Orion SCADA

for Electric Utilities

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NovaTech Orion SCADA

NovaTech Automation produces a license-free, lower-cost SCADA solution for electric cooperatives and municipalities. This document summarizes the key features, the differences between traditional SCADA and Orion SCADA, security features, and customer examples.

Key Features in Orion SCADA

Orion SCADA offers the same features as traditional SCADA, plus additional features for accessing non-operational data such as fault records from protective relays. Features summarized below:

- System Overview screens

- "Real-time" visibility into substations
  - › Breaker positions
  - › Tap and regulator steps
  - › Relay and apparatus alarms
  - › Weather conditions

- Alarm Annunciation
  - › Preformatted Tile Annunciator

- Sequence of Event Records

- Remote control
  - › Circuit breakers
  - › Reclosers
  - › Voltage regulators
  - › Tap changers
  - › Capacitor bank controllers

- Data Archive and Reporting

- MultiSpeak protocol for transferring data to OMS, Dispatch, AMI, and other systems

- Secure access to non-operational data in protective relays
  - › SEL® relay fault records and oscillography
  - › ProView access to Cooper Recloser Controllers
  - › WinECP access to ABB DPU and TPU relays
  - › AcSELerator access to SEL® relays
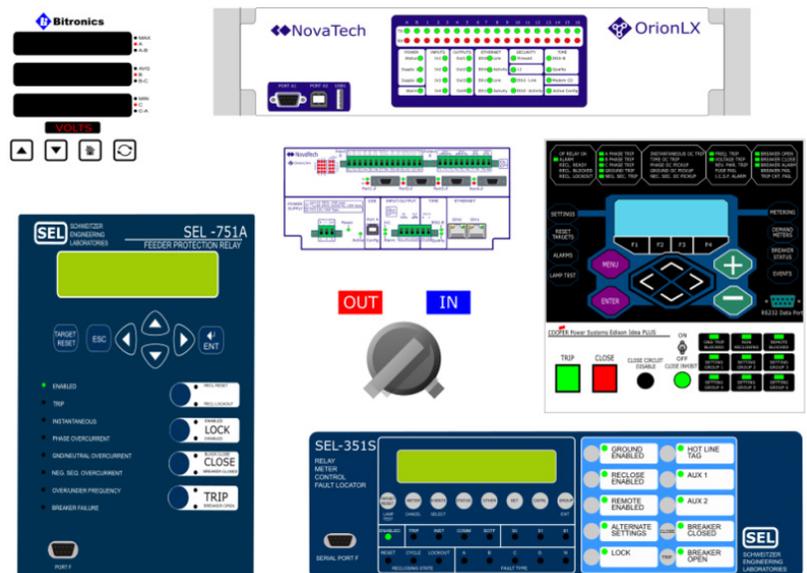
Large library of pre-drawn animated IED faceplates and symbols simplifies screen development.

SEL is a registered trademark of Schweitzer Engineering Laboratories.

DC Fuse — Acknowledge all on page

Acknowledge selected — FDR2 POTT/BU RLY FUSE FB/R12 — On

BUS BU DIFF FUSE FB/C10	FDR1 PRI DCB FUSE FB/ECC	FDR1 PRI DCB RLY FUSE FC/R9	FDR1 BU DCB FUSE FD/ECC	FDR1 BU DCB RLY FUSE FE/R9	FDR1 FUSE FJ/ECC
FDR1 DTT TX FUSE FG/ECC	FDR1 DTT RX FUSE FF/ECC	FDR2 RLY/DCB FUSE FE/R10	FDR2 230KV RLY FUSE FB/R11	FDR2 DCB CARR FUSE FA/R13	FDR2 DCB RLY FUSE FB/R13
FDR2 POTT TONE FUSE FB/R12	FDR2 POTT/BU RLY FUSE FB/R12	FDR2 DTT TONE SET FUSE FH/C13	FDR2 DTT RX FUSE FH/C13	FDR2 DTT TONE MODE FUSE FH/C13	FDR2 DTT TONE TX FUSE FC/R12
FDR1 CB TRIP FUSE FG/C9	FDR1 CB TRIP BUS	FDR3 CB CTRL FUSE FE/403P	FDR3 CB CLOSE FUSE FE/403P	FDR2 CB CTRL FUSE FC/C13	FDR2 CB CLOSE FUSE FC/C13
FDR1 CB BF TRIP FUSE FA/R9	FDR2 CB BF TRIP FUSE FA/R11	FDR2 CB BF TRIP FUSE FA/R12	TRAN 1 MOAB FUSE FD/C15	TRAN 1 HSGS FUSE FK/C15	TRAN 2 MOAB FUSE FA/C7
TRAN 2 HSGS FUSE FH/C7	TRAN 3 MOAB FUSE FA/C9	TRAN 3 HSGS FUSE FK/C4	FDR1 LN MOAB FUSE FN/C9	FDR1 LN MOAB FUSE TS3-CP1	FDR1 BUS MOAB FUSE FP/C9
FDR1 BUS MOAB FUSE TS3-CP1	FDR2 LN MOAB FUSE FN/C13	FDR2 LN MOAB FUSE TS3-CP1	FDR2 BUS MOAB FUSE FP/C13	FDR2 BUS MOAB FUSE TS3-CP1	

