IEEE 1588 Precision Timing Protocol

East 13th Street IEC61850 Project

IEC 61850 Europe 2017 Conference

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Agenda

- Substation Overview
- Project Overview
- System Design
- 1588 Timing System
- Lessons Learned
- Open Discussion

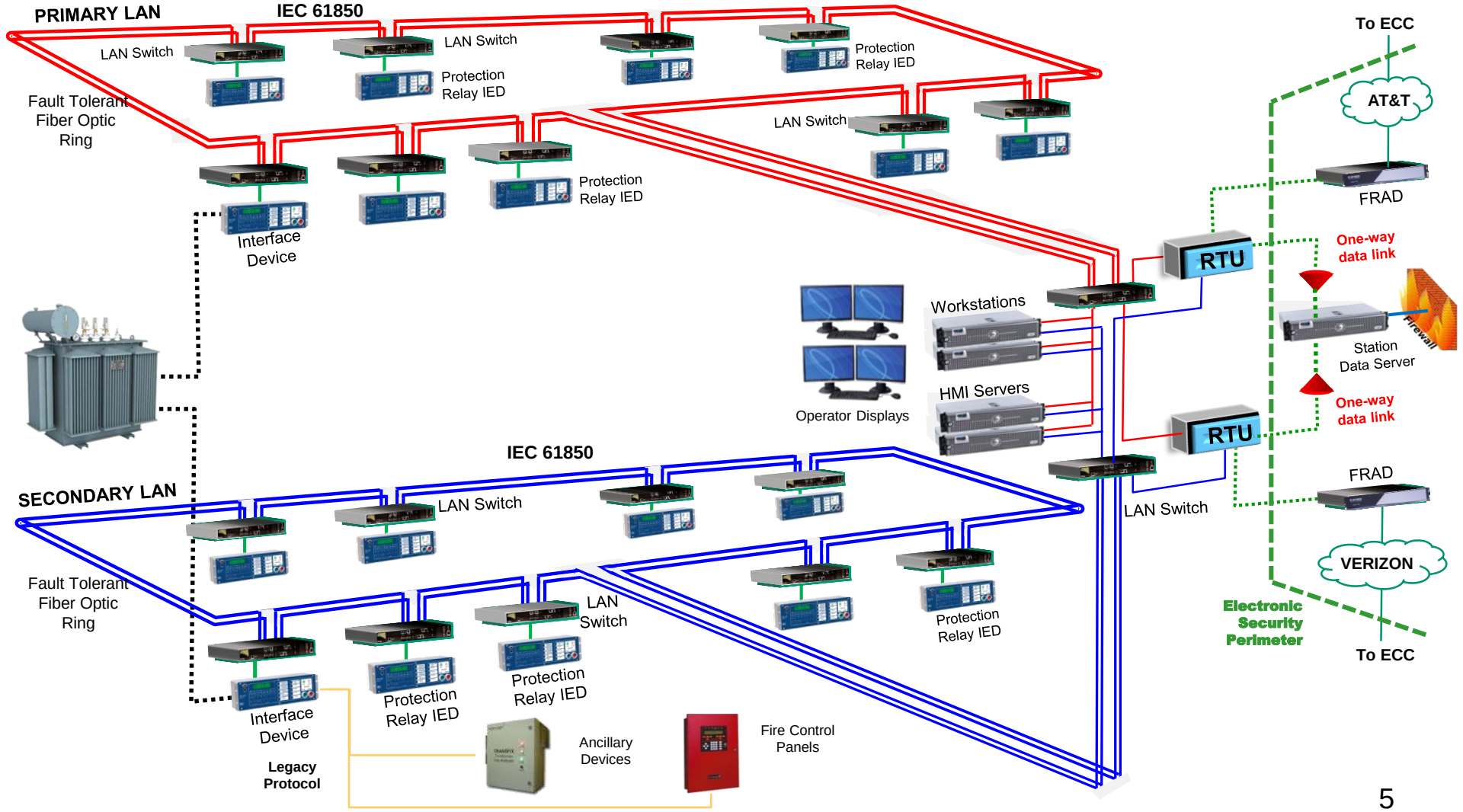
Substation Overview

- In Service since 1965
- 8 Underground 345kV Feeders
  - 10,548MW Total S.T.E Rating
- Feeds
  - 138/69kV Distribution/Generation Station through 6 Tie Feeders
  - 5 Area Stations though 17 Feeders
  - Most of Southern Manhattan (Load Pocket)
- Primary Equipment
  - 33 138kV Breakers
  - Four 345kV PASS Breaker/MOD GIS Assemblies
  - 14 Transformers
  - 21 Dielectric Plants

