A Practical Approach to *Streaming* Point-On-Wave Data

NASPI Meeting

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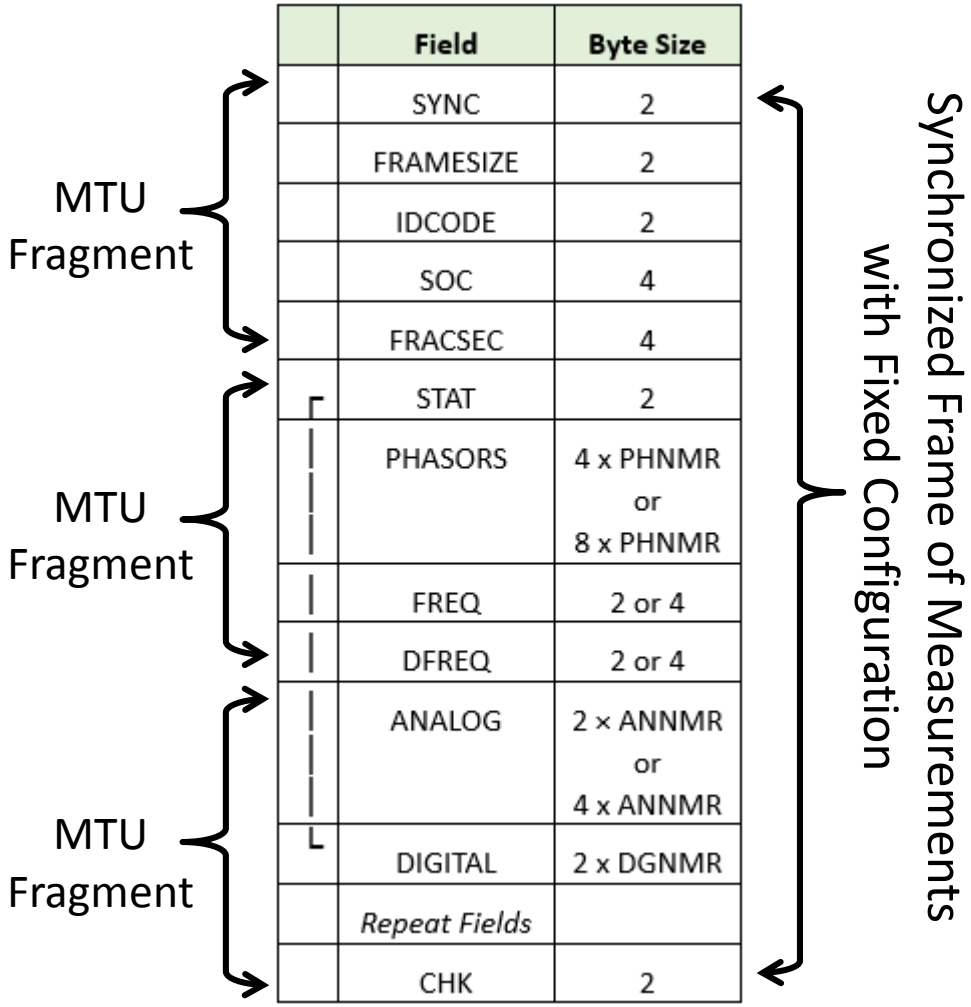
STTP Overview