A typical "Alarm Tile Annunciator" is shown above.
A typical example of a "one-line diagram" is shown below.

HENDERSON
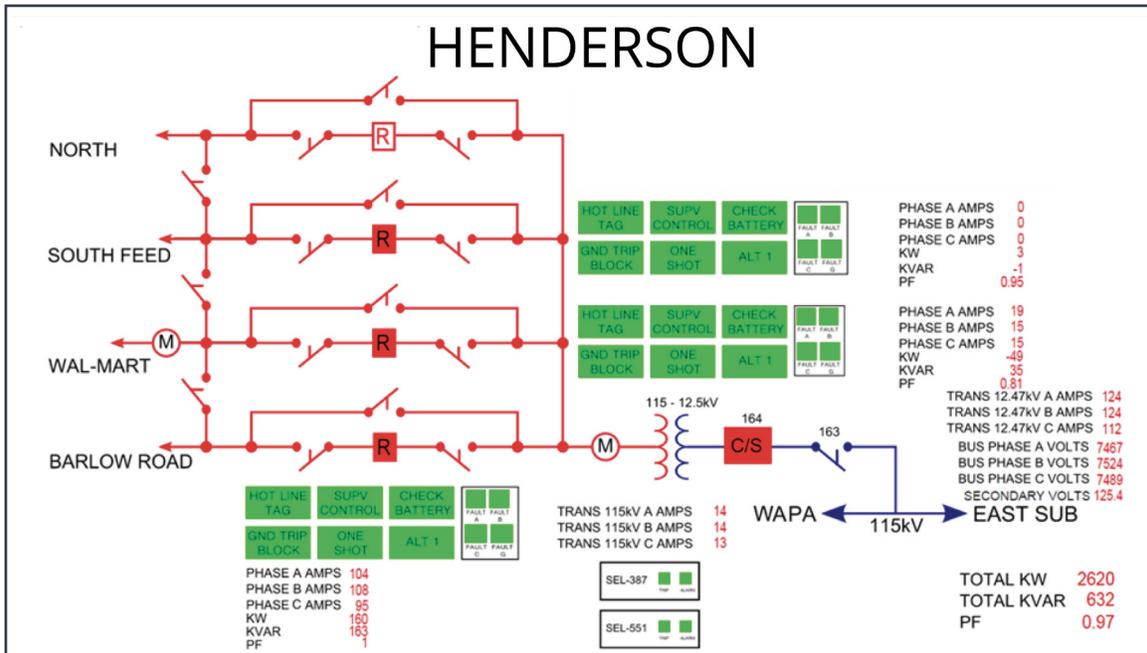
Traditional SCADA vs. Orion SCADA

In traditional SCADA, PCs and servers contain all the software. In Orion SCADA, the Orion Automation Platform contains all the software; PCs only browse web pages served out from the Orion. If no PCs are desired at all, the Orion can support a direct connection to a local monitor.

When inside a substation, SCADA webpages for that local substation can be viewed when attached to the Orion RTU. SCADA pages from other substations can also be viewed. Photo is from a Colorado substation.

Orion SCADA Advantage

- No licensing fees.
- Orion SCADA maintained by same personnel that work on RTUs.
- Longer life expectancy - Users can expect at least 10 years from the Orion when applied as a SCADA host.
- Any SCADA page can be viewed from any Orion RTU in any substation.
- The Orion Direct Video option enables users to connect a monitor to the Orion and view SCADA pages without a PC
- The Orion RTU is designed to access fault records from SEL® relays, and provide secure engineering passthrough using relay manufacturers' configuration software.
- Scalability and smaller initial investment.
- Orion SCADA is a good fit for a utility with three substations, or a utility with 30 substations. The investment for the utility with three substations may be only one tenth as much.

