Web-based visualizations with PI System

Presented by **Nate Chang**
Paul Doering
Patrick Mechenbier
James Butler

About

- Natural Gas and Electric Utility in Northern and Central California
- 5.1 million customer accounts
- 141,215 miles of distribution electric circuits

- Independent system integrator across all major industries
- Over 300 engineers
- Providing PI System integration services for over two decades

About us:

Nate Chang

Product Manager

nyc1@pge.com

Paul Doering

System Administrator/Programmer

Ped1@pge.com

Patrick Mechenbier

Software Developer

Patrick.Mechenbier@rovisys.com

James Butler

Project Engineer

James.Butler@rovisys.com

Enterprise Agreement (EA)

- PG&E Lines of Businesses using PI System:
  - Transmission, Generation, Distribution
- PI products within Distribution:
  - PI AF Builder, PI Server, PI Interface for UFL
  - Future: PI ProcessBook, PI Coresight, PI DataLink

Enterprise agreement (EA)

- PG&E Lines of Businesses using PI System:
  - Transmission, Generation, Distribution
- PI products within Distribution:
  - PI AF Builder, PI Server, PI Interface for UFL
  - Future: PI ProcessBook, PI Coresight, PI DataLink

Enterprise agreement (EA)

- PG&E Lines of Businesses using PI System:
  - Transmission, Generation, Distribution
- PI products within Distribution:
  - PI Asset Framework (PI AF)
  - PI Server
  - PI Interface for UFL
- Future: PI ProcessBook, PI Coresight, PI DataLink

