VELCO's Operator Training Simulator (OTS)

Randy Ettori

VELCO SCADA/EMS Engineer

rettori@velco.com

vermont electric power company
VELCO

VELCO's OTS

- Project Timeline
- Comparison with Real System
- Calculations Developed
- Completed Training
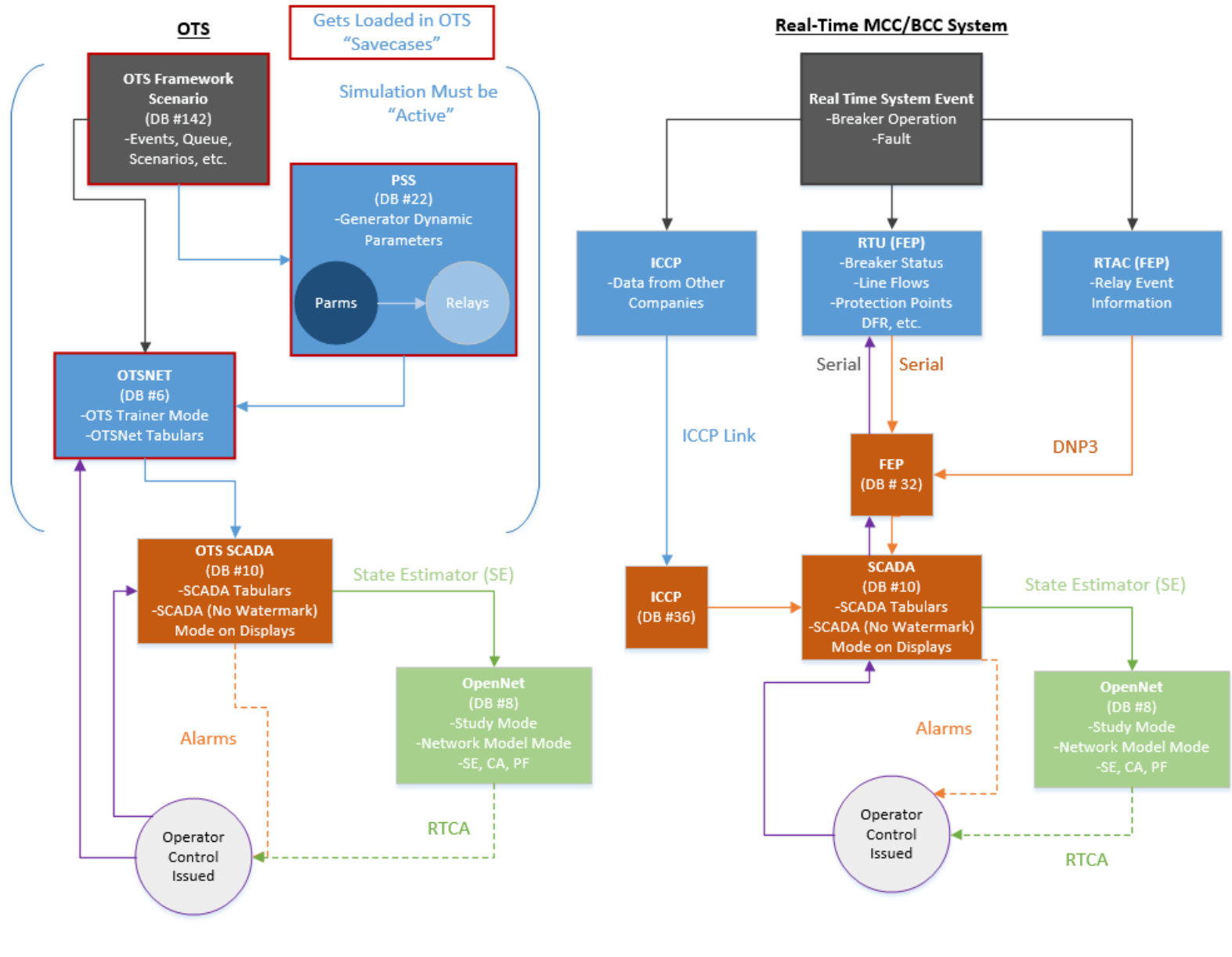- Safeguards
- OTS Maintenance Practices
- Future Uses

OTS Project Timeline

- 11/20/2018 – Kickoff Meeting
- 4/1/2019 – SCADA Vendor Onsite
- 7/1/2019 – VELCO EMS Finishes Software Testing
- 10/22/2019 – First Delivery of OTS Driven Training
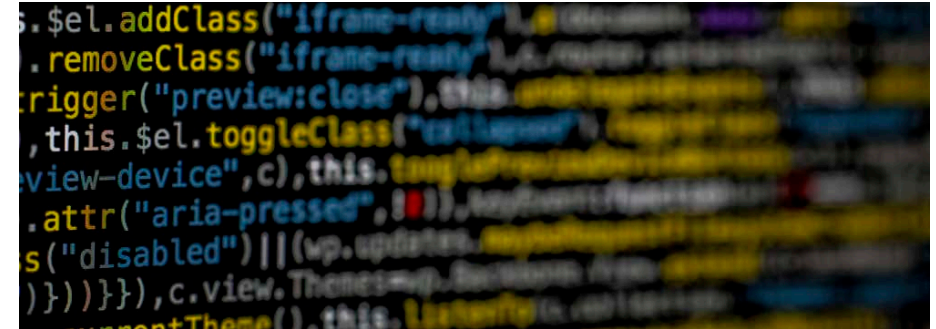- 11/13/2019 – GridEx V

