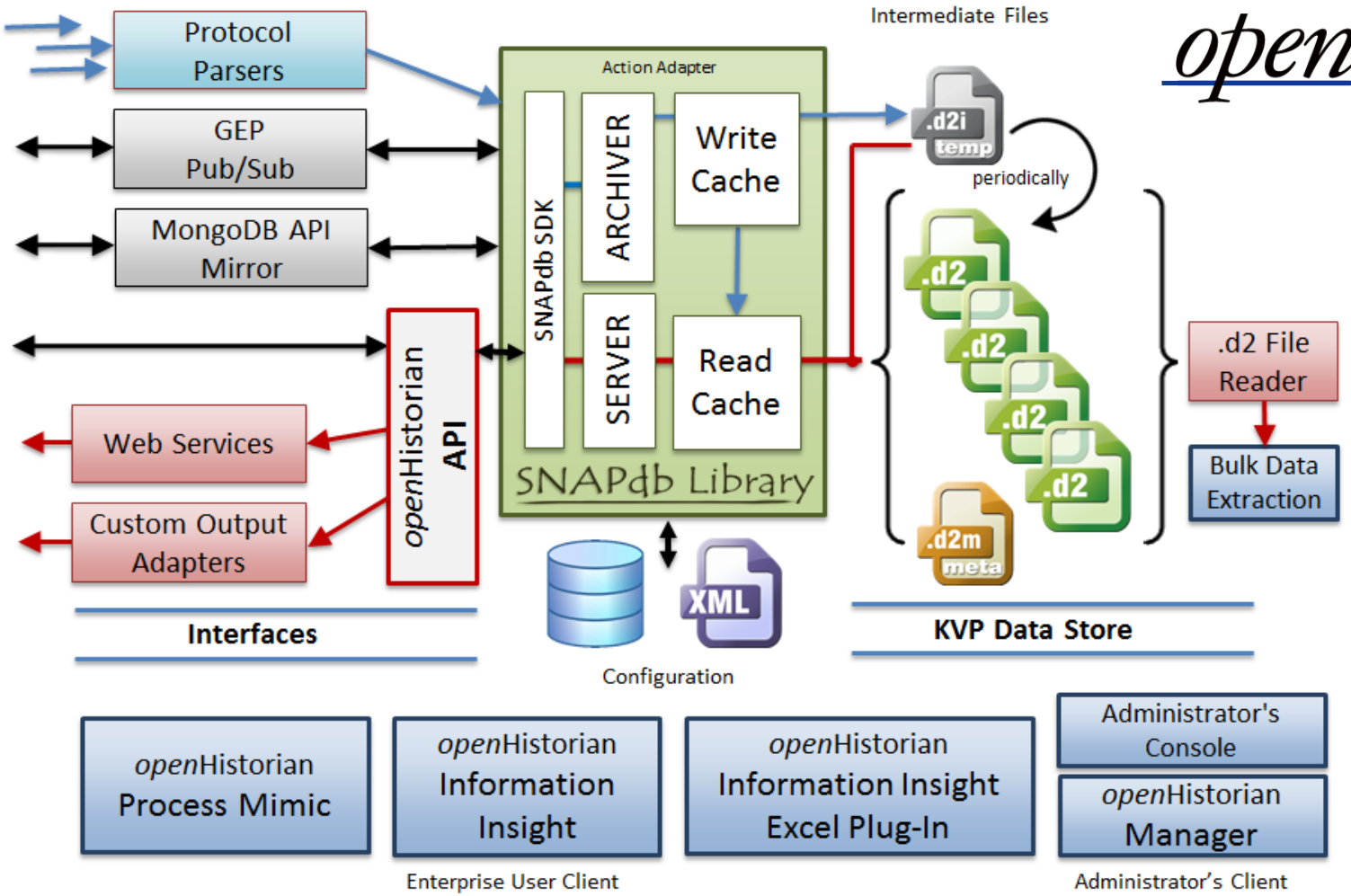
GRID PROTECTION ALLIANCE

openHistorian

NASPI Workshop – Archive Strategies Session

April 15, 2019

Architecture Components



openHistorian 2

Grafana

Self-hosted and security synchronized instance

Common Deployments

- Inside ESP environments
  - Low cost option for versatile archive in secure environment
  - Data forwarded “out” of ESP to other historians