Background of FLISR

- Fault Location Isolation and Service Restoration (FLISR)
- Grid Automation system to isolate and restore outages through fault detection and real-time load monitoring
- PG&E made an investment to target the 400 worst-performing distribution circuits out of 3000 circuits
- Operators and engineers require more visibility and data access than ever before to manage the grid
- With PI System, PG&E found a great solution to drive data visibility to end users
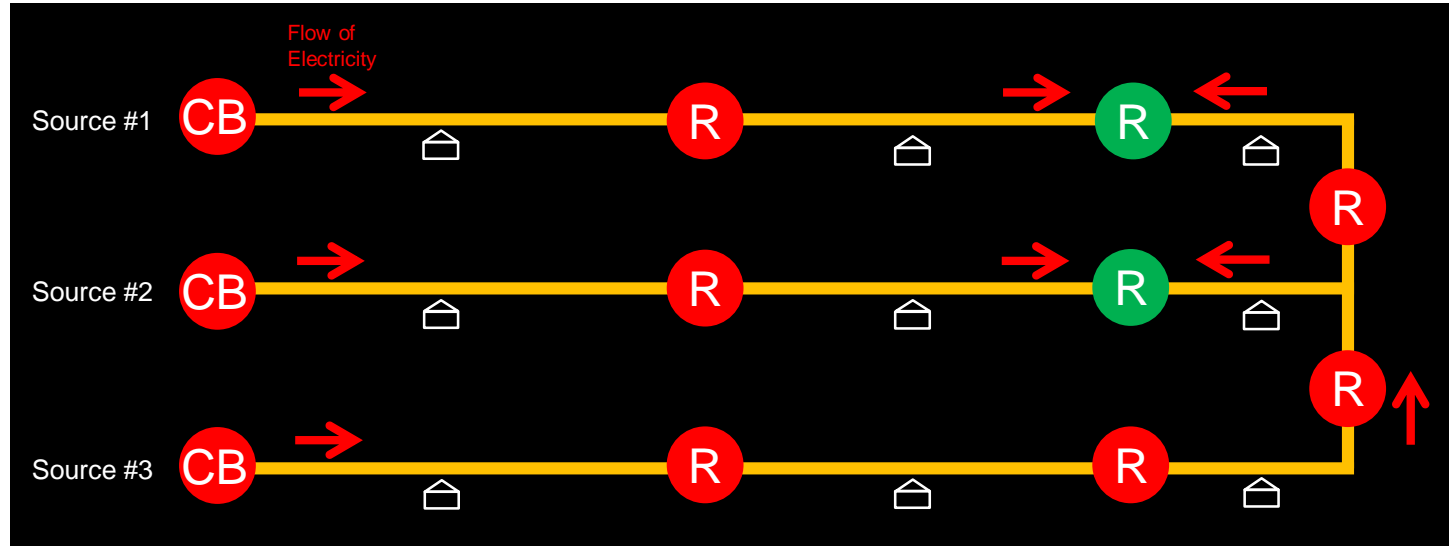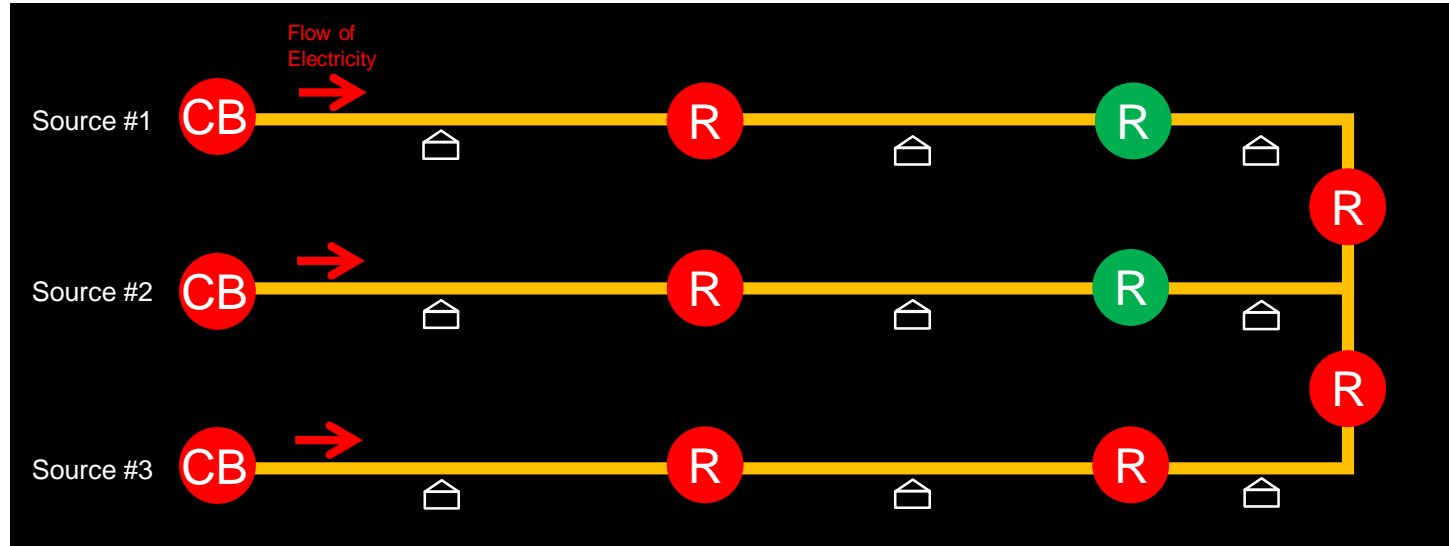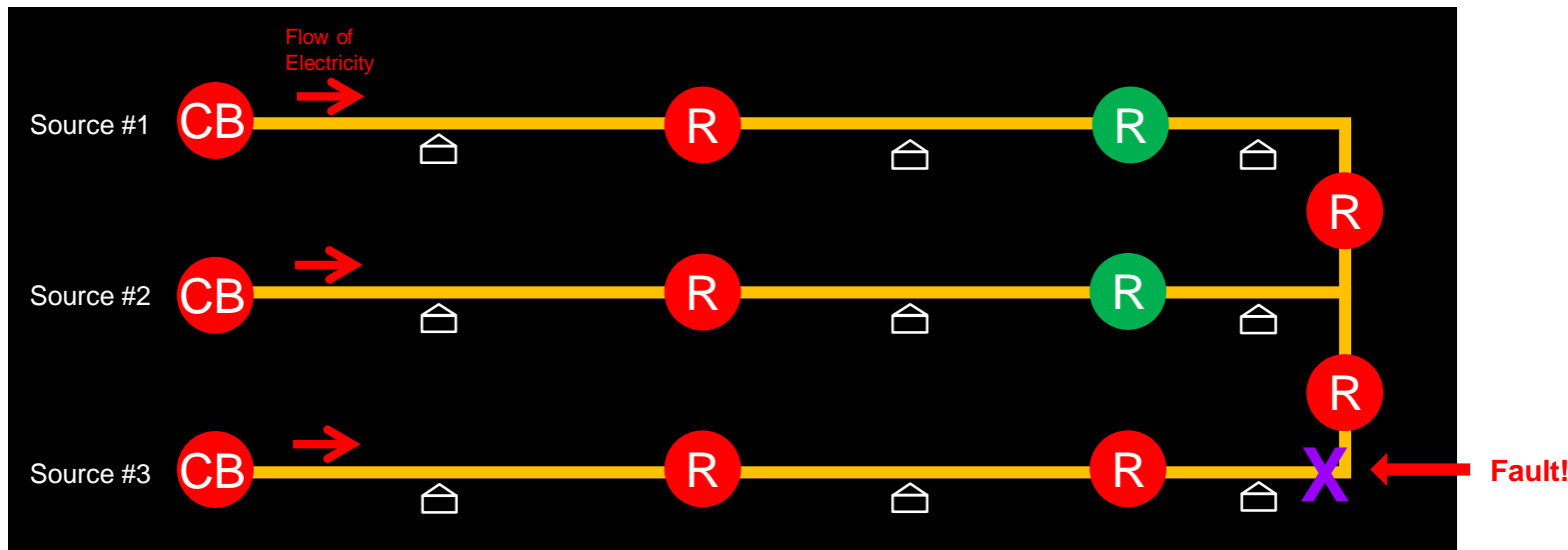
Distribution Automation
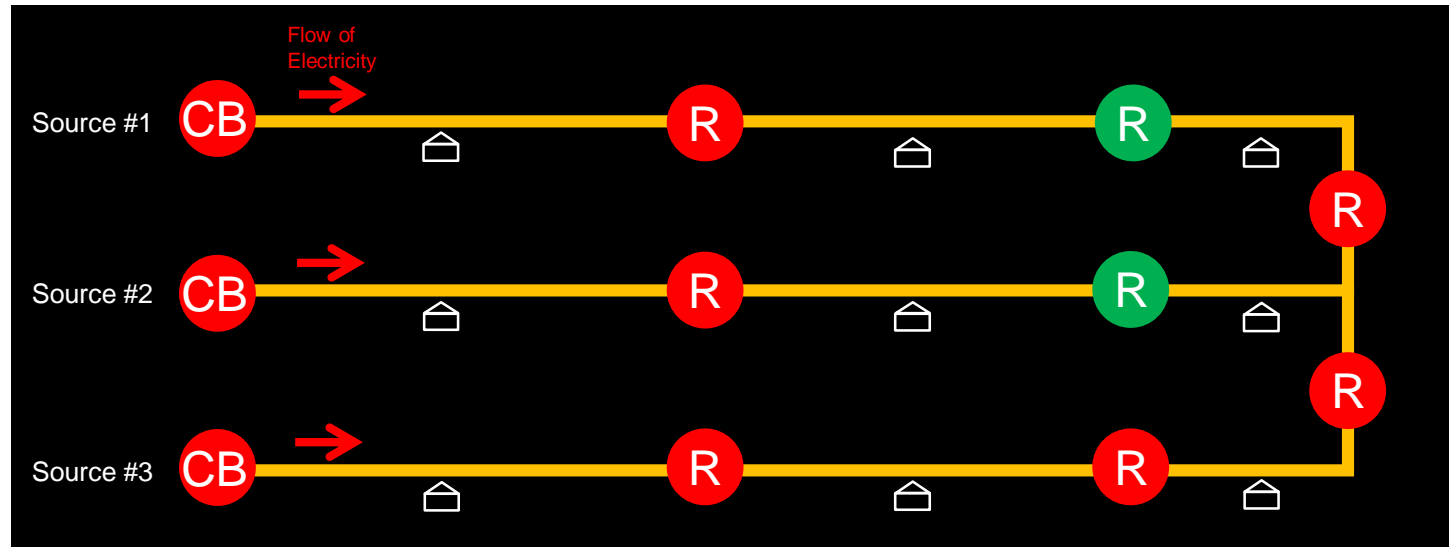
- Fault Location Isolation and Service Restoration (FLISR)

