

April 22, 2022

PQ Users Group Meeting – Utility Updates

Introduction Key GPA Staff



Grid Protection Alliance, Inc., specializes in the development and support of **innovative software solutions** for the **electric industry**.

GPA has a track record of innovation and **has led major software development projects** with client utilities and the Federal Government.

In addition to **custom application development**, GPA offers services for installation, set-up, integration, and on-going **maintenance of its open-source software**.



Stephen Wills
Senior Systems Analyst

ROLE: Software Development

- Major contributor to GPA software solutions and provides system support and integration services to utilities.
- 10 years' experience in developing .NET solutions, much of that time contributing significantly to GPA's core code base – the Grid Solutions Framework.
- Specializes in the management of data from substation devices – PMUs, DFRs, power quality meters, and relays.
- Prior to joining GPA, extensive experience at the Tennessee Valley Authority in development of synchrophasor data software.



Dr. Christoph Lackner
Operating Officer & Lead Engineer

ROLE: Operational & Project Leadership

- Establishes new software development projects and assures the successful completion of established projects.
- Provides engineering oversight of GPA analytic applications.
- 8+ years' experience with synchrophasor data analytics and use of synchrophasor data in various applications such as state estimation, predictive maintenance, and system parameter estimation.
- Specializes in the development of real-time and offline data analytics for power systems.



Ritchie Carroll
Senior Solutions Architect

ROLE: Systems Architect & Lead Developer

- Oversees GPA software development and provides software system design and development services to utilities.
- 25+ years' expertise in high-performance software system design, development, and delivery. Has led numerous large software development projects.
- 10 years at the Tennessee Valley Authority leading synchrophasor software development among other operational systems.
- Active participant in NASPI and other industry efforts to improve synchrophasor data systems.



Gabriel Santos
Software Engineer

ROLE: Software Development

- Recently joined GPA from the firmware industry
- Provides software development for PQDashboard environment
- 4+ years of experience in software development for electrical engineering applications



Russell Robertson
Principal

ROLE: Strategic Studies

- Establishes collaborations within the utility industry to support the development and maintenance of open-source software.
- Founded GPA's open-source software and consulting-service business.
- Expertise in grid operations, IT/OT architecture, information management, and control systems.

New Format for Users Group Meetings

- 3 yearly Webex meetings
 - April – 04/21
 - August/September - TBD
 - November/December - TBD
 - Focused on utility updates
- In-person meeting
 - Focused on newly developed GPA Products
 - Half-day TrenDAP workshop
 - Part of the EPRI Electrification Conference in Charlotte, NC
 - June 28
- Potential separation of distribution and municipal power companies
 - Any interest from transmission companies?

GPA 2022 Outlook

- **New Product lineup**
 - Same products/functionality
 - Separate applications for easier deployment
- **Focus on move towards openXDA 3.0**
 - A few utilities have started that process
 - Significant configuration for full potential
 - Includes move for all GPA PQ Applications
- **Notification Updates**
 - Improved email engine
 - Additional information to be included in emails
 - Improved self-service subscriptions
- **Security Updates**
 - IT managed access via Azure AD and other
 - Improved logon capabilities to comply with various regulations coming
- **PQ Event Share**
 - Already in place between Georgia Power and Georgia Transmission
 - Improved sharing of selected data between OpenXDA instances
 - Can be encrypted to ensure Data Security

OpenXDA Product Suite Overview

Data Collection			
Data Analysis			
Data Visualization			
PQ Interval Data			
	Tier 0 Open Source	Tier I Additional Features Maintenance Support	Tier II Additional Features Maintenance Support

We will be working with each of you as we transition to ensure we minimize any effect this has on existing Deployments

Move Towards OpenXDA 3.0

- New model based Topology
 - Various new Assets
 - Some algorithms require assets to be set up
 - Cap bank analytic (EPRI developed)
 - Various breaker analysis
 - Connectivity between Assets
 - Simplifies setup for channels
- New Configuration UI – System Center
 - Simpler workflows
 - Requires SystemCenter
 - Can hold additional meter information
- Various Improvements to Analytics
 - Fault Location on segmented lines
 - Fault Characterization for Breakers with air Gap resistors

Notification Updates

- Ability to send out Scheduled Emails
 - Nightly reports
 - Weekly Reports
- Ability to include Trending Information
 - Tie in with TrenDAP for Channels around faults
- Ability to include Lightning Information
 - Requires real time Lightning feed
- Self-service subscription page
 - Users can add subscriptions to pre-defined set of assets/locations
 - Admin can set approval required for protected assets
 - Users can manage their own subscription

Security Updates

■ Single Sign-On System

- User signs into openXDA and has access to other Applications

■ Integration with Active Directory

- Can use cooperate sign-on system
- IT can manage accounts independently of GPA applications
- Ensure compliance with executive orders

