Setting the Standard for Automation™

Introduction to ISA112 SCADA Systems Standard

June 2019

Graham Nasby
ISA112 committee co-chair

Standards
Certification
Education & Training
Publishing
Conferences & Exhibits

What is ISA112?

- ISA112 is a standards committee formed by the International Society of Automation in mid-2016
- **Committee Members:** software vendors, hardware vendors, end users, system integrators, consultants, and government. Currently over 100 committee members.
- **Goal:** Develop a series of ISA standards and technical reports that provide guidance for system design, implementation, operation, and maintenance of SCADA systems for pipelines, water and wastewater, power, oil and gas, and other industries to support the overall integrity and reliability of these systems.

Industry/End-User Needs for ISA112

- Need for common terminology for SCADA systems
- Specification for minimum SCADA software requirements
- Suggested I/O interfaces for interfacing with equipment
- Standardized Control Modes: Remote vs. Local, Auto vs. Man.
- Reference architectures for levels of control
- Guidance for applying other ISA standards to SCADA
  - Cyber Security
  - Alarm Management
  - HMI Design
  - Data Storage
  - Designing robust, resilient and redundant systems

Design Consultant Needs for ISA112

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Equipment Vendor Needs for ISA112

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Contractor Needs for ISA112

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System Integrator Needs for ISA112

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Current Status of ISA112

Jun 2016	Committee approved by ISA
Aug 2016	Initial call for volunteers (40 members)
Sept 2016	First meeting held in Newport Beach, California, USA
Jan 2017	Committee co-chairs named -Graham Nasby, City of Guelph Water Services (Guelph, Ontario, Canada) -Ian Verhappen, CIMA+ (Calgary, Alberta, Canada)
Apr 2017	Monthly conference calls start
May 2017	Second meeting in Raleigh, North Carolina, USA Semi-annual face-to-face meetings start
May 2018	ISA112 Lifecycle & Architecture Diagram Developed
Nov 2018	Table of Contents Developed

- 2019 – Document Development / Section Working Groups
- 2020 – Comment rounds
- 2022 – Publication of ISA112

Work so far on ISA112

- Defining what a “SCADA System” is
- General SCADA System Architecture Drawing
- ISA112 SCADA System Lifecycle Diagram
- Key Definitions
- Working Table of Contents

What is a SCADA System?

ISA112 Definition

SCADA, Supervisory Control and Data Acquisition

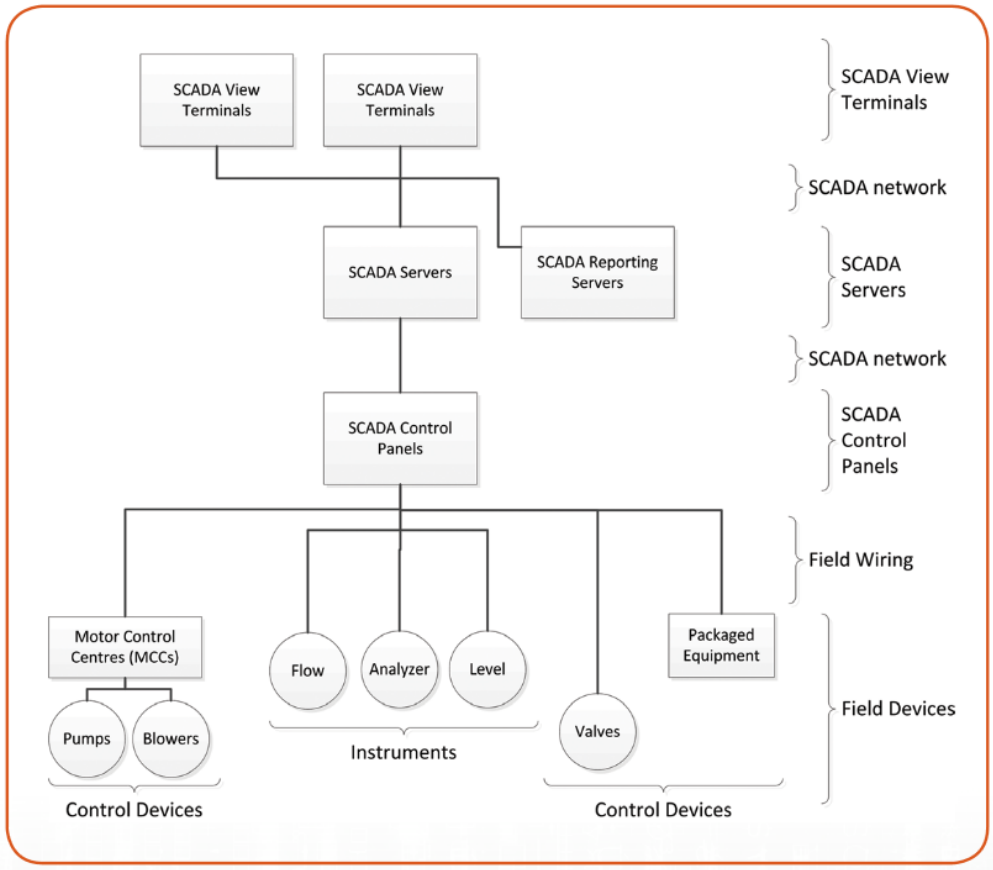
"SCADA = a system which is a combination of hardware and software used to send commands and acquire data for the purpose of monitoring and controlling."

