2013 DHS S&T/DoD ASD (R&E)
CYBER SECURITY SBIR WORKSHOP

CRITICAL RESOURCE AND VULNERABILITY ANALYSIS OF CYBER-PHYSICAL SYSTEMS

Knowledge Based Systems, Inc.

Dr. Ronald Fernandes, Senior Research Scientist
Ms. Biyan Li, Software Architecture

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Homeland Security
Science and Technology

Company Profile

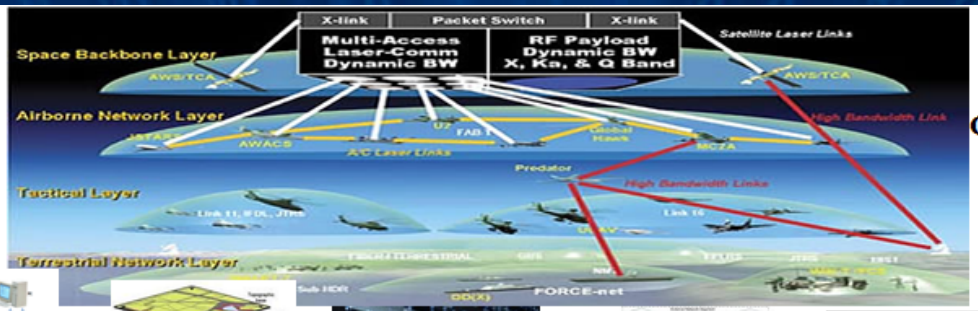
- KBSI has been serving DoD, prime contractors and other federal agencies since 1988 in the research and development areas of
  - Industrial Engineering & Operations Research
  - Artificial Intelligence & Intelligent Agents
  - Data Mining & Knowledge Discovery
  - Systems Engineering Methods & Tools

Customer Need

- ***Problems or opportunities***:
  - Increased Vulnerability due to increasing co-dependency among cyber, physical and electromagnetic domains
  - Lack of automated mapping and dependency analysis among CPES system

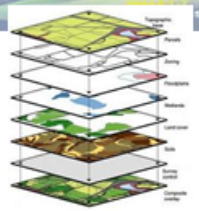
- ***Markets:***
  - Avionics Vulnerability Analysis and Mission Assurance applications in military domain
  - Different levels of homeland security (federal, county and local level) for critical infrastructure protection, emergency preparedness and protection for natural disasters, man-made safety hazards, and terrorism
  - Utility companies

Approach



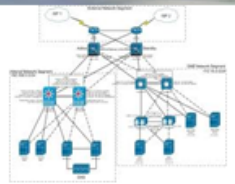
Cyber-Physical-EM domain

Avionics network metadata

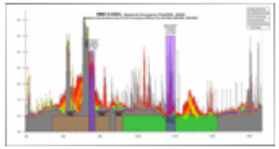


GIS metadata & data

Cyber metadata

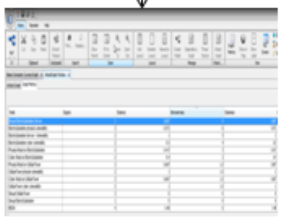


Network metadata



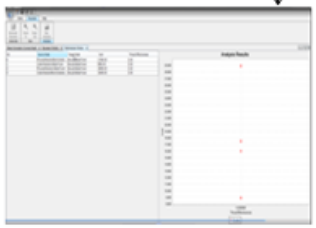
EM Spectrum

Ontology-driven mapping and critical resource identification



Critical Resource ID using Graph Metrics

Bayesian Analysis



Impact & Risk Analysis

Mitigation/Protection

Attack Path / Dependency Analysis

Approach

- Automated extraction of interdependencies among cyber, physical and magnetic systems
- Special treatment of electromagnetic spectrum domain in its relation to cyber and physical domains
- Ontology-based reference model that represent deep domain knowledge for automated extraction and analysis
- Critical Resource Identification
- Impact and Risk Analysis
- Mitigation and Protection

Benefits

- Cyber-Physical-EM system (CPES) modeling and automated independency mapping
- Topological vulnerability analysis using different methods
- Mitigation and protection strategies analysis
- Single application for multi-function
  - critical infrastructure protection and
  - vulnerability analysis in a cyber-physical environment
  - Integrated tool from mapping to vulnerability /risk analysis to visualization

Current Status

- Currently, at the end of SBIR Phase I; submitted Phase II proposal
- Prototype in use at AFRL

Next Steps

- Actively working with consultants for technology transition into DoD and other government agencies
- Actively working with a private company for commercialization opportunities

Contact Information

- Dr. Ronald Fernandes, Senior Research Scientist, rfernandes@kbsi.com
- Ms. Biyan Li, Software Architect, bli@kbsi.com
- 1408 University Drive East, College Station, TX 77840
- 979-260-5274
- http://www.kbsi.com/