Substation Automation SA-3

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Presentation Overview

- Objective
- Concern/gap addressed
- Milestones addressed to meet objectives
- Progress to date
- Next steps
- Lessons learned for industry
- Recommendations for future demonstration projects

Objective

- **In phase 2 (Irvine Smart Grid Demonstration Project)**

  SA-3 Open Standards Based Substation Automation (IEC 61850) was demonstrated successfully and approved as new Standards for SCE Distribution Substation Automation System(Q3 2015)

- **In this phase 3 (EPIC-1)**

  Leverage the SA-3 Standards for Distribution Substation (66kV) to demonstrate IEC61850 platform on Transmission Substations (220kV)

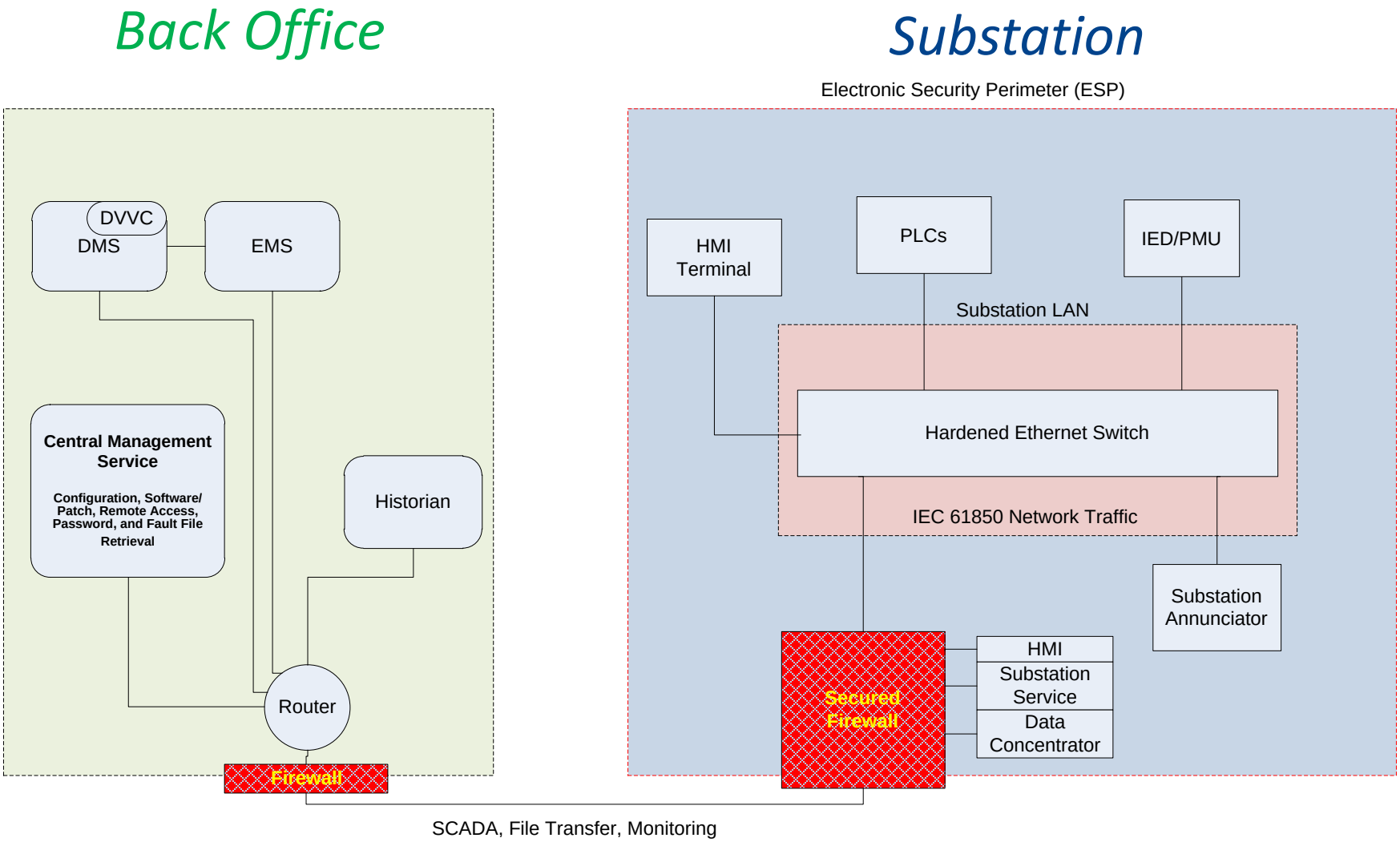
IEC 61850

- International standards describe:
  - Client / server communication
  - Peer-to-peer communication
  - Substation design
  - Configuration standards

