SDN Project

Cybersecurity for Energy Delivery Systems Peer Review

August 5-6, 2014

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
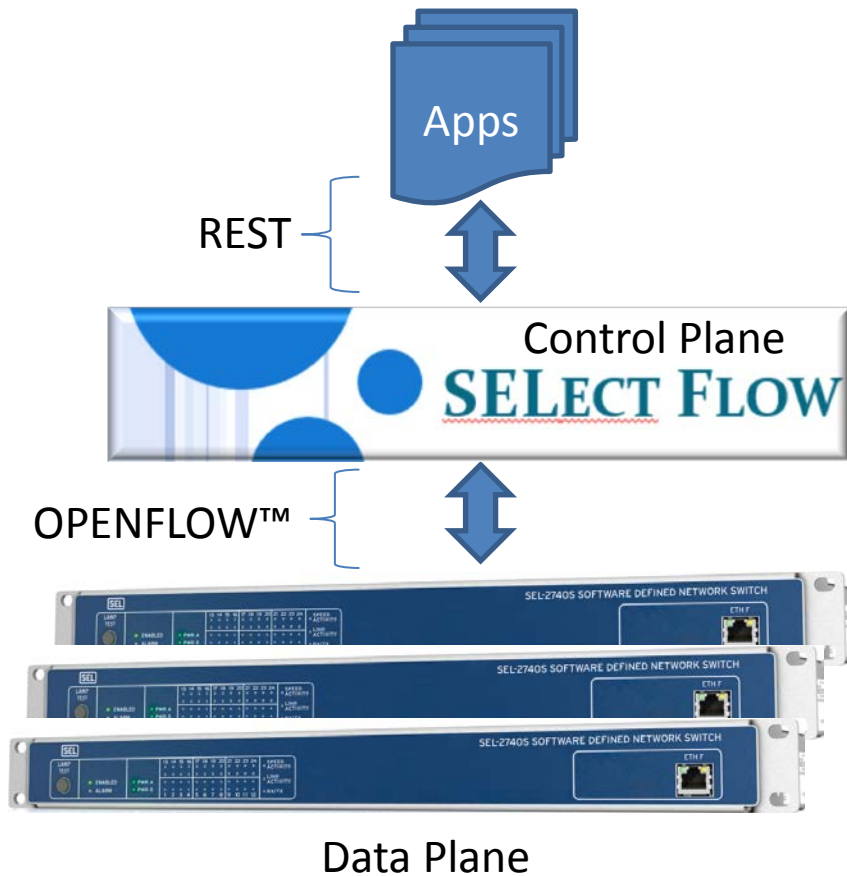 - Energy sector quality testing
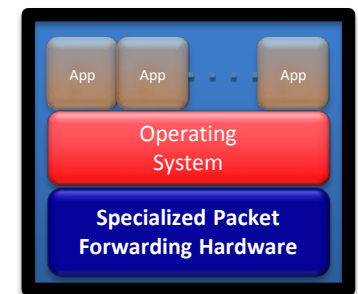
Need for Clean Sheet of Paper