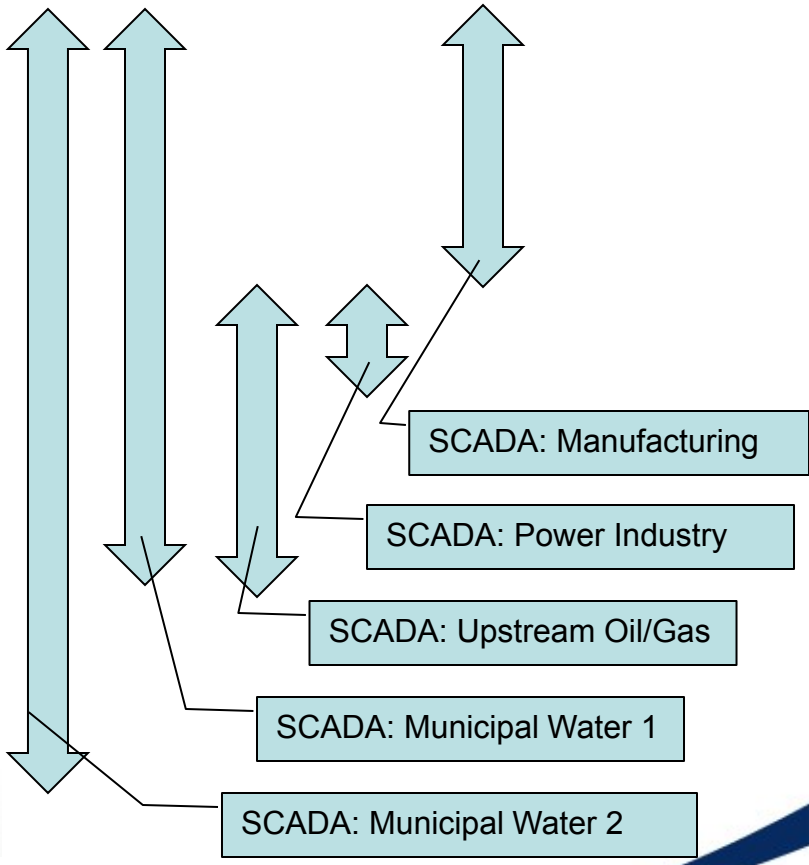
(DEFINITION AS ADOPTED AT THE MAY 5, 2017 MEETING OF ISA112 IN RALEIGH, NORTH CAROLINA, USA)

Different Industries use the term "SCADA" to mean many different things that are specific to that individual industry. Each of these industries is correct in how it uses the term SCADA within its own context. We must be aware of this, and our definition and standard must be written so that it can be used by all industries.

