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Enhancing Power Plant Safety Through Simulated Cyber Events

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Overview

- By integrating mod/sim capability with a NPP simulator, we believe it is possible to enhance the safety and security of power plants with digital components by evaluating operator response to malicious exploit of the underlying plant digital architecture.
- This research will identify operator response to cyber events to provide a basis for improvement
 - Improved operating procedures
 - Enhanced operator training
 - Platform for advance cyber security analysis

R&D Milestones

Year 1

- Develop SCEPTRE/Emulytics plant cyber model
- Couple plant cyber model to NPP simulator and Test
- Develop cyber-attack scenarios
- Begin planning experiments

Year 2

- Develop and run experiments for plant operators

Scope

- Include “spoofed” data
 - Astute observation. This is a key component in the operator research.
- Limit scope to cyber-attack
 - The LDRD scope will be limited to cyber-attack

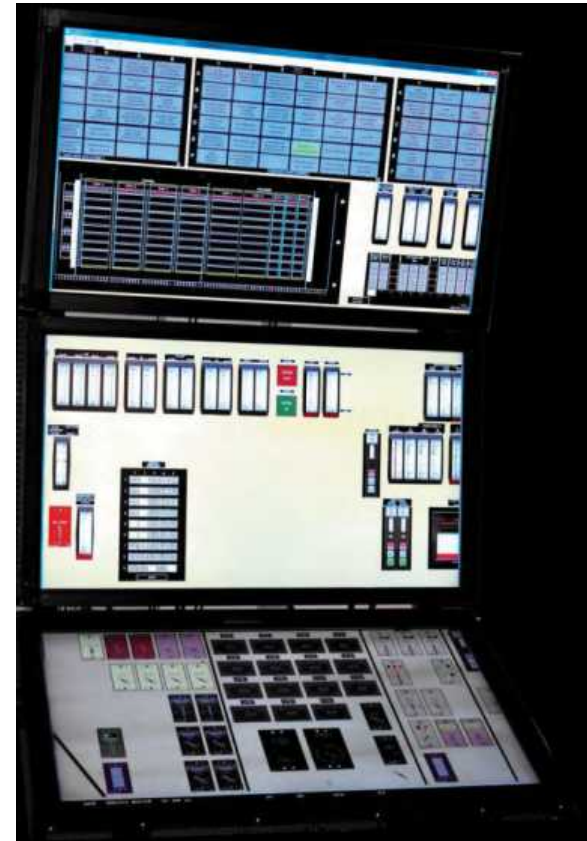
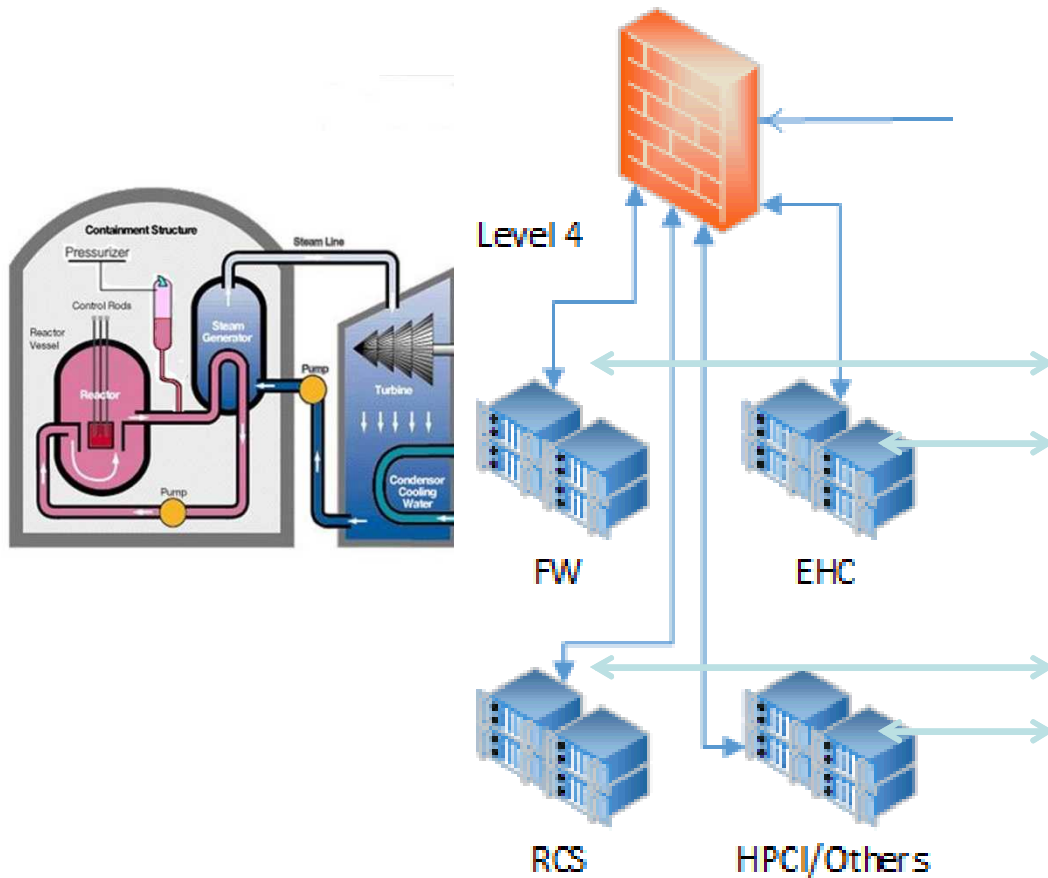
R&D Approach