- Code complexity
- Visualization
- Configuration
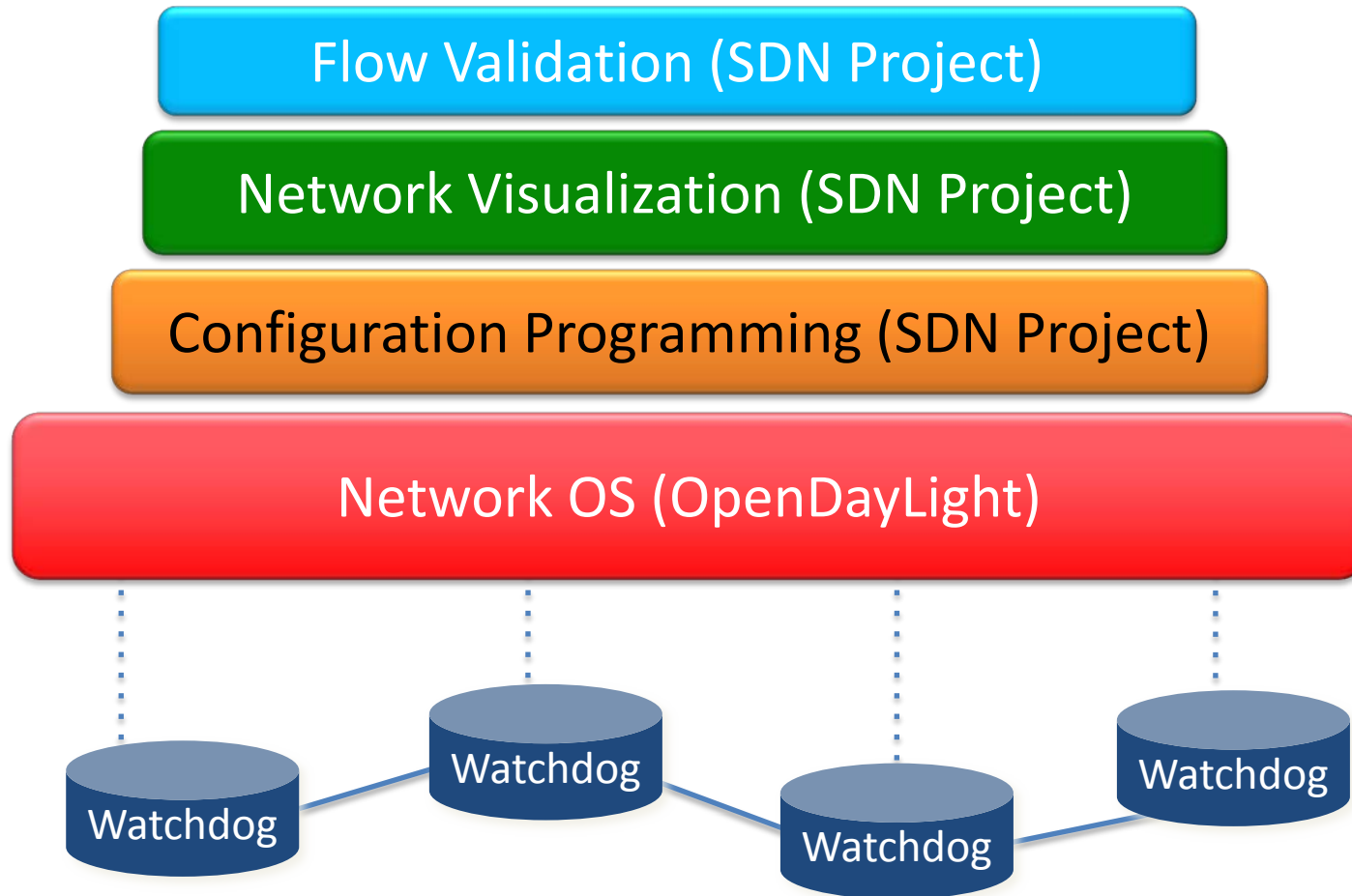- Dynamic admin protocols
- Cybersecurity

Software-Defined Networking (SDN)