Challenges to Traditional SCADA

- Software licensing fees.
- Need for specialized personnel who understand servers and PC architecture.
- Short life expectancy - PC-based systems required operating system upgrades every few years.
- SCADA page viewing options limited.
- Use of PCs for page viewing required.
- SCADA system and RTUs not designed for accessing non-operational data from protective relays.
- Larger initial investment to get started.

Distributed & Centralized Orion SCADA

In Distributed Orion SCADA, the Orion RTUs in the substation serve out SCADA webpages. In Centralized Orion SCADA, an Orion Automation Platform at the enterprise consolidates data from the Orion RTUs in the substations and serves out SCADA webpages.
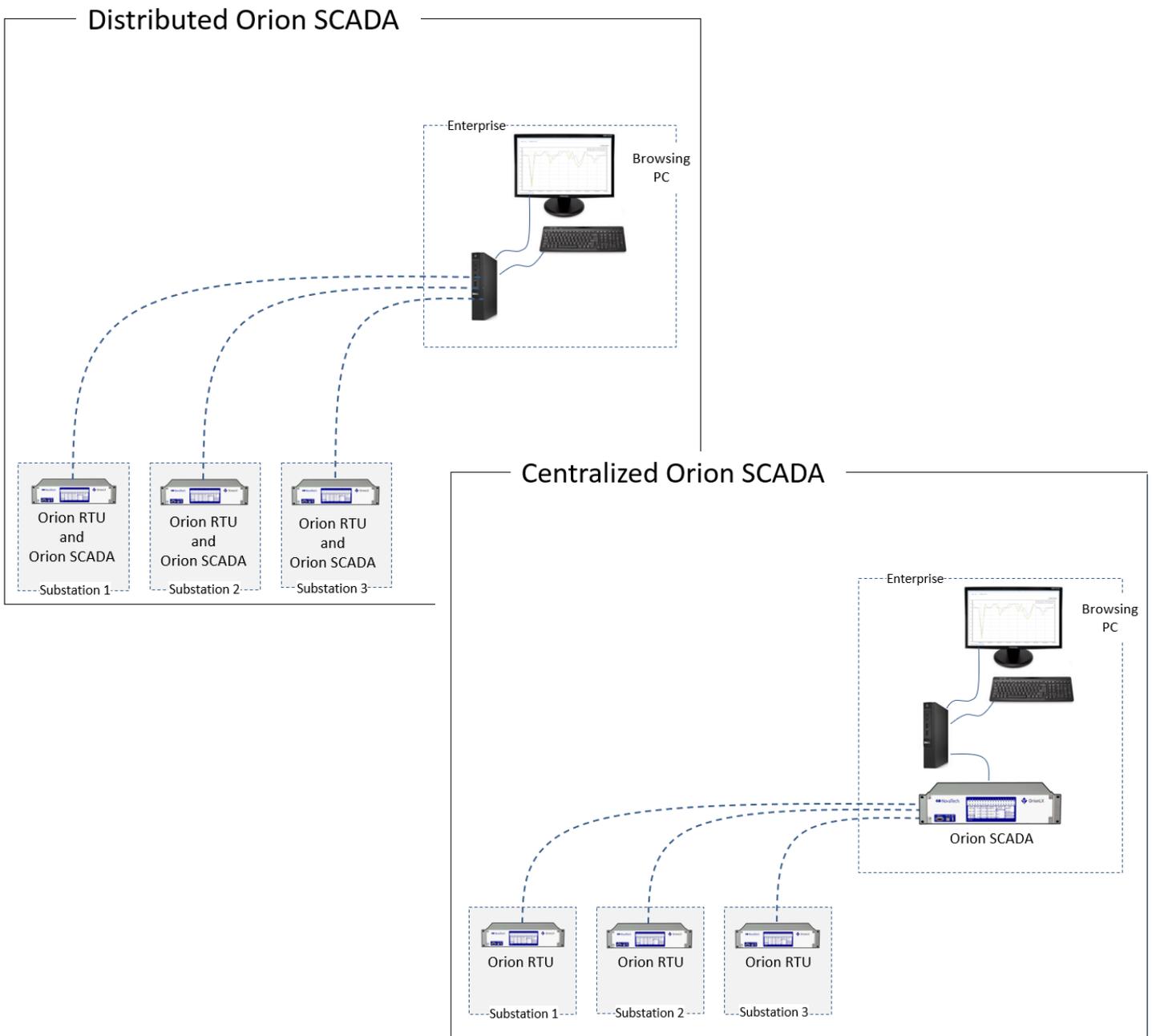
MultiSpeak Protocol Support
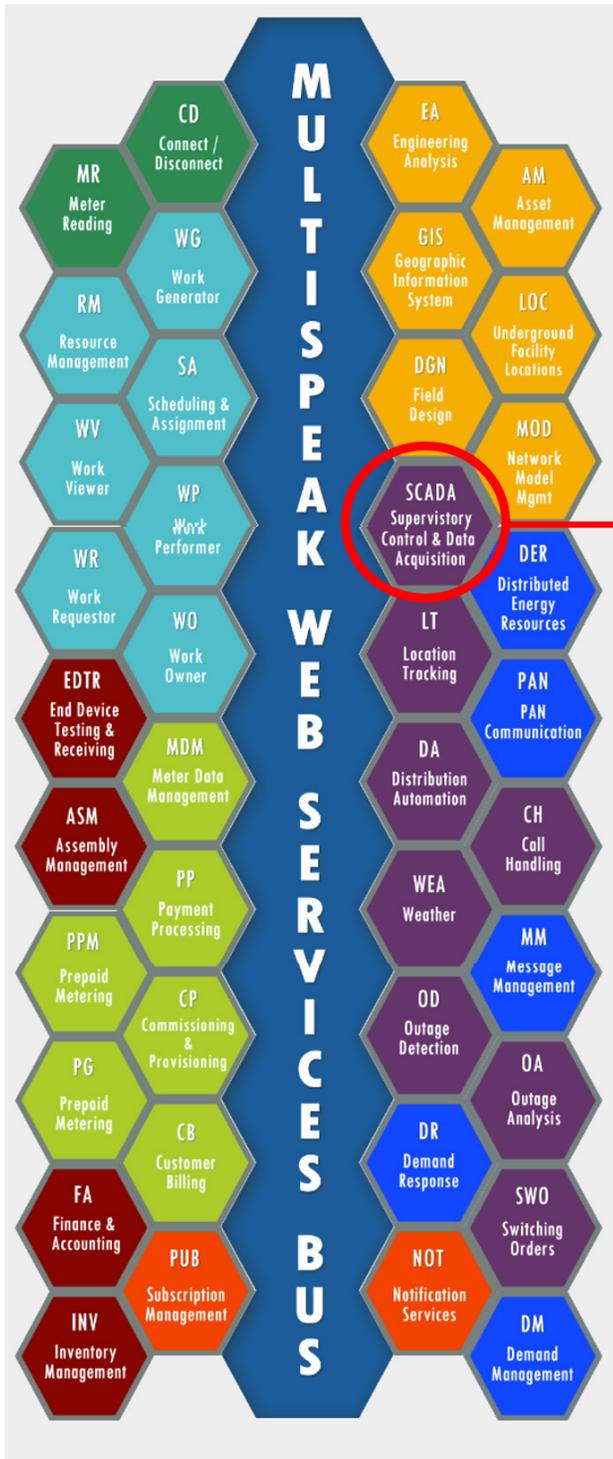
NovaTech is a member of the MultiSpeak Initiative. The MultiSpeak protocol enables breaker status and other data to be transferred from the Orion SCADA system to Outage Management Systems (OMS) from Milsoft, NISC, and other suppliers.

