
Challenges with Installation / Upgrade

PQ Dashboard Users Group Meeting

Wed, September 28, 2022

Austin, TX



Outline

- 1) IT Support
- 2) Network / Environment
- 3) Security / Authentication
- 4) Testing / Bug Resolution
- 5) Configuration

IT Support

- 1) TVA's IT organization funded a large PQ Software Upgrade Project which was approved in Spring 2019.
 - Multiple Project Change Requests approved over past 3 years
- 2) Required approvals from Cyber Security and Data Governance.
 - Added requirements / complexities.
- 3) Required support from Server, Application, Networking, and Database Admins.
 - Large team
- 4) Project Management and Product Delivery & Support
 - Lots of transition in personnel over 3 years.

Network / Environment

Midway into project, the decision was made to move all PQ applications from the IT corporate network into the Operations secure network.

- Advantages

- Field devices (DFRs, PQMs, Meters, Relays, etc) live on secure network
- Provided full redundancy / failover between Primary and Backup Operation Centers
- Better familiarity and stability in support personnel

- Disadvantages

- Most users of the applications are on the corporate network
- Required need for secure file replication
- Cross-network authentication and complex firewall management
- Parallel major project in flight to construct new Primary Operation Center which added complexity
 - PQ applications have been migrated 3 times within Operations network

Security / Authentication

- 1) Over the course of the project, multiple Department of Homeland Security directives have been issued resulting in a significant Project Change Request in 2022.
 - The debate of cloud hosted authentication versus authentication hosted on premises.
 - Managing a large and growing user base across networks (nearing 500 users today)
 - Managing external users and connections
 - Multi-factor authentication requirements
 - Encryption requirements
 - Password management

Testing / Bug Resolution

- 1) Multiple Users Testing Different Applications or Features
- 2) Whose Responsibility is it to Resolve?
- 3) Assigning Severity and Prioritizing Fixes
- 4) How to Track to Resolution and Verify
- 5) Keeping Track of Feature Requests for Future Upgrades

Configuration

1) Moving from Line Centric to Asset Centric Model

- Stations, Meters, Lines, Transformers, Breakers, Busses, Cap Banks (over 10,000 entries thus far)
 - Use scripts to bulk load when possible
 - Good intern work when manual entry is needed

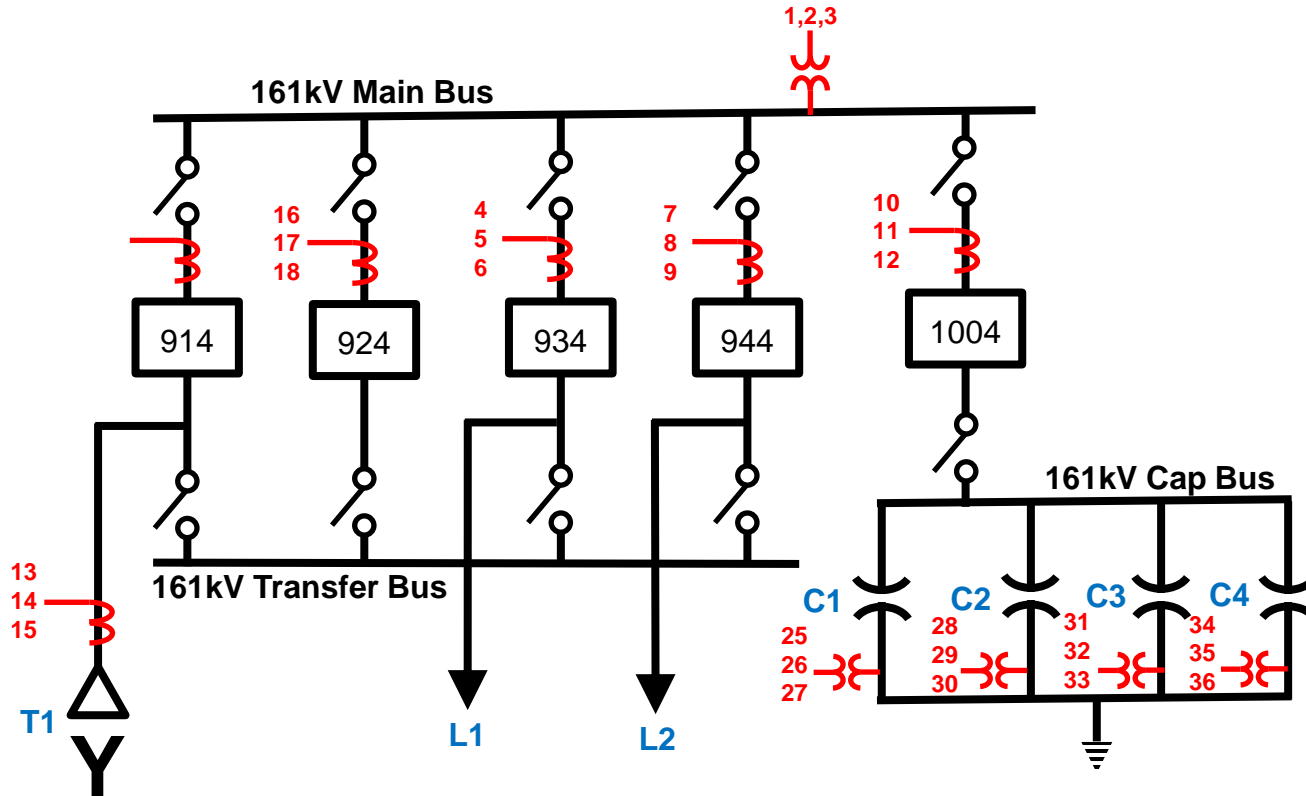
2) Integration with other Enterprise Systems

