

# **Transmission Services Corporation using Synchrophasor Technology - LCRA's Experiences**

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# OUTLINE

- Introduction
- LCRA SYNCHROPHASOR MONITORING SYSTEM
- PMU Data Vs CIP Requirement
- PMU Data Quality
- Summary

# INTRODUCTION

## LCRA's Mission:

To enhance the quality of life of the Texans we serve through water stewardship, energy and community service.

## What we do:

Wholesale power

Electric transmission services

Water management and protection

Outdoor adventure, river access and natural science education

Community services

Located in more than 70 counties across Texas

Provide a vital link between power plants and the statewide, interconnected power grid

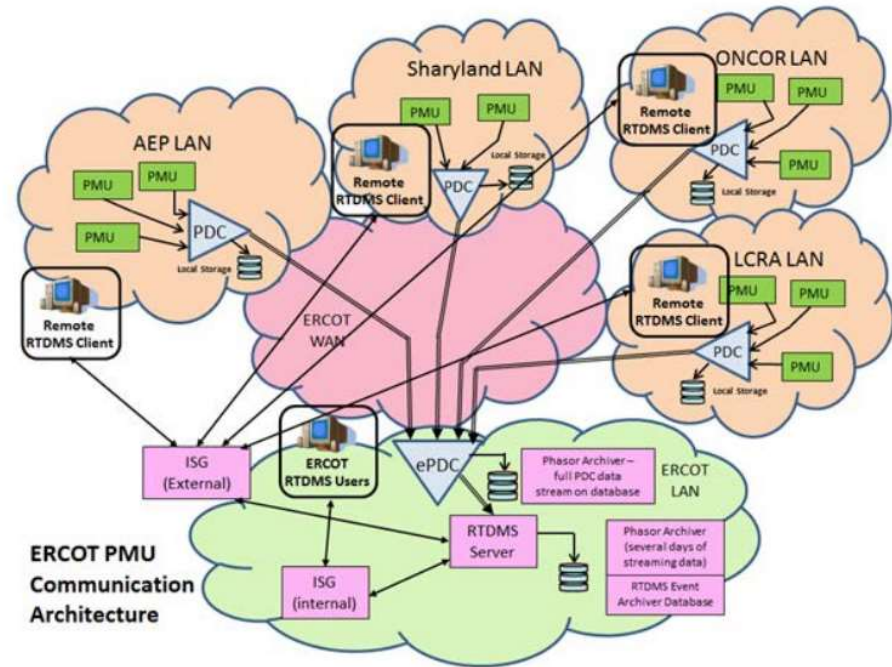
LCRA TSC is regulated by the Public Utility Commission of Texas and coordinates its operations with the Electric Reliability Council of Texas (ERCOT).

# LCRA SYNCHROPHASOR MONITORING SYSTEM (L-SMS)

- Number of PMUs : 90
- Tool to monitor PMU data:
  - RTDMS of Electric Power Group(EPG)
- Data sharing with ERCOT
- Use cases:
  - Oscillation monitoring
  - Event analysis