Distribution Automation

- Fault Location Isolation and Service Restoration (FLISR)
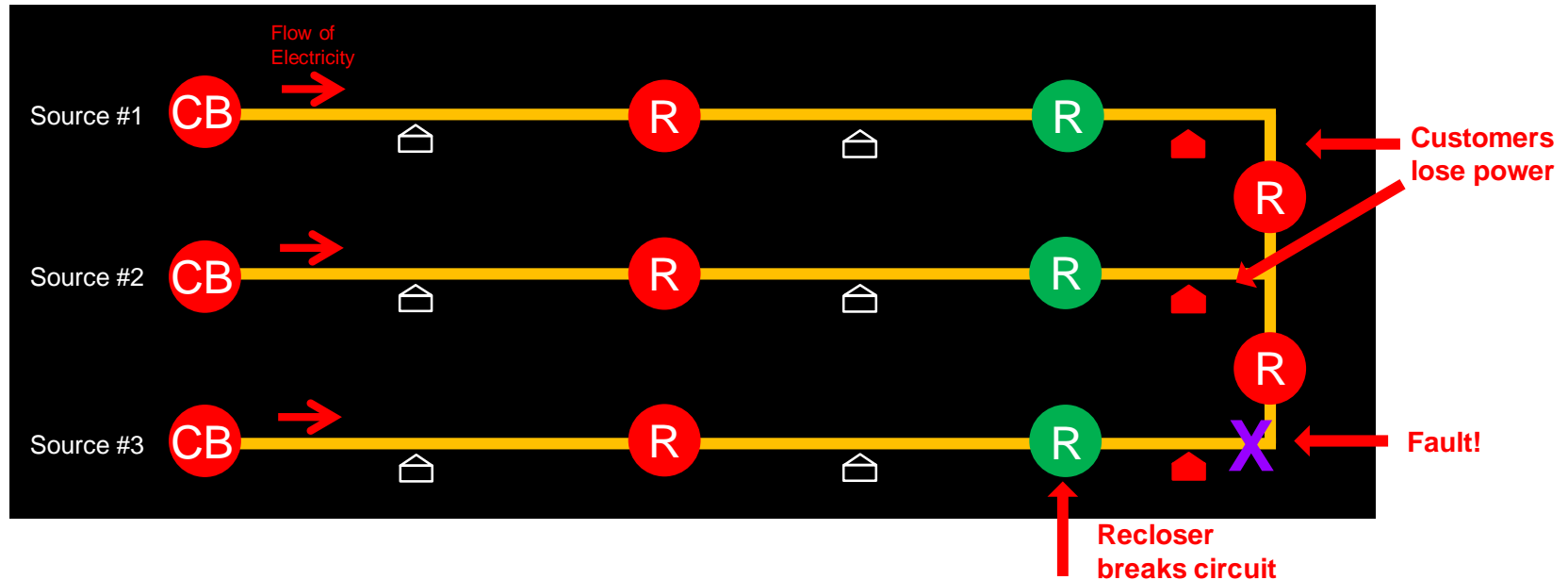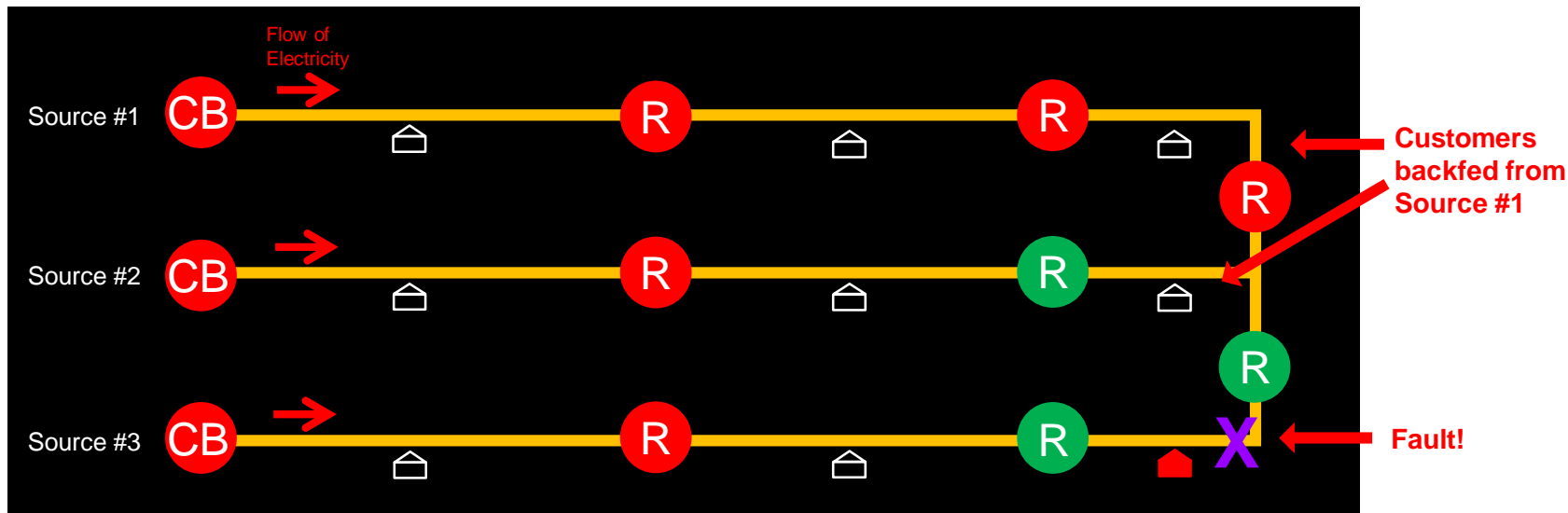
Distribution Automation

- Fault Location Isolation and Service Restoration (FLISR)

Distribution Automation

- Fault Location Isolation and Service Restoration (FLISR)

Distribution Automation

- Fault Location Isolation and Service Restoration (FLISR)