Image courtesy of MultiSpeak website, multispeak.org.

Other Available Protocols

In addition to the MultiSpeak protocol for transferring data to Outage Management and other 'enterprise' systems, Orion SCADA includes protocols for communicating to other SCADA/EMS, protocols for communicating to RTUs, and protocols for password management and diagnostics.

ICCP Protocol
Inter-Control Center Communication Protocol (ICCP) is used for moving data between Orion SCADA and other SCADA/EMS as shown below. An example of this would be where a regional power provider, such as TVA, 'commands' its power utility customers' SCADA systems to achieve a target power factor. The command could be communicated between the TVA EMS and the local utility SCADA systems through ICCP.
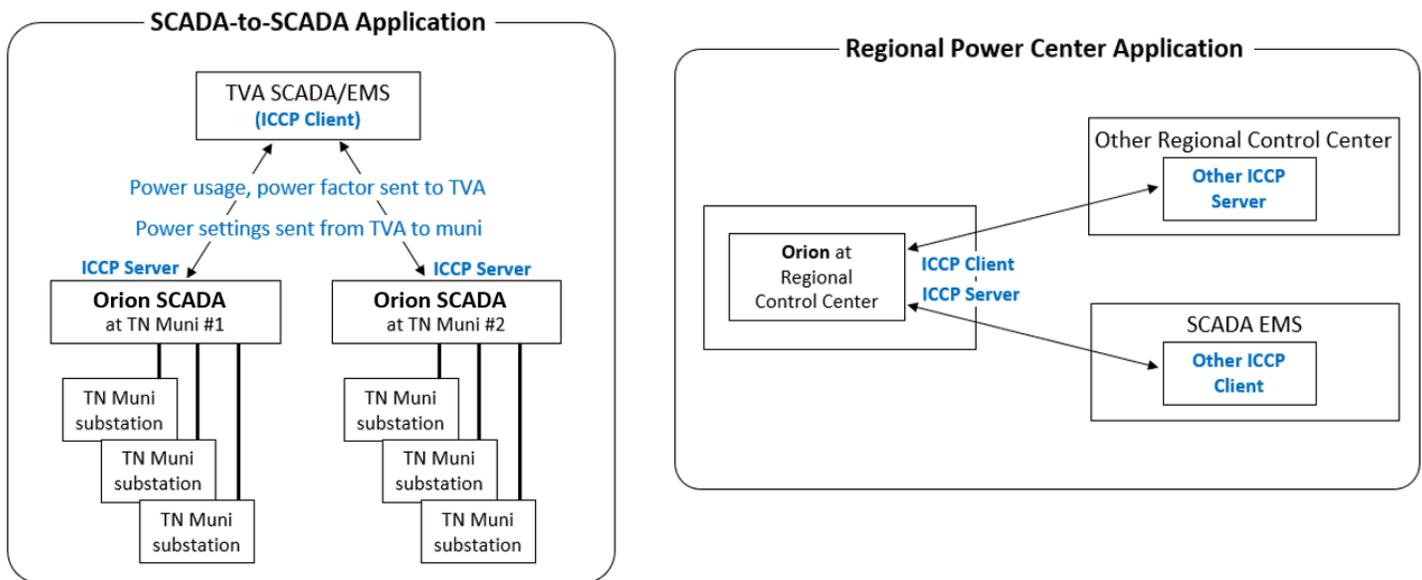
Communication to RTUs
For Distributed Orion SCADA, communication to RTUs is through HTTPS (Hypertext Transfer Protocol Secure). Servers or PCs at the enterprise use HTTPS to browse webpages served from the Orion RTUs in the substations. For Centralized SCADA, communication is usually through DNP3 or IEC 60870-5-101/104. The enterprise Orion SCADA polls the Orion RTUs in the substation using these protocols. FTP/SFTP may also be used to retrieve SEL® relay fault records from the Orion RTUs, as well as other file-based data.

**Protocols for Password Management and Diagnostics**
Orion SCADA supports RADIUS and LDAP, two protocols that enable Orion passwords to be centrally managed. Changes to Orion passwords, removal of a user, or changes to user privileges can all be accomplished using these protocols. For diagnostics, Orion SCADA and Orion RTUs both support SNMP (Simple Network Management Protocol). SNMP can be used to check on the health, CPU/memory loading, firmware version or configuration of Orion and network components quickly and easily.