- Front-end data processor for OSI-PI or eDNA
  - openHistorian manages data connections
  - Maintains a small rolling archive (e.g., less than a month)
  - Forwards data to commercial historian for long term storage
  - Synchronizes meta-data with
- Protocol translation service, e.g., F-NET to IEEE C37.118
- Used as Grafana front-end hosting service

openHistorian includes Grafana (https://grafana.com/)

The open platform for beautiful analytics and monitoring

- Open source
- Rapidly expanding library of graphical widgets
- Tutorials on-line (YouTube)
- Displays easily shared and modified
- Extensible
- Data integrated across multiple domains
- GPA published plug-ins for openHistorian and PI

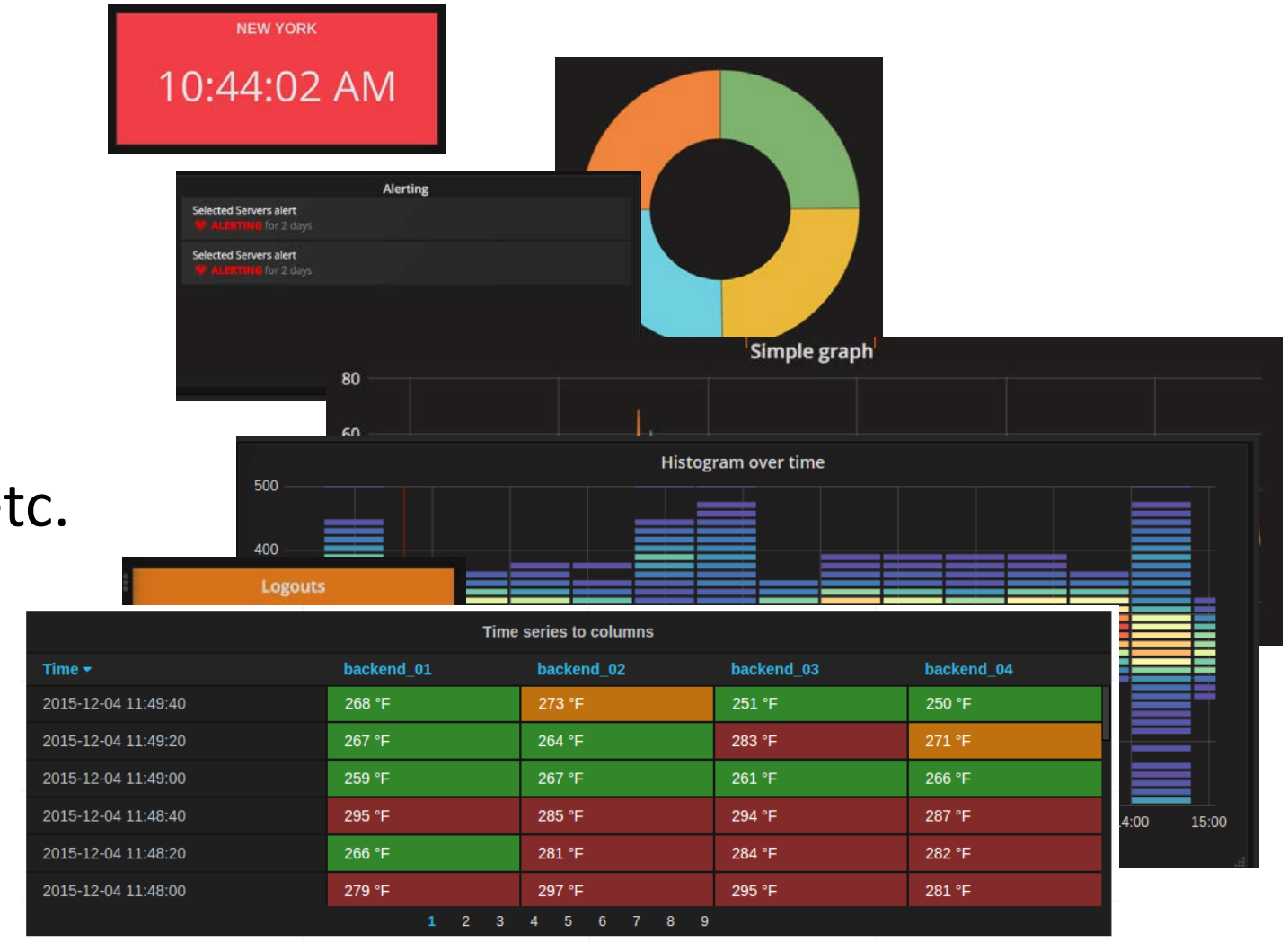
https://www.youtube.com/watch?v=1cRWVMw5U-c&t=610s