Distribution Automation

- Fault Location Isolation and Service Restoration (FLISR)
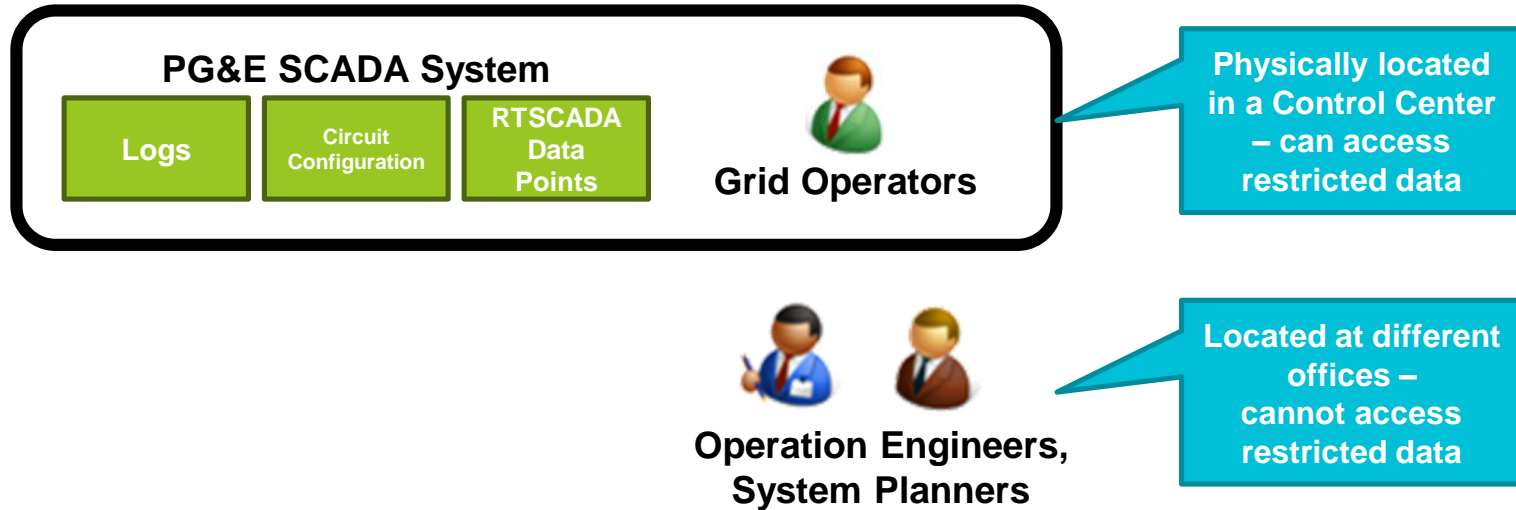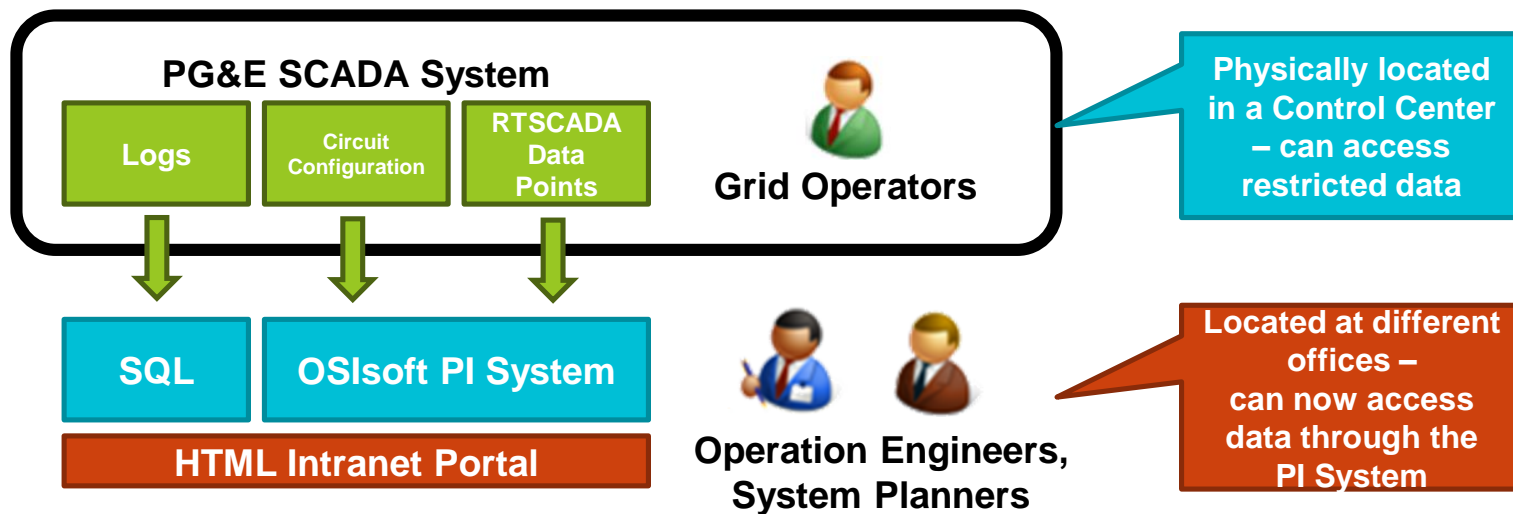
Challenges

- Visibility for real-time monitoring of electricity to our customers → **$$**
- Visibility for long-term system planning and process improvement
- Scalability of data to employees located hundreds of miles apart

PG&E SCADA System

Logs | Circuit Configuration | RTSCADA Data Points

Grid Operators

Physically located in a Control Center – can access restricted data

Operation Engineers, System Planners

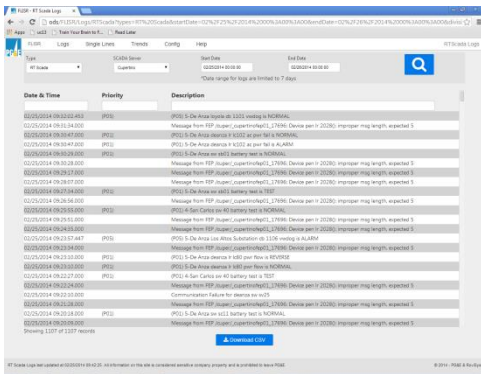**Located at different offices – cannot access restricted data**

Solutions

- PI System to provide real-time data infrastructure
- Integration with DMS, RTSCADA and SQL
- HTML web portal for a "one stop shop" of grid data

PG&E SCADA System

Logs | Circuit Configuration | RTSCADA Data Points

Grid Operators

Physically located in a Control Center – can access restricted data

SQL | **OSIsoft PI System**

HTML Intranet Portal

Operation Engineers, System Planners

Located at different offices – can now access data through the PI System
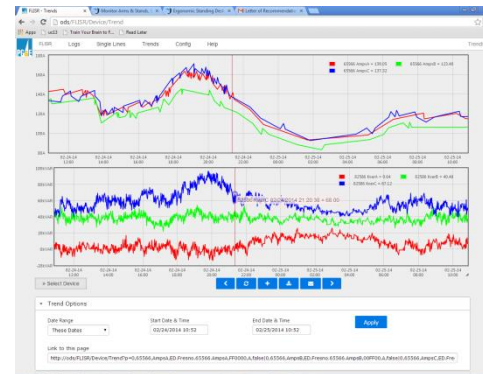
Solutions

