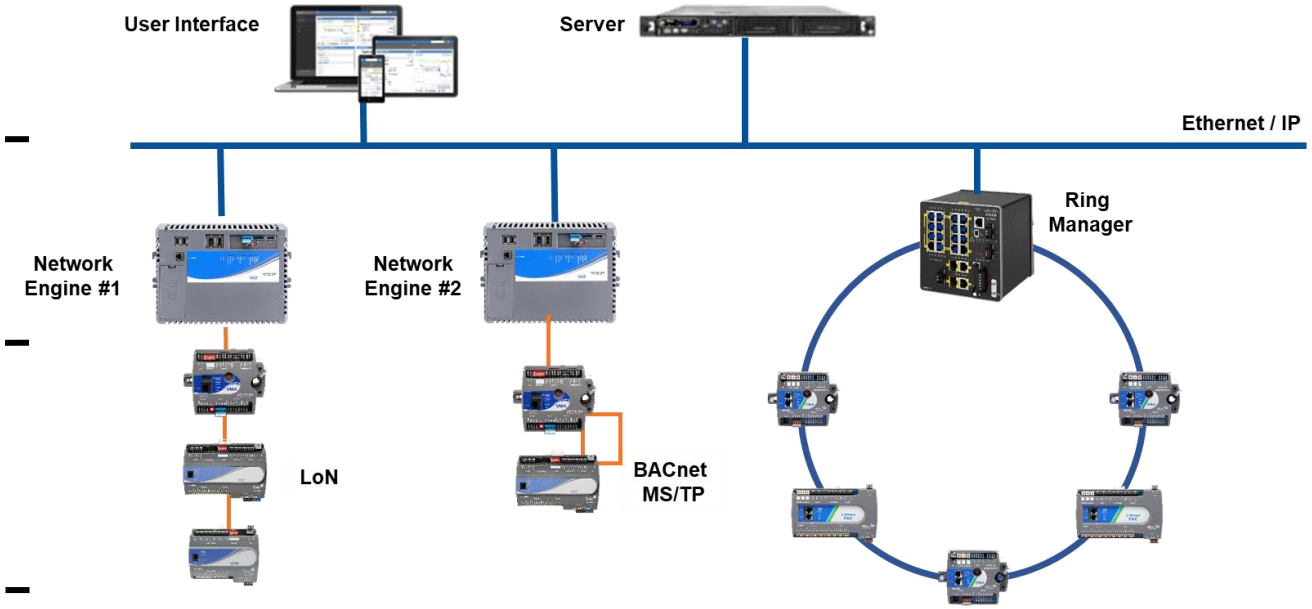
Power | HVAC | BMS | Security | Fire | Lighting / Other

Server / Application

Supervisory

Field

Input / Output



OT vs. IT

- More predictable failure modes
- Tighter time-criticality and determinism
- Higher availability
- More rigorous management of change
- Longer time periods between maintenance
- Significantly longer component lifetimes

Introducing ISA/IEC 62443

- **ISA/IEC 62443**
  - **Family of standards**
  - **Initiated in ISA99 committee – jointly developed with IEC**
  - **Provides a flexible framework to address and mitigate current and future security vulnerabilities in industrial automation and control systems**

- **ISA**
  - International Society of Automation
  - Non-profit professional association founded in 1945 to create a better world through automation.
  - Publishes 62443 as ANSI/ISA-62443
- **ISA Security Compliance Institute (ISCI)**
  - Wholly owned non-profit subsidiary of ISA
  - ISA**Secure** conformity assessment to ISA/IEC 62334 standards
- **International Electrotechnical Commission (IEC)**
  - Founded in 1906, world's leading organization for the preparation and publication of International Standards for all electrical, electronic and related technologies.
  - ISA/IEC 62443 developed in IEC Technical Committee 65/Working Group 10

IEC 62443 Standards and ISASecure Certification:
Applicability to Building Control Systems

2016 ISASecure Building Control Systems Working Group

Download Working Group Final Report at
http://isasecure.org/en-US/Building-Control-Systems-Report