■ PQDigest Security

- Integrates with existing customer portals
- Currently supports azure only
- Integration with other systems in progress

*open***MIC**
METER INFORMATION COLLECTOR

*open***XDA**
eXtensible Disturbance Analytics

*open***SEE**
System Event Explorer

PQDashboard

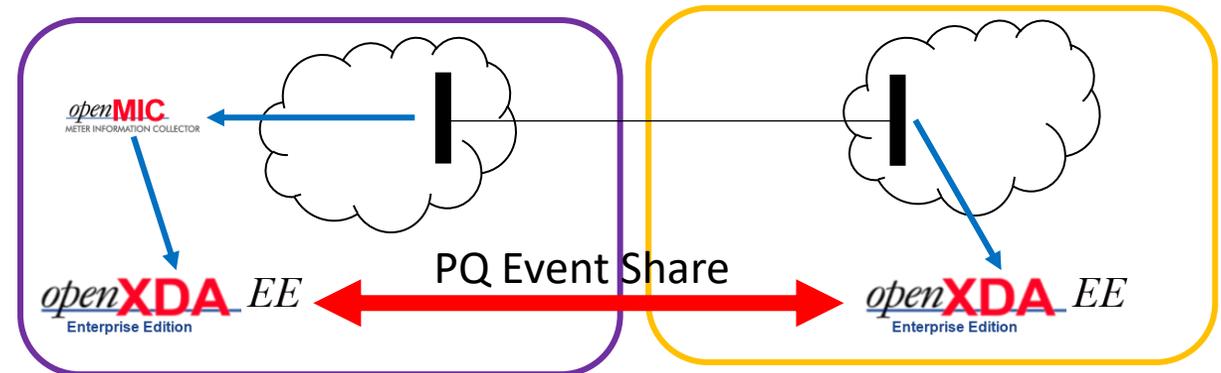
System Event
Browser

TrenDAP
open-source trending-data analytics platform

System Center
for configuration of GPA's PQ Tool Suite

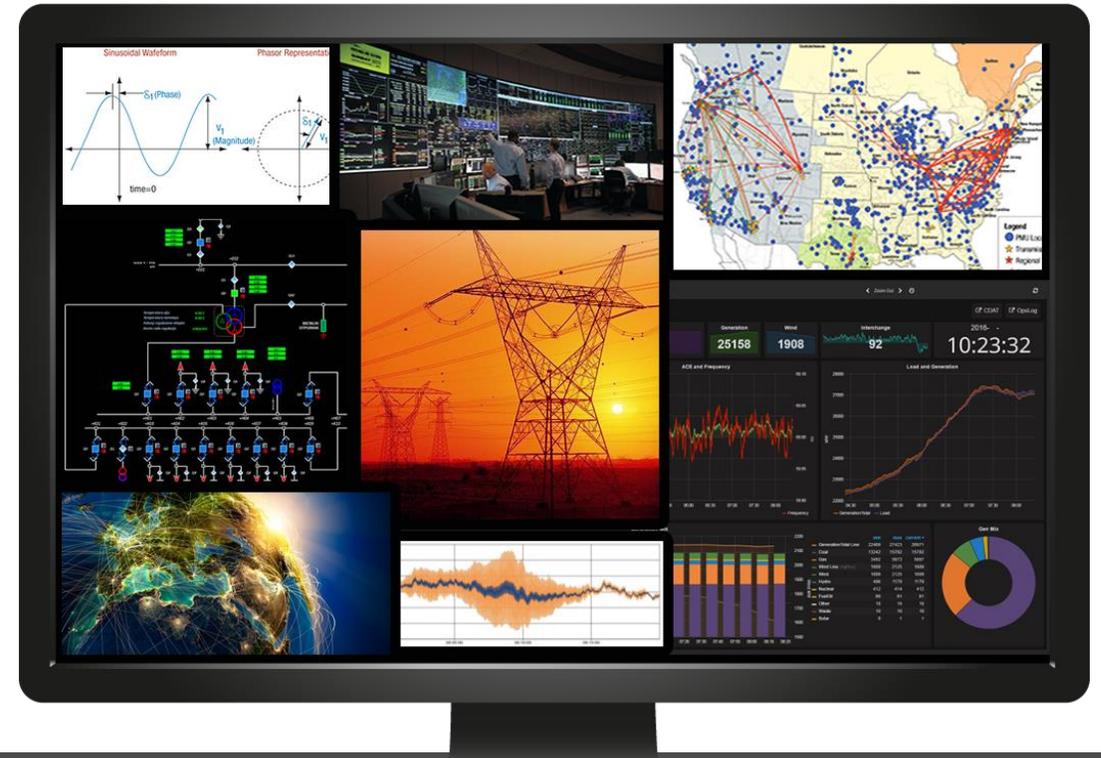
PQ Event Share

- Allows different OpenXDA instances at different utilities to share PQ data automatically
- OpenXDA can send event data for select assets to another OpenXDA
 - Data can be encrypted
 - Utilities can limit what data to share with which endpoint
- OpenXDA 3.0 can transfer select asset models
 - Both instances of OpenXDA can be synchronized
 - Utility can select not to use updated models
- Earlier version already in use