Logs

- Transfer raw event logs from SCADA system to web portal for detailed engineering analysis
- Filter logs based on log syntaxes
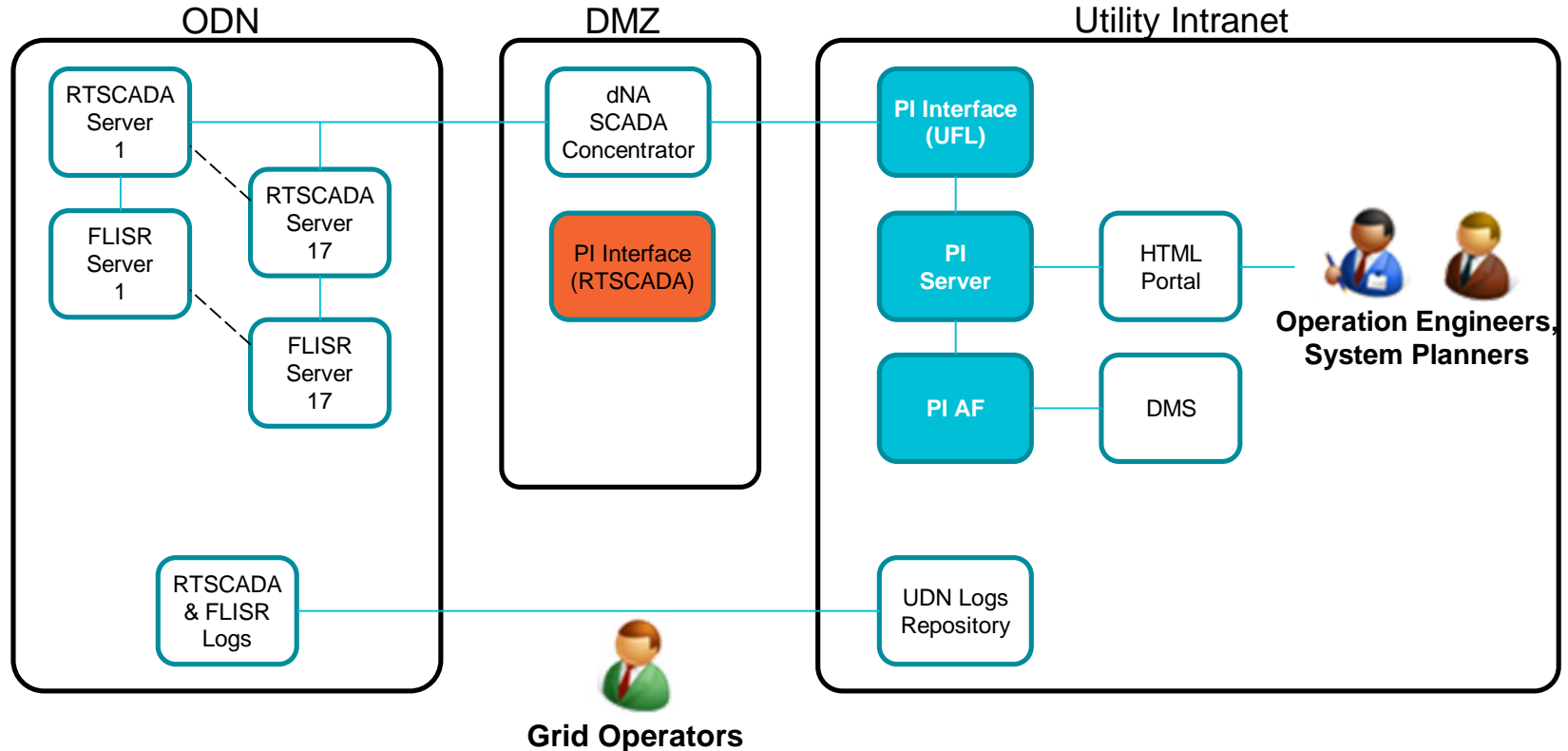
Single Line Diagrams

- Generate diagrams dynamically from GIS data
- Review historical snapshots and video playbacks
- Display real-time status and trends for quick operational analysis
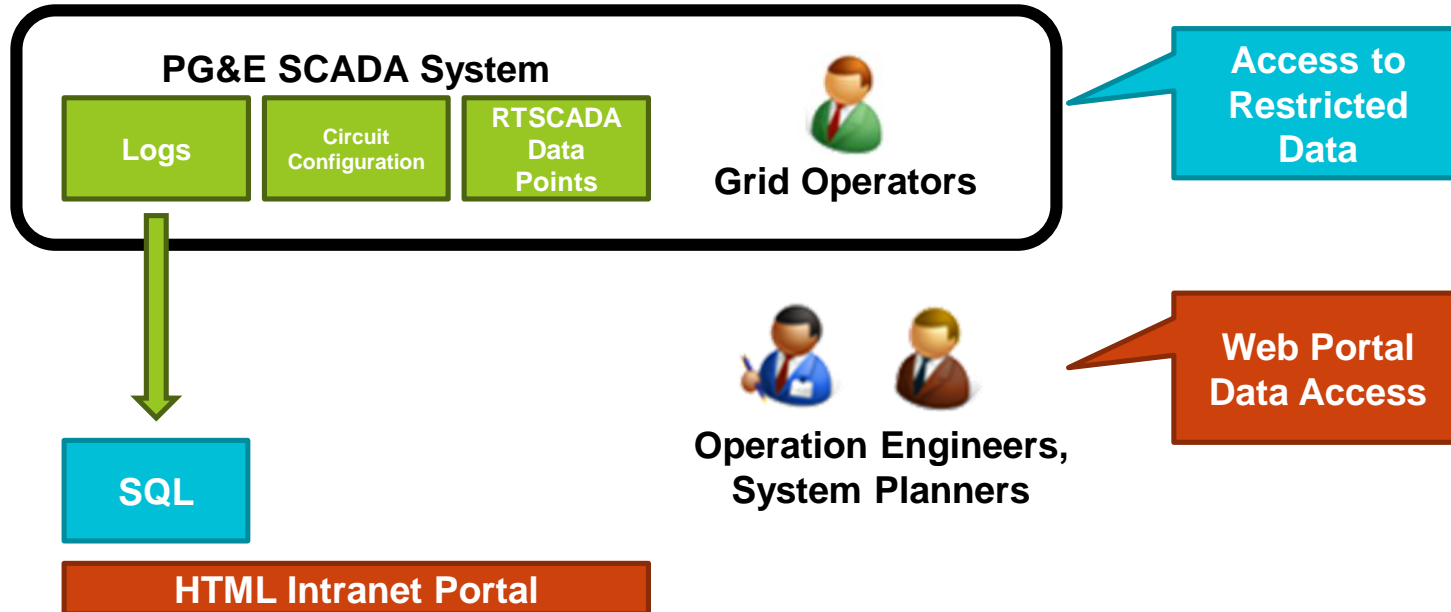
Data Graphs