REST

Apps

Control Plane

SELect Flow

OPENFLOW™

Data Plane
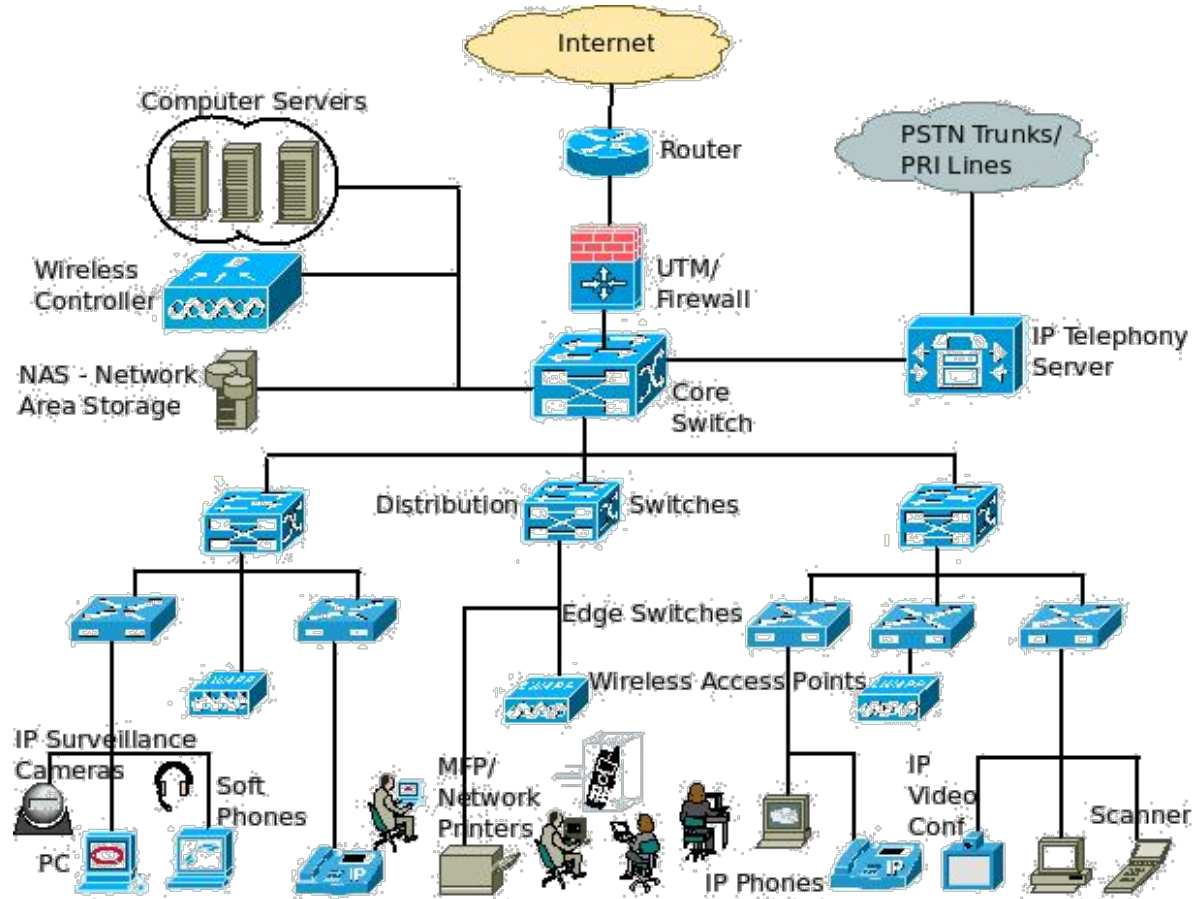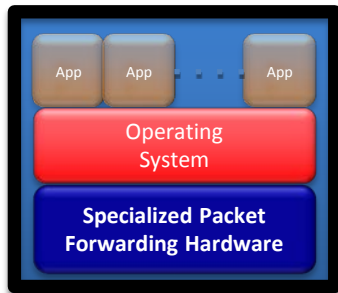
- Centralize control plane technology
- Provide application interface
- Simplify hardware
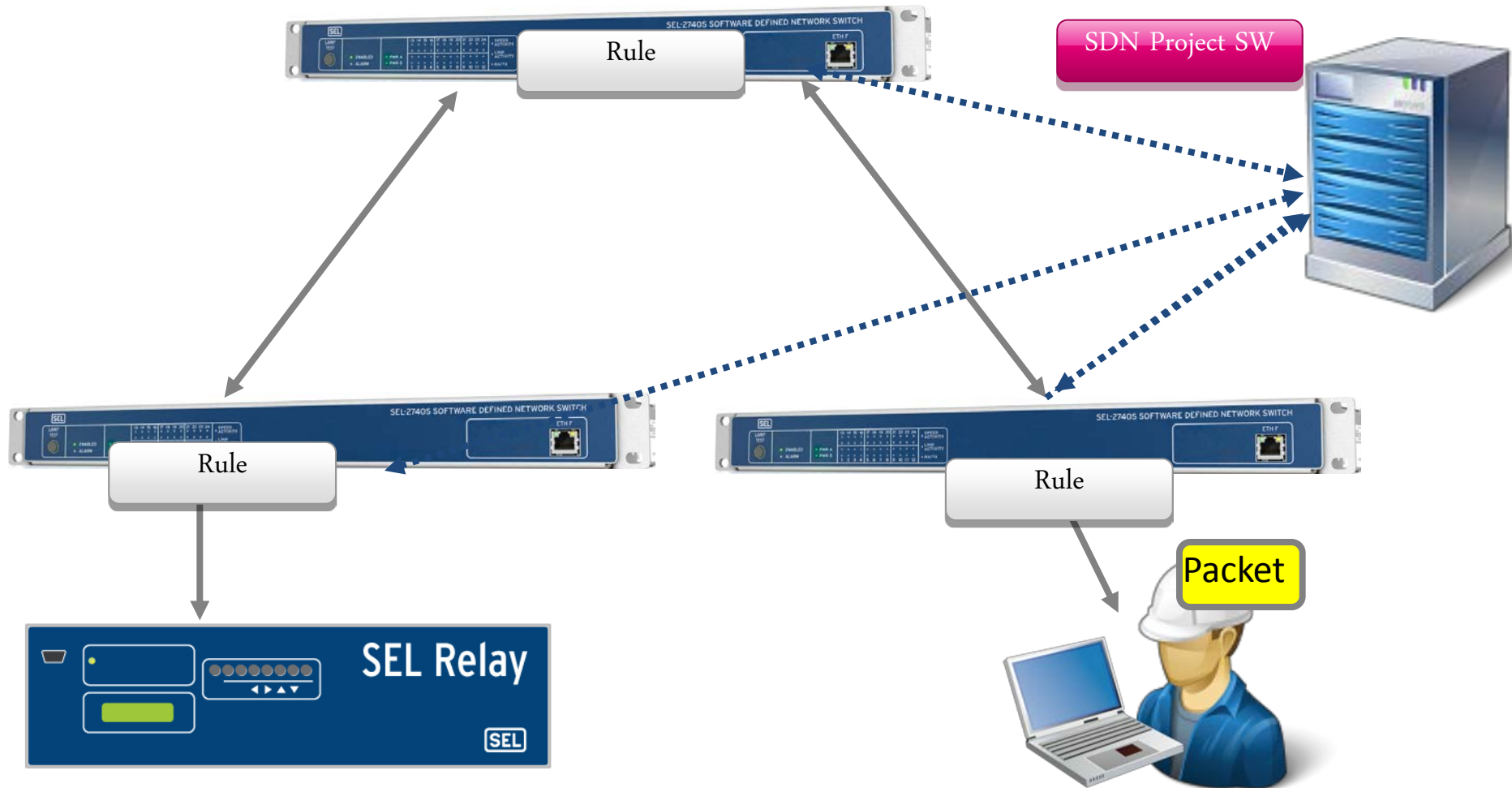- Improve interoperability
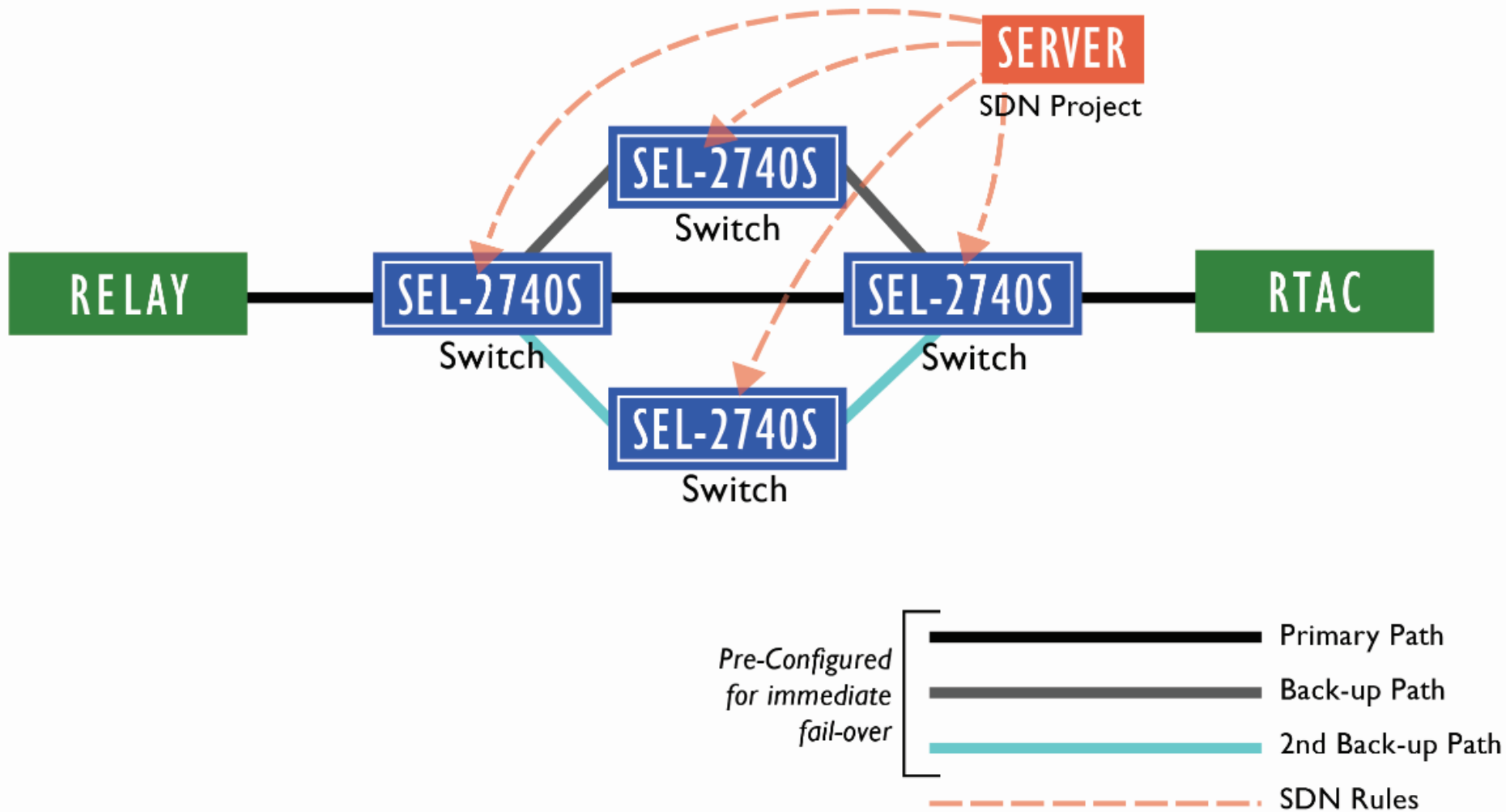- Traffic engineering freedom

SDN Project Components

SDN in Operation

SDN Project SW

Rule

Rule

Rule

SEL Relay

Packet

Software Defined Networking SDN

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

- **Selection of OpenDayLight as FlowController**
- **Virtual testbed configured and running**
  - Virtual switch fabric and traffic generation
- **Industry benefits whitepaper published**

Software-Defined Networking Addresses Control System Requirements

Rakesh Bobba, *University of Illinois at Urbana-Champaign*
Donald R. Borries, Rod Hilburn, and Joyce Sanders, *Ameren Illinois*
Mark Hadley, *Pacific Northwest National Laboratory*
Rhett Smith, *Schweitzer Engineering Laboratories, Inc.*

Abstract—Networking is a central, often essential, function in critical infrastructure... priority control, and support of multiple services all running ... channel. However ...

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**