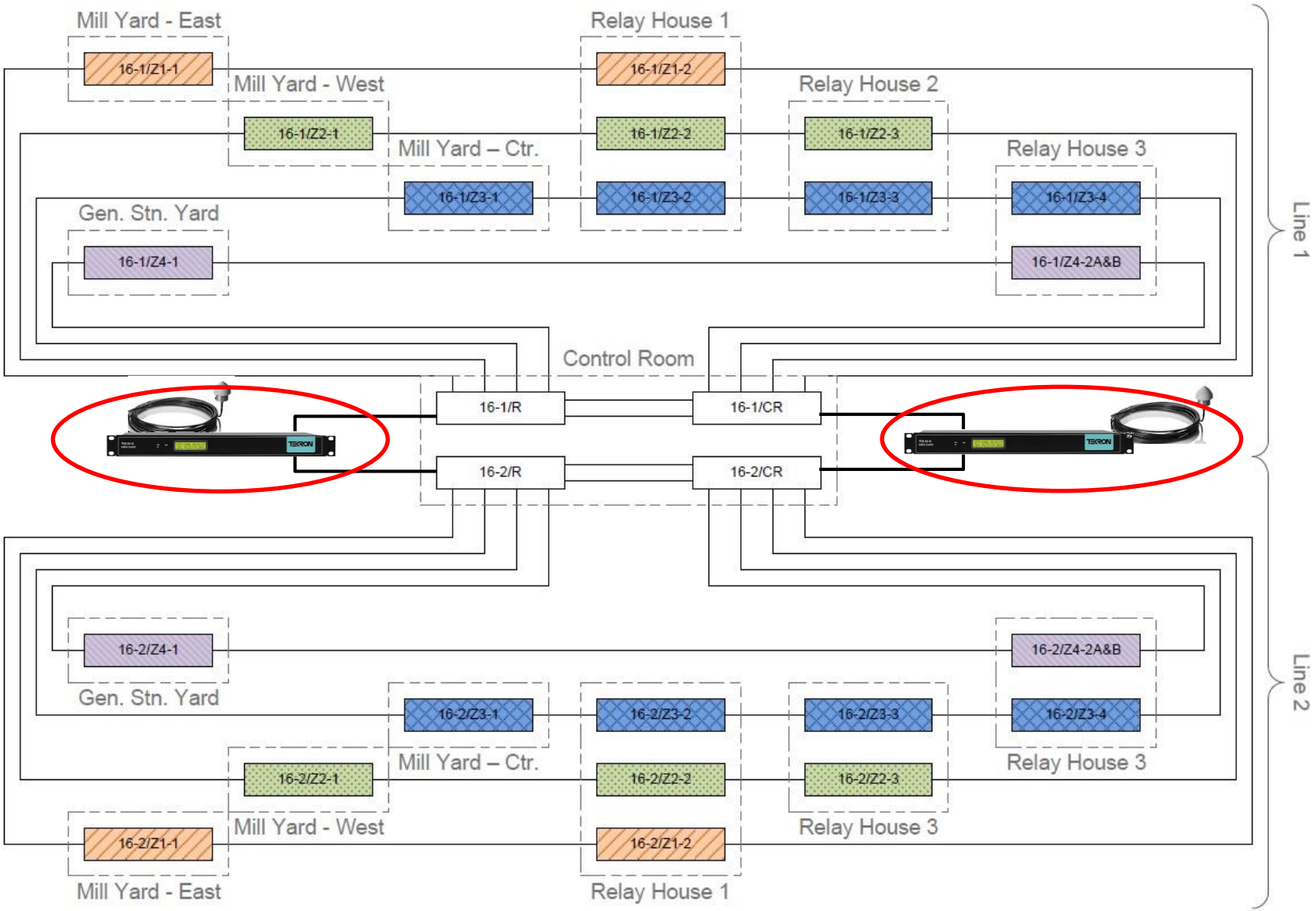
Project Overview

- First IEC 61850 Con Edison project
- Largest brownfield implementation in US
- Robust “storm hardened” architecture
- Dual redundant and independent complete lines of relay protection
- “Future Proof” design goal
- Project Risk mitigation:
  - Station Bus only – no Process Bus
  - Collaborative effort between Con Edison and Vendor
  - Early cycle interoperability demonstration
  - Prototyping