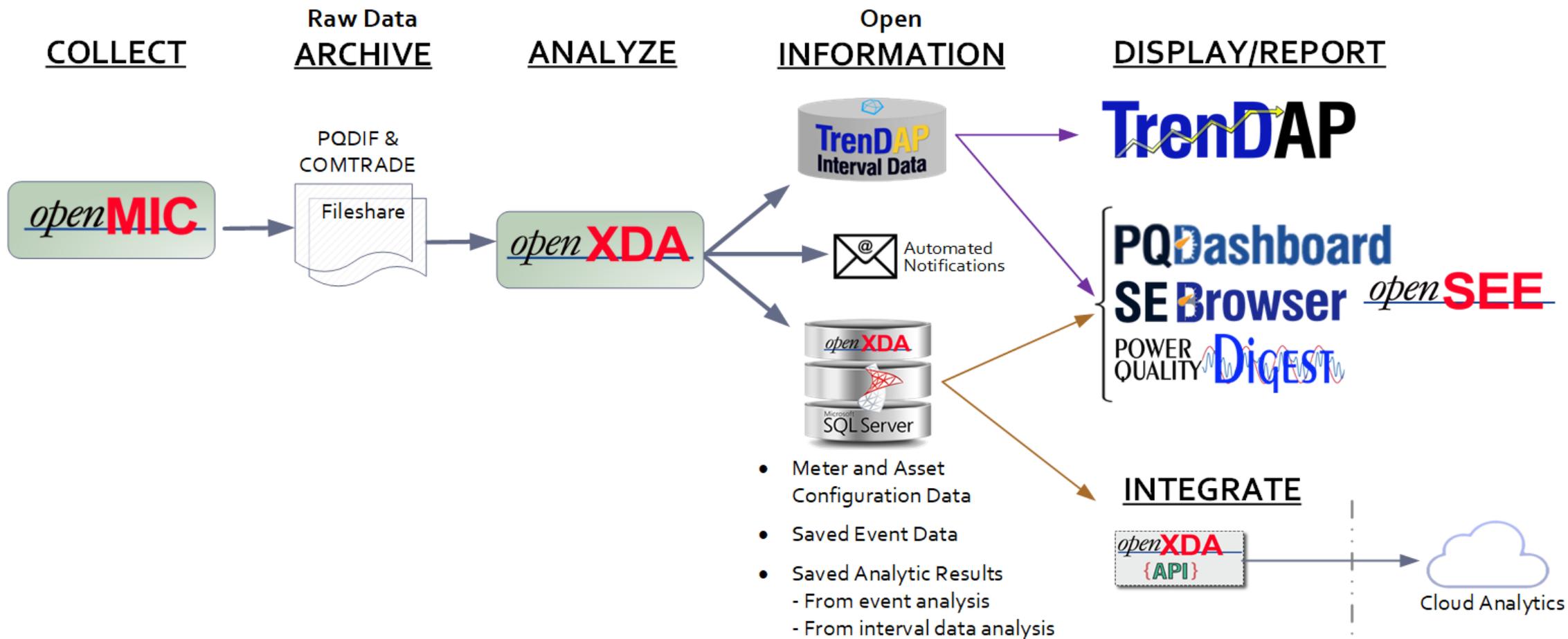


April 21, 2022

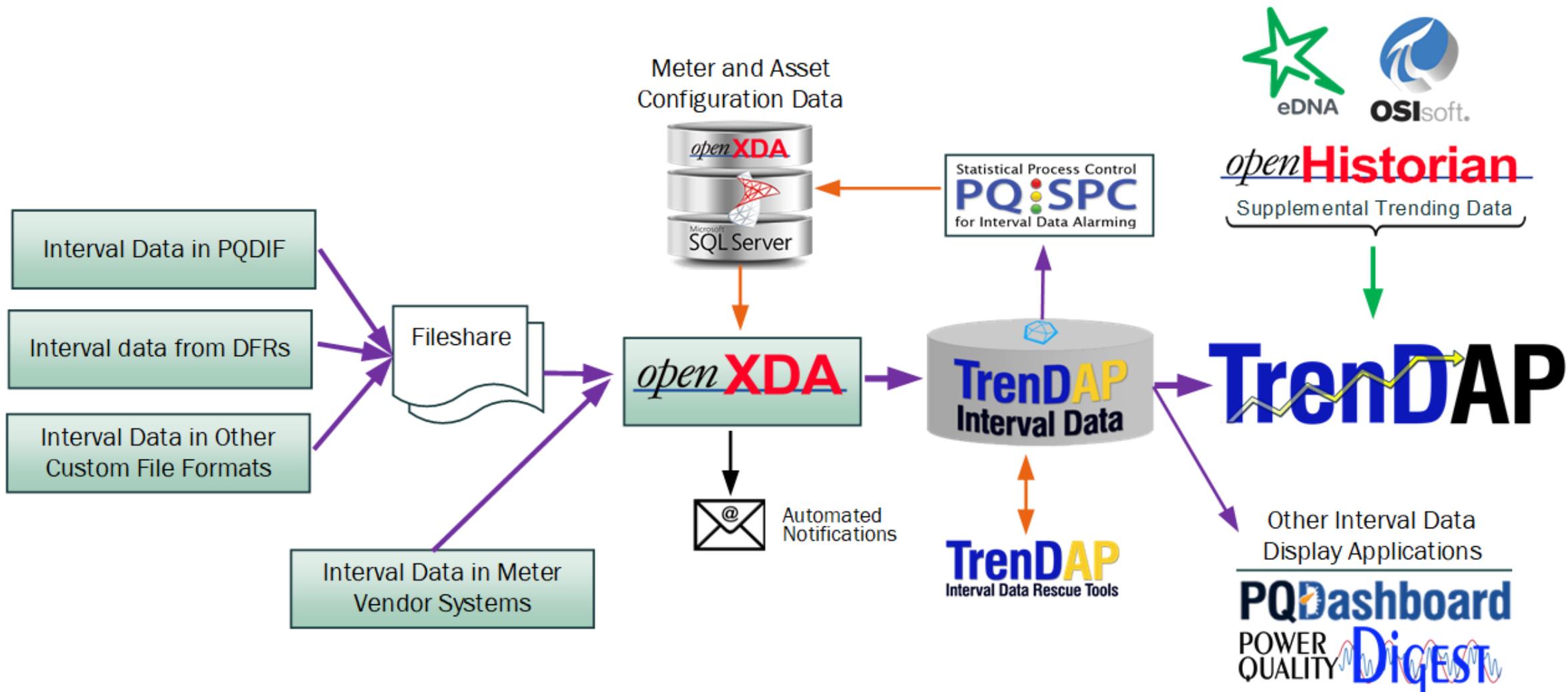


PQDigest Update

High-Level Data Flow



PQDigest Data Flow



PQDigest Workflow

- Authentication driven by Azure
- Client only sees data from their meters
- Simplified workflow to reduce training of clients
 - Clients land on Home page from public internet
 - Home page shows monthly statistics for client's subset of meters
 - Client can search for events for their subset of meters in Event Search page (similar to SEBrowser)
 - Client can view trending data for a meter from their subset of meters
