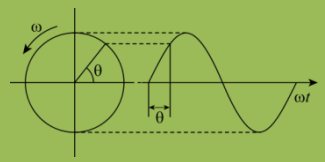
MISO

NASPI North American SynchroPhasor Initiative

June 2012 Success Stories



How to Manage and Use Synchrophasor Data in a Meaningful Way in Real Time Environments.

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Team Background

MISO

- Business knowledge and direction
- Business and operational requirements
- Operational expertise and experience
- Corporate and project vision

Utilicast

- Program / Project Management
- Application and Integration Lead
- Infrastructure Lead
- Operations Engineering Support

MISO Solution

- PMU Deployment
  - MISO expects to have the largest collection of phasor measurements in the country
- After-the-Fact Data Analysis
  - Forensic Event Analysis
  - System Model Improvements
- Real-Time Operations
  - Oscillation and Angle Monitoring

Easy Right?

1) Manage PMU installation
2) Buy Software
3) Train Staff
4) Done ☺

What we found

- All PMUs are not created equal
- There sure is a ***lot*** of data
- Operators were skeptical
- Software was immature
- Uncharted territory

Reality

- Complicated new technology with many avenues to explore and understand
- Realization of complexities caused the team to reevaluate and hone the project scope
- New displays would need to displace existing ones on the video wall
- Was our goal to use data in the control room too ambitious?
- What was really most important to MISO, its Members and the Interconnect?

Restructure

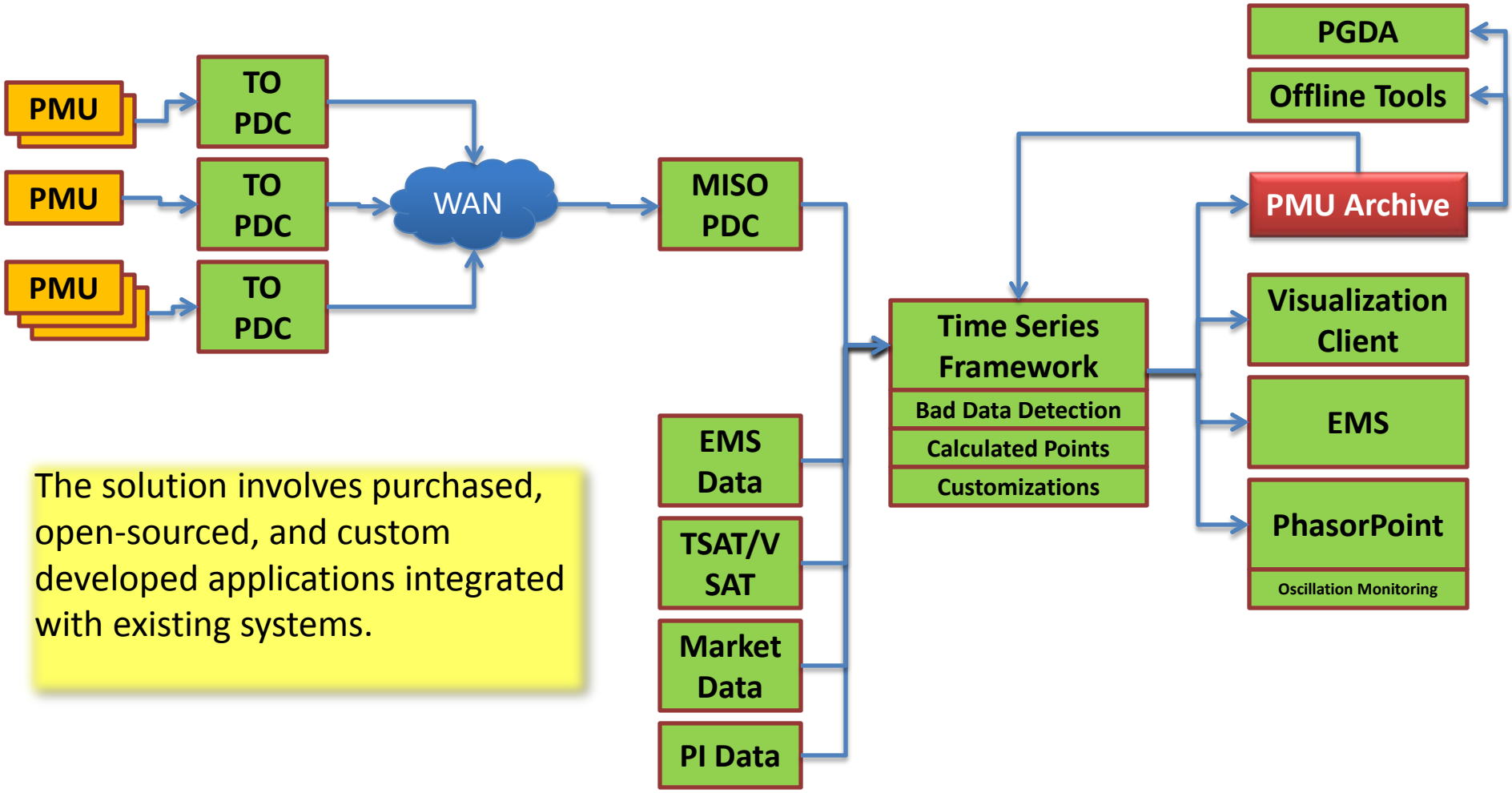
Split team into two tracks.