- Develop model of digital architecture with Sandia's SCEPTRE tool and Emulytics™ and couple with a nuclear power plant (NPP) training simulator
 - Architecture for emulated environment will be derived from plant drawings and plant and industry SMEs
- Experiments
 - **Assess operator characterization of plant status**
 - **Assess operator actions and plant safety**
 - Assess operator workload to determine how burdened and cognitively tasked they are

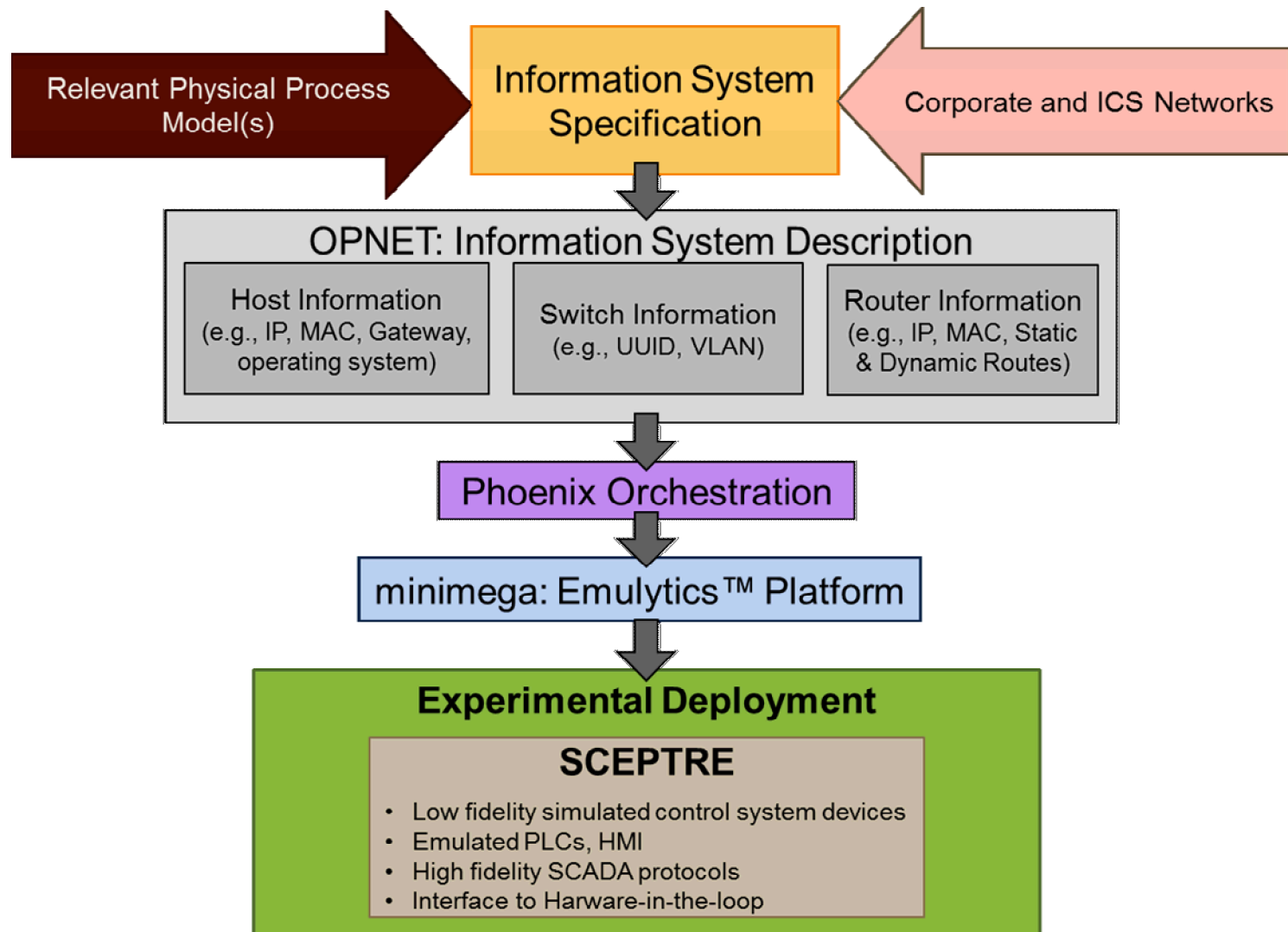
Human Factors Methodology

- Applied Cognitive Task Analysis
- Task Diagram
- Knowledge Audit
- Simulation Interview
- Critical Decision Method
- Data Collection Methods
 - Simulator data
 - Eye tracking
 - Interviews
 - Video

