SDN Project

• **Objective**
  – Develop a FlowController to address Energy sector needs
  – Interoperable with SDN switches
  – Produce the benefit documentation

• **Schedule 2013-2016**
  – Selection of open source controller - Done
  – Publish industry benefits whitepaper - Done
  – Final commercial release – March 2016 with intermediate releases
  – Industry testing and validation results – Oct 2016

• **Software-Defined Networking (SDN)**
• OpenFlow
• Control Plane vs. Data Plane
• FlowController
• Traffic Engineering

• **Performer:** SEL
• **Partners:** Ameren, PNNL, UIUC
Collaboration

• **PNNL**
  – Threat modeling
  – Negative testing

• **Ameren**
  – Functional scope
  – Commercial product testing

• **UIUC**
  – Develop flow validation app

• **SEL**
  – Flow controller development
  – Energy sector quality testing
Need for Clean Sheet of Paper

- Code complexity
- Visualization
- Configuration
- Dynamic admin protocols
- Cybersecurity
Software-Defined Networking (SDN)

- Centralize control plane technology
- Provide application interface
- Simplify hardware
- Improve interoperability
- Traffic engineering freedom
SDN Project Components

Flow Validation (SDN Project)

Network Visualization (SDN Project)

Configuration Programming (SDN Project)

Network OS (OpenDayLight)

Watchdog

Watchdog

Watchdog

Watchdog
SDN in Operation
Advancing the State of the Art
Improving Reliability

- Deny-by-Default
- Traffic Engineering
- Reducing complexity
- Deep packet inspection
- System wide visualization
- Maximizing product efficiency
- Design and test network flows like power flows
Challenges to Success

- **Central communications to the FlowController**
  - Traffic engineer at commissioning to N-1 or greater
- **Industry education**
  - Industry benefits whitepaper and application notes
Challenges to Success

- **FlowController redundancy**
  - Server failover and clustering topologies
- **Testing and validation tools**
  - Flow validation application
Progress to Date

• Selection of OpenDayLight as FlowController
• Virtual testbed configured and running
  – Virtual switch fabric and traffic generation
• Industry benefits whitepaper published
Progress to Date

- System specifications authored
- Development team staffed and working
- Test labs setup at PNNL, UIUC, and SEL
- First commercial release target for Q1 2015
  - Industry request and align with Watchdog Project commercial release
Next Steps

• Develop and commercially release the SEL-5056 flow controller
• Develop the flow validation application
• Complete SDN test labs for Energy sector reliability testing