

① CONFIGURING RTAL-RELAY COMMUNICATIONS (DNP3)

- MAP EACH RELAYS IP ADDRESS AND DNP3 OUTSTATION ID
- THEN DEFINE THOSE IN ACCELERATOR RTAL AS INDIVIDUAL DNP3 CHANNELS UNDER THE APPROPRIATE ETHERNET PORT
- THEN ASSIGN POINT LISTS USING SEL DEVICE TEMPLATES TO STANDARDIZE MAPPING
- ONCE COMM. IS LIVE, VERIFY LINK STATUS & POLLING INTERVALS IN RTAL DIAGNOSTICS
- VALIDATE: DATA ACCURACY BY CROSS CHECKING VALUES IN GUNDEL V. RTAL
- CONFIG RTAL AS SNTP MASTER
- TEST EVENT REPORTING W/ SIMULATED CONDITIONS

② TROUBLESHOOT LOSS OF ETHERNET TO SEL-3620

- ① CHECK PHYSICAL LAYER: LINK LIGHTS, POWER, CABLES
- ② VERIFY NETWORK SETTINGS: STATIC IP, SUBNET VLAN
- ③ TEST REACHABILITY: PING, ARP TABLE, DHCP CONFLICTS
- ④ INSPECT SECURITY CONFIG: ACLS OR FIREWALL BLOCKS
- ⑤ LOGIN: INTERFACE STATUS, ERROR LOGS

OUTSTATIONS: RELAYS, RTUS
• DIFFERENTIATES DEVICES, EVEN W/ SAME IP

ARP TABLE MAPS
IP $\rightarrow$ MAC ADDRESSES
COMMON:

- TWO DEVICES W/ SAME IP = ARP CACHE POISONING
- CACHE NOT UPDATED AFTER HARDWARE SWAP $\rightarrow$ STALE ENTRY

③ MODBUS V.S DNP3 V.S IEC 61850

MODBUS: SERVER-CLIENT POLLING; NO TIMESTAMPS; SIMPLE / LIGHTWEIGHT $\rightarrow$ BASIC

DNP3: REPORT BY EXCEPTION; TIME-TAGGED EVENTS; BUFFERED SOE DATA. $\rightarrow$ ROBUST / TIME AWARE

IEC 61850: OBJECT-ORIENTED; GUNSE / SAMPLED VALUES; SUB-MS PTP COMMS $\rightarrow$ SEMANTIC / HIGH-SPEED

④ IMPLEMENTING LOAD-SHEDDING LOGIC (61131-3)

- STRUCTURED TEXT + FUNCTION BLOCKS IN ACCELERATOR RTAL
- INPUTS: BREAKER STATUS, FREQUENCY
- OUTPUTS: STAGED TRIP COMMANDS
- CREATE THRESHOLD-BASED FREQUENCY MONITORING W/ TIMED SEQUENCES
- SIMULATE LOGIC OFFLINE, VERIFY IN RTAL LOGIC ANALYZER
- FIELD-TEST W/ RELAYS IN TEST MODE FOR VALIDATION
- VERSION-CONTROL LOGIC, DOCUMENT

SEQUENCE OF EVENTS
(EA. INPUT / STATUS CHANGE)

⑤ DIAGNOSE UNEXPECTED TRIPS

- REVIEW EVENT REPORT & OSCILLOGRAPHY FOR EVENT ASSERTION ORDER
- IF [REDACTED] $\rightarrow$ LIKELY COORDINATION OR SYSTEM FAULT ISSUE
- IF INCONSISTENT $\rightarrow$ INSPECT SETTINGS, LOGIC, CT/PT RATIOS
- USE SECONDARY INJECTION TO TEST

CURRENT / VOLTAGE
TRANSFORMER RATIOS

- SCALE HIGH LTP TO SAFE LEVELS FOR RELAYS + METERS
- MISCONFIG =
 - RELAY SEES WRONG MAGNITUDE
 - VERIFY CT/PT SETTINGS MATCH PHYS. TRANS.