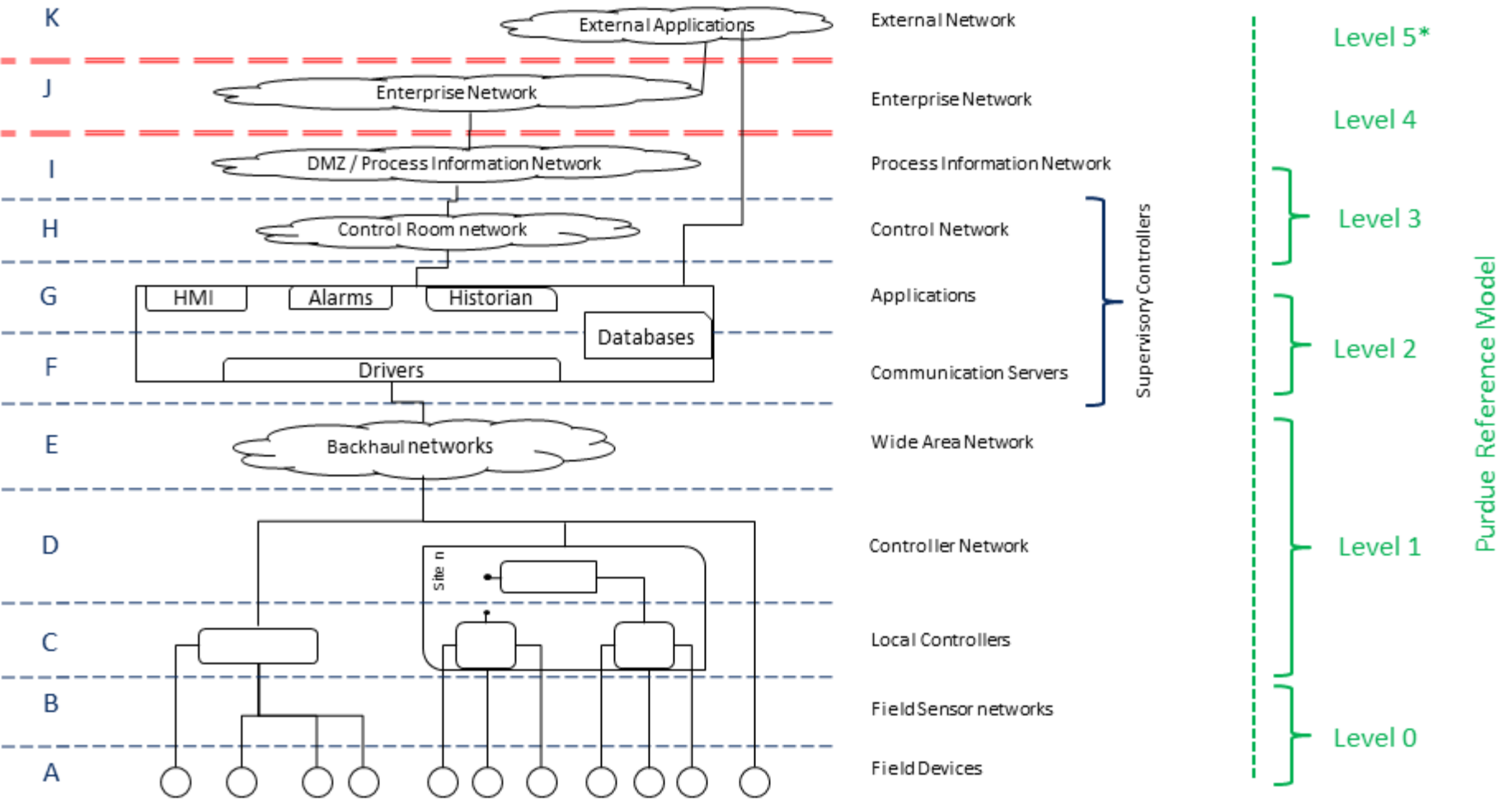
Term “SCADA vs. Several Industries

- Examples of differing definitions of SCADA by industry
- Definitions can also vary by geographic area/country





SCADA System Architecture

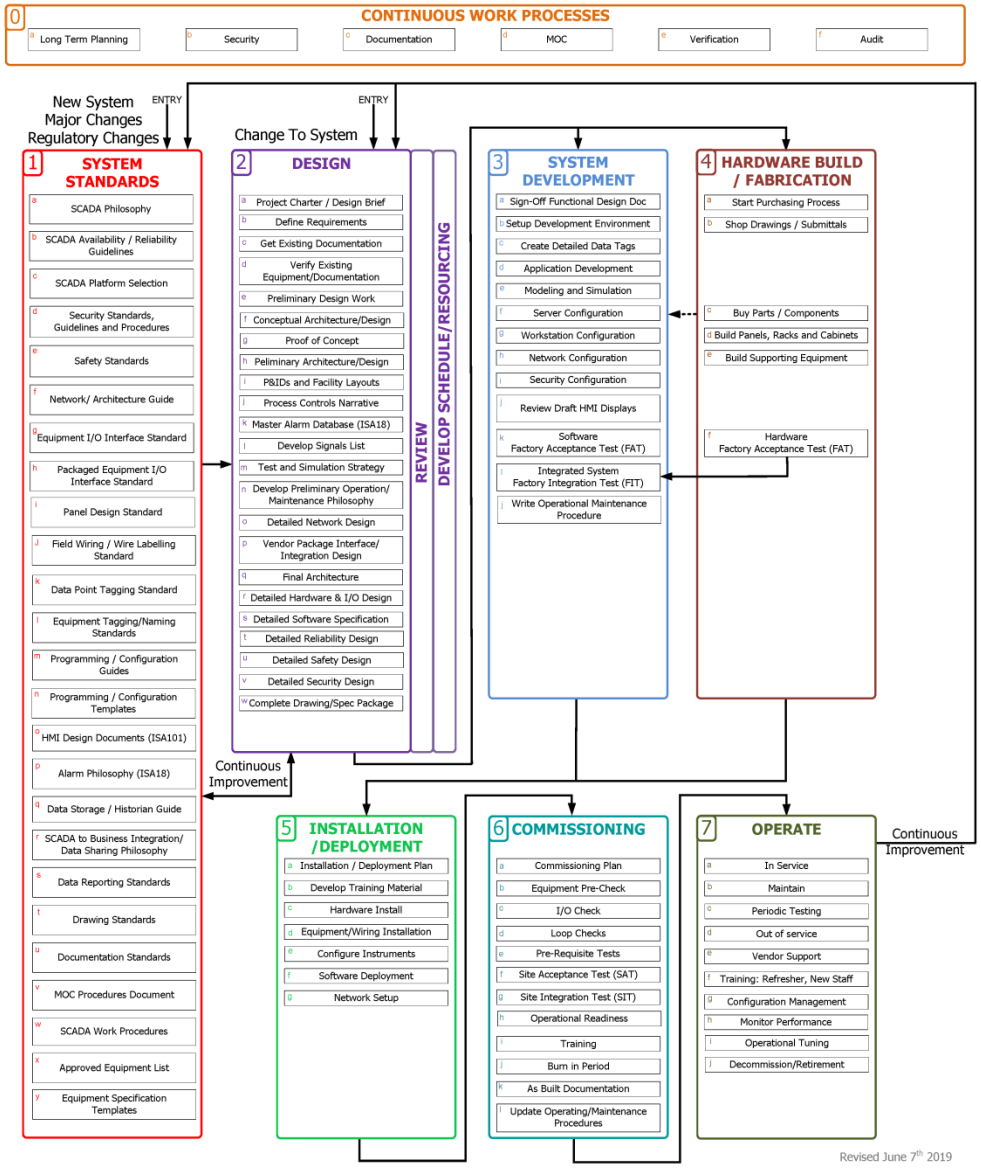


Notes:

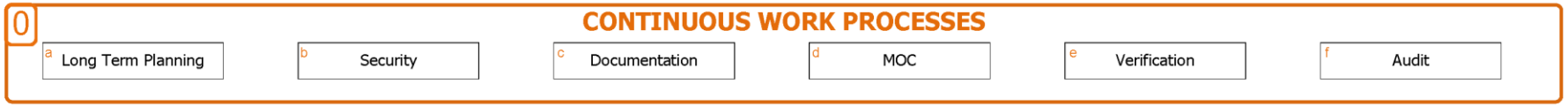
1 Letters are used avoid potential conflict with ISA-95 and other "Layer" models.
2 Routers and Firewalls between layers are not shown.
3 Other system-specific servers, applications, and workstations are not shown.
4 Remote-hosted external applications (Cloud) could be configured to attach to devices at any level, with appropriate firewalls, tunneling and routing.
* We show a Purdue Level 5. The true Purdue Model only has levels 0-4 because it did not anticipate external applications.

Revision June 22, 2018

SCADA Systems Lifecycle Diagram



SCADA Continuous Processes



Long Term Planning – Planning for 5, 10, 15, 20, 25+ year outlook

Security – both Physical Security and Cyber Security

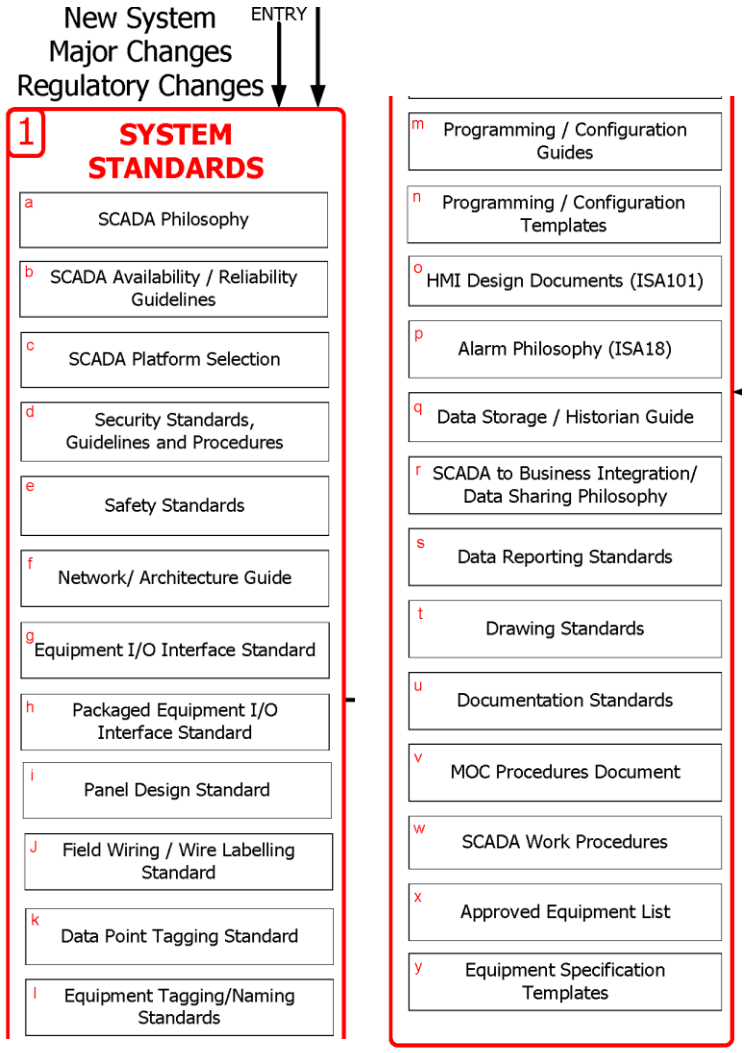
Documentation – ongoing documentation of the system for operations

Management of Change (MOC)