- Display real-time trends for detailed engineering analysis
- Add custom charts to webpage dynamically
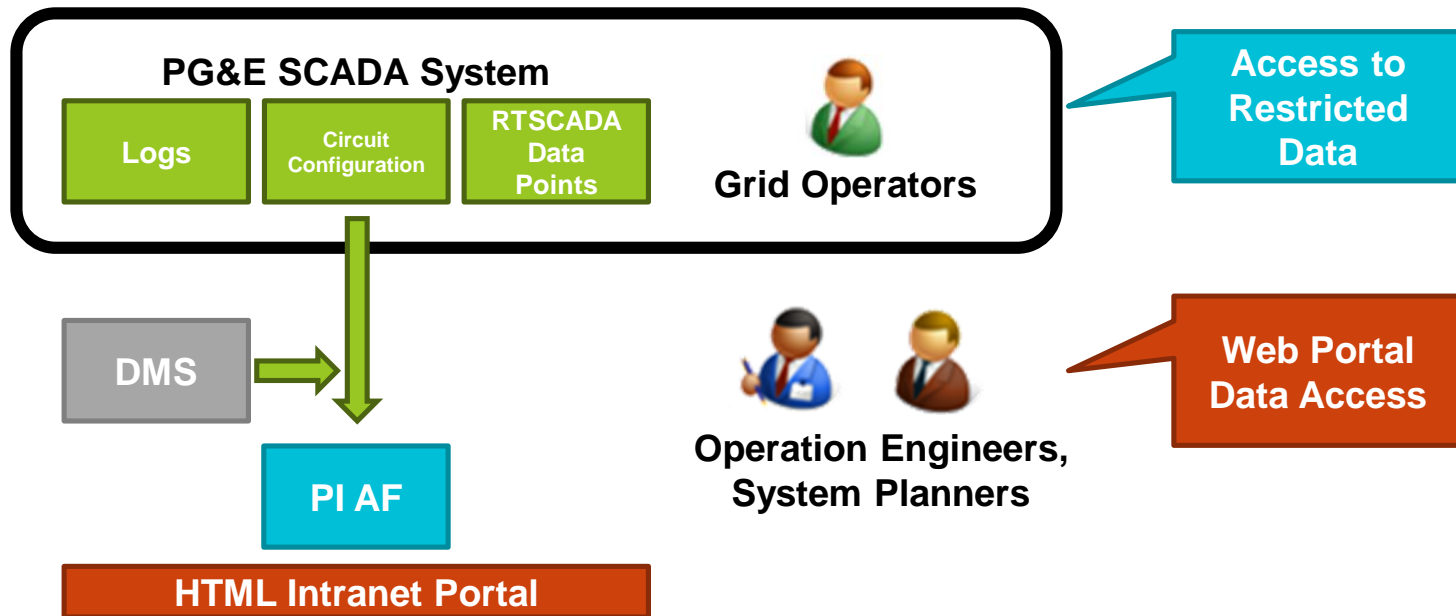- Email custom charts to team members

System Architecture

ODN

- RTSCADA Server 1
- RTSCADA Server 17
- FLISR Server 1
- FLISR Server 17
- RTSCADA & FLISR Logs

DMZ

- dNA SCADA Concentrator
- PI Interface (RTSCADA)

Utility Intranet

- PI Interface (UFL)
- PI Server
- PI AF
- HTML Portal
- DMS
- UDN Logs Repository

Operation Engineers, System Planners

Grid Operators

Logs Integration

PG&E SCADA System

Logs · Circuit Configuration · RTSCADA Data Points · **Grid Operators**

Access to Restricted Data

Operation Engineers, System Planners

Web Portal Data Access

SQL

HTML Intranet Portal

Single Line Diagrams: DMS&PI System

PG&E SCADA System

Logs | Circuit Configuration | RTSCADA Data Points

Grid Operators

Access to Restricted Data

DMS → PI AF

HTML Intranet Portal

Operation Engineers, System Planners

Web Portal Data Access

Single Line Diagrams: DMS&PI System

- Circuit configuration sent to web service
- Web service asks Distribution Management System (DMS) for information about the circuit
- Web service processes and stores pertinent information about circuit and relevant devices in PI AF
  - Automated PI AF hierarchy generation/placement
  - Automated device creation using PI AF Templates
- PI Tags for devices created automatically
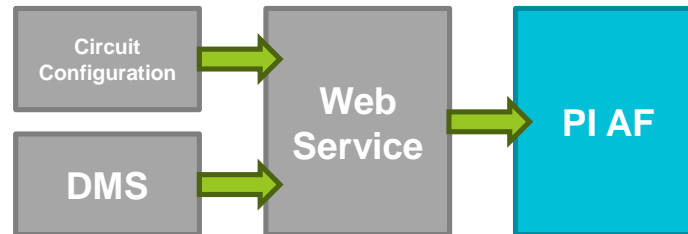
Device Management

PI AF Templates

- Created a portal based on PI AF Templates to drive device management

- Provides an interface for creating a consistent naming scheme

- Instrument tag value suggestions based off existing dNA Plus system

Navigation Strategy
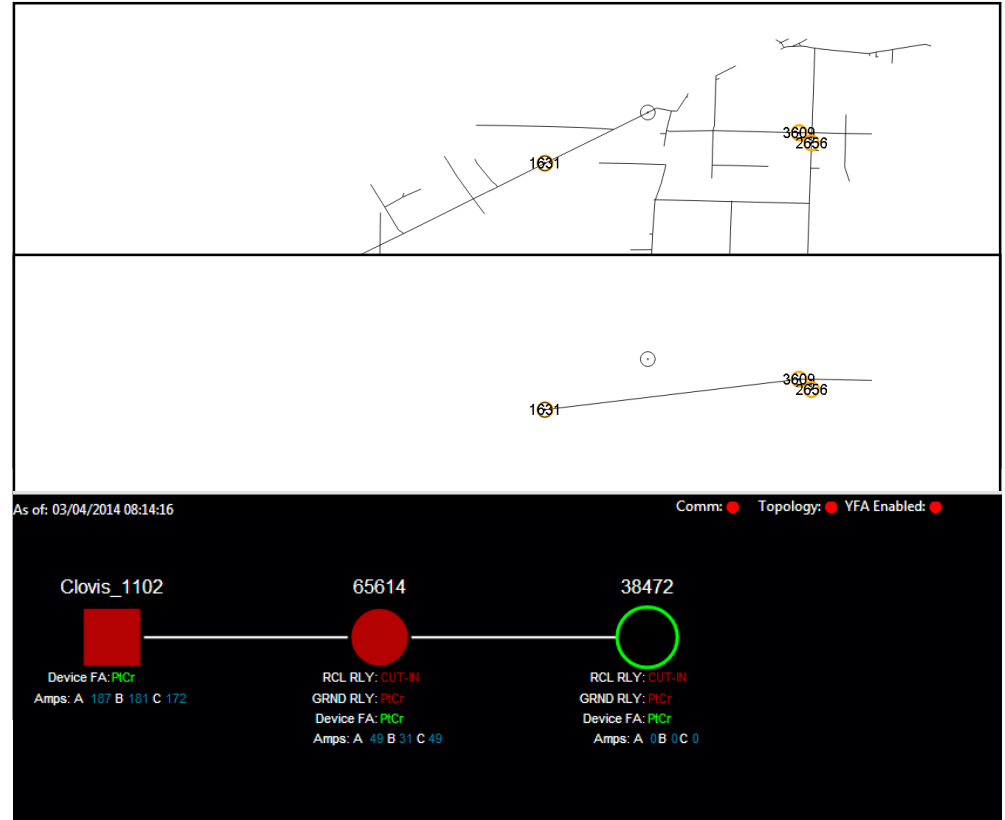
PI AF Driven Navigation