Software Options for Orion SCADA

Advanced Math & Logic	Advanced Math & Logic editor built on the powerful Lua programming language. Includes simulation tool.
Alarm/Archive/Retentive	Stores both discrete and analog events based on time (e.g. every 15 minutes) or change (e.g. ON-OFF or analog change out of deadband). Alarm Annunciation and Alarm Archive functionality included in web tables. Retentive function retains alarm status through power cycling.
Configuration Backup Manager	Retrieves configuration files from substation cyber assets (currently Orion configuration files and SEL® relay settings), names and zips the files, and stores them in non-volatile Orion memory. MDS checksum available. Useful for tracking configuration changes.
Email	Enables email messages containing alarms, SEL® fault record information (*Short Event Summary* or *Full Length Event Report*) to be sent out from Orion SCADA.
IEC 61131-3	IEC 61131-3 is a graphical PLC-style editor with five Math & Logic editors: Ladder Diagram, Instruction List, Structured Text, Function Block, and Sequential Flow Chart. Online simulation available.
LogicPak	LogicPak provides pre-configured logic functions for commonly used routines, including: "**Calculator**" where equations can be typed in using the same format as MS Excel "**Delay**" where a time delay can be applied to any point before it is report as an Event "**AND**", "**OR**" where alarms or health data can be OR'd and AND'd together to simplify SCADA reporting "**XYZ**" where pulse can be accumulated from energy meters "**Primary/Secondary**" where data can be accessed from either a primary or secondary IED depending on availability of communications.
Points Blocking	Also known as "Alarm Shelving", enables users to manually and temporarily block the logging or displaying of alarms. Can be useful during commissioning/testing.
Redundancy	Hot Active-Standby Redundancy enables two identical Orion SCADA systems to work together as a redundant pair. Includes features to manage connections to Orion RTUs, and to synchronize HMIs.
Relay "Data Logger"	Enables Orion to access full length fault records from SEL® relays and to place records in a file in Orion memory. Requires SEL® client protocol.
Tile Annunciator	A web-based, software-defined alarm annunciation product. The Tile Annunciator webpages are served directly from Orion and provide simplified setup as well as categorization and viewing of active and acknowledged alarms. Requires Alarm/Archive/Retentive (AAR).

Orion SCADA Redundancy

Orion SCADA can be applied as a hot standby redundant pair, where complete visibility and control can be maintained through firmware upgrades, or through the failure of any single system component. In Orion Redundancy, both Primary and Secondary Orions maintain the same view of the system through a high-speed data link.
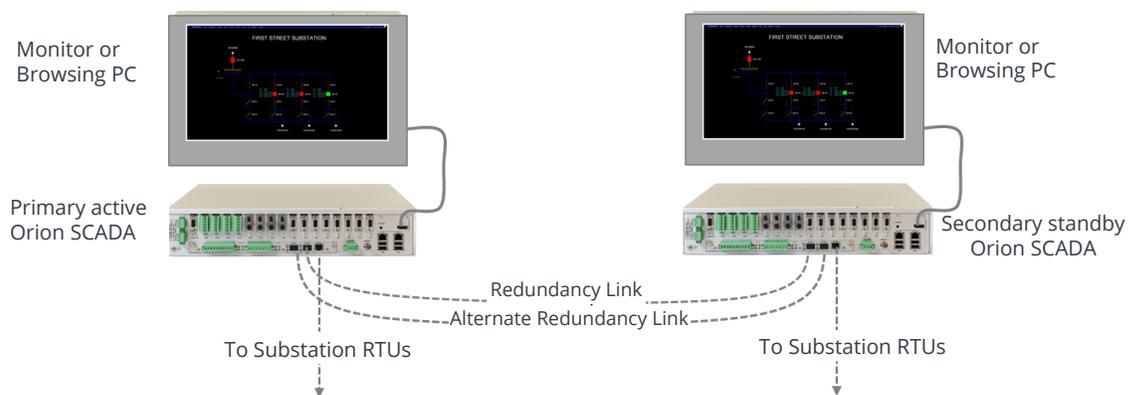

Key Orion Redundancy Features:

- Operators can use either HMI for viewing status, placing tags, acknowledging alarms, blocking points, or executing controls.

- Operator-initiated actions are replicated bi-directionally (applying Tags, acknowledging Alarms, and blocking/unblocking points).

- The Standby Orion can be configured to poll or not poll substation RTUs. Polling confirms communication health.

- Configurations loaded to Primary Orion will be automatically transferred to Secondary Orion.

- Primary and Secondary Orions can be in different locations to reduce chances of common mode failure.

Making Orion SCADA Secure

Orion SCADA provides the highest levels of security to prevent unauthorized access, eliminate eavesdropping, and restrict device control to only users with specific predefined privileges.