one world
one technology
one standard

- Objective: single standard for modeling all data related to substations
  - Supports interoperability between vendor systems and IEDs
- Identified by NIST as part of the North American Smart Grid standards framework
- Specifies how next generation equipment will communicate
- Enables future “plug and play” substation and distribution automation

SA-3 Network Architecture



Benefits of new SA-3 IEC61850 System

- Security / access control
  - Access management
  - Active monitoring / notification
- Robust configuration management
  - Centralized management services for:
    - Configuration, remote access, and fault file retrieval
  - Auto-configuration
  - Elimination of vendor HMI build process & cost
  - Active monitoring / notification
- System operation
  - Integration to other systems (eDNA, DMS/SCADA, EMS, FAN, DVVC)
  - Real time data beyond SCADA (historian eDNA collect data for analysis)
  - Redundancy for higher reliability
  - Centralize substation data (Data Concentrator)

Concern/gap addressed

- Demonstrate common IEC61850 automation system platform for all Distribution & Transmission Substations
- Backward compatibility – Work with legacy systems
- Interoperability – sharing of common standards, infrastructure and security mechanisms
- Ease of use - logical and consistent rules
- Openness – supports multiple vendors, not proprietary
- Scalability – ability to easily expand

Milestones addressed to meet objectives

Milestones
• Define business requirements and use cases
• Complete Request for Proposal (RFP) documentation for HMI, Central Management Services, Substation Services and Data Concentrator
• Evaluate RFPs and select vendors
• Perform Factory Acceptance Test
• Conduct Advanced Technology lab demonstration for all stakeholders
• Complete pilot demonstration at Viejo 220 kV substation
• Develop EPIC final project report

Progress to date

- Completed business requirements and use cases
- Issued Request for Proposal (RFP) for Central Management Services and Substation Services
- Preliminary engineering for Viejo Substation in progress

Next steps

- Evaluate RFPs and select vendors
- Complete Factory Acceptance Test
- Conduct Advanced Technology lab demonstration for all stakeholders
- Complete installations & commissioning testing at Viejo (2017)
- Complete Pilot Demonstration at Viejo 220 kV Substation
- Develop EPIC final project report (2018)

Lessons learned for industry

Worked well

1. SA3 successfully demonstrated that an HMI can be fully configured in minutes, instead of several weeks
2. SA3 Substation Gateway proved the viability of automated:
   - Substation configurations ready for FAT testing.
   - Change of passwords
   - Retrieval of relay fault files

Did not work well

1. Needed more consistent vendor adoption of IEC 61850
2. Cyber security standards are still emerging
3. IEC61850 does not cover all required features and SCE had to go beyond the existing standards