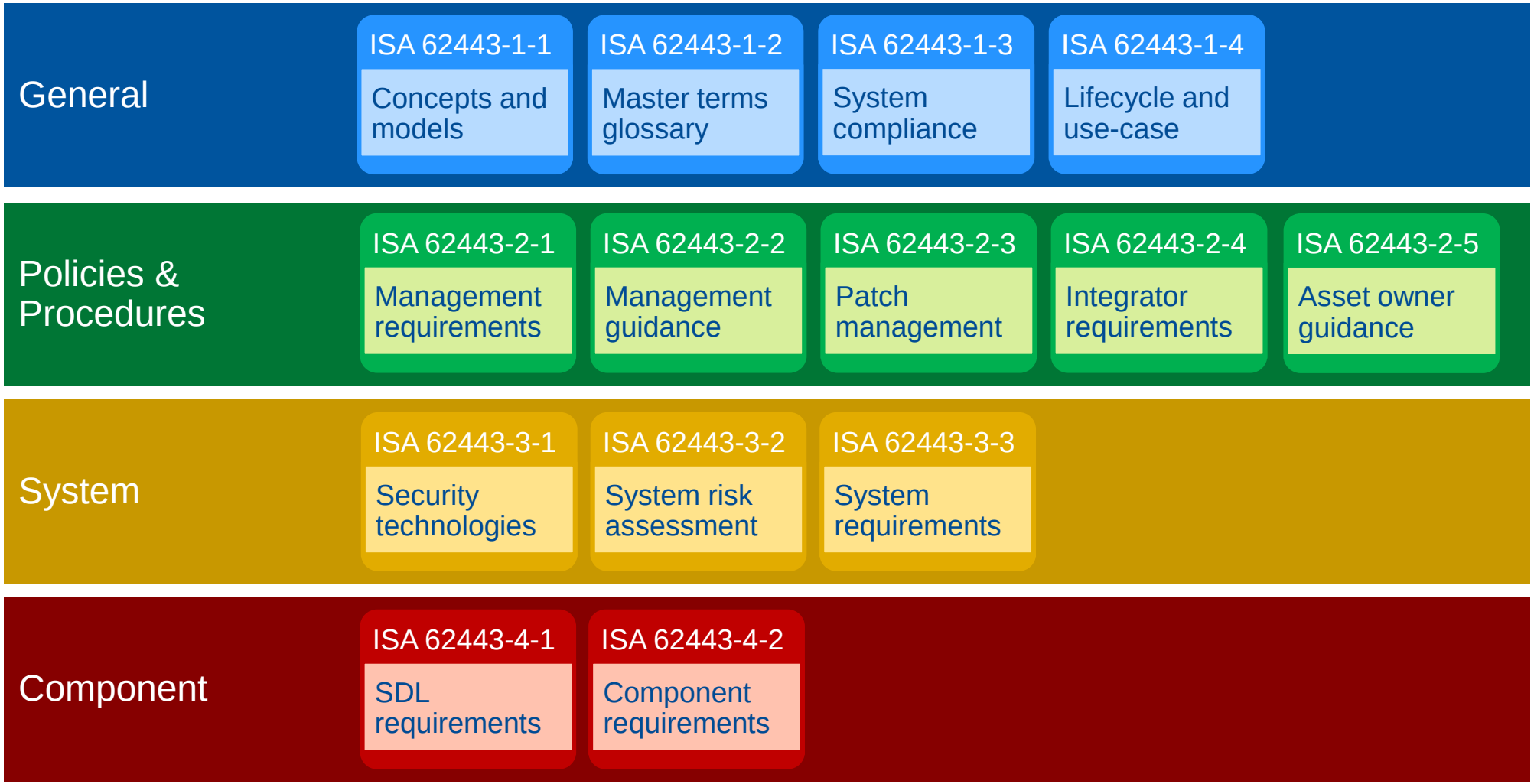
CABA Continental Automated Buildings Association · CSA Group · George Brown College · Honeywell · ireo · Johnson Controls · Maverick Technologies A Rockwell Automation Company · RBCG Ron Bernstein Consulting Group · Schneider Electric · Syska Hennessy Group

Jim Sinopoli-Smart Buildings, LLC

Mike Chipley-PMC Group, LLC

ISA Security Compliance Institute

ISA/IEC 62443 Standards Family



ISA/IEC 62443 Standards Family Application

Smart Building (site specific)

Owner — Operate

- ISA 62443-1-3: System compliance
- ISA 62443-2-1: Management requirements
- ISA 62443-2-3: Patch management

Integrator — Design/Deploy

- ISA 62443-2-4: Integrator requirements

Subsystem 1 | Subsystem 2 | Complementary components

→ ISA 62443-3-3: System requirements

Products (off-the-shelf)