(for a demo)

https://grafana.com

Standard Display Plugins

- Clock
- Pie charts
- Alert List
- Lists of links (to other dashboards)
- Graphs – line, bar, area, etc.
- Heatmap
- Single stat
- Tables
- Markdown Text

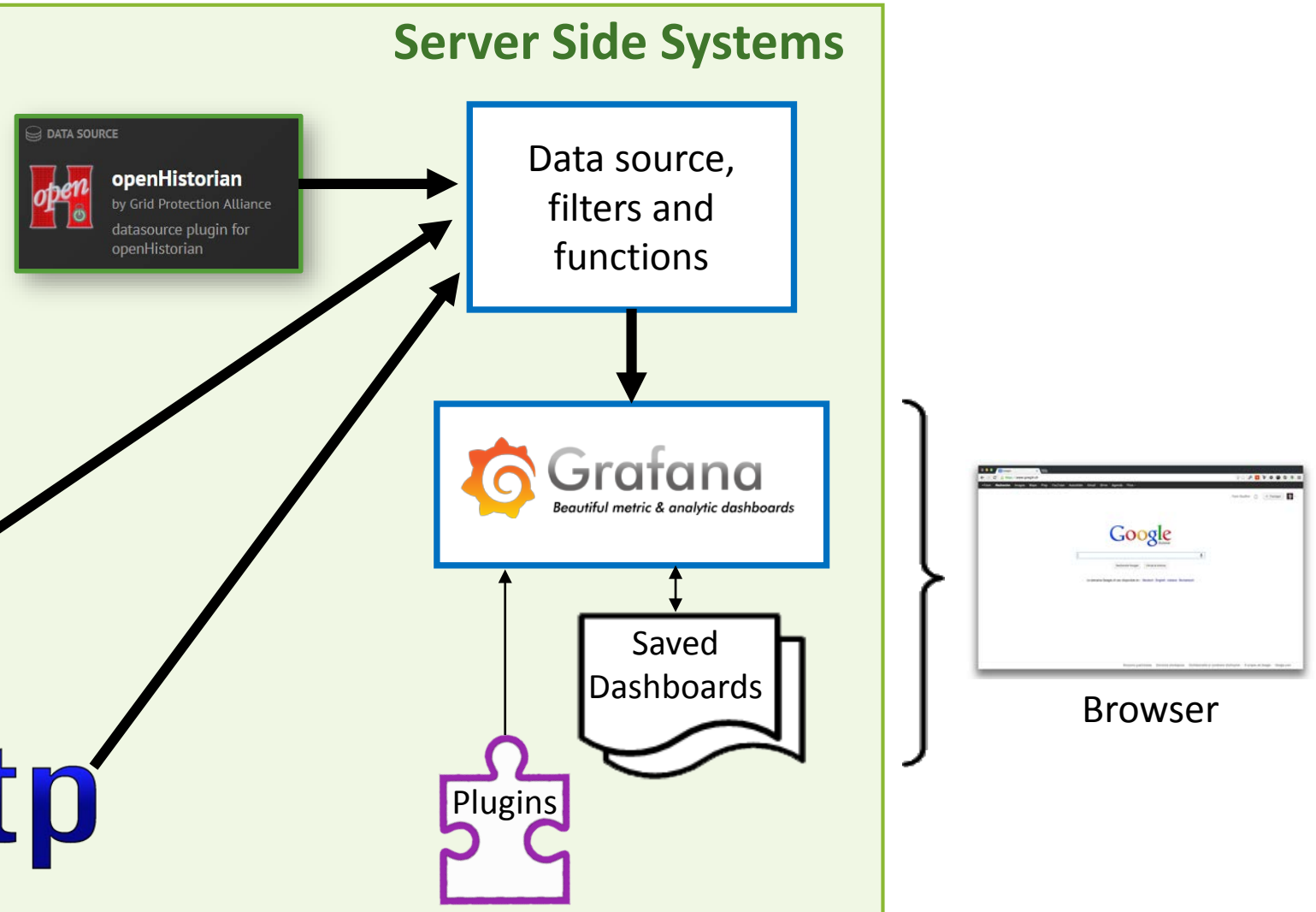