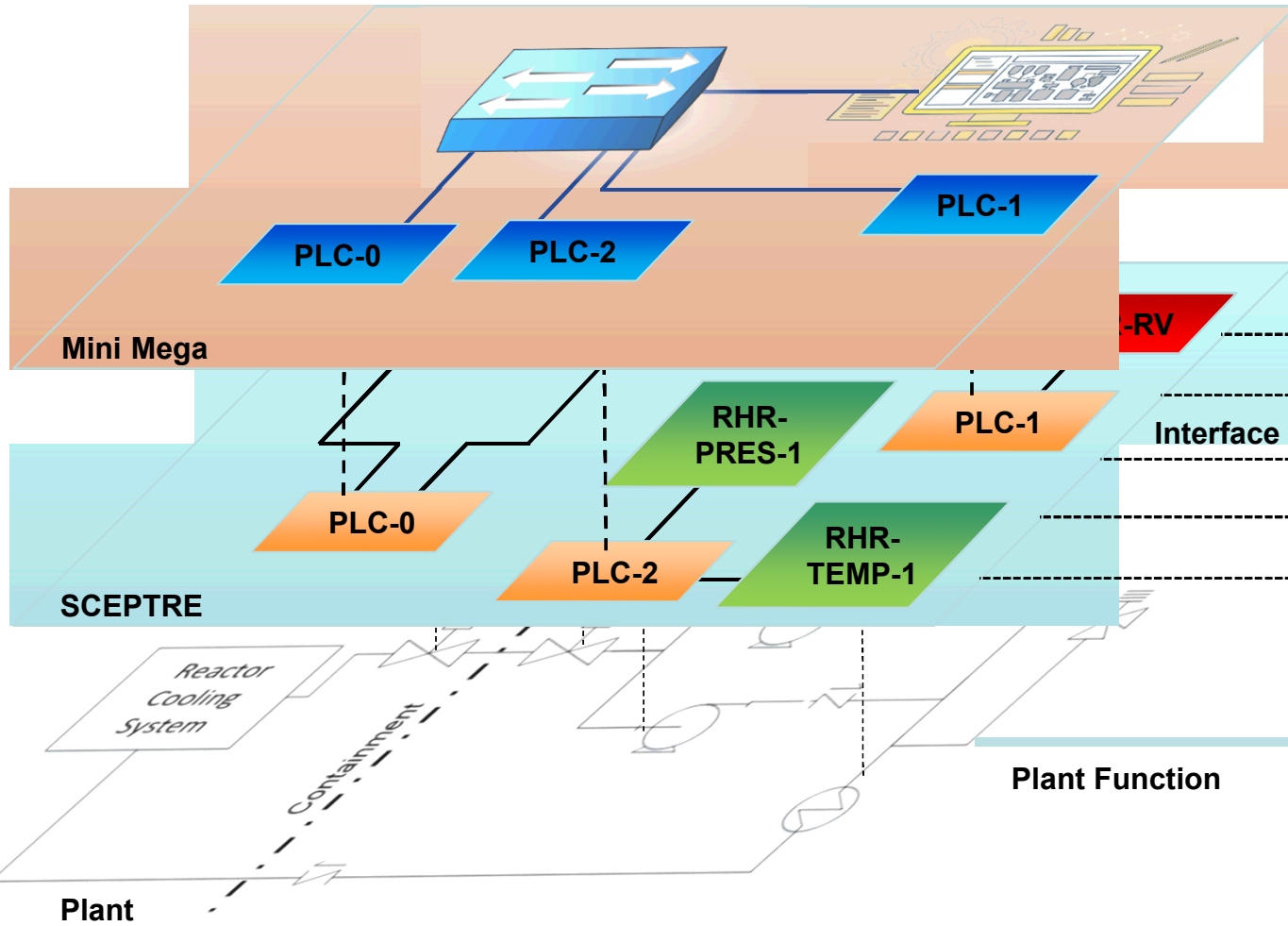
Cyber Modeling and Simulation Integrated Platform - SIMulytics



SCEPTRE Development Pipeline



SIMulytics Platform



NPP Simulator



Scenarios

- Interfacing System Loss of Coolant Accident (IS-LOCA)
 - Looking at two scenarios for IS-LOCA
- Loss of Feedwater
- Loss of Feedwater Heaters

Questions?



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