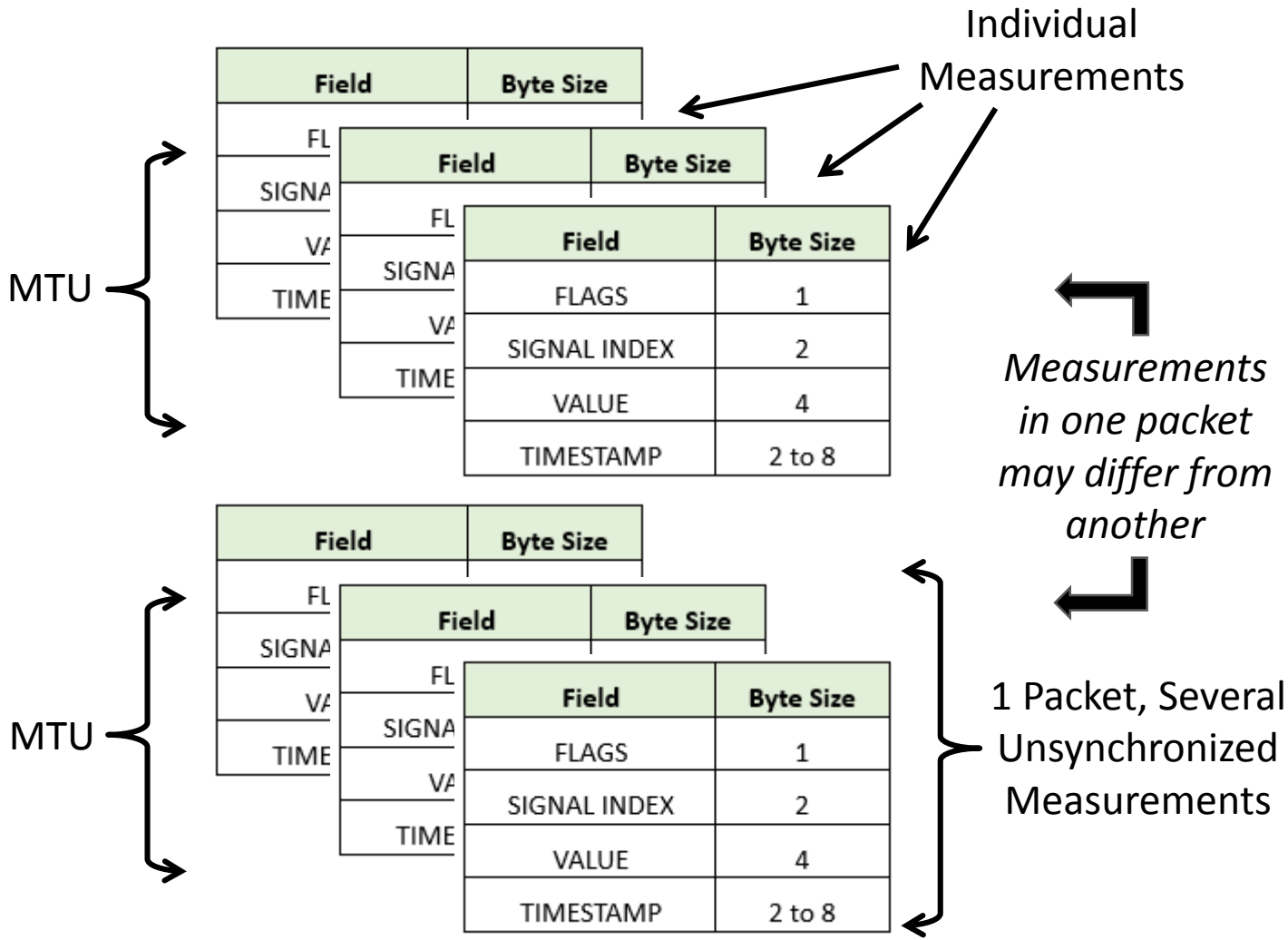
- Created to support control center to control center phasor data exchange, as well as other high-fidelity, high-volume streaming data use cases
- Intrinsically reduces losses (UDP) and latency (TCP) by removing stress of large frame-sizes on networks though data packet optimization
- Allows the safe co-mingling of phasor data with other operational data network traffic rather than having to isolate phasor data on purpose-provisioned networks
- Detailed metadata exchanged as part of protocol helps to simplify configuration management
- Includes lossless compression to reduce bandwidth utilization
- Security-first design with strong authentication and option for encryption