The diagram below summarizes security features:
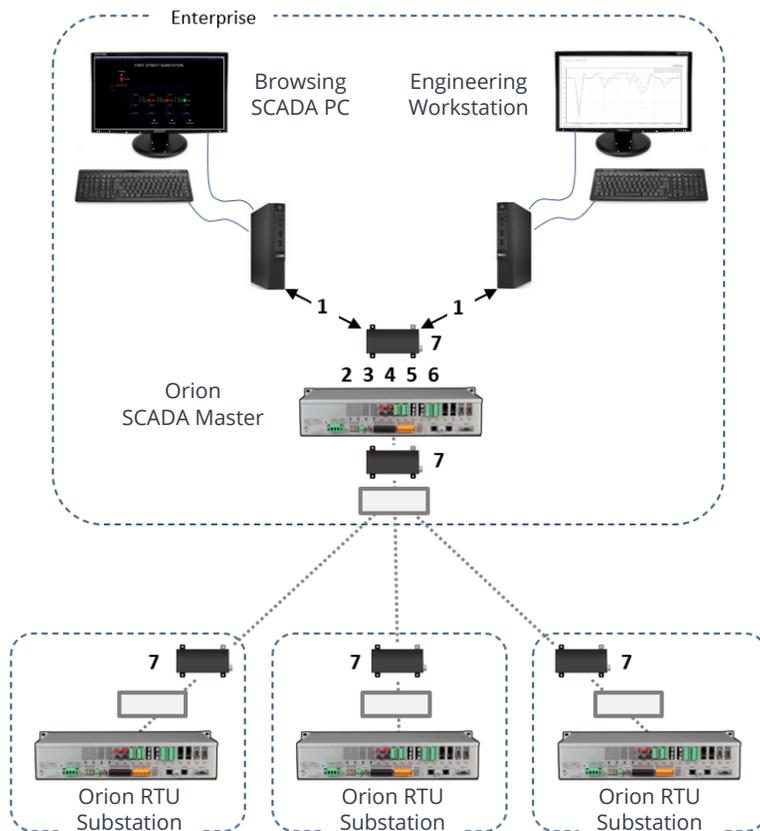
1. Use only encrypted communication using secure protocols (HTTPS, SSH, SFTP)

2. Use Orion firewall

3. Set up users with strong passwords

4. Establish specific user privileges (who can do what)

5. Use "IP Address Lockout" on controls
   - Only PCs at preauthorized IP addresses can control breakers and other apparatus

6. Log all access attempts and activity with syslog, and can be sent to a central syslog server

7. Install a network data guard, such as "Binary Armor" from Sierra Pacific Corp.
   - Processes every byte to and from Orion ensuring only safe traffic reaches Orion
   - Provides two factor authentication through secure key token
   - FIPS 140.2 encryption for all traffic

Improve Operational Performance with Orion SCADA

The following comments were reported to NovaTech by users of Orion SCADA.

Midwest customer:

- Integration with Outage Management System (OMS)
  - › OMS system is configured to automatically create a device outage based on feedback from SCADA about breaker operations.
  - › This helps to streamline operations during an outage and reduce call volume to our dispatcher.
- Data trending
  - › Trend KW, KVAR, PF, etc. for breakers during different load cycles.
  - › Provides historical data for system studies and contingency analysis.
- Reporting
  - › Custom Substation Reports
    - Overall System Peak - Load on each substation during a coincident peak.
    - Substation Peak - Max load on substation regardless of coincident loading.
  - › Reporting package
    - Export to Excel
    - Graphs

Southwest customer:

- The SCADA system has eliminated the need to drive to the substation during a power outage, which shortens the outage time for the customer.
- Allows the City to monitor the power factor on individual circuits, and then adjust the capacitance of the system without having to depend upon other companies.

- "We are able to monitor and capture events such as low voltage or high voltage at the bus; this helps when trouble shooting customer complaints."
- History of events can be accumulated such as: breaker trips, breaker lock outs, reclosers blocked or enabled, low voltage events, high voltage events, and maximum amperage for each circuit.
- It allows the dispatcher to determine at a glance the position of the breaker being opened or closed and the position of the load and line side knife blade switches.

Midwest customer:

- Provides secure web access to any user with appropriate access.
- The SCADA system will eliminate the need to drive to the substation during a power outage, which shorten outage times.
- Substation one-line diagrams show the status of the entire sub at a glance - dispatch can quickly tell what feeders are open, if any are on Hot Line Tag and if there are voltage issues.
- Feeder breaker zoom screens allow more detailed information to be viewed at the office such as: ground trip blocked, non reclosing, max amperage, power factor, and fault currents.
- Cooper software can be used to remotely log into the substation breakers and regulators to view settings, sequence of events, and make changes if needed.

Customer Application Examples

The four users of Orion SCADA below prepared presentations summarizing their application and experience. Details can be provided upon request.