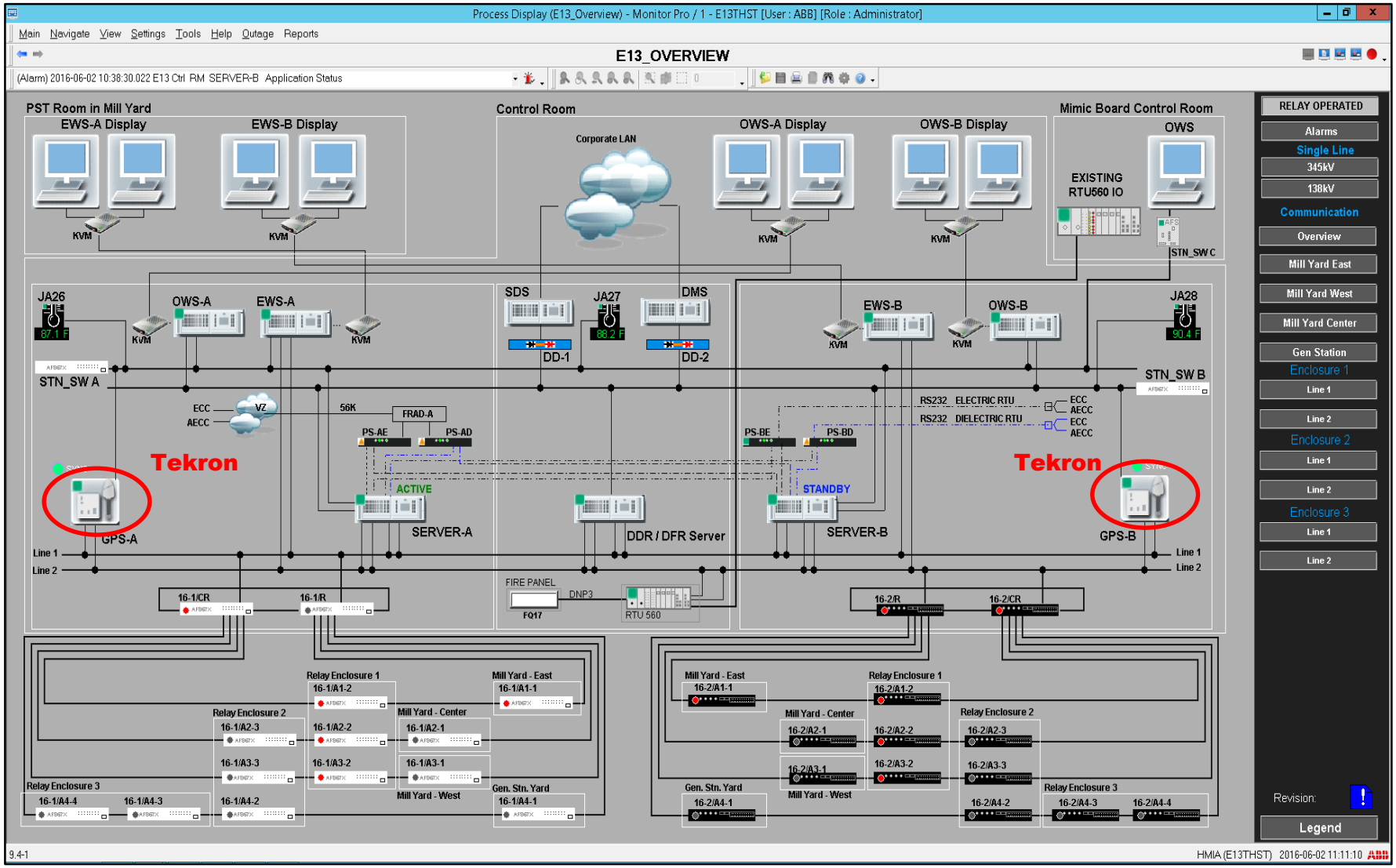
Simplified System Block diagram



Simplified Network Diagram



System Overview Display

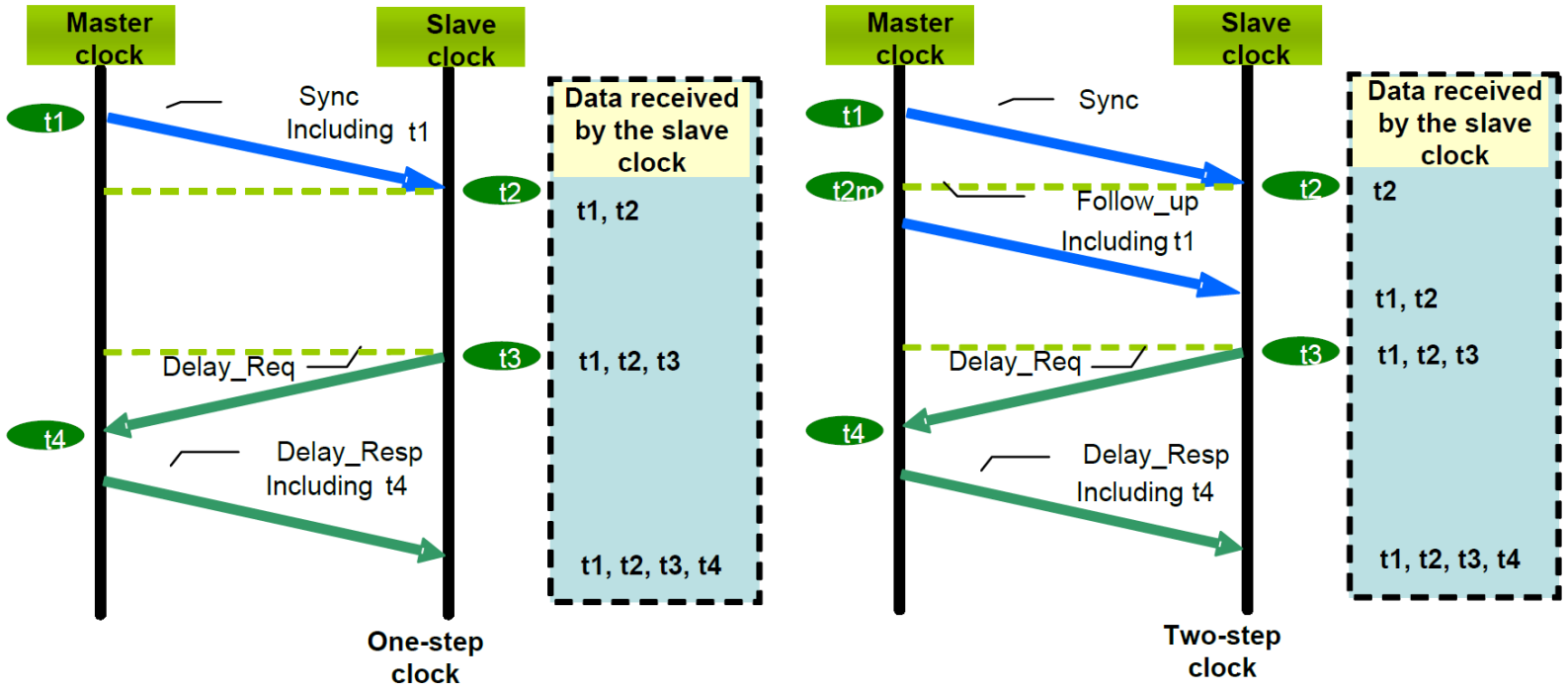


Timing Issues Encountered

- Interoperability
  - PTP not supported by all spec'ed IEDs
    - Newer SEL devices now support PTP
  - Incompatibilities between devices
    - Spec sheets showed initial LAN switches selected were 1588 V2 compliant
    - LAN switches could not be configured as single step peer to peer clocks.
    - Had to return all purchased devices and procure alternate manufacturer

