SCHWEITZER ENGINEERING LABORATORIES

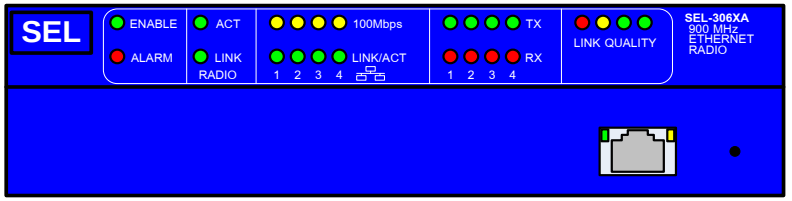
Secure SW-Defined Radio Project

Cybersecurity for Energy Delivery Systems Peer Review

August 5-6, 2014

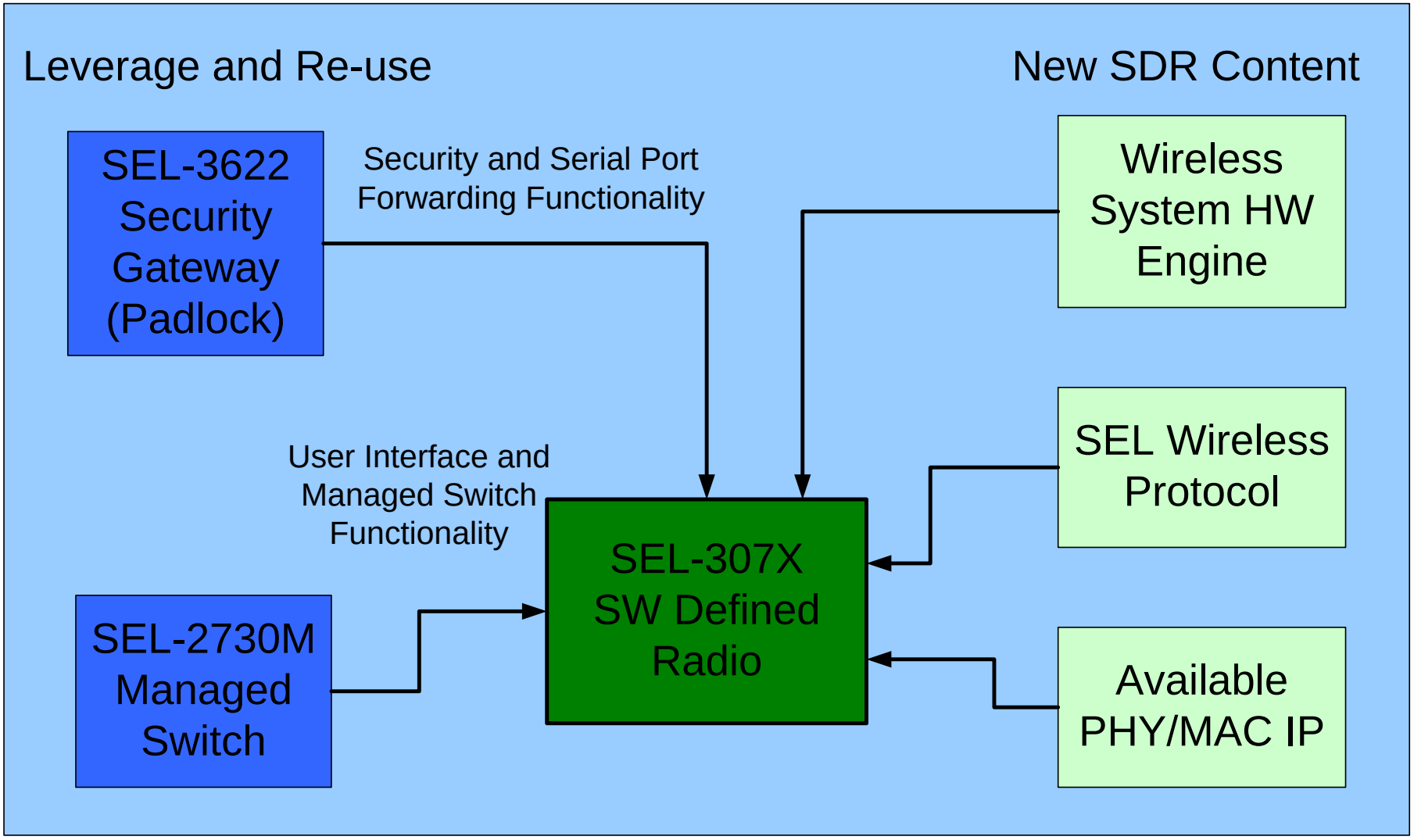
Summary: Secure SW-Defined Radio

- **Objectives**
  - Provide Last Mile wireless network security
  - Enhance throughput, latency and link range for advanced distribution automation
  - Develop a scalable radio platform
- **Schedule**
  - Q4 2013 thru Q4 2016
  - 1st Proto Feb 2015
  - Field Trial Q2 2016
  - SDR Production release Q4 2016



- **Performer:** SEL
- **Partners:** SDG&E, PNNL

SW-Defined Radio System Concept



SDR Integrated Security Features

- **From SEL-3622 Security Gateway (Padlock)**
  - Secure Data Transport
  - Secure Access Control
    - Authentication, Authorization, Accountability
  - Protected Device Management
- **From SEL-2730M Ethernet Switch**
  - Secure Web Interface
  - L2 Traffic Management, VLAN Tagging, MAC Address Filtering, Message Prioritization
  - SysLog, NTP Client, SNMP

Wireless Network Attributes

- **Dynamic TDMA frame resource allocation**
  - Demand based UL/DL sub-frame partitioning
- **Dynamic channel access**
  - Need based access provides efficient support for large number of radios in a network
- **Variable modulation and coding for high system throughput**
- **Spectrally efficient OFDM PHY**
- **Data prioritization to minimize latency for time critical user data**

Industry Benefits

- **Enhanced wireless network security**
  - Integration of Padlock and Watchdog Security Features in advanced radio platform
- **High throughput wireless network capability**
  - Synchrophasor data collection, video, file transfers
- **Low latency for advanced distribution automation applications**
  - GOOSE traffic, and transfer trip applications

Challenges to Success

- **Performance, Feature and Project Scope Tradeoffs**
  - Work with SDG&E on core features and priorities
  - Adopt multiple release product/feature rollout plan
  - Identify first release features
- **High Data Throughput and low latency for short messages over long link distances**
  - Creation of customized TDMA wireless protocol
- **System cooling for robust industrial applications**
  - Specifying Automotive and high temp range components

Progress to Date

- **Major Accomplishments**
  - Aligned with SDG&E on product concept
    - Security and Wireless Network Features
    - Product Instances
    - Wireless System Performance Requirements
  - Created Draft System Specification
  - Created Industry Benefits Guide White Paper and Use Case documents
  - Create Wireless Protocol Architecture Description
  - Selected Radio System Processing Architecture

Next Steps for this Project

- **Project Planning**
  - Detailed task estimation and schedule development
  - Resource planning
  - Development progress and issue tracking
- **Product Development**
  - Detailed system design specifications
  - Wireless network architecture and system design
  - Prototype HW development
  - Application FW porting and integration
  - Wireless System PHY/MAC/Link and Network Layer implementation