- Leveraged PI AF to organize devices and device data

- Filtered PI AF hierarchy is delivered to end user through web portal

- All interactions with the OSIsoft PI System use the PI AF SDK (version 2.5)

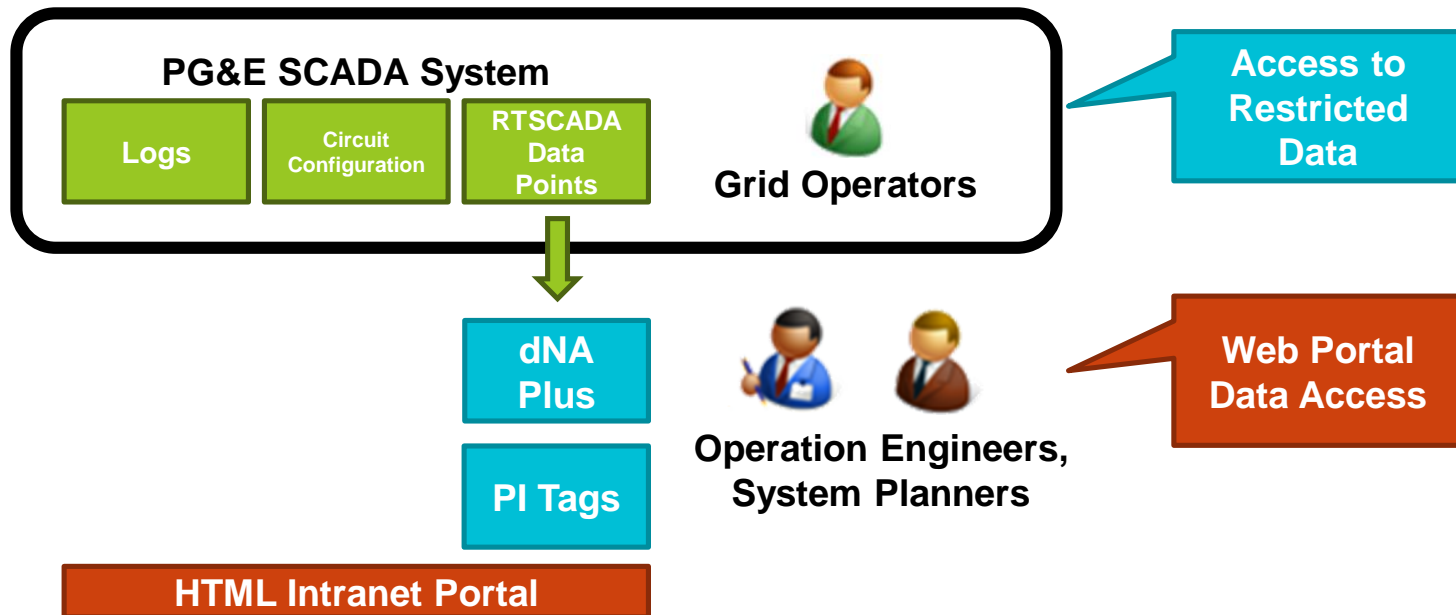- No references to the previous PI SDK
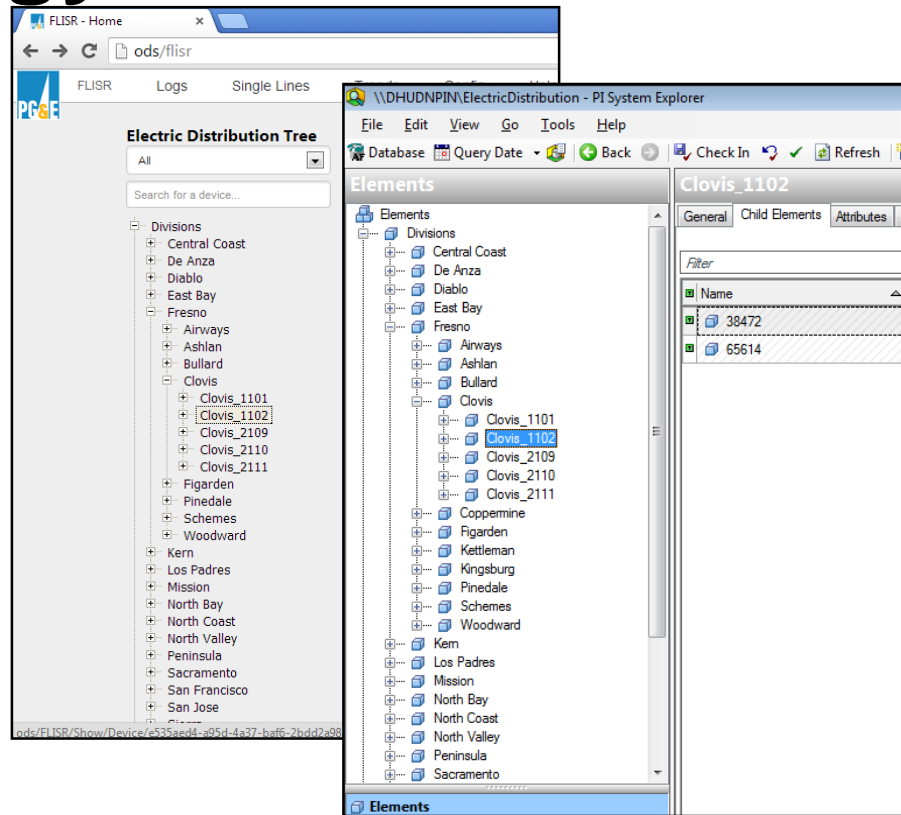
Single Line Creation