⑥ INTEGRATE DISTRIBUTED ENERGY RESOURCES (DER'S) SECURELY

- SEGMENT DER NETWORKS VIA SEL-3620 GATEWAYS + VLANS
- IMPLEMENT IPSec/VPN TUNNELS FOR REMOTE SITES
- USE DNP3 SECURE AUTH VS FOR ENCRYPTED UPSTREAM COMMS
- STANDARDIZE FIRMWARE, REMOVE DEFAULTS; CENTRALIZE LOGGING
- EMPLOY DNP3/IEC 61850 FOR INTEROPERABILITY
- CONDUCT NERC CIP COMPLIANCE & PEN TESTING PERIODICALLY

⑦ REVIEWING AND OPTIMIZING LADDER LOGIC

- IMPORT & RUN STATIC ANALYSIS FOR ORPHANED RUNGS OR REDUNDANT COILS
- SIMULATE W/ TEST TAGS; VERIFY TRANSITIONS + TIMERS
- CONSOLIDATE REPETITIVE LOGIC INTO REUSABLE FUNCTION BLOCKS
- SIMPLIFY NESTED INTERLOCKS FOR CLARITY + MAINTAINABILITY
- APPLY SEL NAMING STANDARDS, DOCUMENT W/ TAG COMMENTS

⑧ DIAGNOSING IEC 61850 GOOSE LATENCY W/ WIRESHARK

- CAPTURE PACKETS ON GOOSE VLAN; FILTER ETH. TYPE == 08868
- REVIEW SEQUENCE #S AND TIMESTAMPS FOR GAPS & DELAYS
- CHECK SWITCH QoS & MULTICAST PRIORITIZATION
- INVESTIGATE RANDOM LOSS → NIE DRIVERS, BUFFER OVERFLOW, PTP DRIEFT
- ENSURE LATENCY < 4 ms

⑨ COMPLEX CONCEPTS TO NON-TECHNICAL STAFF

- REAL-WORLD ANALOGIES ("RTAC IS MESSENGER OF SYS")
- REPLACE PROTOCOL JARGON W/ VISUALS AND STATUS EXAMPLES
- SHOW CAUSE-EFFECT OF EACH CONTROL ACTION

⑩ HANDLING CUSTOMER DISAGREEMENT ABOUT DEVICE FAULT

- EMPATHIZE, ACKNOWLEDGE THEIR OBSERVATION
- PRESENT DATA & EVENT REPORTS - CLEAR & CALMLY
- WALK CX THROUGH NEXT DIAGNOSTIC STEP
- FOCUS ON RESTORING CONFIDENCE, NOT PROVING FAULT

Jeff 12yrs
-SR AUTOMATION

MINE - 9yrs
-TCH REPORT

JESSE - 15yrs
-SR AUTOMATION

BREAN - HM SYS
-AUTO/APP. ENG

STUHHI - 8yrs
-AUTOMATION

NO SETTINGS
FIELD WORK
REC. NOT
DESIGN

NERC COMPLIANCE

• SPREADSHEET
- CASE MGMT
- KNOWLEDGE
BASE

RTD } MANE
ES
PH

POWER-ENG

RTAC
751
651

AUTOMATION
• GENERAL PROTOCOL
• BLUEFRAME

DER IN RTAC

BLUEFRAME → JESSE

MINE → TEAM MGMT / 61850 / DNP3 / HMI

How-to SEL WEBSITE 3401
FLIZZER 2454

SEES / SER'S →

POWER AUTOMATION INTERVIEW 9/11 LEAD - JESSE - 8 Yr. → EATON

DENVER OFFICE

- ES
- SALES

GM
MAP
SPEL

PYTHON

- GROW UP
CONFIGS.



DATA PUSH/
DIGEST

ESP. IN
BLUEFRAME



THRU MENU-DRIVEN
SYS.