 - Client can see lightning strikes for a time period and region

The Home Page

- Monthly Aggregates
- Mag Dur Chart
- Quick Links



[Home](#) | [Trending](#) | [Find Events](#) | [Lightning](#) | [Meter Availability](#) | [Sign out](#)

Welcome, Billy Ernest

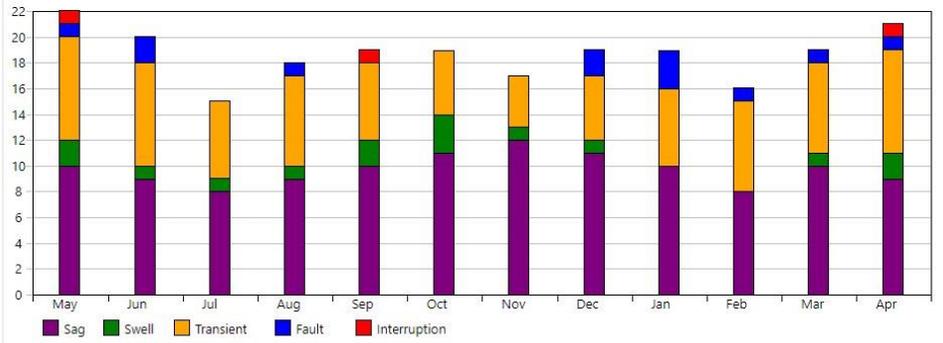
So far this month there have been xx events recorded from your yy power quality meters.

[List of last 100 events from all meters over last 365 days](#)

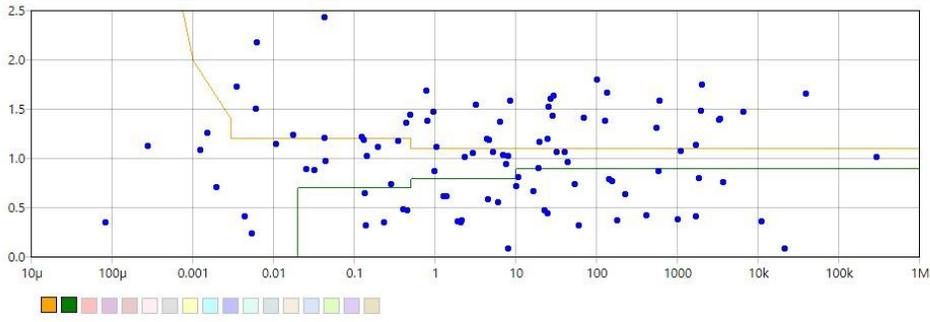
[List of all meter activity over last 30 days](#)