- Asset Management, Planning Models, SCADA Historians, Outage Planning, GIS, etc.
 - No universal naming or indexing convention across tools
 - Mapping these system together is a major undertaking but once completed offers great & powerful opportunities

3) Mapping of Meter Channels to Assets

4) Linking Assets in order to pass Meter Channels

Mapping Meter Channels to Assets

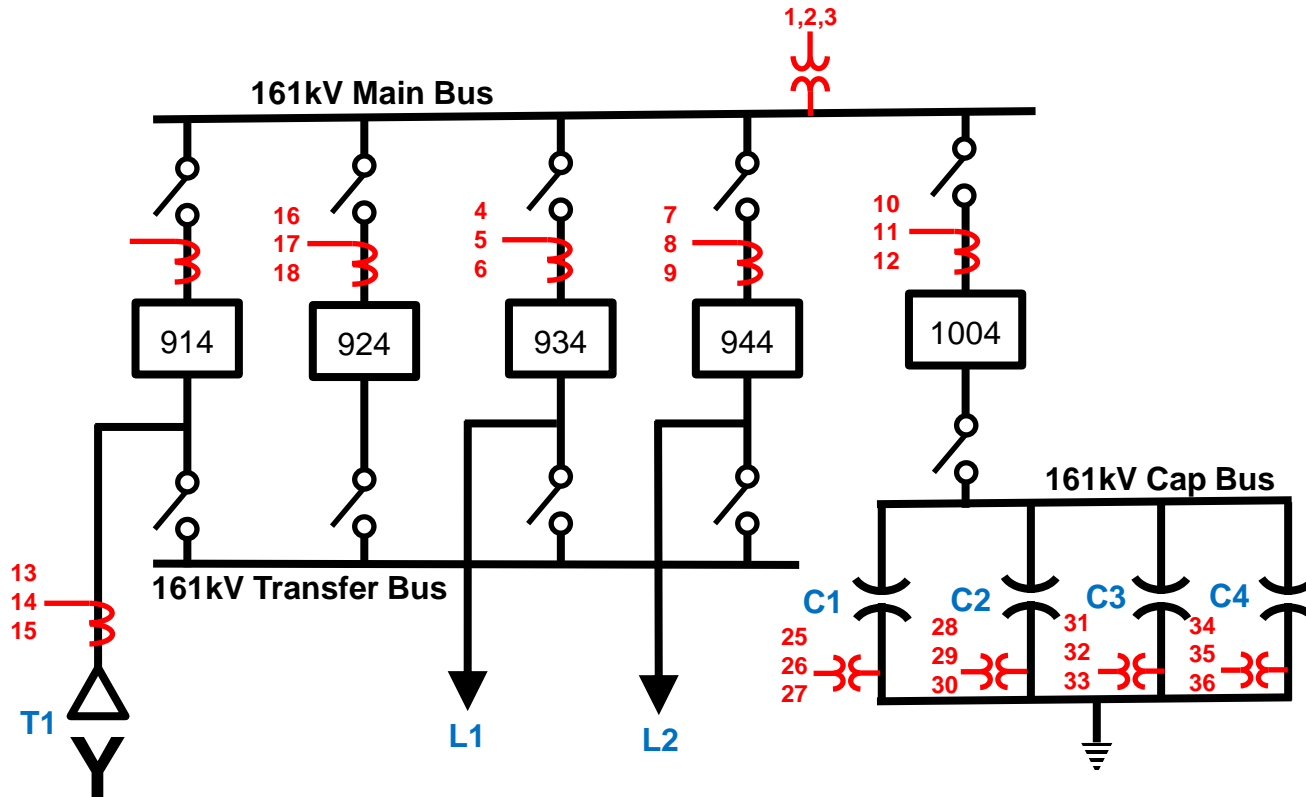


EXAMPLE DFR, 64, 2013

116, 48A, 68D

- 1,A1,Va,161kV (Main Bus) - Van,V,2.320993
- 2,A2,Vb,161kV (Main Bus) - Vbn,V,2.321366
- 3,A3,Vc,161kV (Main Bus) - Vcn,V,2.322322
- 4,A4,Ia,B934 (Line 1) - Ia,A,1.042871e-02
- 5,A5,Ib,B934 (Line 1) - Ib,A,1.042353e-02
- 6,A6,Ic,B934 (Line 1) - Ic,A,1.042440e-02
- 7,A7,Ia,B944 (Line 2) - Ia,A,1.041942e-02
- 8,A8,Ib,B944 (Line 2) - Ib,A,1.041318e-02
- 9,A9,Ic,B944 (Line 2) - Ic,A,1.042015e-02
- 10,A10,Ia,B1004 (Cap Bank) - Ia,A,4.29192
- 11,A11,Ib,B1004 (Cap Bank) - Ib,A,4.28966
- 12,A12,Ic,B1004 (Cap Bank) - Ic,A,4.28791
- 13,A13,Ia,161kV (Transformer 1) - Ia,A,1.044752e-02
- 14,A14,Ib,161kV (Transformer 1) - Ib,A,1.044752e-02