→ QUIKSET, PDC

→ HYPER JOURN

↓
PYTHON

1 (EE)
PM

OIL & GAS

TOLLING

DAN - MACHINE TOOLS

PANKAJ -

RTU → REMOTE TERMINAL
UNIT

ST - STRUCTURED TEXT

[RTAC PROGRAMMING]

↳ STRUCTURED
SUBSTATION

↳ CREATE
ARRAY

GRID CONNECT SYS

↳ LIBRARIES ARE WORKING LOWER

SECURITY, NETWORKING,
COMMUNICATION

30-45 Yr GAP IN BUZZ/CONCEPTS

REVERSE ENG. COMMON

SPECIFY IN PROPOSAL WRITING
IS HIGH

IS IEDS → INTELLIGENT
TAGS AUTOMATED
CONTROLS → DEVICES

NETWORK TRANSLATION

- ISOLATE

CLOS CERT

RESORT / COGS / COHEN / PANKAJ BATTERY

- ENCRYPTION
EMBEDDED IN FRAME
- SOFTWARE DEFINED
NETWORKING
- AIRGAPPING
- SEL - 24x7
- VPN TUNNEL

A CUSTOMER LANGUAGE

A FLEXIBILITY

- SALES REP.
- CONNECTION TO
ENG.

FROM → BUZZ

SEL INTERVIEW PREP - POWER AUTOMATION

IEC 61850

SUBSTATION SETUP

- SINGLE LINE DIAGRAM ←
- PROTECTION, CONTROL, AUTOMATION REQ. ←
 - FUNCTIONAL + EQUIPMENT
- SCADA COMMUNICATION + SIGNAL LIST ←
- PHYSICAL SWITCHYARD ARRANGEMENT

IMPACTED

- COMM. ARCHITECTURE
- DEGREE OF FUNCTION INTEGRATION
- OBJECT MODEL
- NAMING CONVENTION
- COMMUNICATION SERVICES
- ENGINEERING PROCESS
- TOOL REQUIREMENTS

SYSTEM CONFIGURATION LANGUAGE (SCL)