Verification – SCADA system is working the way it is documented

Audit – that work processes are being followed and documented

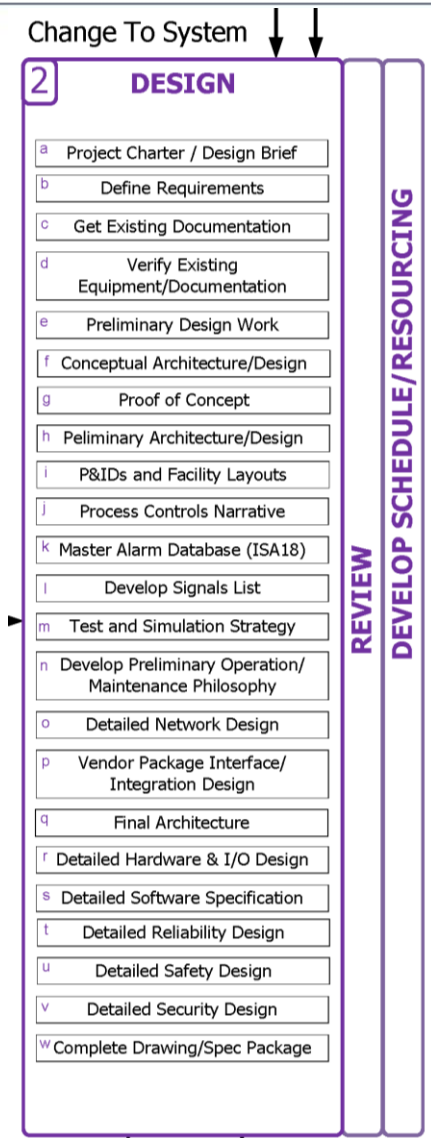
SCADA Facility System Standards



SCADA Philosophy Document
SCADA Availability/Reliability Guideline
SCADA Platform Selection
Security Standards, Guidelines and Procedures
Safety Standards (for automatic shutdown systems)

Network/Architecture Guide
Equipment I/O Interface Standard
Packaged Equipment Interface Standard
Panel Design Standard
Field Wiring/Labelling Standard
Data Point Tagging Standard
Equipment Tagging/Naming Standards
Programming/Configuration Guides
Programming/Configuration Templates
HMI Design Documents
Alarm Philosophy
Data Storage/Historian Guide
SCADA to Business Integration/Data Sharing Philosophy
Data Reporting Standards
Drawing Standards
Documentation Standards
MOC Procedures Document (Change Management)
SCADA Work Procedures
Approved Equipment List
Equipment Specification Templates

SCADA Design Work Process



Project Charter / Design Brief
Define Requirements

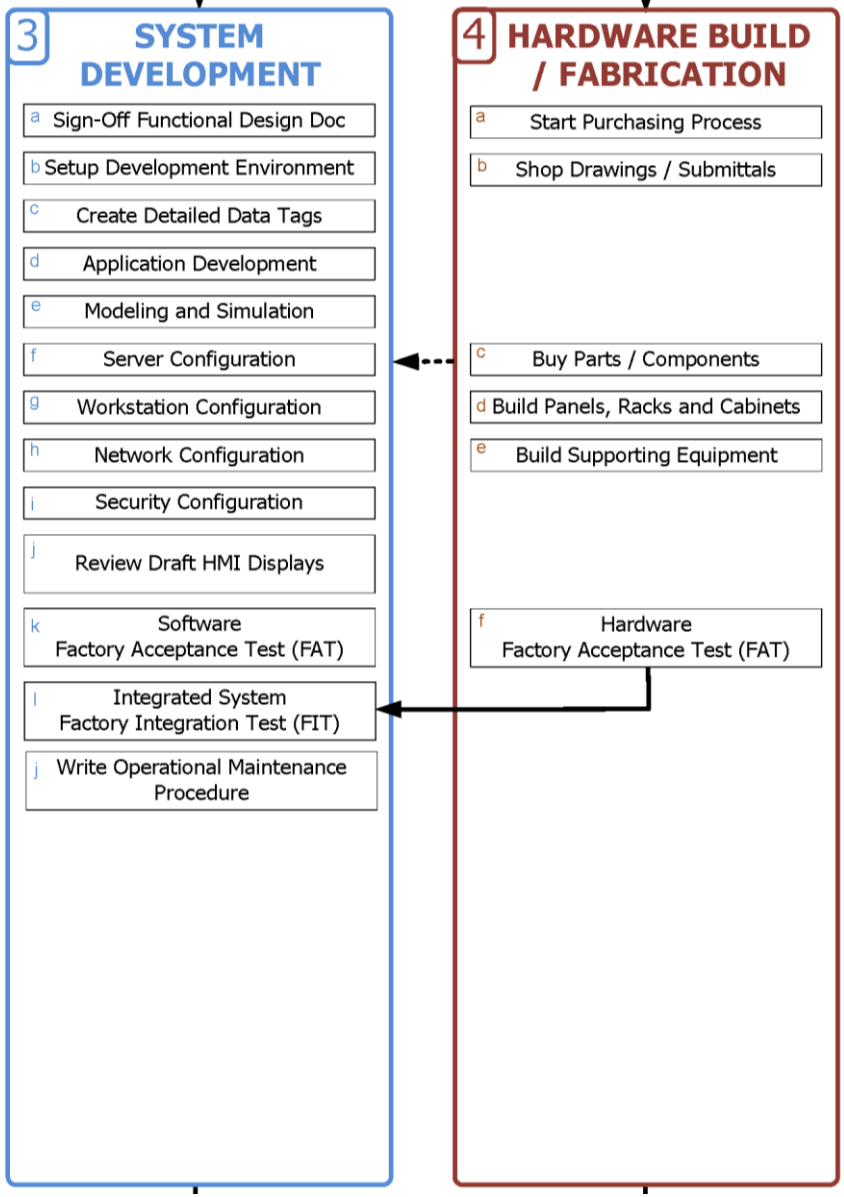
Get Existing Documentation
Verify Existing Equipment/Documentation
Preliminary Design Work
Conceptual Architecture/Design
Proof of Concept
Preliminary Architecture/Design