Protocol Difference: Frames vs Atomic Packets

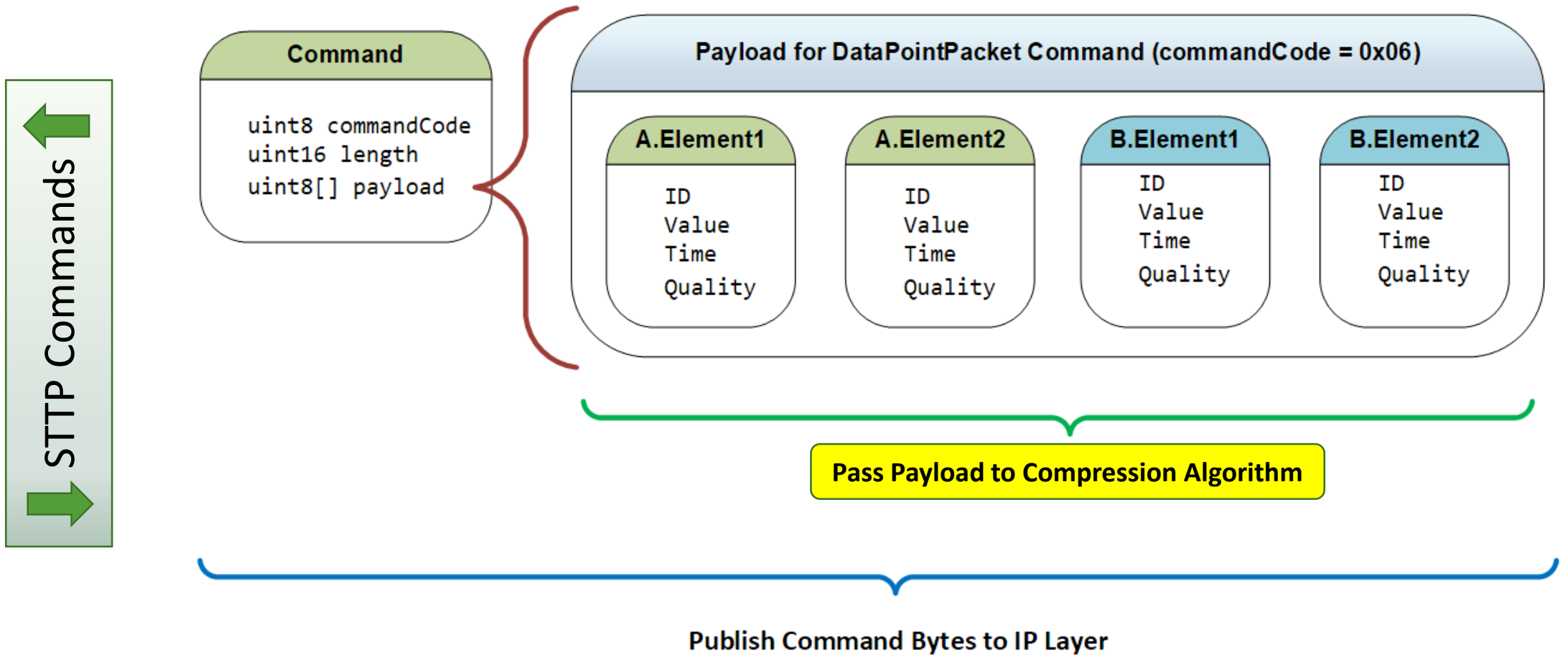
IEEE C37.118 / IEC 61850-90-5



STTP – IEEE 2664



Protocol Difference: Data Packets Allow for Compression

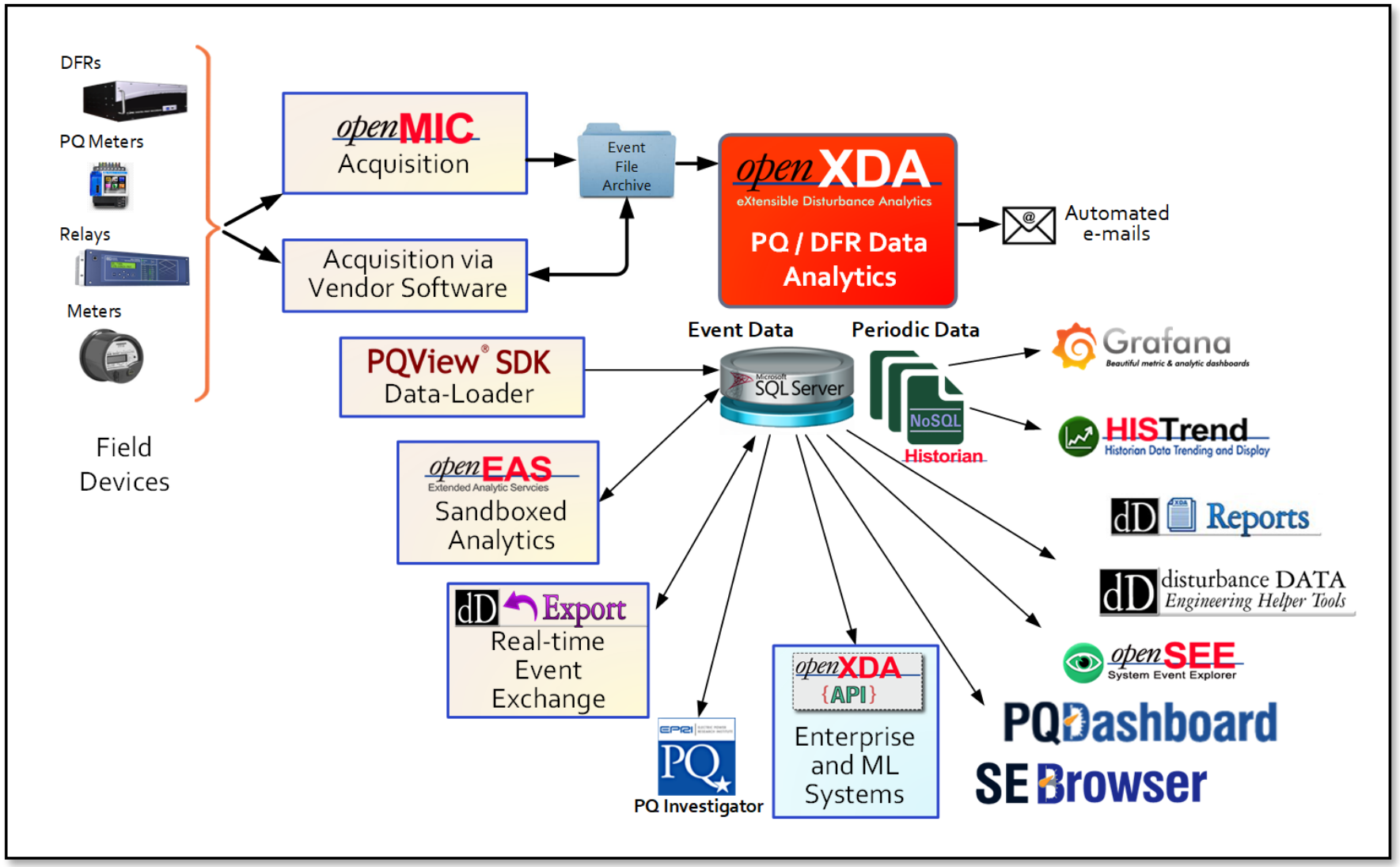


DFR Sampling Rates

- Digital Fault Recorders (DFRs) capture and analyze point-on-wave data
- Typical sampling rates are from 5 to 10kHz
  (e.g., APP DRF uses 160 samples/cycle = 9.6 kHz)
- GPA's tool suite includes software for analyzing captured waveform data