Any questions? Please contact: [The PQ Team](#)

Historical Event Counts



Magnitude Duration - Last 30 Days



Meter Activity - Last 30 Days

Meter ^	Total	Sag	Swell	Int	Trans	Fault
Meter 1	22	10	2	1	8	1
Meter 2	20	9	1	0	8	2
Meter 3	15	8	1	0	6	0
Meter 4	18	9	1	0	7	1
Meter 5	19	10	2	1	6	0
Meter 6	19	11	3	0	5	0

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The Event Search Page

- Select Subset of meters
- Waveform Preview
- Trending data Preview
- Mag Dur for selected event

POWER QUALITY **Digest**

Home Trending Find Events Lightning Meter Availability Sign out

Return # Meters Type Start Date End Date

Events

Date ^	Meter	Type	Mag (pu)	Dur (s)
09/29/2020 03:25:47	Apison Pike TN 13-T3	Sag	0.81	2.23
09/29/2020 03:25:50	Hawthorne TN 13-T2	Sag	0.87	2.07
09/29/2020 03:25:50	Apison Pike TN 13-T2	Sag	0.80	2.26
10/02/2020 14:52:59	Hawthorne TN 13-T3	Sag	0.88	0.06
10/10/2020 07:26:15	Apison Pike TN 13-T1	Sag	0.75	0.02
09/28/2020 06:40:51	West Ooltewah TN 13-T3	Sag	0.89	0.17
10/01/2020 17:41:12	Apison Pike TN 13-T2	Sag	0.67	2.47
09/29/2020 05:08:06	Concord TN 46-Total	Sag	0.10	0.01
09/29/2020 03:26:12	Apison Pike TN 13-T2	Sag	0.88	0.01
10/11/2020 06:23:52	Apison Pike TN 13-T2	Sag	0.90	0.02
10/04/2020 12:27:49	Apison Pike TN 13-T2	Sag	0.82	0.02

View Waveform

View Trending Data

PQI - Ride-through Curves

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The Trending Data Page

- Select meter
- Select subset of channels
- Grouped by channel type
- Quick picker for time ranges
- Shows statistics and cumulative percentage data

POWER QUALITY **Digest**

Home Trending Find Events Lightning Meter Availability Sign out

Meter: Millington Solar TN Channels: 10Selected Date Range: 1 month 10/12/2021 11/12/2021 Summary: Stats Export CSV

Current RMS

Phase	Hover	Min	Avg	Max	StDev	Counts	Outliers
AN-Avg	3.46	0.01	1.00	4.00	1.41	3884	0
AN-Max	3.49	0.02	1.10	4.55	1.50	3884	0
AN-Min	3.44	0.01	0.89	3.97	1.32	3884	0
BN-Avg	3.48	0.02	1.01	4.01	1.40	3884	0
RN-Max	3.52	0.03	1.11	5.44	1.50	3884	0

Voltage RMS

Phase	Hover	Min	Avg	Max	StDev	Counts	Outliers
AN-Avg	115	111	114	116	1.27	3884	0
AN-Max	115	112	114	120	1.34	3884	3
AN-Min	115	98	113	116	1.34	3884	6
BN-Avg	115	111	113	115	1.12	3884	0
RN-Max	115	111	114	119	1.17	3884	4

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The Waveform Viewer

- Based on openSEE
- Can compare waveforms
- Can choose analytic
- Phasor chart and values section based on chart clicks instead of hovering



The Lightning Page

- Uses free weather overlay service for precipitation contours
- Needs lightning database for strikes

POWER QUALITY **Digest**

Home Trending Find Events Lightning Meter Availability Sign out

Date: 10/28/2020 12:05 PM Tolerance: 1 Day(s)