Other users of NovaTech Orion SCADA:

- Athens Utility Board (TN)
- Augusta (KS)
- Bartow, City of (FL)
- Beatrice Board of Public Works (NE)
- Butler County PUD (NE)
- Chanute (KS)
- Chickasaw Electric Coop (TN)
- Cochran Marine (WA)
- Conway (AR)
- Colby, City of (KS)
- Coles-Moultrie Electric Coop (IL)
- Fairfield, City of (IL)
- Farmington, City of (MO)
- Fremont, City of (NE)

- Gardner (KS)
- Gladstone Power and Light (MI)
- Goodland, City of (KS)
- Hyrum, City of (UT)
- Kinston, City of (NC)
- Kirkwood (MO)
- Lena, Village of (IL)
- Lindsborg, City of (KS)
- Loudon Utilities (TN)
- McPherson, City of (KS)
- Milford, City of (IA)
- Monroe County Electric Coop (IL)
- Natchitoches (LA)
- Nebraska City (NE)
- North Carolina State University

- Norris Public Power District (NE)
- Norris Electric Coop (IL)
- Oak Ridge, City of (TN)
- Pampanga Electrical Cooperative (Philippines)
- Paris, City of (KY)
- Pulaski Electric System (TN)
- Russel, KS (converted from NV+)
- Seward, City of (NE)
- Shrewsbury, City of (MA)
- Siloam Springs, City of (AR)
- Southwestern Electric Cooperative (IL)
- Smithville Electric System (TN)
- United Electric Coop (ID)

NovaTech Engineering Services

Almost half of the NovaTech utility business is comprised of services: engineering design, packaging, commissioning, and training. We work closely with utility customers to define and engineer RTU panels and custom cabinetry, design HMI screens, create special logic, and manage complete web-based SCADA systems. On-site installation, commissioning, and training services are dispatched from local offices in seven US locations to assist users to implement projects quickly and safely. NovaTech provides high levels of post-project support.

Examples of projects shown below:

Substation HMI

Orion RTU

Keyboard

NovaTech I/O modules
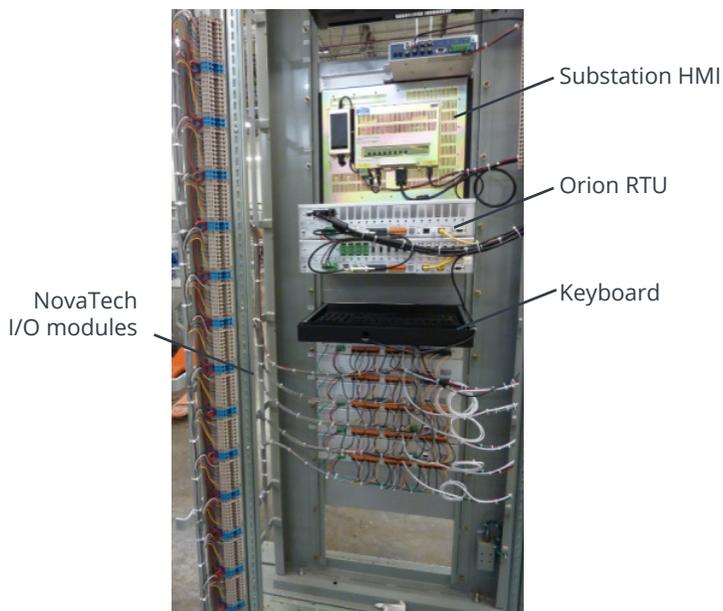
RTU cabinet for corn processing plant
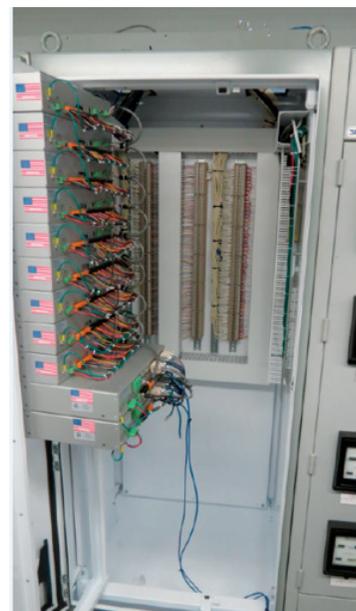
The new RTU cabinet located at Keys Energy Thompson Street Substation

Rob DePhillips, Keys Energy Project Engineer, in front of the new RTU cabinet located at Thompson Street Substation