APP DFR in GPA Test Rack

GPA's Disturbance Monitoring Tool Suite

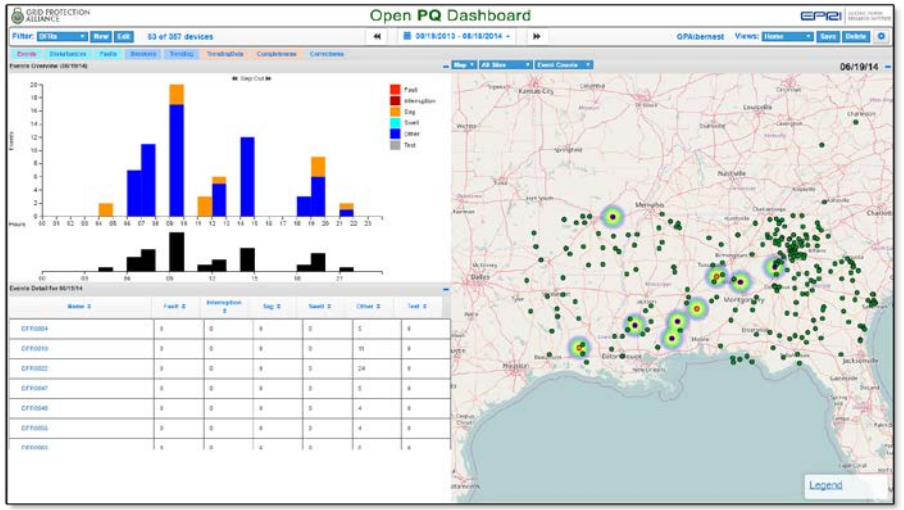


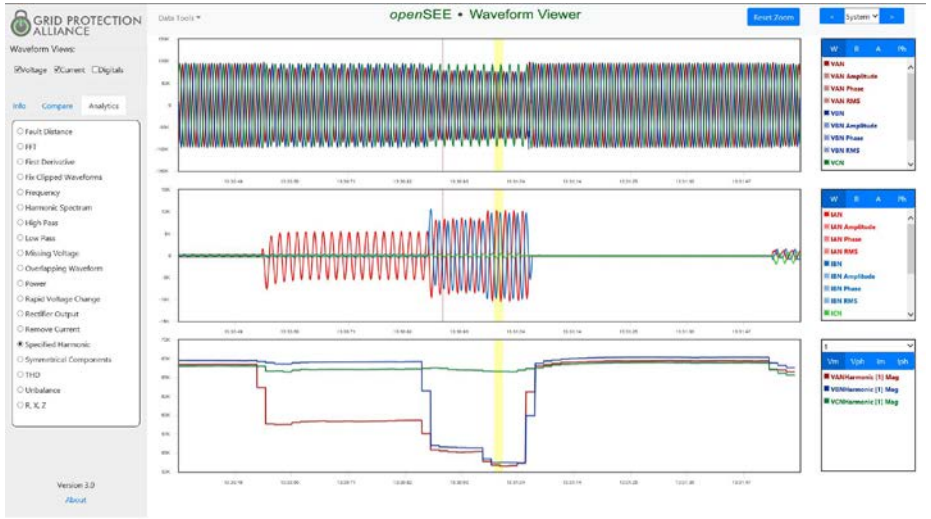
PQ Dashboard

PQDashboard

Features

- The display layer for openXDA data
- Drill-down from wide-area data displays all the way to waveforms
- Complements traditional vendor-provided waveform analysis tools





Recent Improvements

- New waveform view tool with embedded analytics

Using STTP for High-Resolution Data Transfer

- Some results -- Synchrophasor and SCADA
  - Example: Recent EIDSN Testing
- Real-Time Demo -- 88kSPS (~155 PMUs)
  - Example: CD Quality Music (44kHz * 2 signals)
- Real-Time Demo -- 300kSPS (~32 signals of 160 samples/cycle)
  - Example: Demodulated Radio Frequency