Relating the OTS to the Real-Time System

- Model VS Real System
- Operator Actions and Feedback
- Specialized Equipment/Alarms

OTS Custom Calculations/Scripts Examples

- ## Battery Voltage Decay
  - Station batteries aren't modeled
  - Trainer override
- ## VELCO STATCOM
  - Complex behavior
  - Requires different alarming based on configuration
  - Prioritized capacitor switching
  - Capacitor discharge timers
  - Capacitor Bank "hunting" alarms

Completed OTS Training

- Cycle Three OTS training scenario
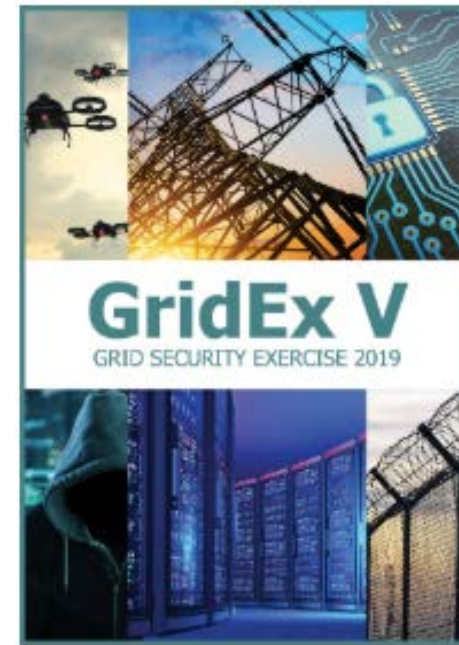- GridEx V

Cycle Three Training

Preliminary OTS training scenario:

1. Switching and Tagging for a planned outage.

2. Routine system monitoring with changing load levels

3. Unplanned outage of transmission line

4. Take action to mitigate overloads/violations

5. Debrief

GridEx V (November 2019)

- About GridEx
  - Biennial NERC Grid Security Exercise
  - Exercise Incident Response Plans
    - Cyber threats
    - Physical threats
  - Local and Regional Response
  - GridEx IV had 6,500 Participants, 450 organizations
  - First GridEx took place in 2011
  - Goal: Lessons Learned

VELCO and GridEx IV (2017)

- GridEx IV
- Relied on Development SCADA/EMS System
- Issues:
  - No "live" SCADA data
  - No true controls
  - Great Deal of EMS Support/Intervention

VELCO and GridEx V

- OTS was utilized
- Advantages:
  - SCADA values update from solved model data
  - Operator controls are consistent with production
  - GridEx Scenarios
    - Much easier to configure
    - Executed on timers or manually triggered
  - GridEx scenarios can be easily tested

Safeguards Against Inadvertent Controls

- Watermark
- Production Extra Sign-on
- Control Box Color
- Trainer Procedure
- Training Room Permissions

VELCO OTS Maintenance Practices

Databases

- Sync from Production
- Run scripts to make data applicable for OTS

Displays

- Transferred as they are updated*
- OTS Specific displays
  - Custom built for the Operations Trainer

- *Freeze Periods
  - No changes made to OTS
  - Scenario/Simulation Construction
  - During training cycles

Future Use Cases

- New System Operator Qualification Training
- Black Start/System Restoration Training (February 2020)
- EMS Personnel Training and Qualification

Pre-OTS System Operator Qualification Training

- Previous Training Methods:
  – Mentor delivers the OJT to the Trainee
  – Trainee Confirms Understanding of the OJT
  – Trainee discusses with Evaluator and describes actions to be taken
  – Evaluator verifies proper steps using the Task Qualification Sign-off (TQS)

OTS System Operator Qualification Training

- OJT will be delivered
- TQS will be completed on OTS
  - Consistent
  - Clear whether or not the actions met the criteria
  - Easy to document results
- Advantages:
  - Issue controls and observe effects
  - Run study cases on outages
  - Switching and Tagging Training
  - OTS changes do not alter real system

Black Start/System Restoration Training

- Currently Using BRICK simulator with ISO-NE and other LCCs
- This year OTS and BRICK
- OTS requires subtransmission actions

EMS Personnel Training

- Previously:
  - Custom save-cases
  - Real-time
- Issues:
  - The model is continually changing
  - Real-time issues are inconsistent

- OTS:
  - We can create base cases for tuning scenarios
  - No risk of inadvertent changes
  - Follow real-time tuning procedures