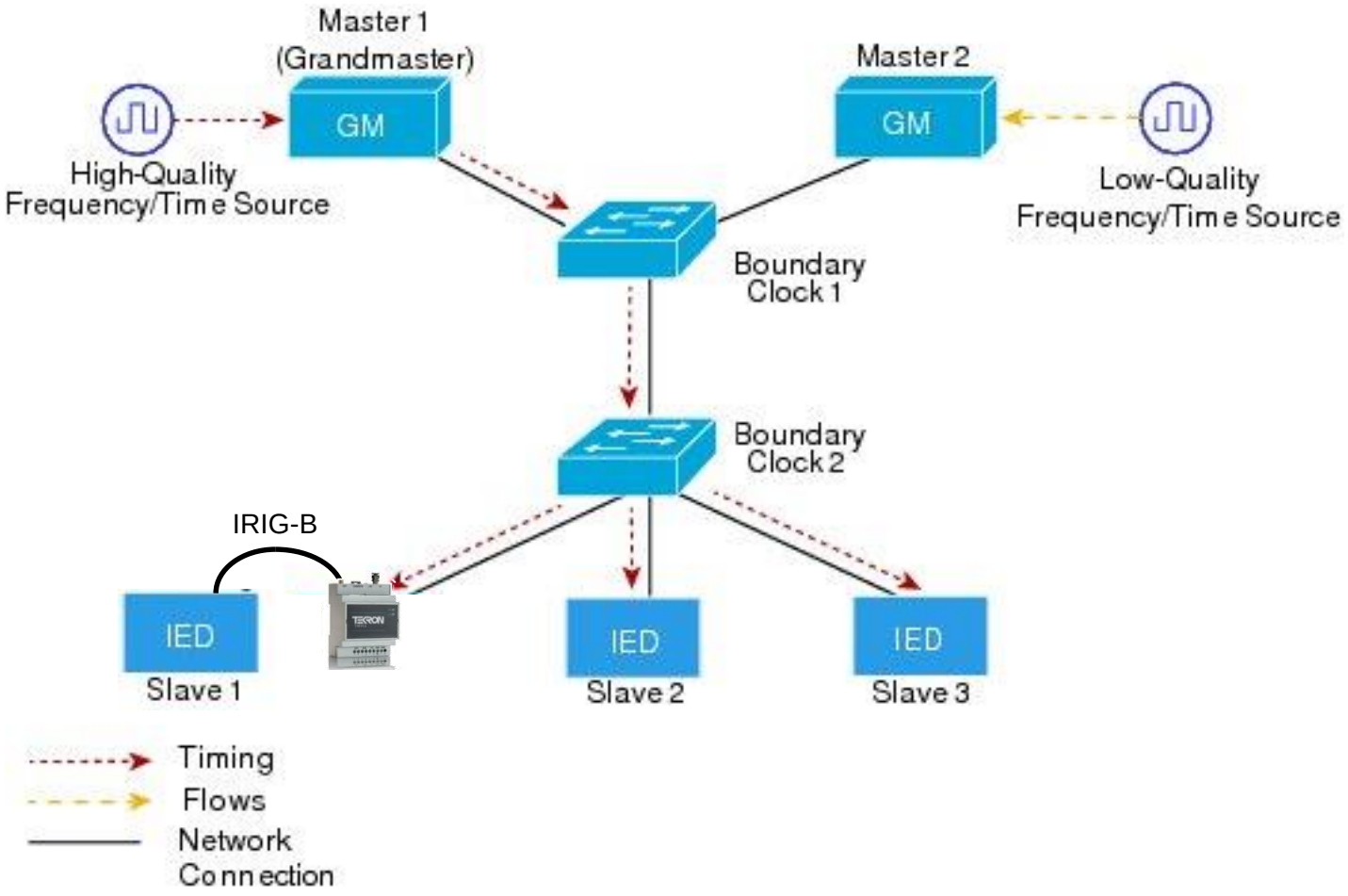
Timing Issues Encountered

One–Step versus Two-Step implementation

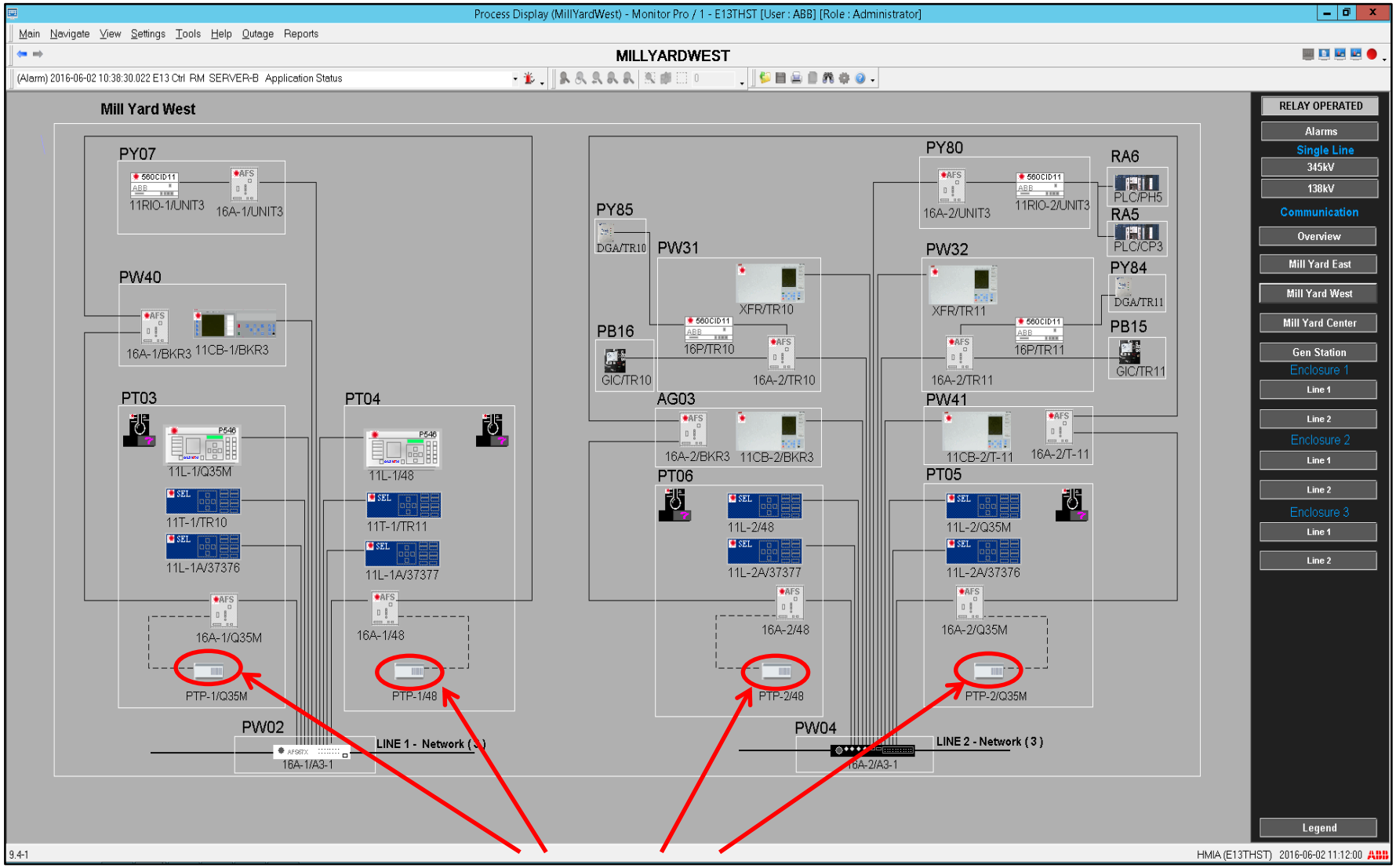


Timing Issues Encountered

Basic PTP Configuration



Transformer Bank Display



PTP to IRIG-B Translators

Lessons Learned

- Surprise incompatibilities
  - Specs are not infallible; implementation differences create risk
  - Spec compliance not always a guarantee of plug and play
  - Sometimes even equipment manufacturers are not aware of latent issues

- Mitigate risks at every possible stage
  - Interoperability testing in early project cycle is ALWAYS a good idea
  - Prototyping as close to final configuration as possible

Maintenance Considerations

- Timing is a critical system function
  - Technicians need to be more proficient with Network analysis tools
  - Network devices (LAN switches) are integral part of timing system
  - Device configurations must be closely managed and tracked
  - PTP profiles become a new maintenance item

Thank you.

Questions?