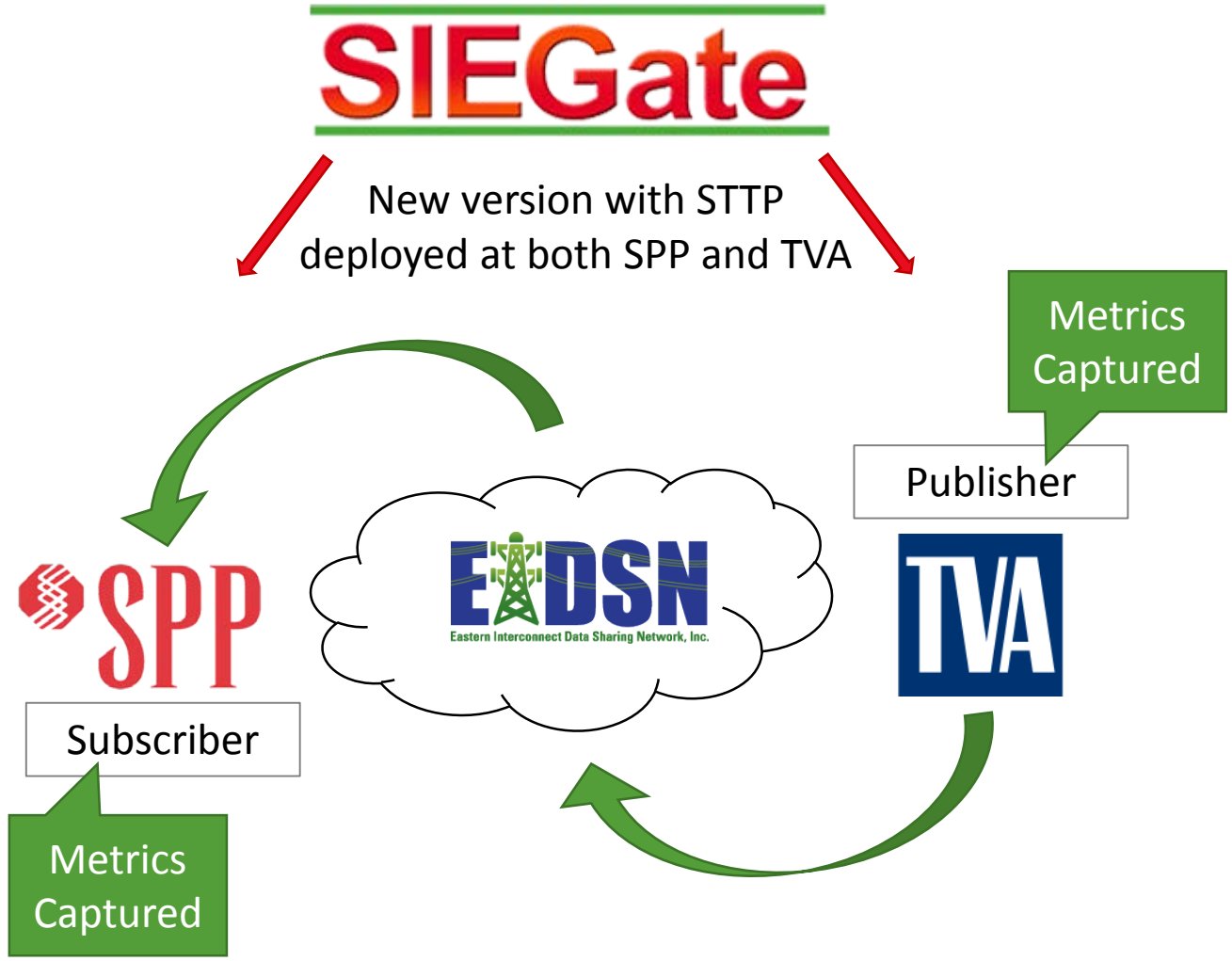
STTP over EIDSN Demonstration

- Purpose

  To compare STTP protocol performance to IEEE C37.118

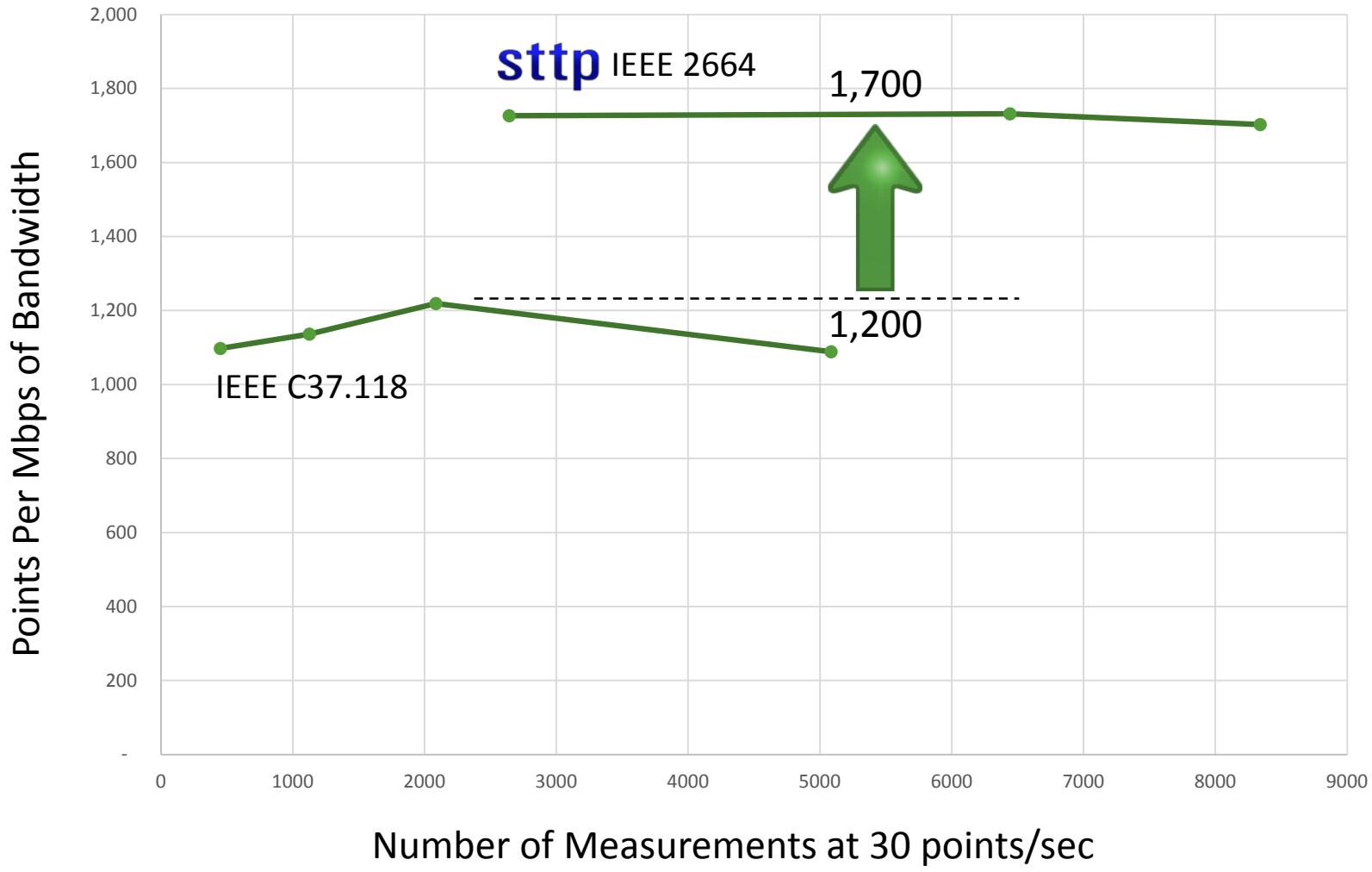
  https://www.osti.gov/search/semantic:1504742
  https://github.com/sttp/dotnetapi

