
IDEA2021
Powering the Future: District Energy/CHP/Microgrids
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SCADA Modernization for Increased Resiliency and Operational Awareness

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INTERNATIONAL DISTRICT ENERGY ASSOCIATION

SCADA System Resiliency

- Resiliency is the ability to recover quickly from difficulty
- SCADA systems must be resilient at all layers:
  - Field Devices and Controls
  - Communications Networks
  - HMI and Alarm/Events
  - Historian

SCADA System Operational Awareness

- Operational/Situational Awareness is the perception of elements and events with respect to time and area
  - SCADA should present critical and useful process information that can be interpreted to support operator action
- SCADA systems support operational awareness with:
  - Intuitive display configuration and navigation
  - Smart Objects for easy interpretation
  - Ease of deploying complex objects
  - Alarm Management

Characteristics of Older SCADA Systems

- Designed to work on out of date or even obsolete/end of life hardware infrastructure
- Made up of separate pieces that don't integrate easily
- System security does not meet current standards
- Rigid graphical interface with high learning curve for implementation
- Alarm system designed for reactive as opposed to proactive

Out of Date Infrastructure Impedes Resiliency

- Proprietary or legacy control and computer hardware and software components
  - Difficulty in maintaining spares or finding support
  - Impediments to securely deploy changes
- Unsupported Operating Systems
  - Security gaps
  - Unable to get necessary drivers for new components
- Communications Technology/Drivers
  - Can’t take advantage of modern high speed and network redundancy
  - Rely on some fragile systems i.e., coaxial cable
  - Unable to get drivers for old components on new systems

Modern SCADA Infrastructure Improves Resiliency

- Can take advantage of current hardware platforms
  - Hardware is usually readily available if replacements are needed
  - Modular components allow multiple methods to create communications networks
- Virtualization is available
  - Allows for very fast backup/recovery
  - Can utilize ‘thin client’ HMI machines for quick plug and play
- Modern operating systems are maintained
  - Regularly patched for security and reliability
  - Have well-defined lifecycles which allow for migration planning
- Possibility for high speed and redundant networks
  - Take advantage of DLR in field
  - Ease of configuration segmentation and security
  - Modern switching/routing components integrate with SCADA for monitoring

Poorly Integrated Systems Impede Resiliency

- SCADA is inherently made up of different components
  - Controls, Data Acquisition, HMI, Alarm/Events, Historian, Configuration/Administration, External/Remote Access
- Older systems are poorly integrated
  - Process tags are not easily connected across system components which results in difficulty troubleshooting
  - Updates/adjustments must be made in multiple places that cause impacts in other aspects of the system resulting in downtime
  - Proprietary interfaces require specialized knowledge to recover from failures, extending downtime
  - Difficulty in implementing backup/recovery methods
- Requirements to be on same domain or network zone create security risks

Modern SCADA Design Improves Resiliency

- SCADA Systems integrate seamlessly across separate components
  - Some integrate the development environment directly in the HMI allowing for real-time observation of changes
  - SCADA tags can be created directly from PLC tags via import or reading directly from the PLC
  - Many historians are integrated directly in SCADA systems and allow simple one-click addition of data to a historian, or direct integration into industry standard historians
  - Many methods available to export data or use various 3rd party reporting tools
- Ability to utilize redundancy on individual components of system
- Flexible architectures that allow segregation between control and enterprise networks
- Modern SCADA include access to secure platform independent remote viewing/alerting systems to accelerate diagnostic and troubleshooting efforts

Security Deficiencies Impede Resiliency

- Security risks inherent in the design of older SCADA systems lead to vulnerabilities and potential disruption
  - SCADA systems and protocols were designed when security was of little concern due to the closed nature of the networks
  - Very little encryption or authentication is integrated into the SCADA communications
  - Cyber Security was not the focus of the SCADA
- IT risk and SCADA risk have different priorities and requirements
  - Older SCADA tried to either work within IT structure or work around IT to integrated diverse systems

Modern SCADA Security Improves Resiliency

- Many features are implemented in modern SCADA systems to support Cyber Security standards
  - Tracking of authentication (login/logout) and actions
  - Username and password requirements
  - Encryption between devices
  - Encryption of system configuration files and historized data
- Sophisticated management of users and privileges reduces risk of unintentionally interacting with systems
- Integrated change management reduces risk in deploying changes
- Modern network architectures allow more flexible segmenting to reduce impact of network interruptions

Older SCADA HMIs Are Not Conducive To Operational Awareness

- Many SCADA systems focused on displaying live status and process values for the operator
  - They were designed to produce color changing text or objects indicate status and alarm
  - Meant to recreate P&ID on screen with navigation
  - As availability of information increased and costs reduced for implementation, more and more data was added to displays
- Complex configuration and editing methods for HMI displays
- Out of the box objects were very rigid and not always applicable outside of the specific vendor hardware
  - Customization difficult and required very specialized skills

Modern SCADA HMIs are focused on Operational Awareness

- Many have embraced “high performance” HMI principles
  - ISA 101 emphasized situational awareness by limiting use of color, creating context for raw data values, using levels for navigation, etc.
  - Built-in libraries of preconfigured symbols and objects that present contextual references for live data and embedded trending
  - Flexibility to create navigation methods that fit the facility needs
- Intuitive configuration and editing methods
  - Many incorporate live data visualization during edits prior to deploying changes
  - Customization is encouraged via use of expressions or scripting
- Integration of communications systems and other diagnostics in HMI
  - Out-of-the-box indications allow integration with network and other communications hardware