- 15,A15,Ic,161kV (Transformer 1) - Ic,A,1.044752e-02
- 16,A16,Ia,B924 (Spare) - Ia,A,1.041328e-02
- 17,A17,Ib,B924 (Spare) - Ib,A,1.039365e-02
- 18,A18,Ic,B924 (Spare) - Ic,A,1.039449e-02
- 19,A19,Ir,B934 (Line 1) - Ir,A,1.044752e-02
- 20,A20,Ir,B944 (Line 2) - Ir,A,1.044752e-02
- 21,A21,Ir,B1004 (Cap Bank) - Ir,A,4.29696
- 22,A22,Ir,161kV (Transformer 1) - Ir,A,1.044752e-02
- 23,A23,Ir,B924 (Spare) - Ir,A,1.044752e-02
- 24,A24,?, Spare Virtual,V,5.140170e-03,0.0
- 25,A25,Va,161kV CapBk1 (Unbalance) - Van,V,2.320993
- 26,A26,Vb,161kV CapBk1 (Unbalance) - Vbn,V,2.321366
- 27,A27,Vc,161kV CapBk1 (Unbalance) - Vcn,V,2.322322
- 28,A28,Va,161kV CapBk2 (Unbalance) - Van,V,2.320993
- 29,A29,Vb,161kV CapBk2 (Unbalance) - Vbn,V,2.321366
- 30,A30,Vc,161kV CapBk2 (Unbalance) - Vcn,V,2.322322
- 31,A31,Va,161kV CapBk3 (Unbalance) - Van,V,2.320993
- 32,A32,Vb,161kV CapBk3 (Unbalance) - Vbn,V,2.321366
- 33,A33,Vc,161kV CapBk3 (Unbalance) - Vcn,V,2.322322
- 34,A34,Va,161kV CapBk4 (Unbalance) - Van,V,2.320993
- 35,A35,Vb,161kV CapBk4 (Unbalance) - Vbn,V,2.321366
- 36,A36,Vc,161kV CapBk4 (Unbalance) - Vcn,V,2.322322

