Synchrophasors in the Utility Control Center: Today and the Future

Tariq Rahman (SDG&E®), Greg Zweigle (SEL)

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The Next Generation WASA System at SDG&E
A visualization software system (VSS) platform that provides:

- Single information visualization and navigation HMI for all applications including multi-layer geospatial displays
- Centralized intelligent event detection and alarm management
- Platform handle all system integrations with other systems and various data sources
- Open API for integrating all types of applications

Provide greatly enhanced and extended WASA capabilities to system operators!
What Does The Operator Care About?

Synchrophasors
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What is the state of my power system?

- What does that state mean?
- Is the present state secure?
- Is the present state safe?
- Is it reliable?
What Does The Operator Care About?

What is the system going to do next?

- What events is the system vulnerable to?
- Why is the power system doing what it is doing?
- What should I do next?
If the system is not safe or secure:

- How do I get the power system from where it is, to a safe and secure state?
- How do I get the power system to that new state, in a safe and secure manner?
We provide the Operator huge amounts of data
We provide the Operator huge amounts of data

Safety and reliability for millions of people
Software solutions must focus on making operations (and engineering) simpler, safer, more reliable, more economical.
Practical, Simple Solutions for System Operators

Synchrophasor applications (techno-speak) → our job → What operators care about

It’s hard, but there is a process…
Operator Centered Design Process

Understanding the Operator:

- Spending time in the control center
- Operator input
- Define personas
- Document workflows
Observation Examples from SDG&E WASA

Quotes from SDG&E Operators:

“5 minutes is a blink of an eye in our environment.”

“I have a mental model of everything.”

“Synchrophasor data must be combined with other data to help me make a decision.”
Operator Centered Design Process

Innovating for the Operations Center:

- Results from operator observation
- New technology
- Operating procedures
- Engineering practices
Design Example from SDG&E WASA

Operator needs from Design step:

Quickly access data for transmission line

Technology:

GIS Map

Asset Dashboards

Local Weather

Design:

One-click navigation to asset data via map
Operator Centered Design Process

Goals of Prototyping:

- Get feedback to user quickly
- Maximize development team efficiency
Operator Centered Design Process

Benefits of User Feedback:

- Validate ideas early
- Direct operator feedback
- Uncover new opportunities
User Feedback Example from SDG&E WASA

In Development
- App/Feature 1
- App/Feature 2
- App/Feature 3
- App/Feature 4
- App/Feature 5
- App/Feature 6

Monthly Demo Day
1. Use Case
2. Requirements
3. Demo
4. Feedback

SDG&E Users Group
- Operators, Engineers, Advisors, and Management team (SDG&E, Quanta)
Operator Centered Design Process

Importance of Iteration:
- Integrate feedback from operators
- Fine tune design
- Builds trust with operators
Operator Need: Quickly access data for transmission line

Operator Feedback: What if I don’t know the exact GIS location of the transmission line

Iteration: Asset Search
Operator Centered Design Process

The “final step”:

- Final Specifications, Code, Test
- Share with the world
- Continue collaborating
Power System Operations Also Includes...

Software technology  our job  What operations support cares about
Building A Software System

Hardware

- Analog IC
- Microprocessor
- FPGA
- DRAM

Software?
Why Would The User Care?
Why Would The User Care?

- Simplicity
- Quality
- Lead Time
- Openness
- Cybersecurity
I Want Independently Manageable Applications!
But, non-modular on the inside inhibits modular on the outside.
Microservice Architecture

Software

Application 0

Application 1

Application 2

Application 3
Modern Redundancy, Reliability and Cybersecurity

Example Applications

- HISTORIAN
- STTP READER
- NOTIFICATIONS
- DISTURBANCE ANALYTICS
- POWER SYSTEM MONITORS
- WEATHER
- APPLICATION MANAGER

Container Technology

- Operating System
- Server Hardware
- Operating System
- Server Hardware
- Operating System
- Server Hardware
WASA Software for Today’s World

Modern Software Technology
WASA Software for Today’s World

Connect To All Utility Data (more than synchrophasors or “POW”)

Modern Software Technology
WASA Software for Today’s World

- Designed In Collaboration With System Operators
- Connect To All Utility Data (more than synchrophasors or “POW”)
- Modern Software Technology