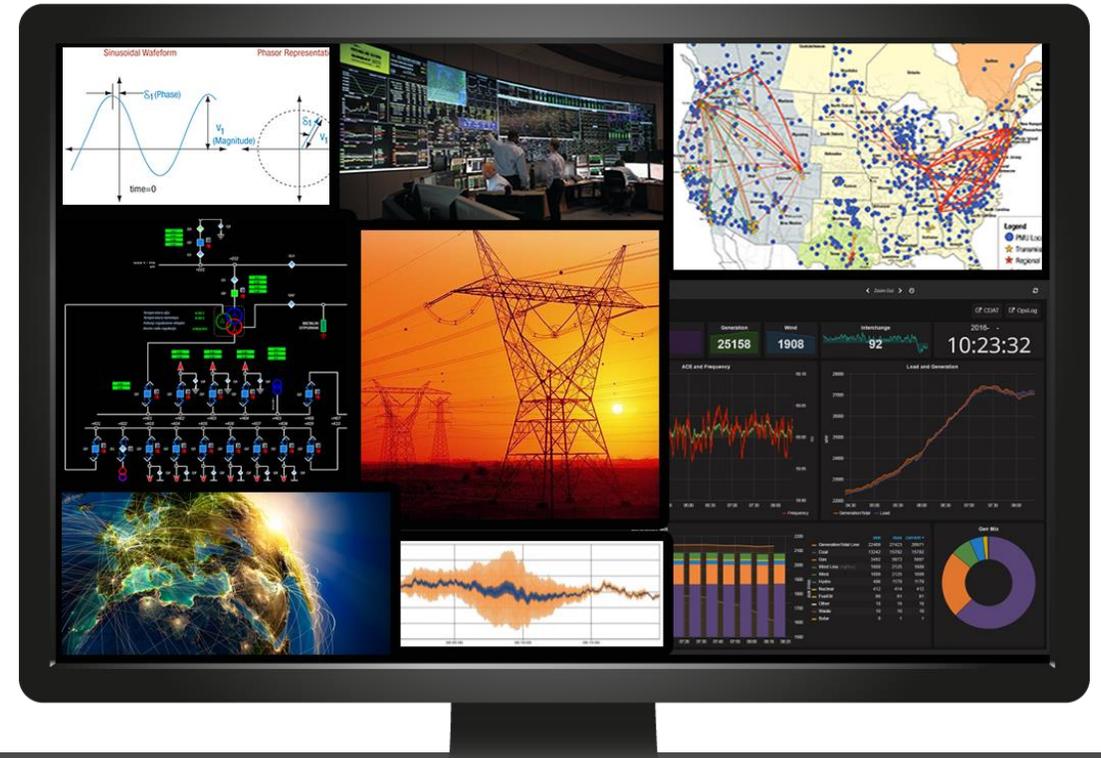
ESRI Map Show Radar Streets Strikes Export CSV

Time	Amplitude	Lat	Lon
10/27/2020 19:13:58	55.503	32.06865	-85.61261
10/27/2020 19:20:38	-7.661	32.06454	-85.70922
10/27/2020 19:32:50	32.812	32.00126	-85.31988
10/27/2020 19:41:30	-4.378	32.19612	-85.64431
10/27/2020 19:58:56	-64.791	32.17153	-85.45375
10/27/2020 20:02:55	33.414	32.26572	-85.57308
10/27/2020 20:25:01	-66.038	32.48274	-85.58907
10/27/2020 20:27:50	50.714	32.49556	-85.57408
10/27/2020 20:37:50	30.293	32.02382	-89.56281
10/27/2020 20:41:27	17.035	32.49053	-85.50682
10/27/2020 20:46:48	-5.816	32.03748	-89.68827
10/27/2020 20:48:21	-22.148	32.52423	-85.03013
10/27/2020 20:51:44	-25.335	32.04107	-89.75254
10/27/2020 20:51:44	-12.853	32.04904	-89.75854

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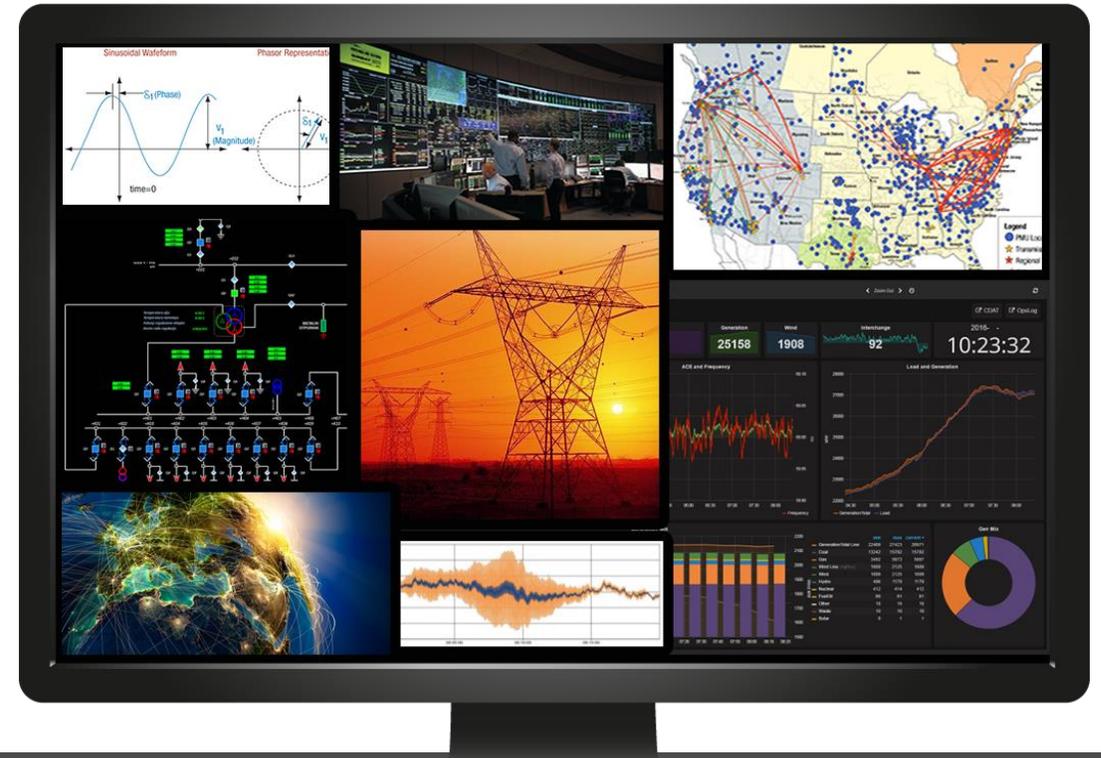
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Round Table / Discussion