• FUNCTIONALITY OF SYSTEM

- SINGLE LINE
- PROCESS HIERARCHY
- FUNCTION/SUB-FUNCTION HIERARCHY

• COMMUNICATION

- NETWORK CONFIG.
- INFORMATION EXCHANGE

• DEVICES

- IED CONFIG
- IED DATA MODEL

AREAS THAT NEED ADDRESSED

• INTERFACES

- PROCESS INTERFACE
- SCADA INTERFACE / CONTROL CENTER
- SERVICE / MAINT. ACCESS

• CONSTRAINTS

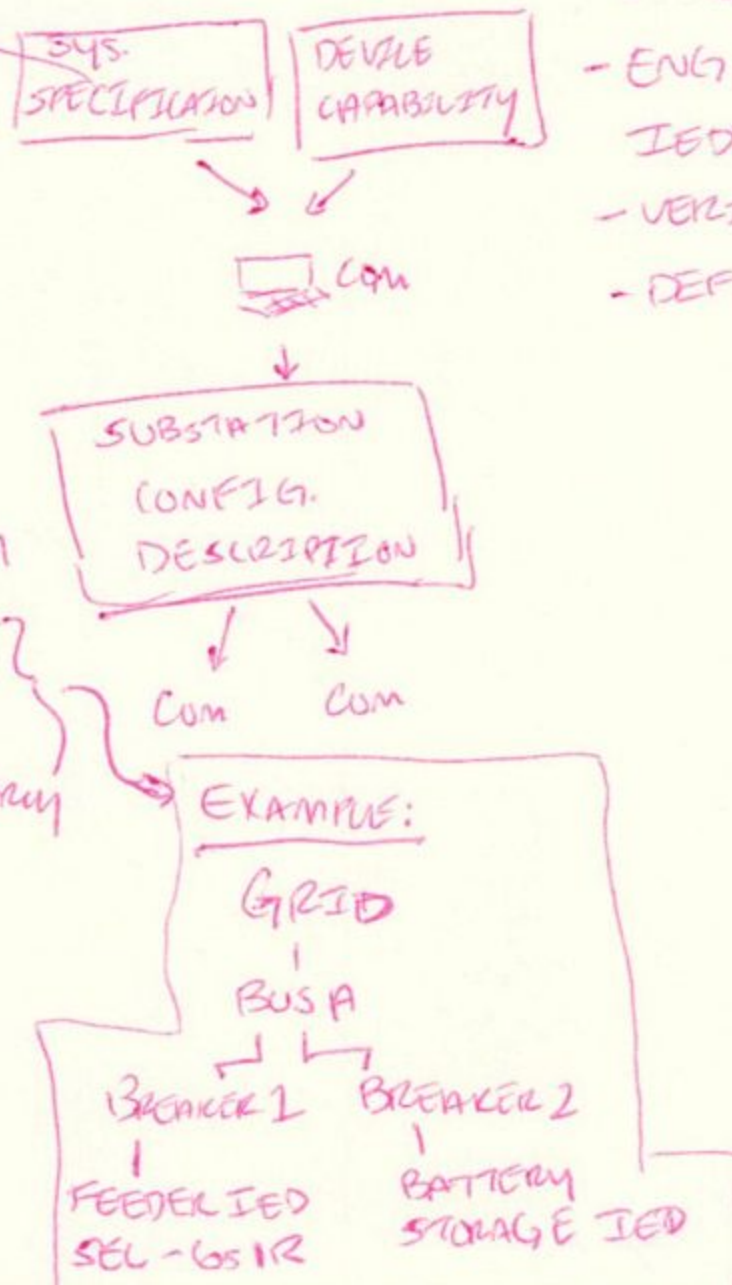
- OPERATOR ROOM BAY HOUSES, PULTS
- POWER SUPPLY SYSTEM

- ★ - RE-USE OF NON-61850 COMPLIANT GEAR

SYSTEM INTEGRATOR

- SELECT IEDS
- REVERSE ENG. SIGNAL LIST
- DESIGN COMMUNICATION NETWORK
- DESIGN DETAILS OF SCHEMES
- ENG. INFORMATION FLOW B/W IEDS AND CLIENTS
- VERIFY COMM. ARCHITECTURE
- DEFINE SYS. TEST SPECIFICATION

61850 ENG. PROCESS



- BALANCE B/W SEL + LEGACY/COMPETITOR SYS. INTEGRATION?

IED → DNP3 → TCP/IP → SCADA → OPERATOR

- HOW OFTEN ARE WE REVERSE-ENG SIGNAL LOST?

- COMMON GAPS/SURPRISES?

- HOW STANDARDIZED ARE PROTECTION & AUTOMATION SCHEMES? LIKE AUTO-RECLOSE OR LOAD TRANSFER W. CUSTOMIZED FOR EACH FEEDER?

- PROCESS/WORKFLOW FOR VALIDATING NEW SCHEMES OR DEVICE SETTINGS BEFORE GO-LIVE?

- WHAT INTEGRATION STEPS ARE REMOTE V. IN-PERSON? ACCURACY & SAFETY IN EACH CASE?

- SINCE THERE ARE A LOT OF BACKGROUNDS ON THIS TEAM, WHAT SKILLS OR EXPS HAVE YOU FOUND MOST CRIT. FOR SUCCESS?

- BONUS: BATTERY STORAGE CHARGE/DISCHARGE LOGIC?

- STILL USE GOOSE FOR PTP TRIPS & INTERLOCKING?

- ISLANDING & INTERLOCKING

SEL/IED FILE

DEFINES FULL

CONFIG OF

SUBSTATION ILL.