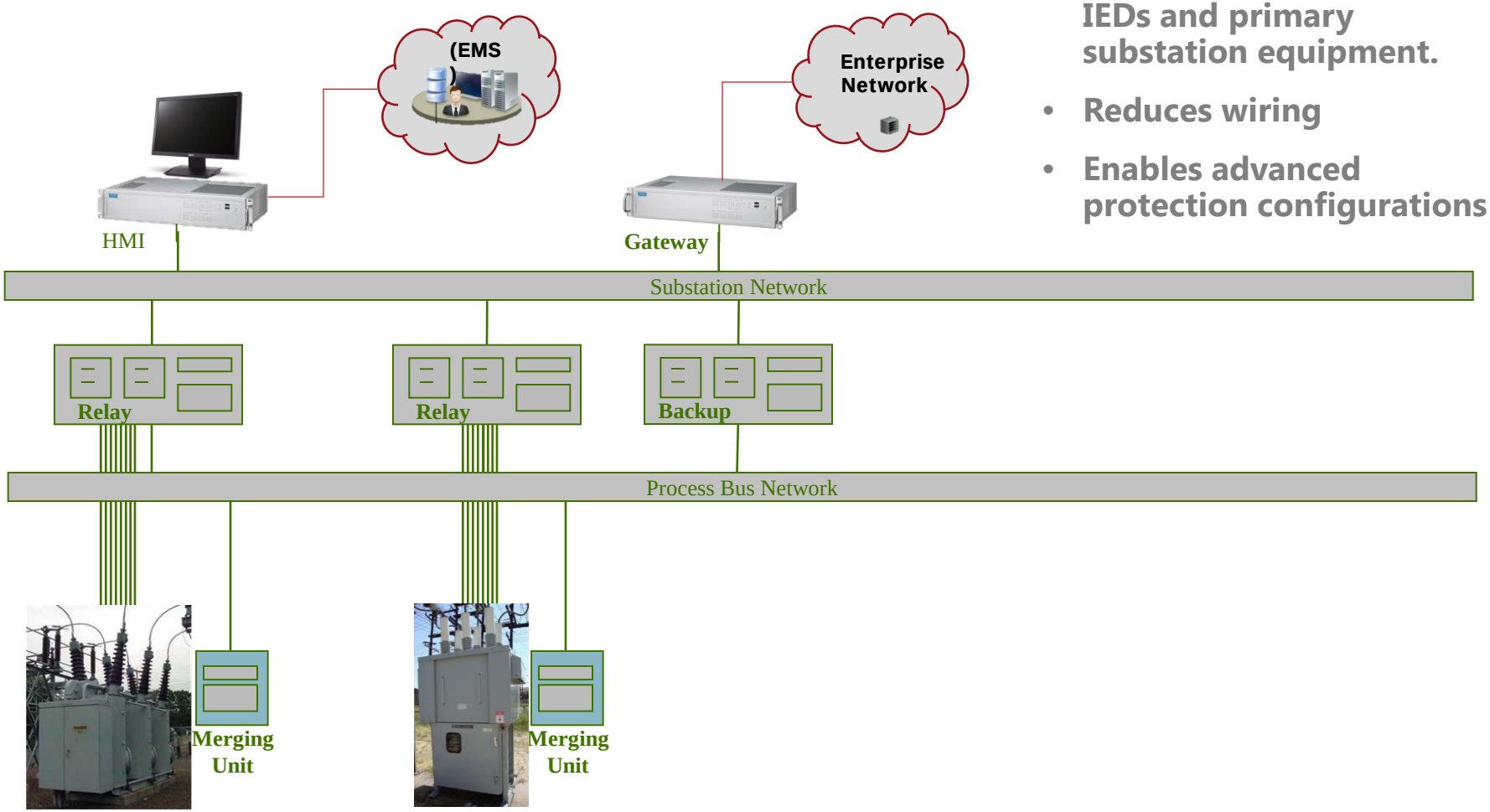
Next steps

1. Work with vendors and standards development organizations on standards updates
2. Expand substation gateway functionality to satisfy NERC CIP v5 requirements

Recommendations for future demonstration projects

- **IEC 61850 Process Bus – Fully Digital Substation**
- **System Intelligence and Situation Awareness Capabilities**

IEC 61850 Process Bus – **Fully Digital Substation**



- **Facilitates fiber communications between IEDs and primary substation equipment.**
- **Reduces wiring**
- **Enables advanced protection configurations**

Recommendations for future demonstration projects

- **System Intelligence and Situation Awareness Capabilities**
  - Demonstrating an intelligent alarming system that can identify the source of the problem and present EMS operators with only the relevant information needed to make informed decisions. The tool will identify and demonstrate an intelligent algorithm that goes beyond simple alarm prioritization and can reliably pinpoint the event triggering the alarms.
  - Improve substation test tools to explore the benefits of automated testing using a power system simulator, other Substation test tools with scripting capability, and propose test methodologies that can be implemented into the factory acceptance testing (FAT) and site acceptance testing (SAT) processes.