IEEE 1588 Precision Timing Protocol

East 13th Street IEC61850 Project

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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 through 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

- PRIMARY LAN
  - LAN Switch
  - IEC 61850
  - Protection Relay IED
  - Fault Tolerant Fiber Optic Ring
- SECONDARY LAN
  - LAN Switch
  - IEC 61850
  - Protection Relay IED
  - Fault Tolerant Fiber Optic Ring

- Interface Device
- Ancillary Devices
- Fire Control Panels

To ECC
- AT&T
- FRAD
- One-way data link
- Station Data Server
- One-way data link
- VERIZON
- Electronic Security Perimeter

Legacy Protocol

Operator Displays
HMI Servers
Workstations
Simplified Network Diagram

- Mill Yard - East
- Mill Yard - West
- Mill Yard - Ctr.
- Gen. Stn. Yard
- Relay House 1
- Relay House 2
- Relay House 3
- Control Room
- Line 1
- Line 2

conEdison
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
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?