- LOGICAL NODES

- DATA POINTS

- COMMS MAPPING

SEL: GOSSET

SCADA

SUPERVISORY CONTROL + DATA ACQUISITION

- BUILD HMI

- ALARM/EVENT HANDLING

- OPERATOR CONTROLS

- DATABASE OF POINTS & TAGS

DNP3

COMM. PROTOCOL B/W

IED & SCADA

- MAP POINTS

- SET ADDRESSING

- POLLING UNSOLICITED BEHAVIOR



DNP3 CONFIG

1. SET IED ADDRESS

2. COMM MODE

- TCP/IP OR SERIAL

- SET PORT #'S, IP

ADDRESS, SUBNET MASK

3. MAP IED TO DNP3 POINTS

- BREAKER OPEN → BINARY INPUT 1

- OVERCURRENT TRIP → BINARY INPUT 2

- VOLTAGE READING → ANALOG INPUT 1

4. REPORT STYLE

SEL

THE BEST WAY TO PROTECT THE FUTURE
IS TO INVENT IT - ALAN KAY



↑ VOLTAGE FOR
DISTANCE

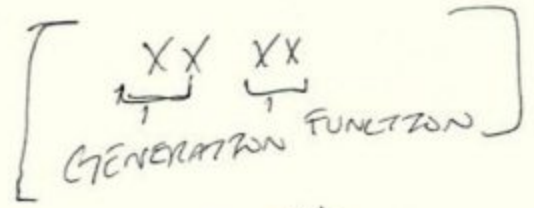
↓ VOLTAGE

↓ VOLTAGE

↓ VOLTAGE

STEP-DOWN
TRANSFORMER

~ AUTOMATION, SAFETY, ~



UNIT #'S

750 EE'S
22 COUNTRY
100+ APPLES

→ CIRCUIT BREAKER → OUTLET SWITCHES

1994 - ISO 9001 CERT

- INFA SERVICES + GUV → GW CONTRACTS

- MY: SAN WIS POST

WD / -WEEKDAY

- 2004: LAKE ZURICH, IL

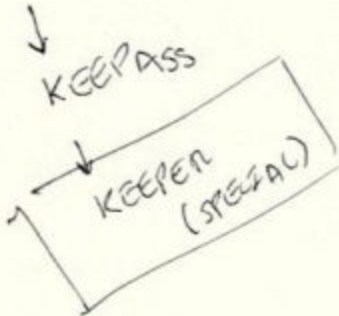
NEW SOFTWARE /
+ SOFTWARE
CENTER

- 2009: ESOP

- 2012: LEWISTON

- 2020: PURDUE, IN

- 2023: MOSCOW (PEBS)



REVIEW (DETECTRON 2)
VISION SYS.

ADRIAN GENZ
VP - QUALITY
(RATEGY)
FELLOW START

ARC FLASH PROTECTION
• LIGHT SENSOR

THUMBPRINT:
- EE AGENCY -

SCHED:
6A - 3P? 10A - CLASSES

6/11 - RACHEL GEIER ZORTON - MIL. GUY.

DAVE → EMAIL ABOUT NIGHT @ SEL

BILL KING → SECURITY DIGITAL

FRANK → PHOT → FBI → SEL

TABUE

AMBER BEROGUE
JP MCANALLY
BRIAN FURCH

• PRESCRIPTION SAFETY GLASSES

• STEEL TOE (9100)