- Track 1: Build a set of technology and tools that could be used to manage, monitor and visualize not only phasor data, but a combination of existing data matched with phasor data.

- Track 2: Develop a very detailed understanding of the PMU data end-to-end, which requires understanding vendor differences and the underlying causes of data quality issues. The same team was also responsible for defining how phasor data could in Real-Time Operations today, as well as in the short to mid term.


The best visualization appears obvious once complete. However, it is anything but straight forward to invent

Architecture

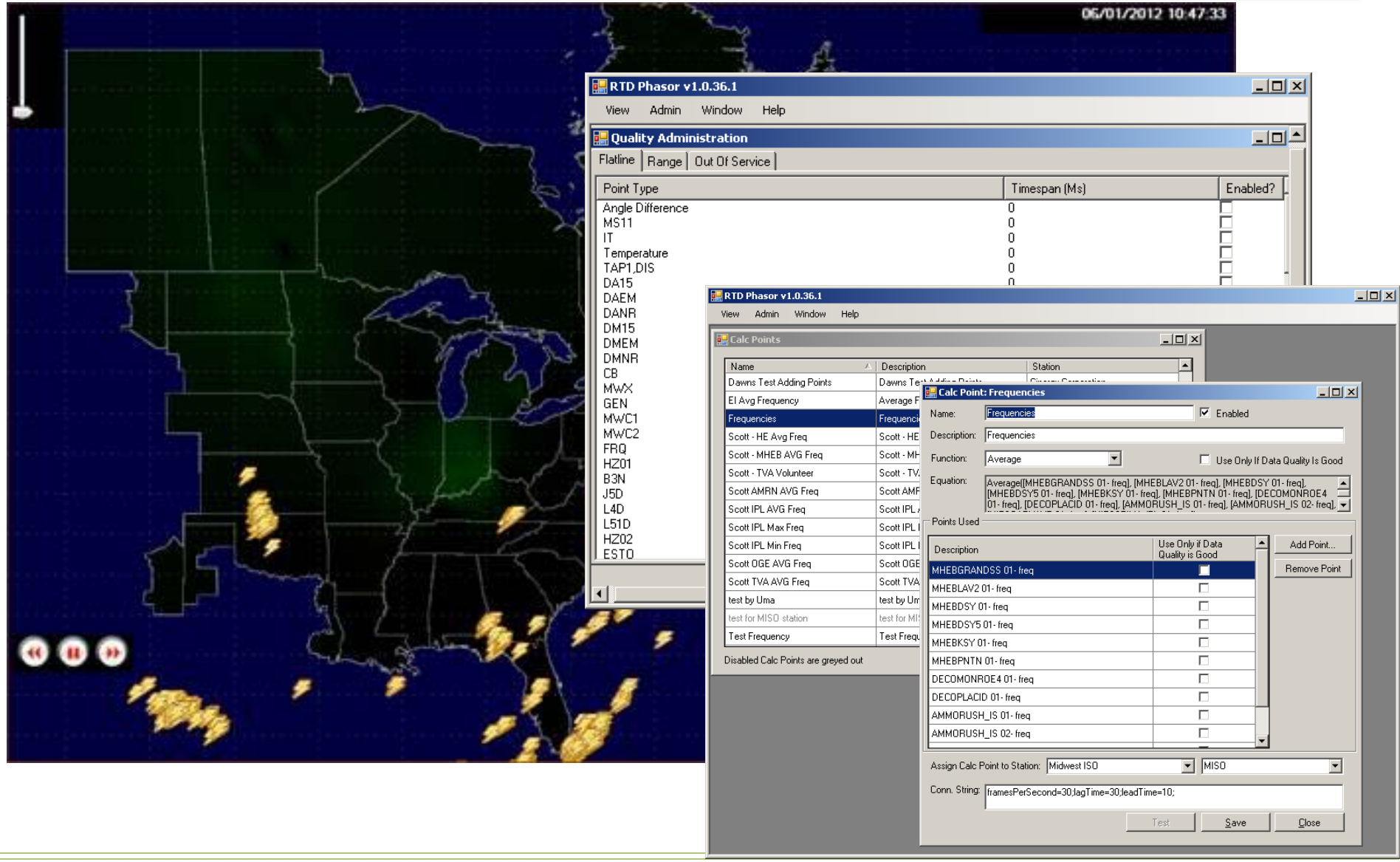


The solution involves purchased, open-sourced, and custom developed applications integrated with existing systems.

Problem #1: Operator Trust in new Data

Solution: Eliminate false positive alarms to the fullest extent possible

- Automated bad data detection/monitoring
- Composite alarms
- Show PMU data and calculations alongside of existing data to build trust
- Utilize existing processes and teams (evolutionary over revolutionary solutions)
- Comprehensive training – emphasize that real-time PMU data is useful because of its high fidelity - deemphasize high speed and low latency.