Older SCADA Alarm Management Is Not Conducive To Operational Awareness

- Older SCADA focused on reactionary alarms
  - Legacy “light and horn” alarms that relied on operator logs → printed alarm lists → software alarm lists
  - Indicated time of alarm, trigger value, acknowledge time and “return to normal” time
  - Additional available data resulted in an overwhelming amount of alarms
  - Did not provide any context for alarm, recommended action, or any connection to process

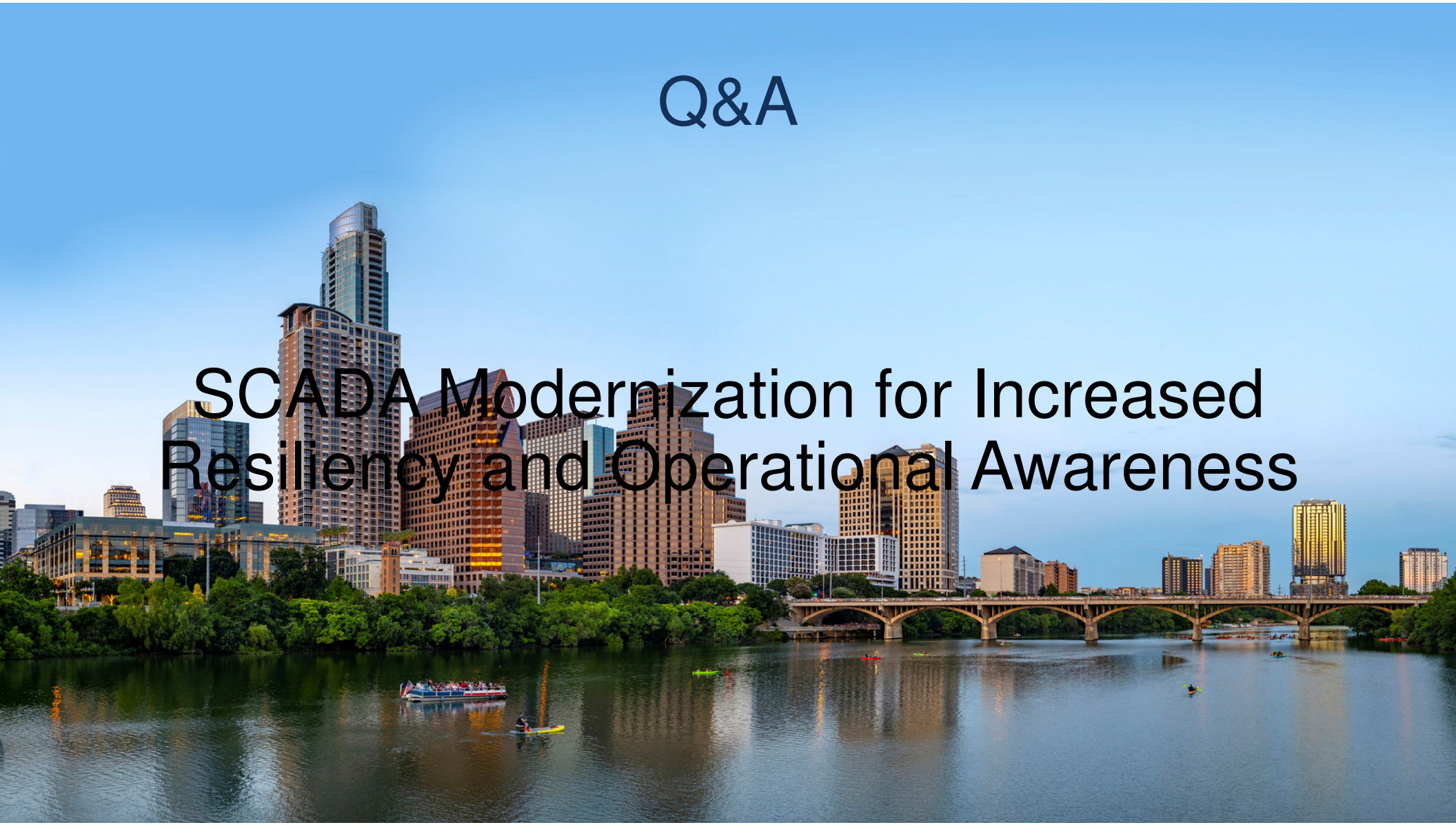
Modern SCADA Alarm Management Supports Operational Awareness

- Modern SCADA has adopted Situational Awareness in Alarm Management
  - Many are ISA 18.2 compliant allowing best practices to be implemented through SCADA
  - Allow direct jump from alarm list/page to display that shows the tag or a trend of data
  - Ability to shelve alarms and add notes upon acknowledgement
  - Built in reports for alarm floods, or bad actors
- Can filter and prioritize alarms for different displays and process areas
  - Includes alarm dialers or rosters to get alarms to appropriate responders
- Expanded ability to alert remote responders and manage alarms remotely

Lessons Learned - SCADA Modernization

- Significant planning is required to migrate a SCADA system
  - Resiliency should be considered as part of the process and is the driver of many upgrades
- Changing operators' interface to the process needs substantial preparation
  - High-performance HMIs and other situational awareness methods can be a significant departure from existing operator interface

Q&A



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Thank You!

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