- Approach
  - Use the EIDSN as the transport layer
  - Use GPA's secure gateway, SIEGate as the test application
  - Test performance at differing data volumes



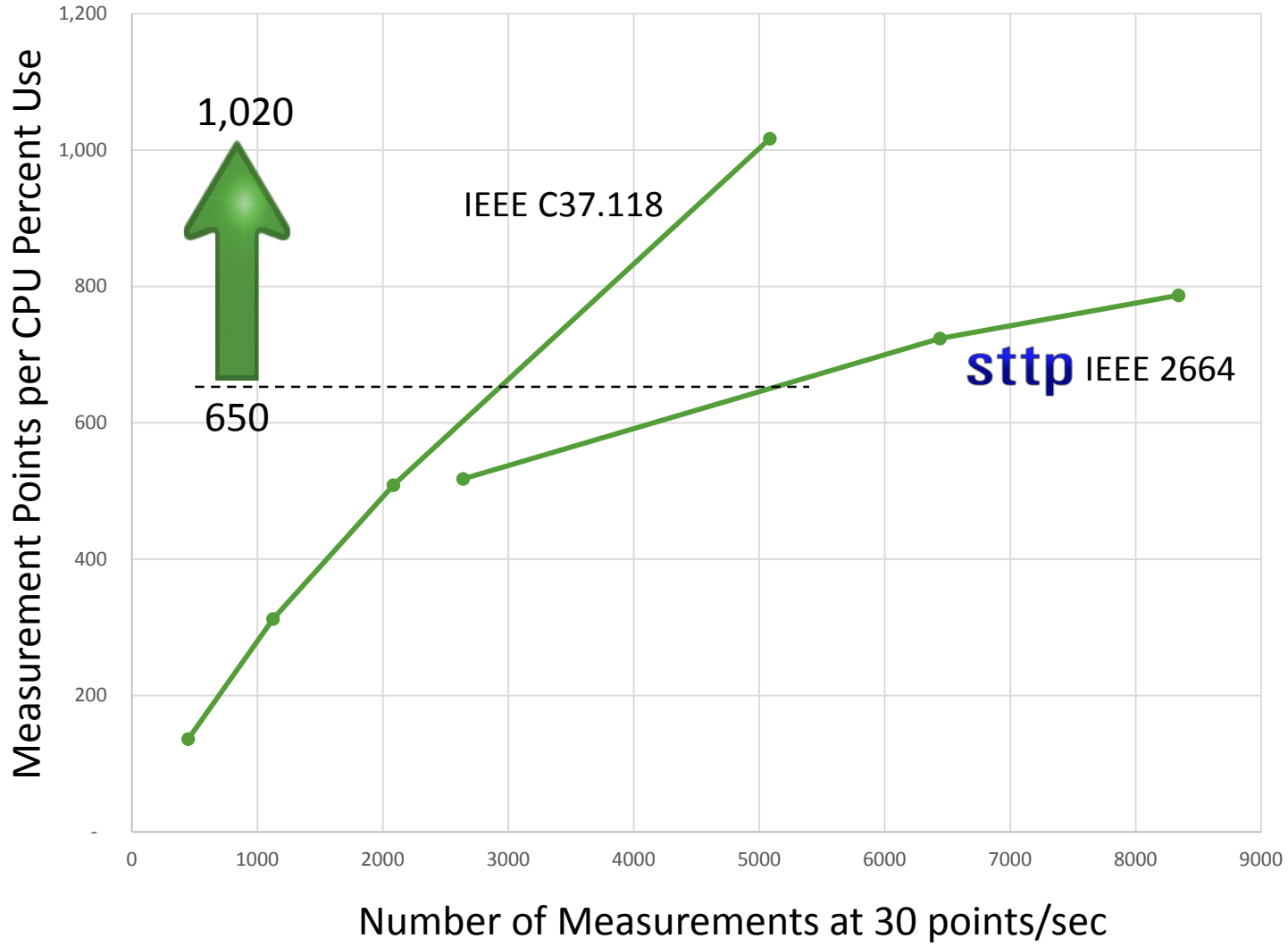
EIDSN Demonstration Test Results