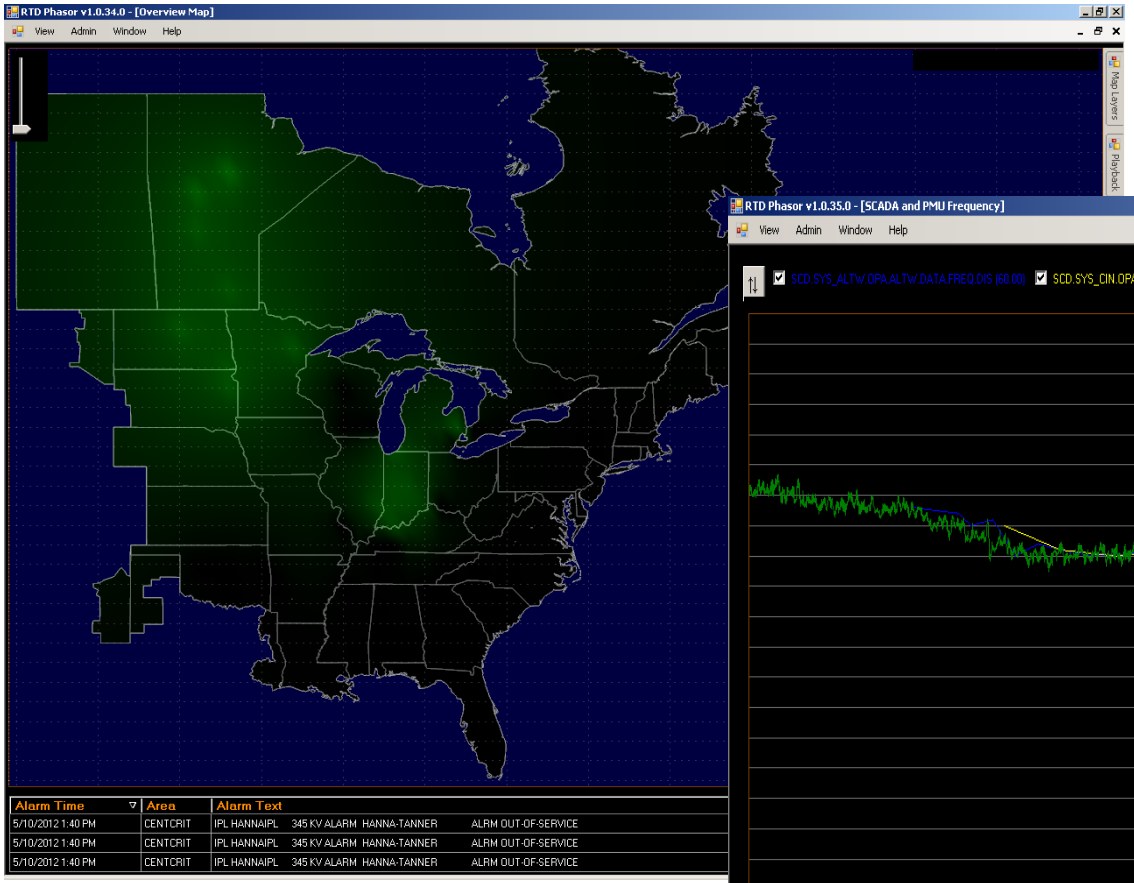

06/01/2012 10:47:33
RTD Phasor v1.0.36.1
View
Admin
Window
Help
Quality Administration
Flatline
Range
Out Of Service
Point Type
Timespan (Ms)
Enabled?
Angle Difference
MS11
IT
Temperature
TAP1,DIS
DA15
DAEM
DANR
DM15
DMEM
DMNR
CB
MWX
GEN
MWC1
MWC2
FRQ
HZ01
B3N
J5D
L4D
L51D
HZ02
ESTO
RTD Phasor v1.0.36.1
View
Admin
Window
Help
Calc Points
Name
Description
Station
Dawns Test Adding Points
EI Avg Frequency
Frequencies
Scott - HE Avg Freq
Scott - MHEB AVG Freq
Scott - TVA Volunteer
Scott AMRN AVG Freq
Scott IPL AVG Freq
Scott IPL Max Freq
Scott IPL Min Freq
Scott OGE AVG Freq
Scott TVA AVG Freq
test by Uma
test for MISO station
Test Frequency
Disabled Calc Points are greyed out
Calc Point: Frequencies
Name:
Frequencies
Enabled
Description:
Frequencies
Function:
Average
Use Only If Data Quality Is Good
Equation:
Average([MHEBGRANDSS 01- freq], [MHEBLAV2 01- freq], [MHEBDSY 01- freq], [MHEBDSY5 01- freq], [MHEBKSY 01- freq], [MHEBPNTN 01- freq], [DECOMONROE4 01- freq], [DECOPLACID 01- freq], [AMMORUSH_IS 01- freq], [AMMORUSH_IS 02- freq],
Points Used
Description
Use Only if Data Quality is Good
Add Point...
Remove Point
MHEBGRANDSS 01- freq
MHEBLAV2 01- freq
MHEBDSY 01- freq
MHEBDSY5 01- freq
MHEBKSY 01- freq
MHEBPNTN 01- freq
DECOMONROE4 01- freq
DECOPLACID 01- freq
AMMORUSH_IS 01- freq
AMMORUSH_IS 02- freq
Assign Calc Point to Station:
Midwest ISO
MISO
Conn. String:
framesPerSecond=30;lagTime=30;leadTime=10;
Test
Save
Close