# ERCOT SYNCHROPHASOR DATA COMMUNICATION NETWORK

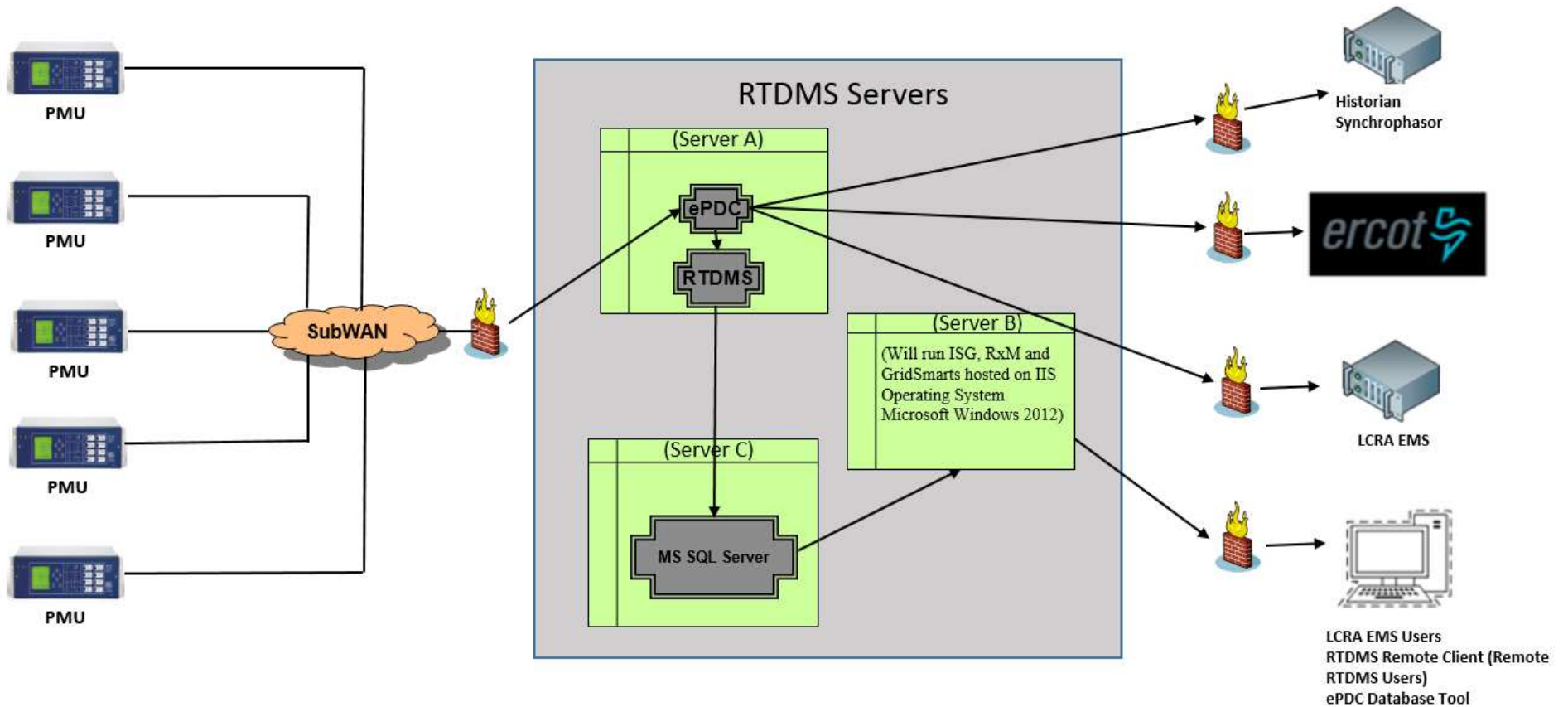
The Synchrophasor Data Communication Network



Ref: Patrick Gravois, 'Synchrophasor Based Oscillation Detection in ERCOT Operations', NASPI, September 2017



# LCRA SYNCHROPHASOR NETWORK



# PMU DATA VS CIP REQUIREMENTS

If PMUs are used for making real-time decisions:

At substations:

- PMUs would inherit the Impact Rating of the substation (medium or low)
- PMUs would become individual BES Cyber Assets and be part of a BES Cyber System based on the substation Impact Rating

At control centers:

- Infrastructure would inherit the Impact Rating of the control center (high, medium)
- Servers, switches, firewalls and operator PCs (if dedicated for PMUs) would become individual BCA, EACMS and be part of the BES Cyber System based on the control center Impact Rating

Based on the assessed Impact Rating, all CIP Standards, CIP-002 – CIP-013, would apply

<https://www.nerc.com/pa/Stand/Reliability%20Standards%20Complete%20Set/RSCCompleteSet.pdf>