Lossless compression enables greater STTP throughput

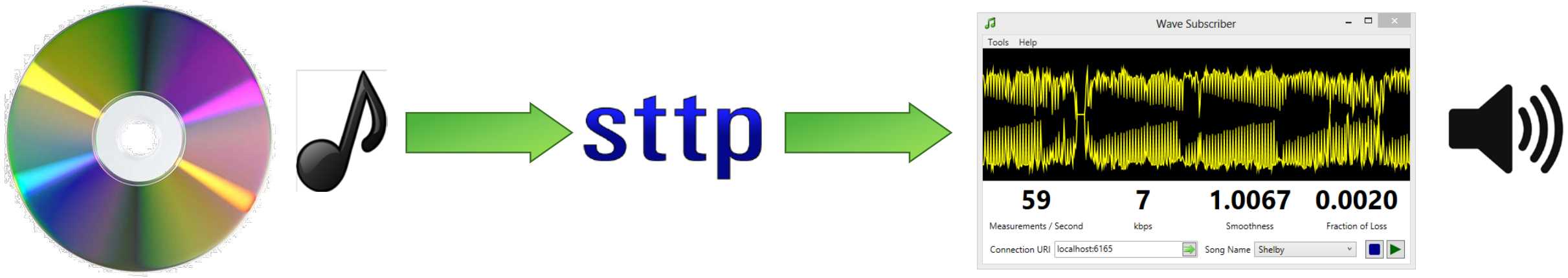


EIDSN Demonstration Test Results

Lossless compression requires more CPU cycles

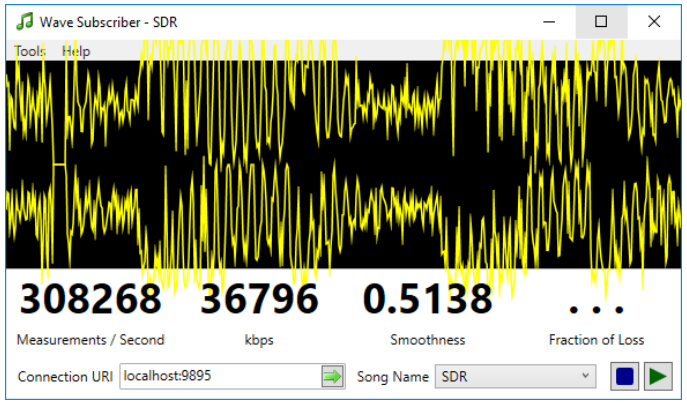


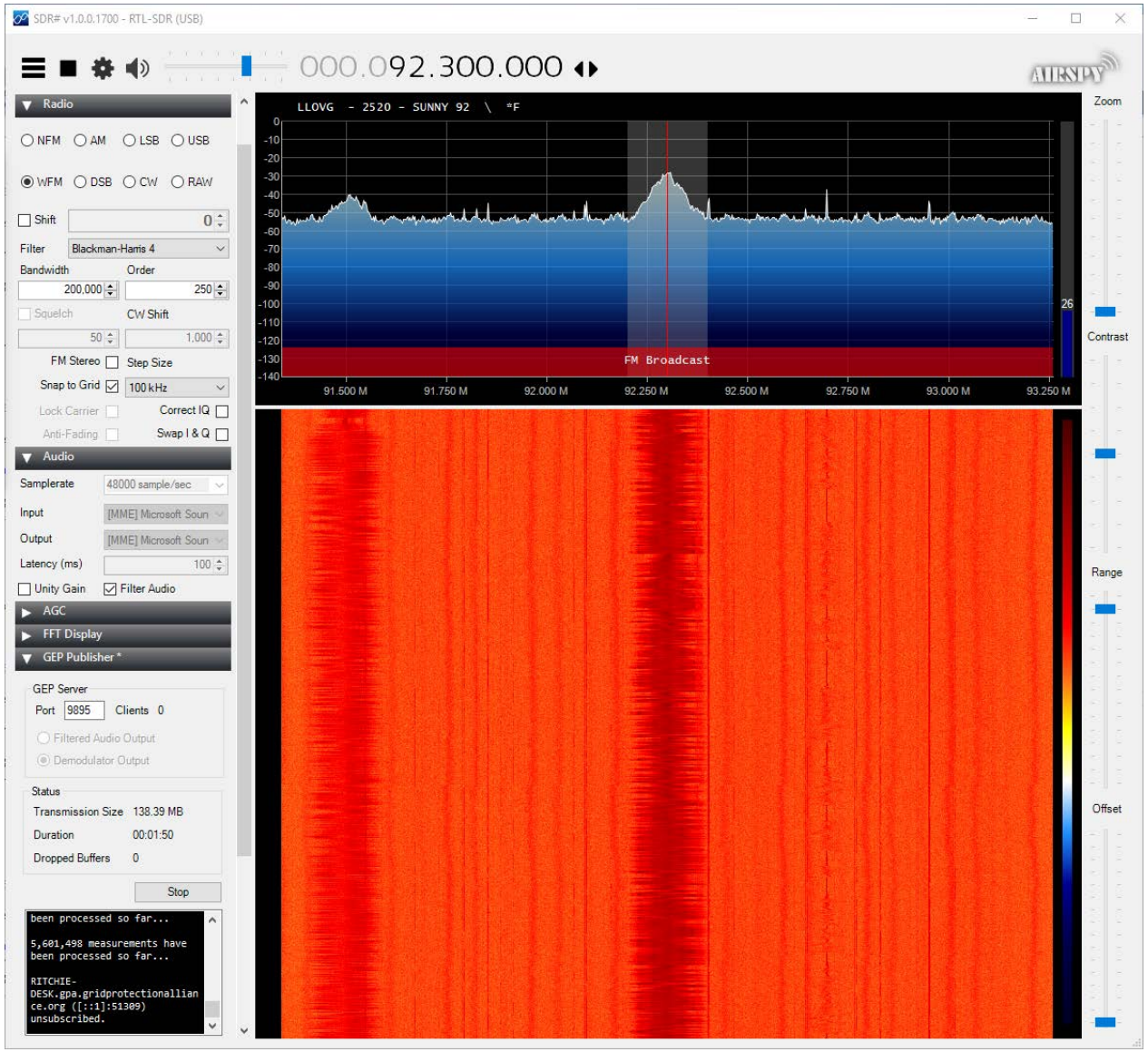
CD Quality Audio (~88kSPS)