Contributed Display Plugins

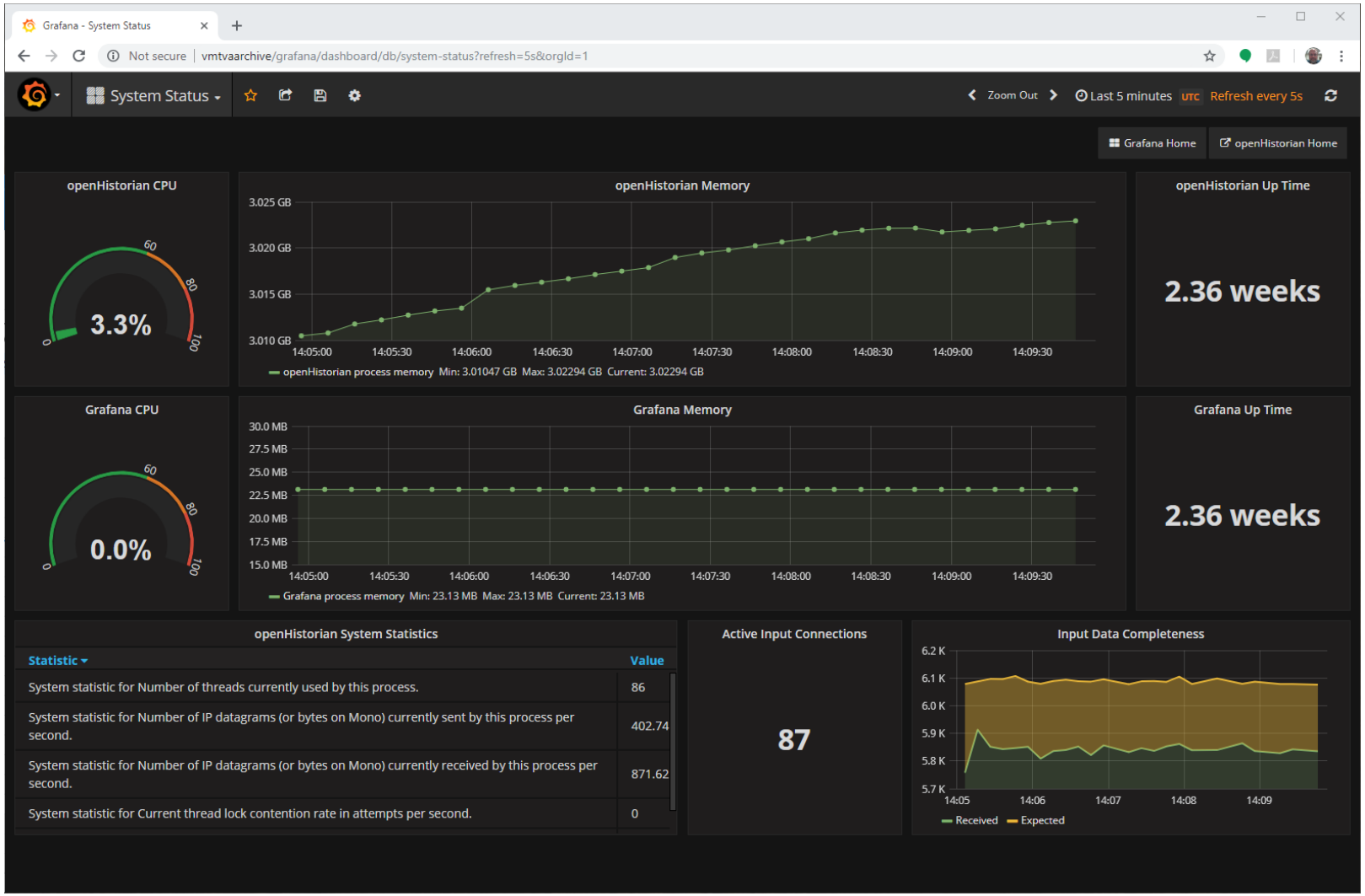
- Gauges
- Traffic Lights
- Annotated Diagrams
- State vs. Time Panel
- Geo-Loop Heat Maps
- User Interaction
- Plot.ly
- Radar Charts
- Data overlay on pics
- Status Dot (SSAM)