P&ID's and Facility Layouts
Process Control Narrative
Master Alarm Database (ISA18)
Develop Signals List
Test and Simulation Strategy
Develop Preliminary Operation/Maint. Philosophy
Detailed Network Design
Vendor Package Interface/Integration Design
Final Architecture

Detailed Hardware & I/O Design
Detailed Software Specification
Detailed Reliability Design (UPS's, redundant equipment)
Detailed Safety Design (automatic shutdown systems)
Detailed Security Design (check of security & cybersercurity details)

Complete Drawing/Spec Package (for group that will do building/programming)

SCADA Development & Hardware



System Development

- Sign-Off Functional Design Doc (Process Control Narrative)

- Setup Development Environment
- Create Detailed Data Tags
- Application Development (PLC & HMI Programming)
- Modelling and Simulation (so one can test as they program)

- Server Configuration
- Workstation Configuration
- Network Configuration
- Security Configuration (check all security settings are right)

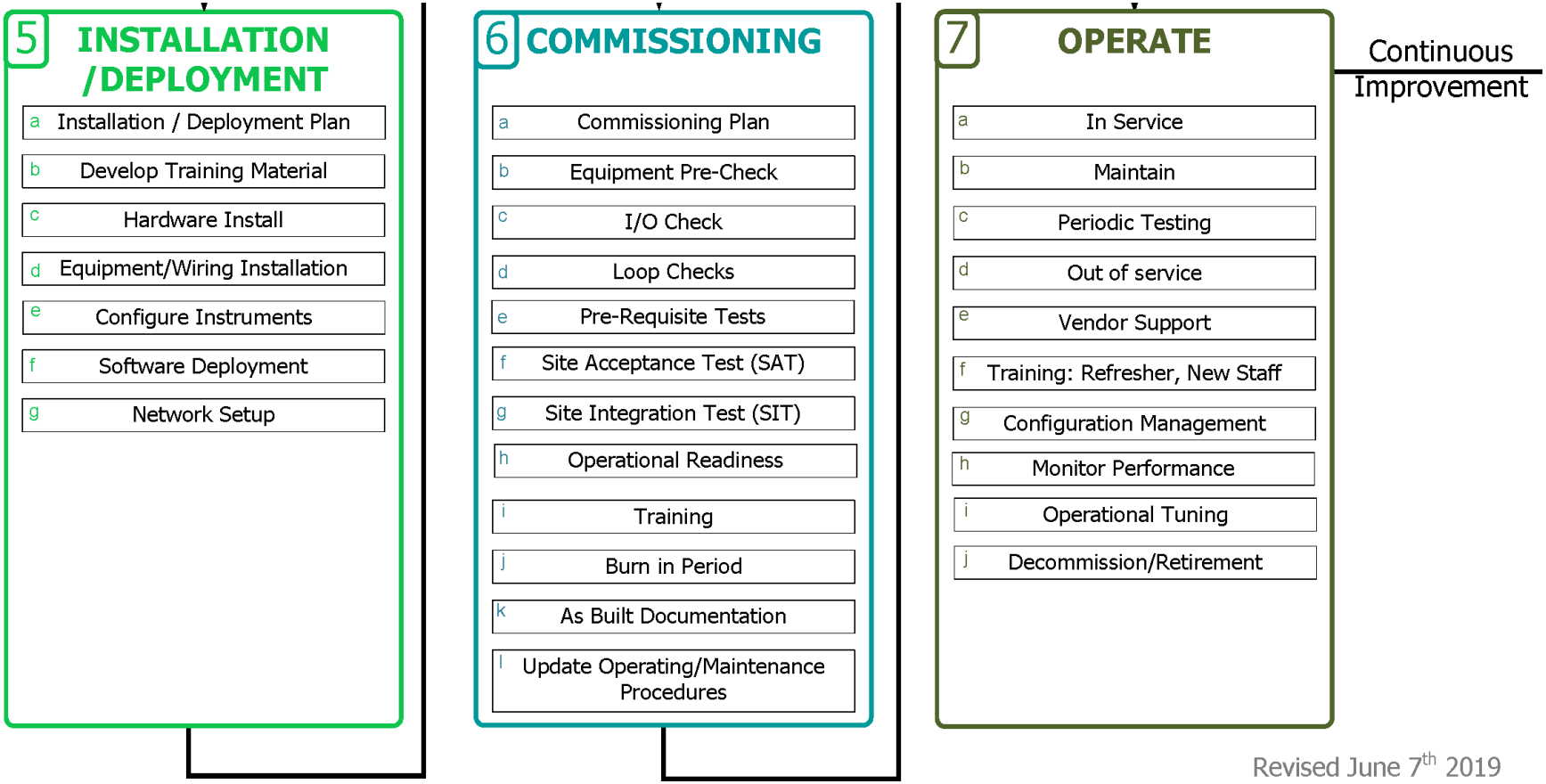
- Review Draft HMI Screens
- Software Factory Acceptance Test (FAT)
- Integrated System Factory Integration Test (FIT)
- Write Operational Procedures (how to use the control system)