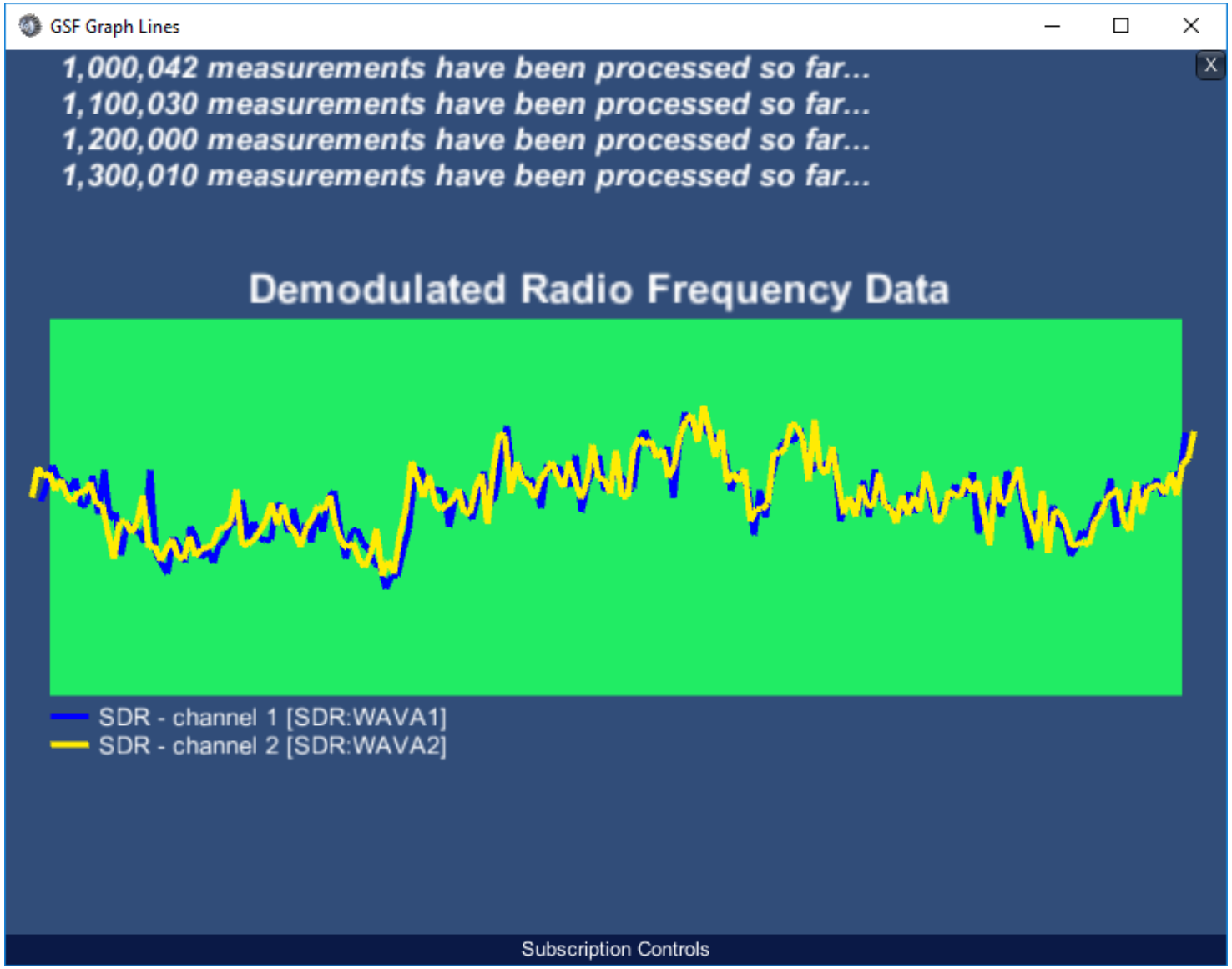
Audio Client

Demodulated Radio Frequency (~300kSPS)





High Speed Graph



Project Partners

Advanced Synchrophasor Protocol Project

sttp

DOE FOA 1492
DE-OE0000859

ASP

Streaming Telemetry Transport Protocol

Project Collaborators	Project Financial Partner	Vendor	Utility	Demonstration Host
Bonneville Power Administration	◆		◆	
Bridge Energy Group				
Dominion Energy	◆		◆	EPG
Electric Power Group	◆	◆		
Electric Power Research Institute				
ERCOT			◆	
Grid Protection Alliance (Prime)	◆	◆		
ISO New England			◆	
MehtaTech		◆		
Oklahoma Gas & Electric	◆		◆	WSU
OSIsoft		◆		
Peak Reliability			◆	
PingThings		◆		
PJM Interconnection			◆	EPG
Southern California Edison			◆	
San Diego Gas & Electric	◆		◆	WSU
Schweitzer Engineering Laboratories	◆	◆		
Southern Company Services			◆	
Southwest Power Pool	◆		◆	WSU
Space-Time Insight		◆		
Trudnowski & Donnelly Consulting Engineers		◆		
Utilicast	◆	◆		
Tennessee Valley Authority	◆		◆	WSU
University of Southern California				
V&R Energy		◆		
Washington State University	◆	◆		
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