ISA112: Supporting SCADA System Reliability

By Graham Nasby

The ISA112 consensus-based technical standard identifies and promotes best practices.

When it comes to supervisory control and data acquisition (SCADA) systems, oil and gas industry users and vendors have a need for common terminology, minimum hardware/software specifications, standardized control modes, and other references. The ISA112 standards and reference models provide a common framework that can be used for specifying, designing, pricing, building, and maintaining SCADA systems. This framework helps define how all the disparate parts of a control system can be linked together to form a single system able to communicate machine-to-machine as well as machine-to-human.

The ISA112 standards committee is actively developing a series of SCADA system standards and technical reports to help users in all industries integrate those controls and follow best practices. Established in 2016, the committee now has more than 300 SCADA experts from around the world representing a broad cross-section of roles, industries, and geographies. These members include

software and hardware vendors, end users, system integrators, consultants, distributors, and government.

Work on the first ISA112 SCADA systems standard is not fully completed yet, but it is already having a major impact on how SCADA systems are designed, used, and implemented in multiple industry sectors. For example, the majority of the largest water utilities in Ontario, Canada are already using the ISA112 framework for managing large automation projects and SCADA master-planning activities. Many other water utilities, sewerage districts, oil and gas companies, and other organizations are now starting to look at the ISA112 SCADA framework for managing their automation assets. There is a need for this sort of guidance, and ISA112 is actively working to provide it.

The ISA112 committee's role is to develop a series of ISA standards and technical reports that provide guidance for the system design, implementation, operation, and maintenance of SCADA systems. The ISA112 standard is being developed as a "horizontal standard" so that it can be applied to a wide range of industries, including pipelines, water and wastewater, power, oil and gas, and other industries. By having a broad membership from multiple sectors, the committee has an overall goal to provide a set of SCADA best practices to support the overall integrity and reliability of these systems.

Through the committee's leadership, the ISA112 committee has made a conscious choice to encourage active participation of experts from a diverse cross-section of industries from around the world. Of the committee's over 300 members, 75 are active co-authors and the rest are reviewers. As an open committee, the committee welcomes expert members from around the globe. Further information can be found on the committee webpage at www.isa.org/isa112/.

ISA112 committee work to date

Since it was formed, the ISA112 committee has been able to accomplish the following milestones.

- Developing a consistent and inclusive consensus-based definition for what a SCADA system is, which can be used by a wide variety of industries and geographic locales
- Developing a SCADA system management lifecycle diagram, which contains workflows for building, long-term management, operation and continuous improvement of SCADA systems that can be easily applied to small, medium and large sized SCADA installations

Oil and gas companies and others are starting to look at the ISA112 SCADA framework for managing their automation assets.