Grafana Data Sources

- openHistorian
  (~ 25 mSec Latency)
- GSF Performance Historian(s)
  - openPDC
  - SIEGate
  - …
- OSI-PI
- STTP / Real-time
  (Futre)



Built-in System Status



PMU Dashboard with Alarming

DNP3 Sourced Dashboard

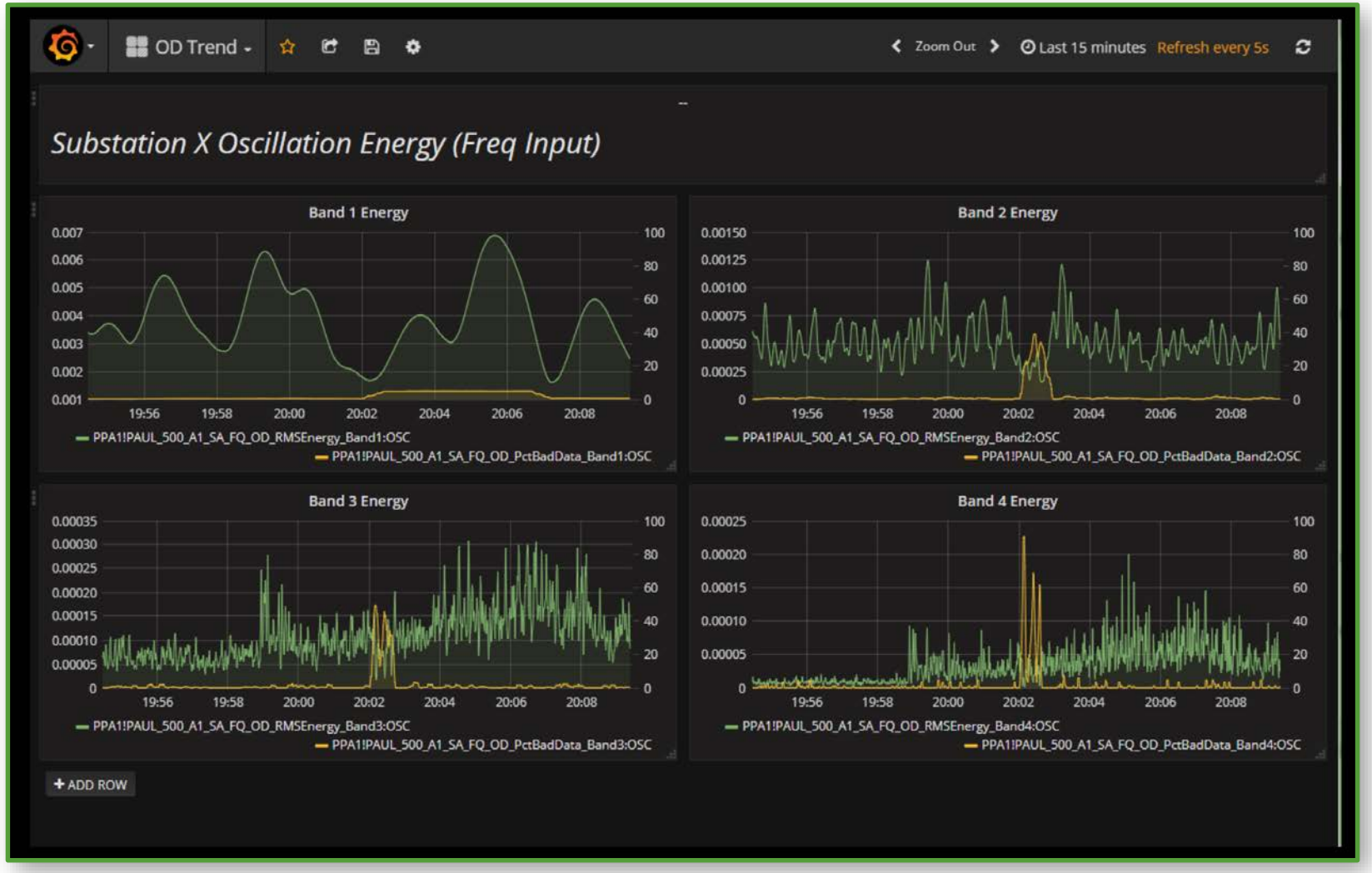
Real-time data from relays via DNP3 and *open*MIC