Hardware Building / Fabrication

- Start Purchasing Process
- Shop Drawings / Submittals
- Get Parts / Components
- Build Panels, Racks and Cabinets
- Build Supporting Equipment

- Hardware Factory Acceptance Test (FAT)

SCADA Install, Commission, Operate



Revised June 7th 2019

ISA112 Current Work Plan

- Write ISA112 definition for “SCADA System” – done
- Refining the SCADA Life Cycle Diagram – done
- Developing SCADA Reference Architecture Diagram – done

- Draft Table of Contents (list of items to cover in ISA112) – done
- Developing “use cases” and “examples” for applying standard - done
- Aligning TOC with Life Cycle Diagram and Architecture Diagram -done
- Create plan for writing content, assign section authors & writing –done
- Defining Key SCADA Terms – in progress
- Writing Content – in progress
- Review Cycles

- Work in Progress
- As of June 2019

More Information on ISA112

- www.isa.org/isa112/
- Contact the committee co-chairs
  - Graham Nasby
    graham.nasby@guelph.ca
  - Ian Verhappen
    ian.verhappen@cima.ca

The committee is still looking for volunteers from end-users, vendors, system integrators, consultants, utilities, and government to help with writing, editing and reviewing content.

About ISA Standards Committees

Introduction to ISA Standards Committees

Standards Committees

- The consensus bodies for standards developed under the SCC/ANSI Essential Requirements.
- Committees have:
  - Title,
  - Scope, approved by the ISA S&P Board,
  - Purpose, approved by the ISA S&P Board.
- Committees consist of:
  - a Chair or two Co-Chairs,
  - members who have a direct and material interest in the subject,
  - members may be voting, alternate, or informational members .
- Membership is not conditional upon ISA membership, or unreasonably restricted for any other reason.
- Membership not dominated by a single interest category. Safety committee membership interest categories are limited to 1/3.
- Minimum of 5 voting members.