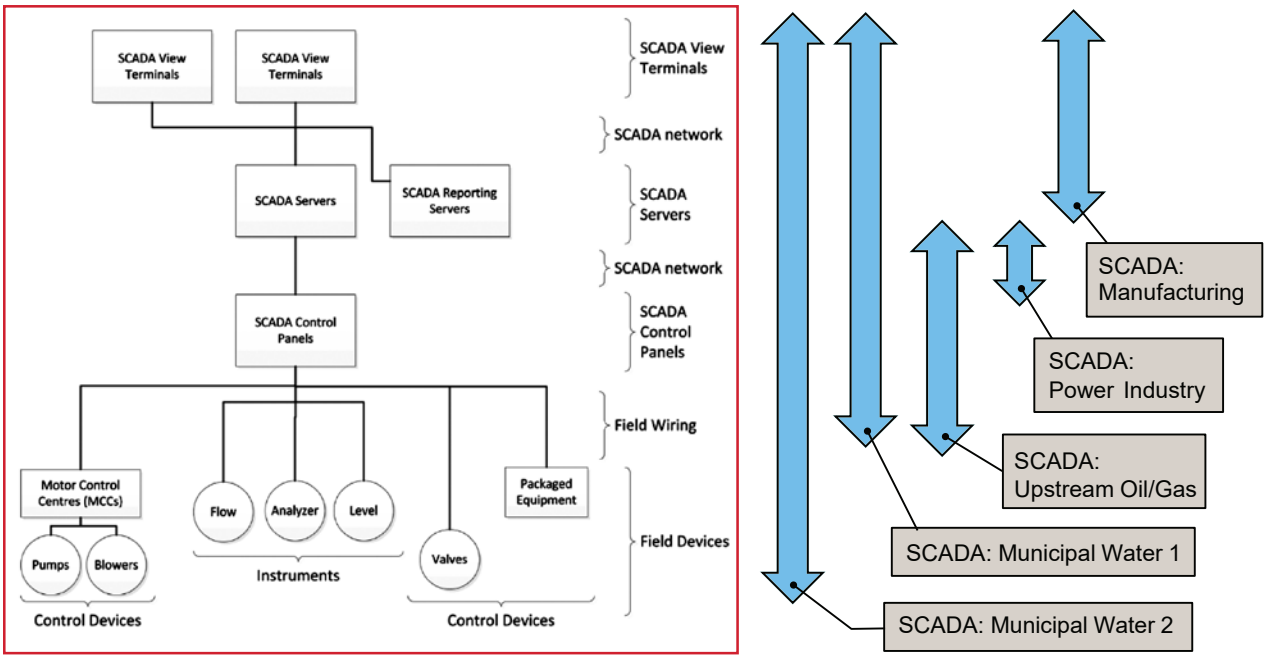


Figure 1. Between different industries, companies, and regions, the definition of what SCADA is can vary widely. Each is correct in its own context, so the ISA112 standard had to take this into account.

- Developing a SCADA Model Architecture diagram that can be applied to a wide range of SCADA technologies, including PLC, RTU, DCS and IIoT based solutions
- Developing more than 800 pages of technical content that is now being assembled into a 3-part published standard and associated technical reports
- The committee is now starting on the formal commenting cycles for Part 1 of the ISA112 standard, which is expected to be published in early 2024. Parts 2 and 3 will follow soon after.

Like all ISA standards committees, the ISA112 committee uses an open, consensus-based process for writing and developing vendor-neutral standards.

SCADA definition: The committee's first significant accomplishment was to reach consensus with an open and inclusive definition of the term "SCADA." Because of the considerable variation in terms of how SCADA systems are designed in various regions, industries, and backgrounds, nailing down consensus on the definition was more of a challenge than originally anticipated. After discussion, the committee adopted the following definition at at a face-to-face meeting on May 5, 2017 in Raleigh, NC USA.

"Supervisory control and data acquisition, or SCADA, is a system that is a combination of hardware and software used to send commands and acquire data for the purpose of monitoring and controlling."

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 (Figure 1). Taking this into account, the ISA112 committee

has defined the term SCADA in such a way that can be applied to a wide variety of industries, each with their unique needs.

Some consider SCADA to be the upper layers of software. Others consider it to be end-to-end, from the field devices to the view terminals. Many others consider it to be somewhere in between. For example, in the municipal water sector the term SCADA is used by regulators to refer to the entire automation system, whereas for many oil/gas applications SCADA is often used to refer to just the software and telemetry systems.

SCADA system architecture: After much debate and consideration, the committee reached a consensus for a common logical architecture that could be used for any SCADA system, regardless of its technology or size (Figure 2). The committee described SCADA in layers. It uses letters for the layers instead of numbers to avoid any potential confusion with the Purdue reference model levels (shown at the right in Figure 2).

The committee's first significant accomplishment was to reach consensus on a definition of the term "SCADA" which could be used by multiple industries.