Web service integration of GIS data

- Algorithms developed to reduce DMS data to a core connectivity model

- Reduced information stored as PI AF attribute information

- After reduction all requests for display generation are made solely through PI AF SDK to the PI Server

Tag/Point Data: PI-SCADA Integration


PG&E SCADA System

Logs | Circuit Configuration | RTSCADA Data Points

Grid Operators

Access to Restricted Data

dNA Plus

PI Tags

HTML Intranet Portal

Operation Engineers, System Planners

Web Portal Data Access

Tag/Point Data: PI-SCADA Integration

- RT SCADA points and data are already flowing to existing dNA Plus historian
  - dNA Plus is going to be phased out
- dNA Plus writes point data to file
- PI UFL Interface is used to write data to the OSIsoft PI System
- In the future, going to use the PI Interface for RT SCADA

RT SCADA → dNA Plus → PI UFL Interface → OSIsoft PI System
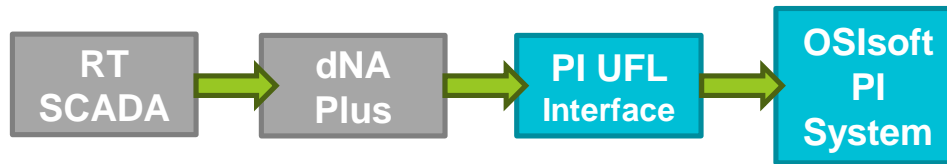
Product Demo

- Video Playback

Results

- Immediate Results:
  - Continuous Improvement
    - System Planners identify patterns in data and provide process improvements for installation and management of FLISR automation
  - Quick Outage Response
    - Engineers immediately support restoration of outages as they occur in real time, shaving customer minutes off of outages

Future Plans and Next Steps

- Replace PG&E legacy historian with OSIsoft PI System
  - Enterprise Agreement (EA) with OSIsoft
  - Scale out from 400 FLISR circuits to 3000 electric distribution circuits
- OSIsoft is developing and testing an interface to connect PI System directly to the RTSCADA system (replace UFL)
- Alarms and Notifications
  - Use PI Notifications to alarm and alert users
  - Store Notification history in PI Event Frames
- Dynamic creation of single line for outage boundaries
  - Trigger with PI Event Frames
  - Query DMS for connectivity model
  - Generate single lines for each outage event for engineering analysis
- Use PI ProcessBook and PI Coresight for ad-hoc engineering analyses

Grid Data Visibility

"Through the PI System, PG&E's engineers have gained visibility to the real-time operational data to allow them to support the operations of the grid and long-term system planning."

Dan Pinsonneau
PG&E
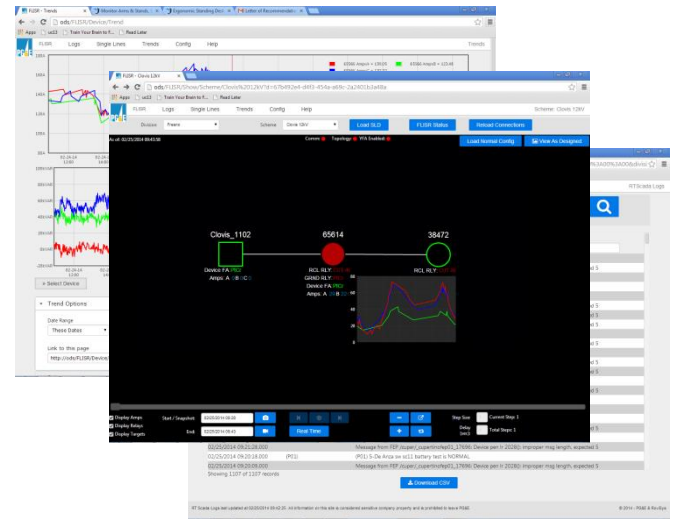
Business Challenge

- Real-time monitoring of grid automation system

- Long-term planning of grid automation system

- Scalability of data across scattered employee locations

Solution

- PI System implemented as a Real-Time Data Infrastructure

- PI System with multiple existing systems

- Custom HTML portal

Results and Benefits

- Increased collaboration between engineers and grid operators

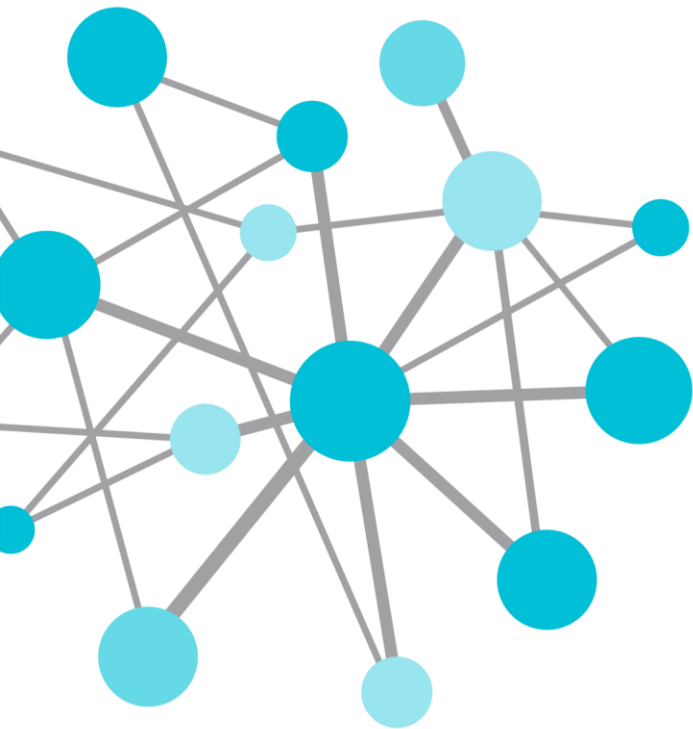- Quick response to customer power outages

Contents:

Nate Chang

Product Manager

nyc1@pge.com

Paul Doering

System Administrator/Programmer

Ped1@pge.com

Patrick Mechenbier

Software Developer

Patrick.Mechenbier@rovisys.com

James Butler

Project Engineer

James.Butler@rovisys.com

THANK YOU

Brought to you by OSIsoft.