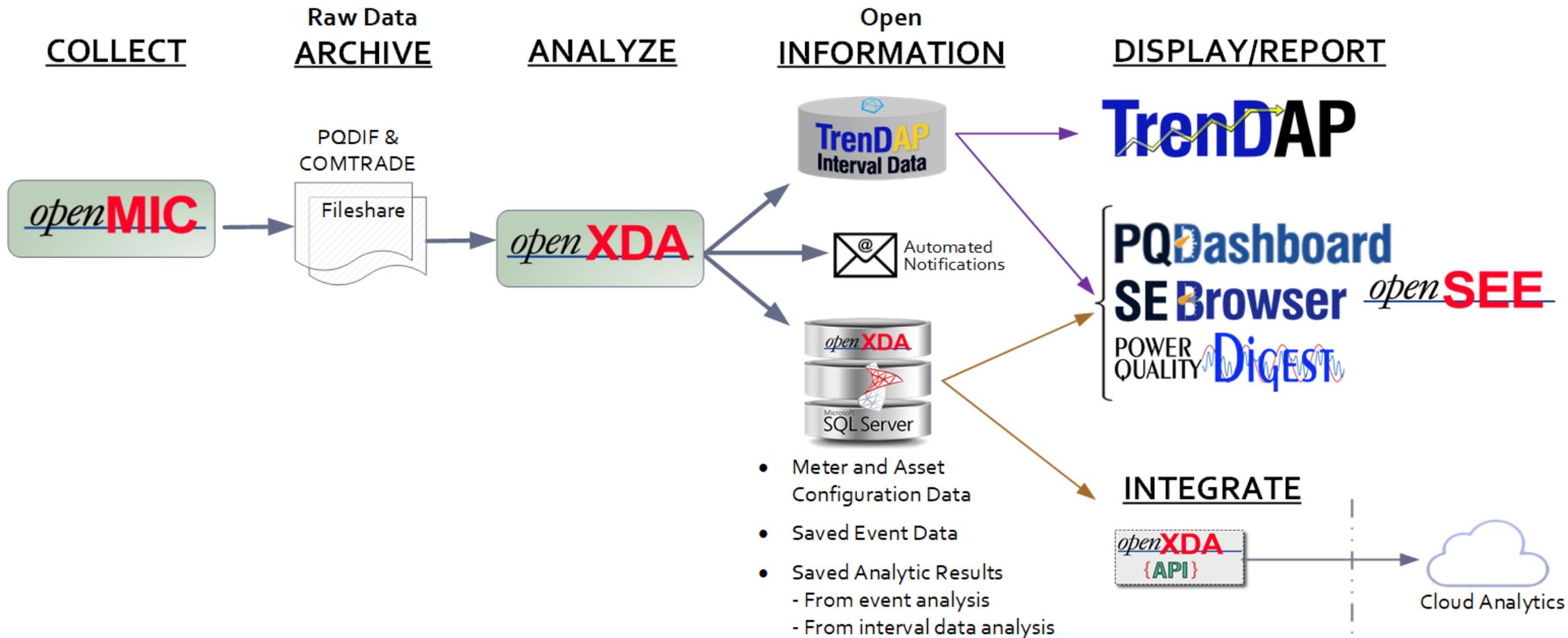


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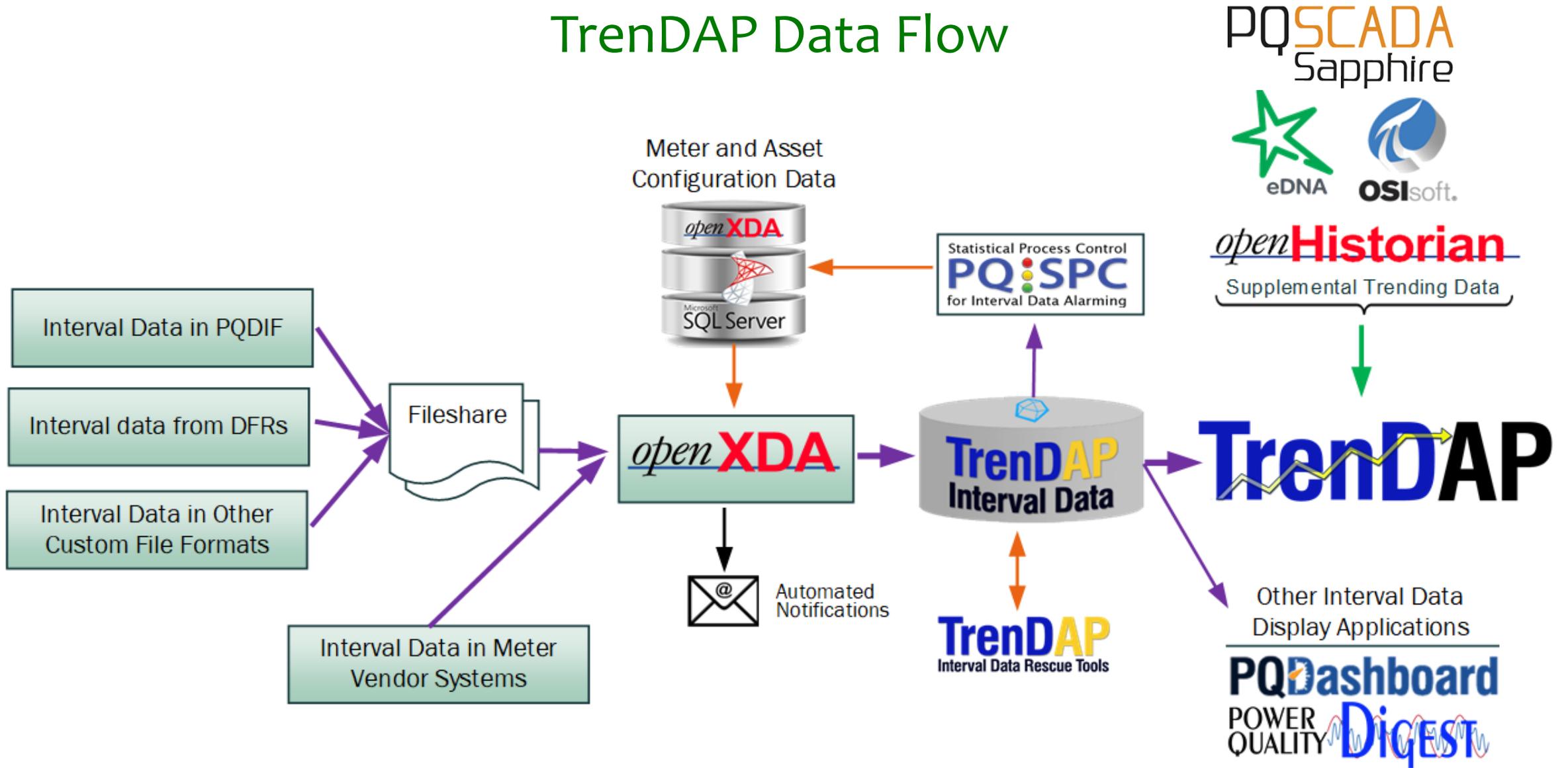


TrenDAP Update

High-Level Data Flow



TrenDAP Data Flow



TrenDAP Handles Two Types of Data

- TrenDAP is optimized to display **interval data** that is collected by PQ Devices – a tuple (min, max, average) typically collected every 10 min
 - The source of this interval data is the TrenDAP database that has been processed by openXDA and the Sapphire Web API
 - TrenDAP can handle “instantaneous” (top-of-the-interval) values collected at the same periodicity by using the average
 - The minimum interval supported by openXDA processing is 1 minute
- TrenDAP can also display **trending data** from other data sources. Trending data is single-valued periodic data such as 4-second Transmission SCADA data that is stored in a historian.
 - Currently this external data is not connected to the openXDA asset model
 - There are no plans for external data to be processed by openXDA so that openXDA bad data detection and/or alarming can be applied to this data

TrenDAP Workflow

- Define Data Sources
 - TrenDAP database for interval data
 - Other sources for trending data
- Establish Data Sets
 - Can use an existing one – or create a new one
 - Can include one or more data sources
 - For a specific or relative time-range of interest and for a specific collection of values from each data source
- Chart / Display Data in Widgets in a Workspace
 - Can create multiple workspaces per data set
 - Multiple display widgets are currently available
 - The library or widgets is expected to grow significantly
 - Templatable

The Main Display

- Browser-based
- Simple Navigation
- Data Source
- Data Set
- Workspaces
- Recent Workspaces



- Multiple rows of one or more Widgets in a Workspace