Trending Data Displays

- Frequency
- ACE
- Load
- Generation (Wind Generation)
- Interchange
- Time

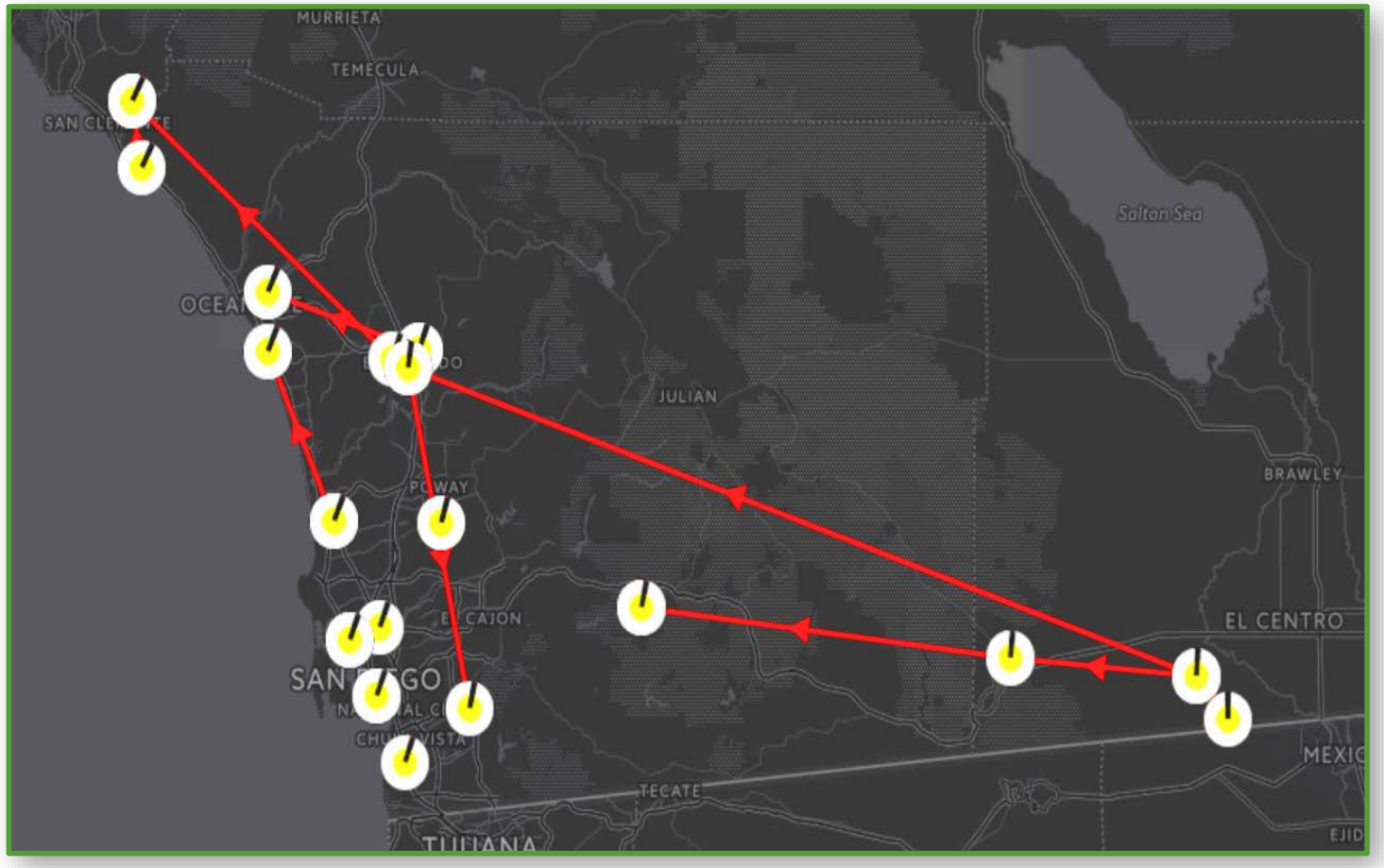
Trending Data Displays – T&D Oscillation Detection

- 2-Axis
  - Energy
  - Bad Data
- 15 minute window
- 5 second refresh
- Oscillation Bands
  - Band 1 – 0.0 to 0.1 Hz
  - Band 2 – 0.1 to 1 Hz
  - Band 3 – 1 to 5 Hz
  - Band 4 – 5 Hz and Up