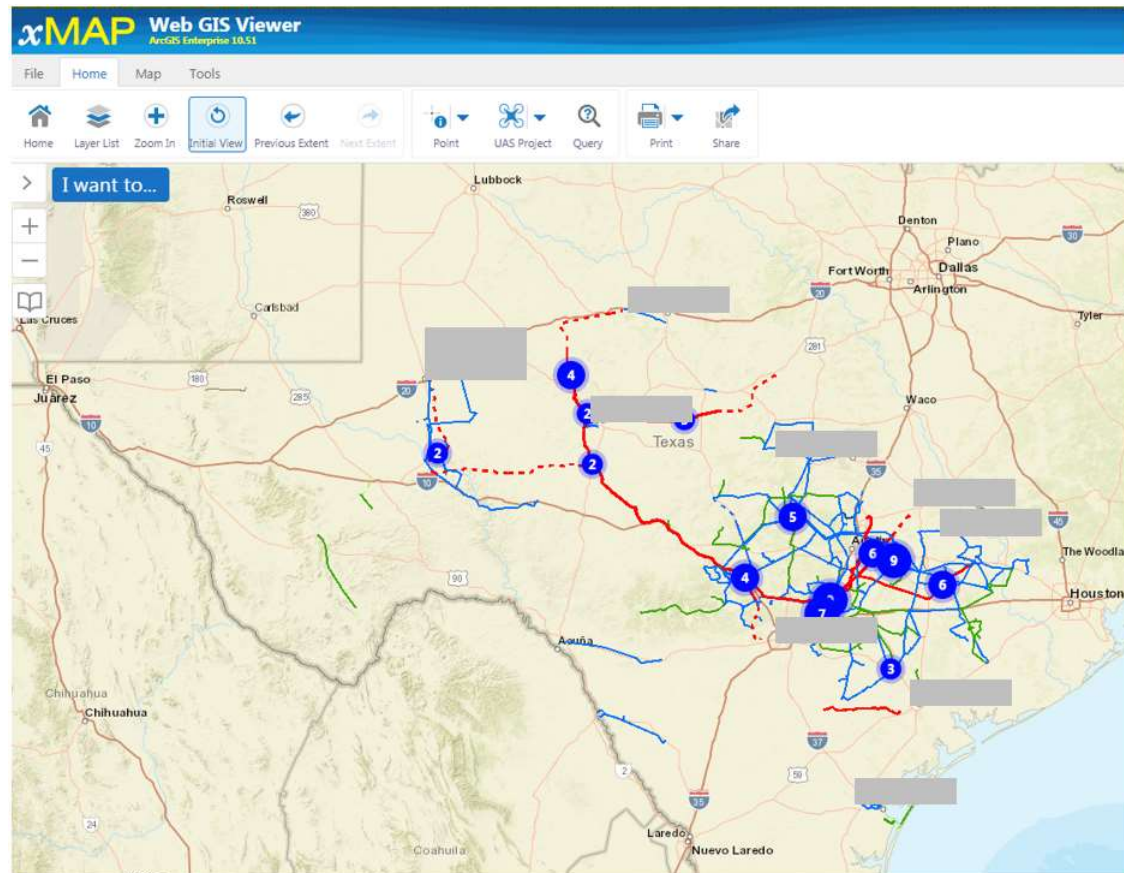
# PMU DATA ISSUES

- Initial PMU data testing
  - Done in the field during initial deployment
- PMU data dropouts
  - Attempt to bring back PMU data stream by sending an IEEE 37.118 command from PDC
  - If PMU is unable to be brought up remotely, troubleshoot across groups to look for issues among devices (SEL 3610, SEL 2407), network communication and the PMU
- PMU data quality
  - Timing errors among devices could result from relays, SEL 3610s, SEL 2407s
    - Reboot devices to solve timing issues in the field
  - LCRA TSC is currently tuning ePDC latency for output timing issues



# PMU LOCATION INFORMATION TO LCRA ENGINEERS

- On Maps
- On EMS Displays



# EVENT ANALYSIS

- Fault analysis

From: [REDACTED]  
Sent: [REDACTED]  
To: SYSTEM FAULTS <SYSTEMFAULTS@LCRA.ORG>  
Subject: Fault Event - T246, 07/03/19 15:51

Date/Time: 07/03/19 15:51

Line: T246 - From LYTTON-SPRINGS TO ZORN 345kV

Event Type: Automatic - Protective devices (equipment) originated event

Fault Type: A-phase to ground

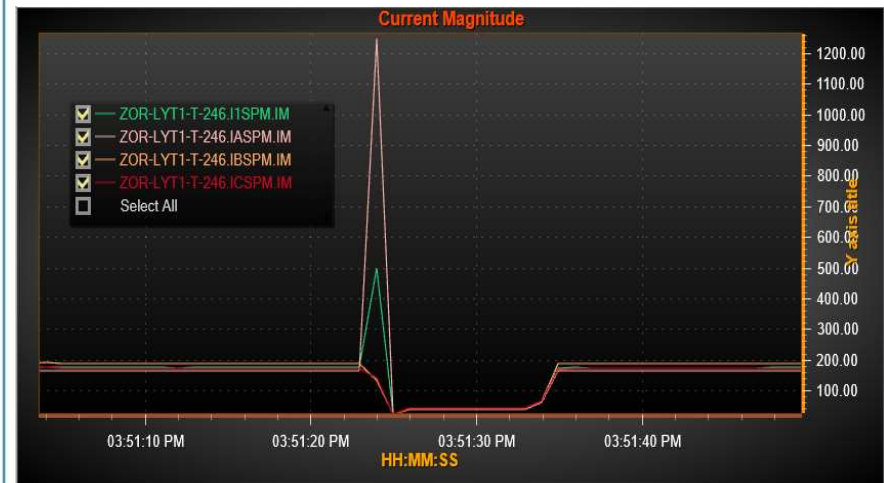
Voltage: 345kV - Transmission

Description of Event:  
Lytton Springs CB's 1207 & 1208 trip/close auto

Zorn CB's 6240 & 13310 trip/close auto

Heavy Lioghtning in the area

Distance to Fault:  
LYTTON-SPRINGS - 5.99 miles  
ZORN - 19.6 miles



# SUMMARY

## LCRA's Motivation for Synchrophasor Technology

- LCRA opted to take advantage of digital relays' PMU functionality to implement low cost system
- Initial focus was on 345 kV facilities
- Original goals were to gain experience with PMU data, support ERCOT efforts, and investigate integration opportunities with other systems
- Visibility of angle across key series compensated double circuit lines\*
- Required involvement from Planning, System Protection, Telecom Engineering, Operations
- 138 kV locations were added to have monitoring at a different voltage class and closer to load
- Geographically diverse locations were also selected to provide a robust set of monitoring points and to get a better sense of event propagation.
- PMUs are now a standard relay function, similar to reclosing, DNP, DTF reporting, etc.
- Integration work with other "mainstream" Computer Applications such as EMS and State Estimator continues.

# Thank you!

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