Problem #2

Problem #2: PMUs are not as ubiquitous as SCADA data

Solution: Make it easy to use Synchrophasor Data alongside of existing data

Shared Space



EMS Alarms and PMU Frequency

SCADA and PMU Frequencies

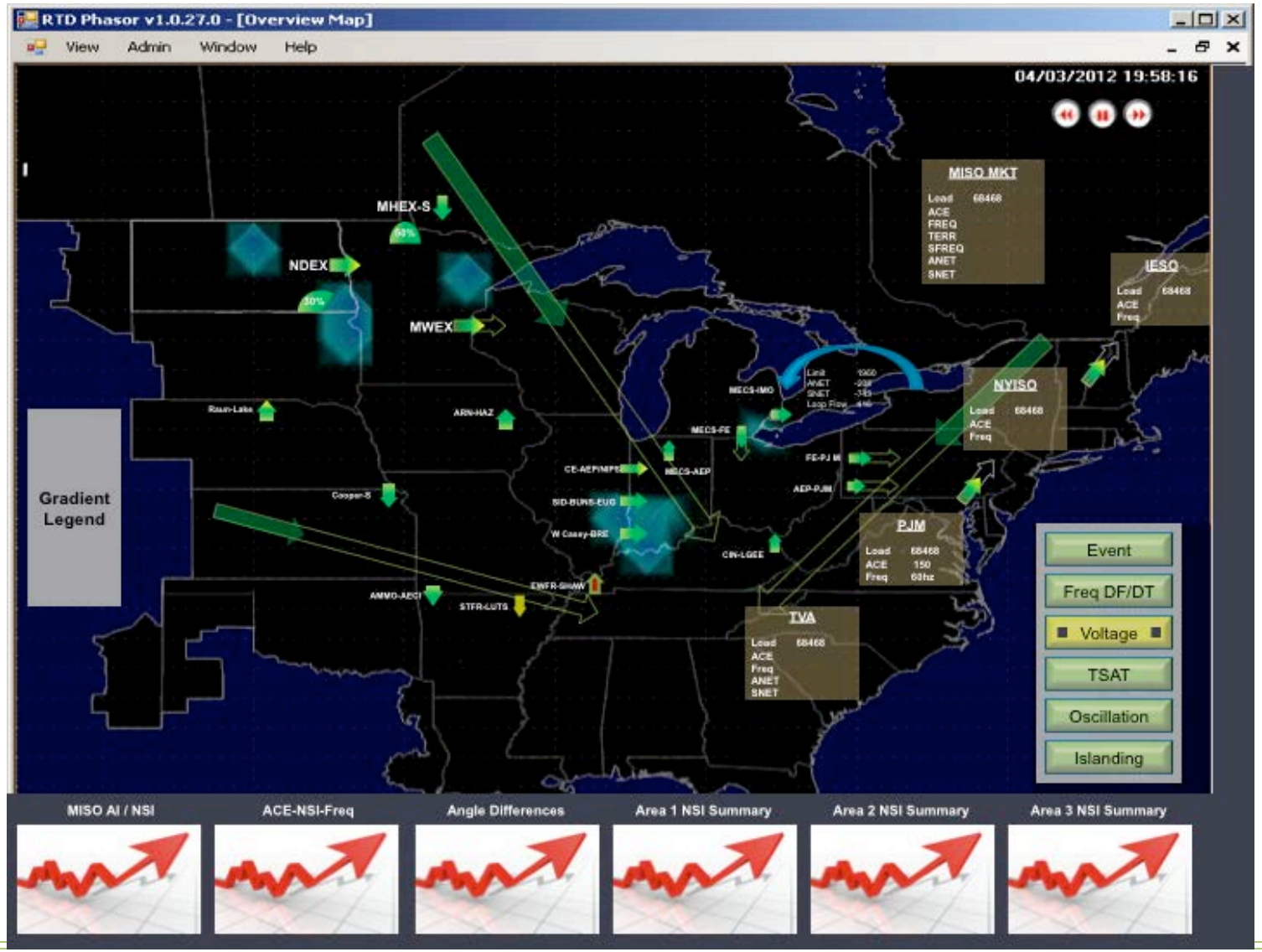
Problem #3

Problem #3: Speed and fidelity of PMU data can be overwhelming to operators and engineers

Solution: Use technology and human factors engineering to simplify visualization

- Advanced data smoothing (averaging, filtering, …)
- Visualization techniques like gradients and animations
- Context based displays – highlight what is important and allow drill down
- De-clutter – Roads and streams do not add to situational awareness
- Avoid use of 3D without overwhelming benefit
- Complex event processing (CEP) – Ability to process data on the fly instead of round tripping to the database for a better user experience

Wide Area Mock-Up



The success at MISO can be attributed to:

- Building the right team
  - Committed with authority to make actionable decisions
  - Based in real-time operations
  - Small size combined with being highly skilled
- Deep understanding of the business and data
- Selecting the proper problems to solve – do not get distracted
- Evolutionary and Agile development
- Understand technology, applications and standards are all evolving
- Use knowledge gained in after-the-fact analysis to enhance control room visualization
- Learn from one another

Questions?