• SHIP PLAN to OEAR

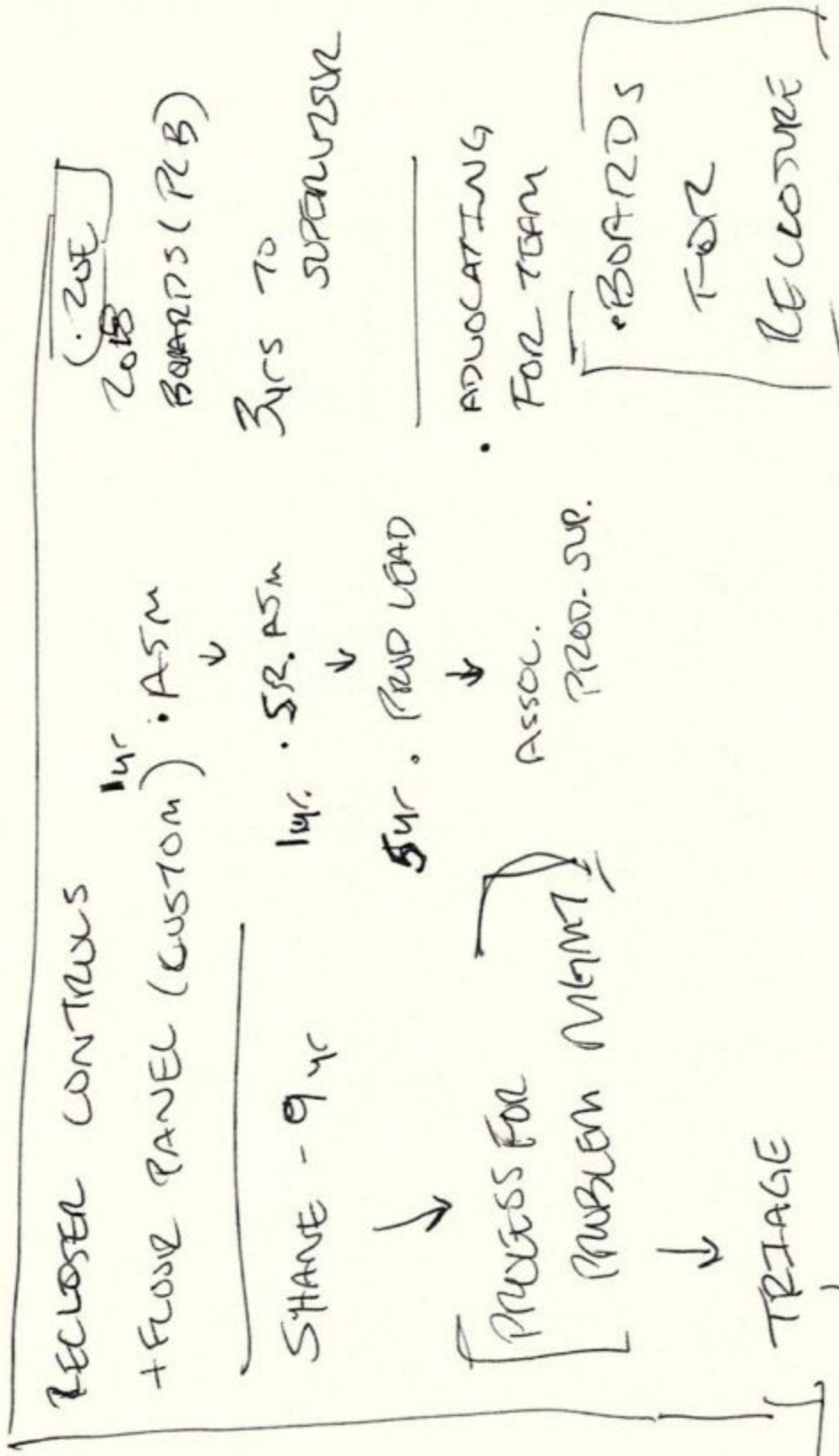
EXAMINER

W7 IMPROVEMENT

SEL

Q:

- LAST PERSON PROMOTED
- WHATS THE SEL VALUE THAT YOU REMEMBER MOST/
- GROWTH? → WAFERS



WORK → EVERYDAY MATTERS

TRIAE

CUSTOM CABINET →

VENDOR MGMT

EXPEDITE

EVALUATE TO FACTORY MTR WHEN

CANT MEET QUOTA

REL DENSE CONN

CELL/BOARDING/WL/MNGR

FUNCTIONAL
OPS/FACTORY
ENG/DESIGN

OE WCM (NON-UNION)

DEUTATED

1043 AGO

BACK TO WCM

PROO RUSH → 202