“Mapped Data” Displays – Phase Angle Difference Monitoring

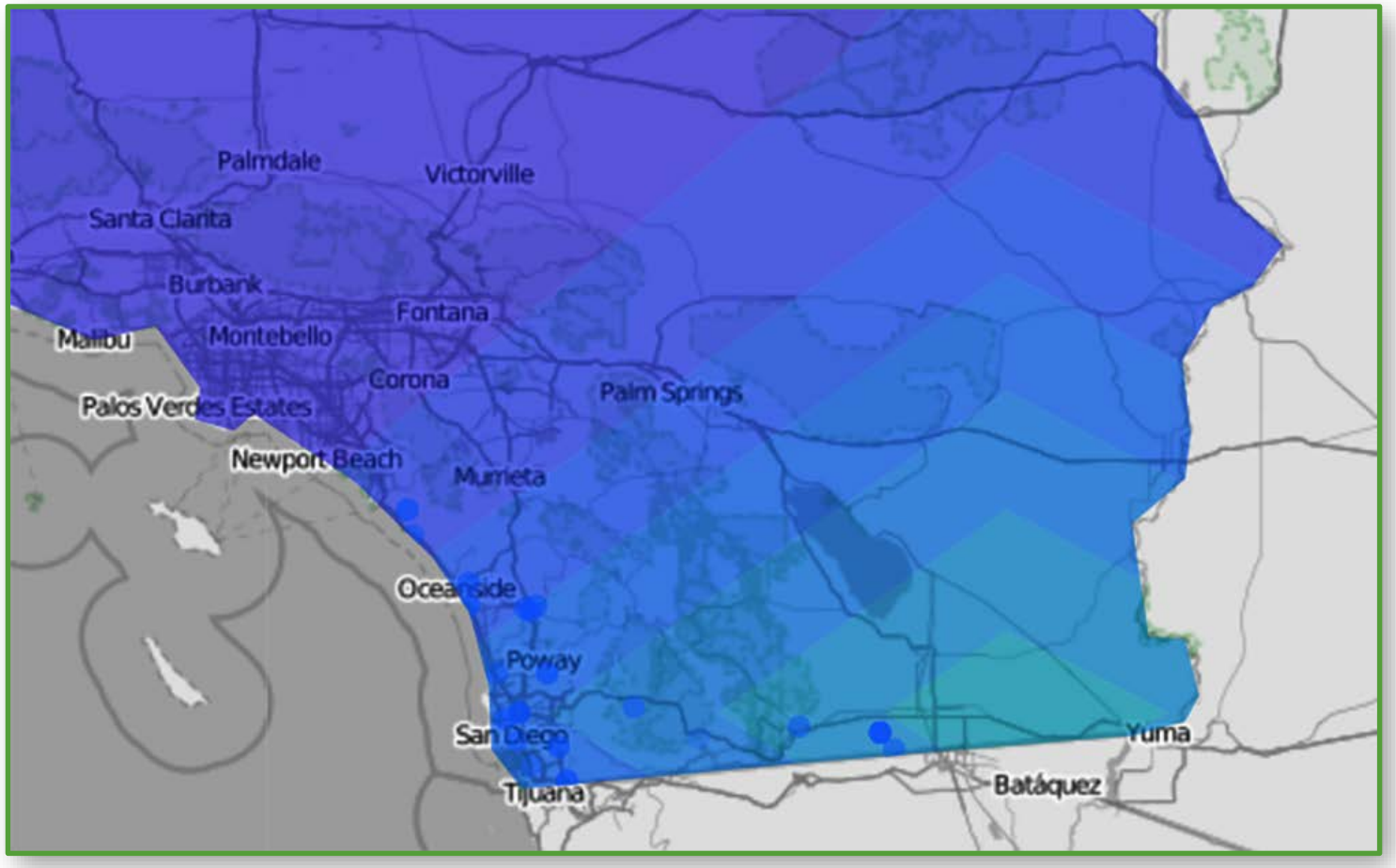
- Used Leaflet and new “polar widget”
- Demo will show:
  - Ability to build custom Grafana panel with configurable options.
  - Geospatial display with zooming
  - Options for multiple map base layers
  - Drill down to more detail



A display to monitor angle differences.

“Mapped Data” Displays – Map Overlays

- Map overlays via Leaflet
- ESRI provides a tile layer for Leaflet
- Demo will show:
  - df/dt on a gradient display
  - Ability to zoom and pan the map display
  - Addition of a weather layer



A display to highlight frequency change.

GPA Data Plug In – *36 functions for on-the-fly analytics and growing*

- Average
- Minimum
- Maximum
- Total
- Range
- Count
- Distinct
- Absolute Value
- Add
- Multiply
- Round
- Floor
- Ceiling
- Truncate
- Standard Deviation
- Median
- Mode
- Top
- Bottom
- Random
- First
- Last
- Percentile
- Difference
- Time Difference
- Derivative
- Time Integration
- Interval
- Include Range
- Exclude Range
- Filter NaN
- Unwrap Angle
- Wrap Angle
- Label
- Subtract
- Divide