Supplier — Develop

- ISA 62443-4-1: SDL requirements

Applications | Embedded Devices | Network Components | Host Devices

- ISA 62443-3-3: System requirements
- ISA 62443-4-2: Component requirements

ISA/IEC 62443 Standards Family Application

ISA 62443-4-2

Component requirements

Component	Industrial Automation and Control System	Building Automation System	Video Surveillance System
Embedded device	Programmable Logic Controller Intelligent Electronic Device	Supervisory controllers Field controllers - Unitary - Terminal - General purpose	Video Camera Video Transceiver (analog to IP)
Network device	Switch VPN terminator	Switch Router / Gateway VPN	Switch Router / Gateway VPN
Host device/application	Operator workstation Data historian	Operator workstation (facility manager level) Advanced workstation (engineering level) Application Server (handles data storage)	Network Video Recorder Video Client / Workstation

ISA/IEC 62443-4-2 Foundational requirements for components

Develop

ISA 62443-4-2

Component requirements

Foundational Requirement Groups

- **FR1** - Identification and authentication control (IAC)
- **FR2** - Use control (UC)
- **FR3** - System integrity (SI)
- **FR4** - Data confidentiality (DC)
- **FR5** - Restricted data flow (RDF)
- **FR6** - Timely response to events (TRE)
- **FR7** - Resource availability (RA)

Security Levels	Definition	Means	Resources	Skills	Motivation
SL1	Protection against casual or coincidental violation	simple	low	generic	low
SL2	Protection against intentional violation using simple means with low resources, generic skills and low motivation				
SL3	Protection against intentional violation using sophisticated means with moderate resources, IACS-specific skills, and moderate motivation	sophisticated	moderate	IACS-specific	moderate
SL4	Protection against intentional violation using sophisticated means with extended resources, IACS-specific skills, and high motivation	sophisticated	extended	IACS-specific	high

ISA/IEC 62443-4-2 Foundational requirements for components

Develop

ISA 62443-4-2

Component requirements

Foundational Requirement	Component Requirement
FR 1 – Identification and authentication control	CR 1.1 – Human user identification and authentication CR 1.2 – Software process & device identification and authentication CR 1.3 – Account management CR 1.4 – Identifier management CR 1.5 – Authenticator management CR 1.6 – Wireless access management CR 1.7 – Strength of password-based authentication CR 1.8 – Public key infrastructure certificates CR 1.9 – Strength of public key-based authentication CR 1.10 – Authenticator feedback CR 1.11 – Unsuccessful login attempts CR 1.12 – System use notification CR 1.13 – Access via untrusted networks CR 1.14 – Strength of symmetric key-based authentication

ISA/IEC 62443-4-2 Foundational requirements for components

Develop

ISA 62443-4-2

Component requirements

Foundational Requirement	Component Requirement
FR 2 – Use control	CR 2.1 – Authorization enforcement CR 2.2 – Wireless use control CR 2.3 – Use control for portable and mobile devices CR 2.4 – Mobile code CR 2.5 – Session lock CR 2.6 – Remote session termination CR 2.7 – Concurrent session control CR 2.8 – Auditable events CR 2.9 – Audit storage capacity CR 2.10 – Response to audit processing failures CR 2.11 – Timestamps CR 2.12 – Non-repudiation CR 2.13 – Use of physical diagnostic and test interfaces
FR 3 – System integrity	CR 3.1 – Communication integrity CR 3.2 – Protection from malicious code CR 3.3 – Security functionality verification CR 3.4 – Software and information integrity CR 3.5 – Input validation CR 3.6 – Deterministic output CR 3.7 – Error handling CR 3.8 – Session integrity CR 3.9 – Protection of audit information CR 3.10 – Support for updates CR 3.11 – Physical tamper resistance and detection CR 3.12 – Provisioning product supplier roots of trust CR 3.13 – Provisioning asset owner roots of trust CR 3.14 – Integrity of the boot process

ISA/IEC 62443-4-2 Foundational requirements for components

Develop

ISA 62443-4-2

Component requirements

Foundational Requirement	Component Requirement
FR 4 – Data confidentiality	CR 4.1 – Information confidentiality CR 4.2 – Information persistence CR 4.3 – Use of cryptography
FR 5 – Restricted data flow	CR 5.1 – Network segmentation CR 5.2 – Zone boundary protection CR 5.3 – General purpose person-to-person communication restrictions
FR 6 – Time response to events	CR 6.1 – Audit log accessibility CR 6.2 – Continuous monitoring
FR 7 – Resource availability	CR 7.1 – Denial of service protection CR 7.2 – Resource management CR 7.3 – Control system backup CR 7.4 – Control system recovery and reconstitution CR 7.6 – Network and security configuration settings CR 7.7 – Least functionality CR 7.8 – Control system component inventory