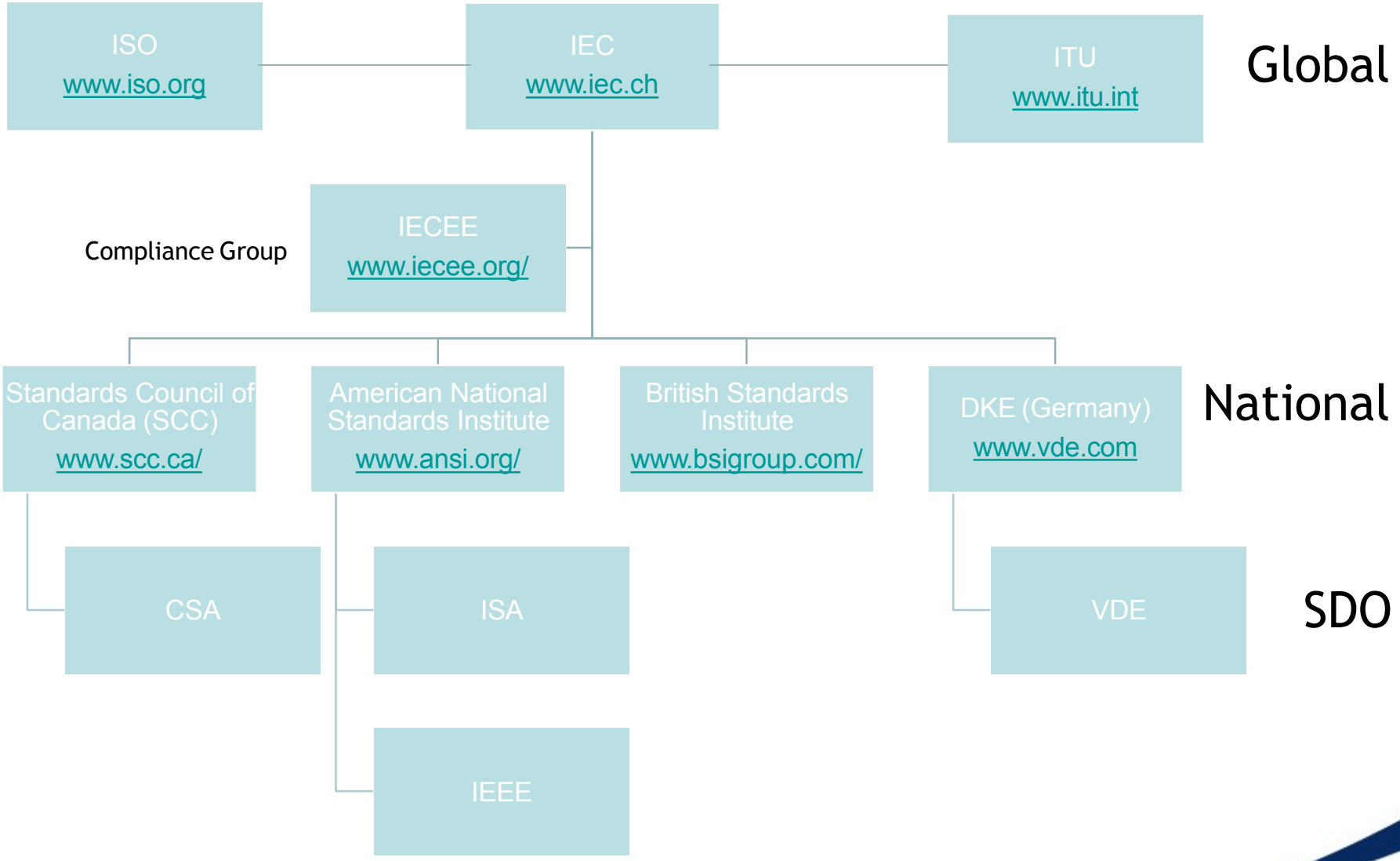
Standards Committees

- Member affiliation and interest category shall be disclosed.
- Members shall also disclose the "ultimate parent entity" of his or her affiliation.
- Failure to disclose affiliation or misleading disclosure shall result in loss of any membership privileges and may also result in loss of privileges for such affiliated members.
- Interest categories:
  - General,
  - Architect-Engineer, Engineer-Constructors, Integrators,
  - Testing/Certification/Approval,
  - Regulatory/Government,
  - Producer,
  - User.

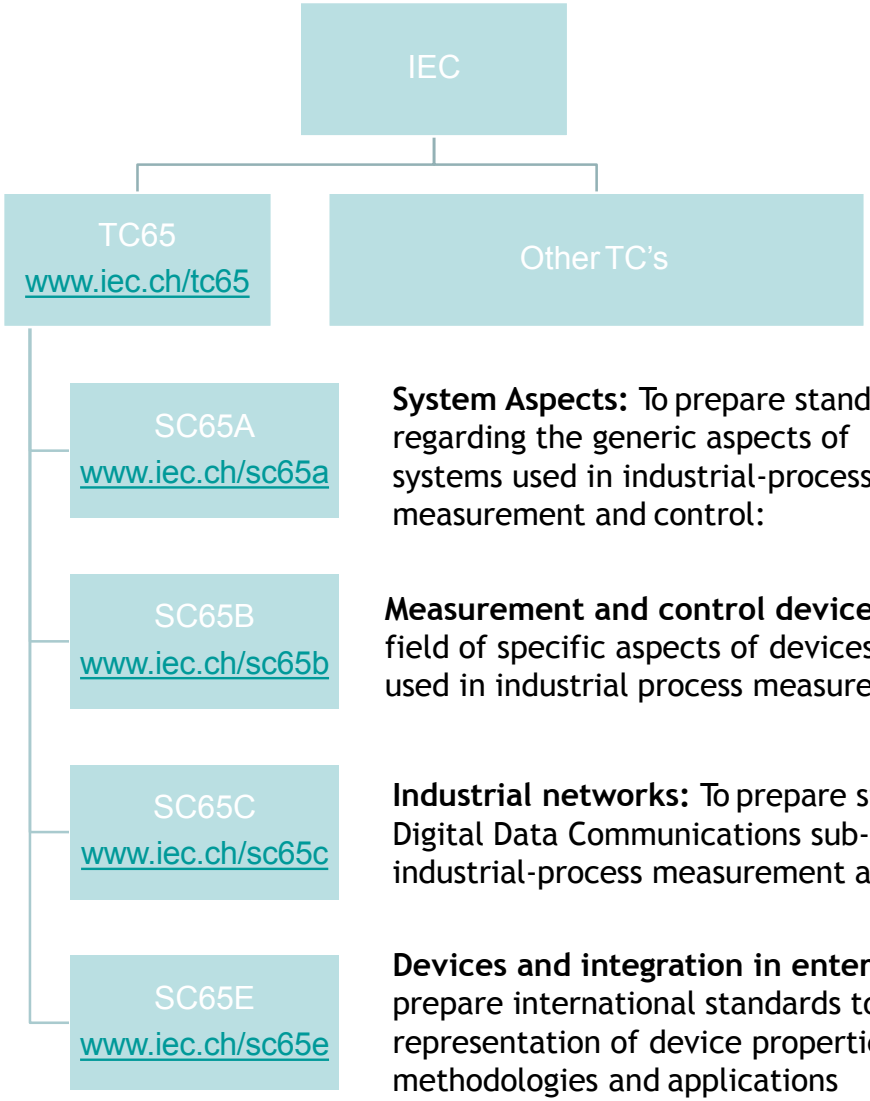
ISA & the IEC

- ISA is a recognized Standards Developing Organization (SDO) by ANSI (American National Standards Institute)
  - In Canada CSA is an SDO for the SCC (Standards Council of Canada) which is the equivalent to ANSI
  - Other countries, there will be an equivalent national standards body
- National Standards Bodies are members of the IEC and ISO
  - Only countries can be made members of IEC/ISO
  - IEC membership can be as P (Participating) or O (Observer)
- Can also have direct link between organization and IEC through Liaison

International Standards Development



IEC Organization



System Aspects: To prepare standards regarding the generic aspects of systems used in industrial-process measurement and control:

Measurement and control devices: Standardization in the field of specific aspects of devices (hardware and software) used in industrial process measurement and control

Industrial networks: To prepare standards on Digital Data Communications sub-systems for industrial-process measurement and control

Devices and integration in enterprise systems: To prepare international standards to specify digital representation of device properties and functions, methodologies and applications

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