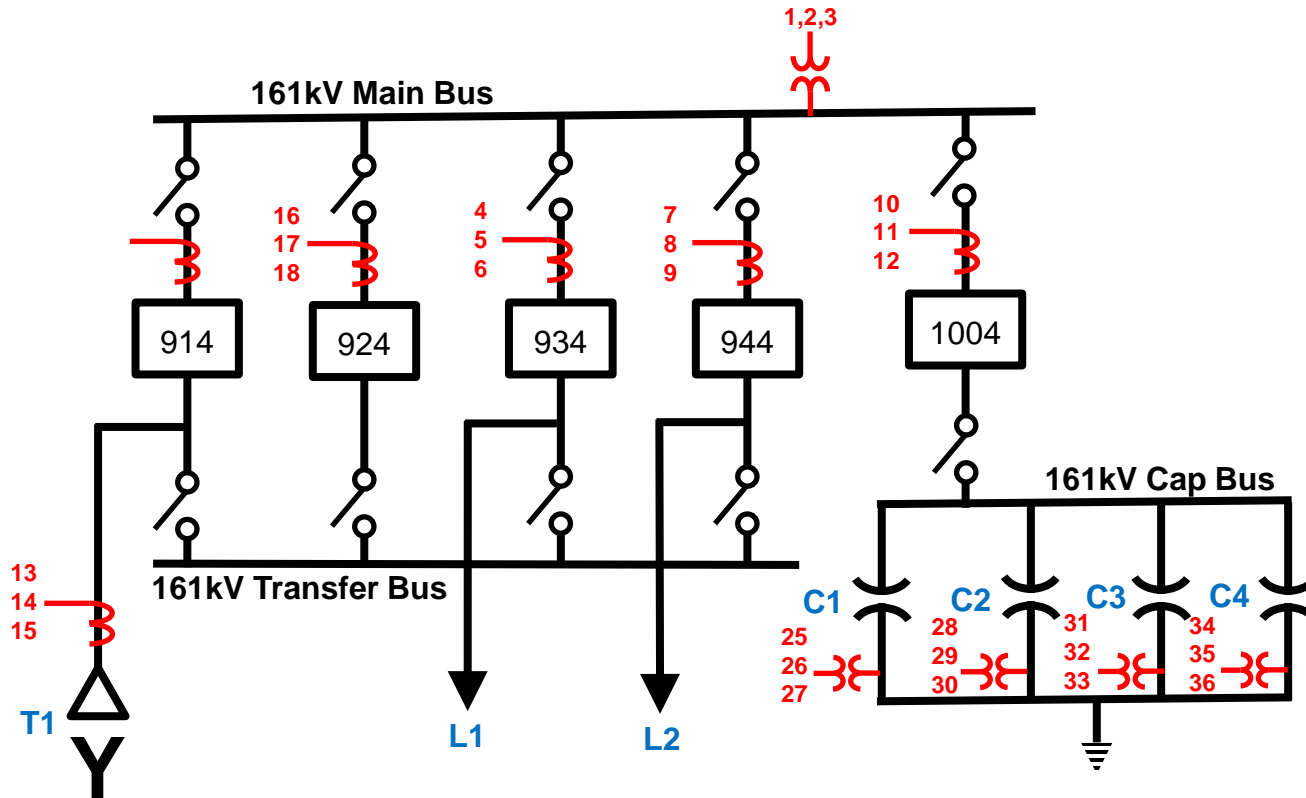
Linking Assets to Pass Channels



161 Main Bus

- B914
 - Transformer 1
- B924
 - 161 Transfer Bus
- B934
 - Line 1
- B944
 - Line 2
- B1004
 - Cap Banks 1-4
 - Cap 1 Relay
 - Cap 2 Relay
 - Cap 3 Relay
 - Cap 4 Relay