ISASecure Process and Product Certifications

Simplifies compliance and supplier selection

process

SDLA

Security Development Lifecycle Assurance

ISA/IEC 62443-4-1

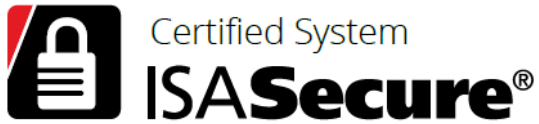
product

CSA

Component Security Assurance

ISA/IEC 62443-4-1, **ISA/IEC 62443-4-2**

Vulnerability Identification Test + Communication Robustness Test



product

SSA

System Security Assurance

ISA/IEC 62443-4-1, ISA/IEC 62443-4-2, **ISA/IEC-62443-3-3**

Vulnerability Identification Test + Communication Robustness Test

ISASecure Training & Certificates

Qualifies cybersecurity experts
Aligns ISA/IEC 62443 practices

ISASecure®

ISA Cybersecurity Training

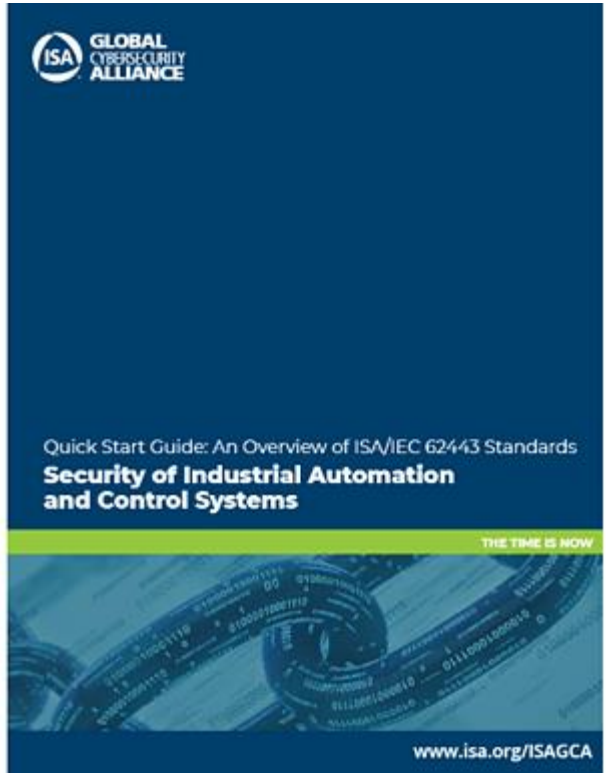
- ISA/IEC 62443 centric training – awareness, assessments, design, operation, maintenance, etc.

ISA Cybersecurity Certificates

- ISA certificates for students who complete ISA training courses and pass professional examinations.

ISA/IEC 62443 addresses Smart Building needs

Quick Start Guide



isa.org/cyberguide

Framework well suited for unique needs of Smart buildings

- More predictable failure modes
- Tighter time-criticality and determinism
- Higher availability
- More rigorous management of change
- Longer time periods between maintenance
- Significantly longer component lifetimes

Full lifecycle support

- Supplier
- Integrator
- Asset owner

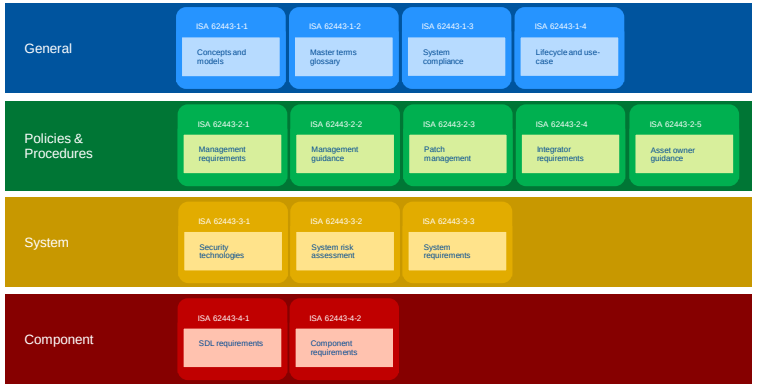
Conformance provides drives risk reduction

- Requirements
- Guidance
- Training
- Certificates

OT attacks on the rise

Applicable to all architecture levels

Host Devices	Network Components
Applications	Embedded Devices



Compliments existing Smart Building standards

ISASecure webinar

Address Smart Building Cybersecurity with IEC 62443

Questions

ISASecure®

Johnson Controls