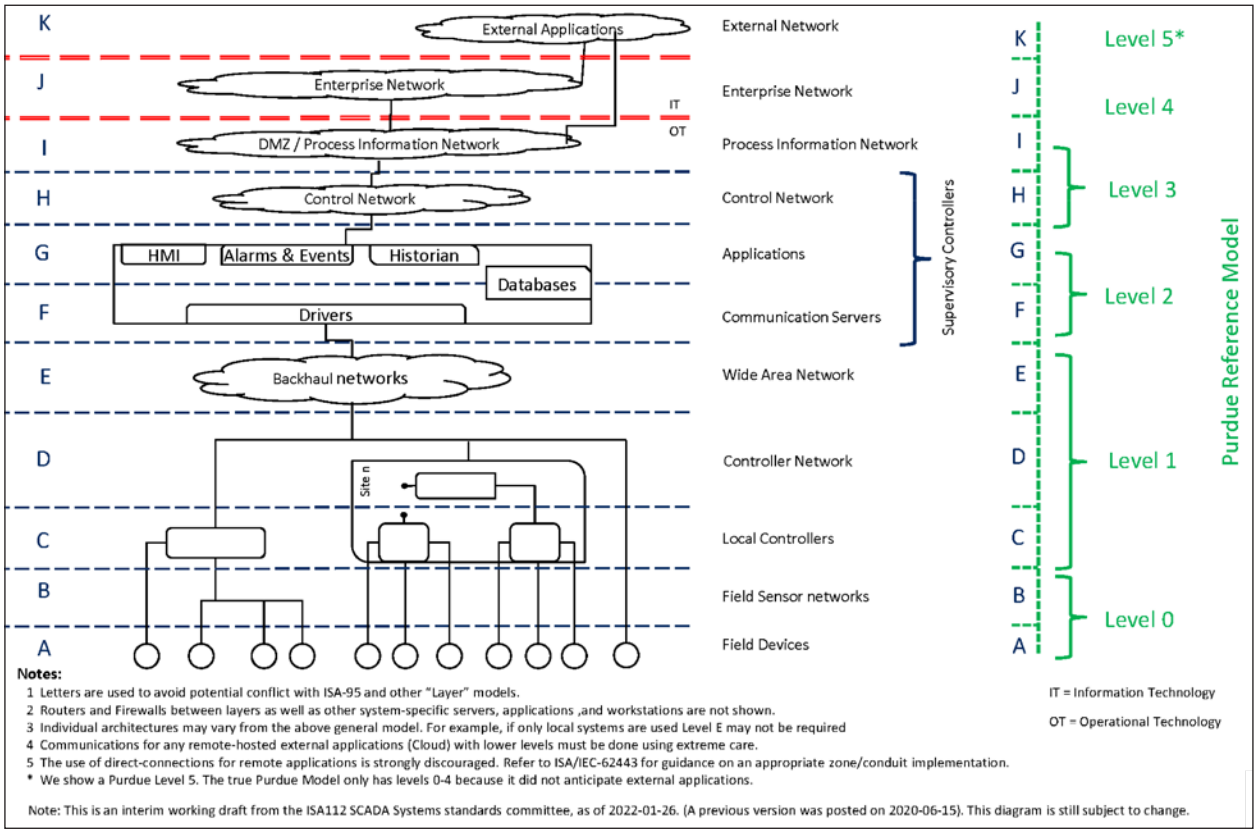
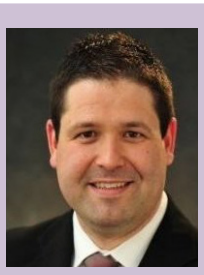


Figure 2. The ISA112 SCADA model architecture diagram is a functional diagram outlining how most SCADA systems are structured, and how this relates to other architectural models.

Looking ahead

The ISA112 committee uses a combination of monthly conference calls, semi-annual face-to-face meetings, and offline work to carry out its endeavors. However, much of the collaboration and face-to-face meetings have only recently resumed after what had been a 3 year hiatus due to the COVID 19 pandemic. Most recently the committee met face-to-face in Galveston Texas in Nov 2022 as part of the ISA's Annual Leadership Conference.

The committee is currently hard at work putting Part 1: SCADA Systems Lifecycle, Diagrams and Terminology through formal commenting rounds, with an aim to go to final ballot in 2023. Part 1 is expected to be published in early 2024. In parallel, the next two parts of the standard - Part 2: SCADA Lifecycle Work Processes, and Part 3: SCADA System Architecture—are on track to be published in 2025 and 2026 respectively. ■



ABOUT THE AUTHOR

Graham Nasby, P.Eng is co-chair of the ISA112 committee and an industry-recognized leader in the OT (operational technology), SCADA, and industrial automation sectors for his efforts in cybersecurity best practices, standards development, alarm management, and operational efficiency. He led development of ISA112 SCADA Management Lifecycle workflow, now used by water/wastewater, electric power, and pipeline utilities across North America. Through his work with ISA, CSA, ANSI and IEC, he has co-authored international standards on systems design, cybersecurity, industrial automation, alarm management, and HMI systems. He is currently Senior Manager—OT Security Architecture for CN Rail.