Integrating With Other Systems



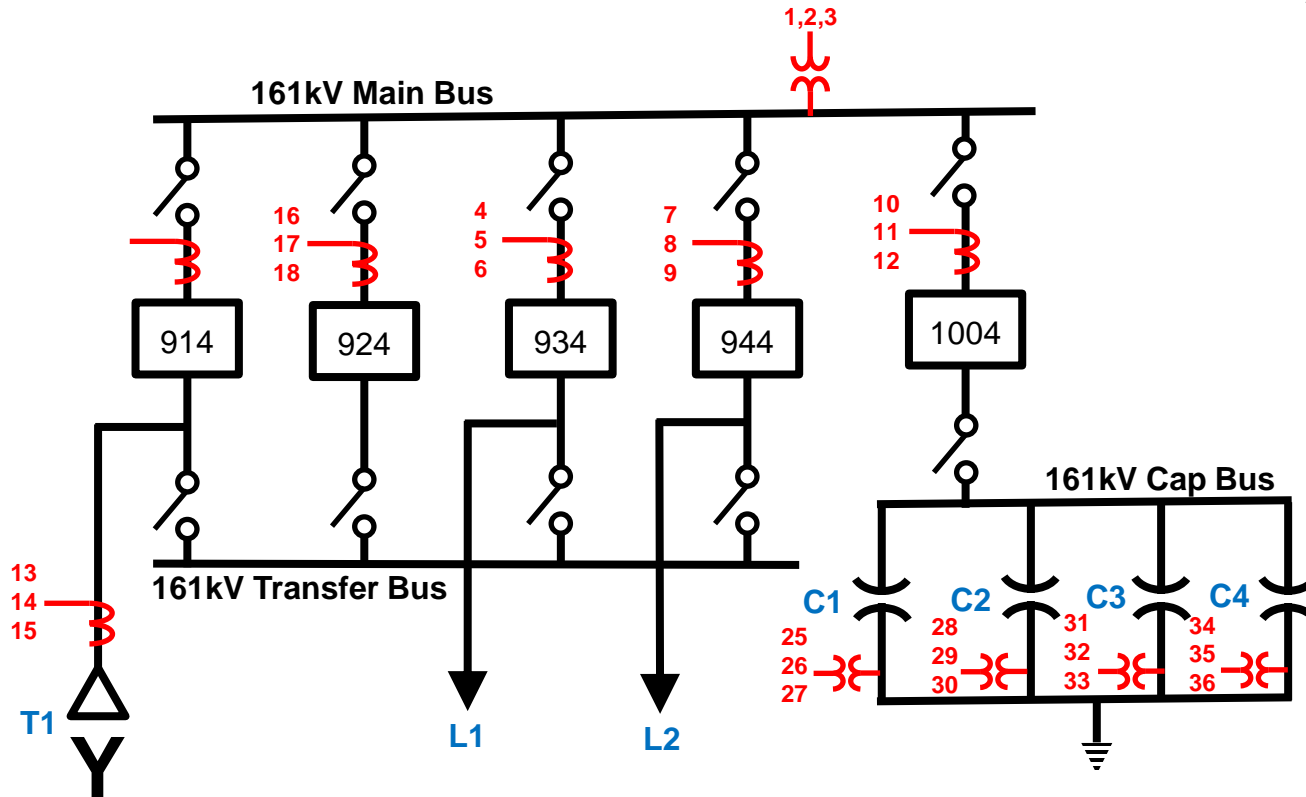
SCADA Historian

- B914 = Status Point 123401
- B924 = Status Point 123402
- B934 = Status Point 123403
- B944 = Status Point 123404
- B1004 = Status Point 123405

Benefits

- 1) OpenMIC Priority Polling
- 2) OpenXDA Vetting of Analytics

Integrating With Other Systems

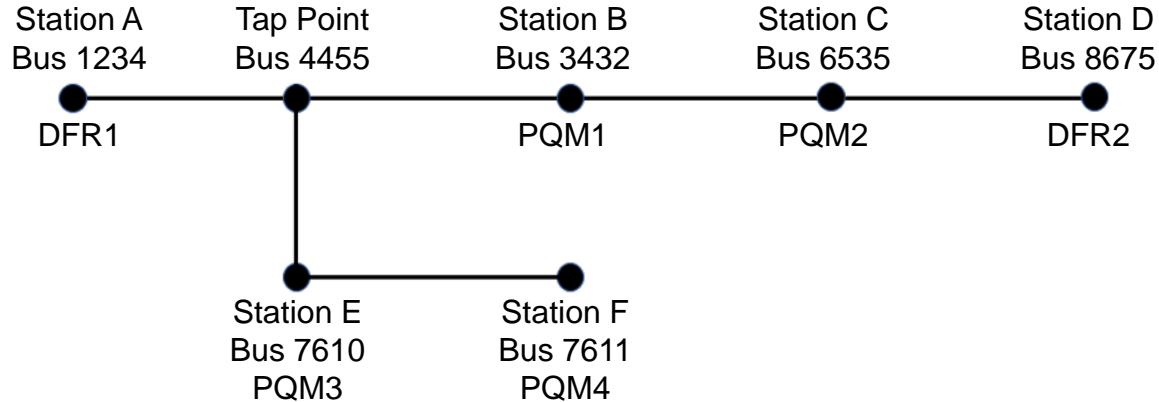


Asset Management System

B1004 = Unit ID: S5445-1004

- Mfg = ABB
- Model = 169-40-30-125-3-G
- Serial = B006090-02
- Mfg Date = 9/30/2007
- ISD Date = 4/30/2010
- Amps = 3000
- Interrupt Rating = 40kA
- Max Voltage = 169kV
- Trip Voltage = 125Vdc
- Insulating Medium = SF6
- Mfg Dwg = XA-9655

Integrating With Other Systems



Planning Models

Line 1

- Station A = Bus 1234 = End Point
- Station B = Bus 3432
- Station C = Bus 6535
- Station D = Bus 8675 = End Point
- Station E = Bus 7610
- Station F = Bus 7611 = End Point

Segment 1 (from 1234 to 4455)

- Length = 12.36 miles
- R0 = 8.48 ohms
- X0 = 28.82 ohms
- R1 = 1.35 ohms
- X1 = 8.71 ohms
- Thermal Rating = 816 amps

TVA

**TENNESSEE
VALLEY
AUTHORITY**