## **Anomaly Detection in Multilayer Networks**

#### **Challenge:**

Early detection of anomalies in an integrated system of heterogeneous inter-dependent networks

- The Internet, the power grid, financial, transportation, and other networks, are mutually dependent and synergistic effects may lead to cascading phenomena.
- Communication and traffic across networks may differ in nature/ capacity.

## **Solution:**

- Use distributed methods for anomaly detection, sharing non-sensitive information across and within networks.
- **Develop** mathematical models to understand and optimize the efficiency and accuracy of the detection methods.

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**Network Science** Study topologies /interconnections of lavers Provide multi-layer structures for simulation Mathematical modeling Develop model on information sharing Optimize decision framework Cybersecurity **Privacy** Secure ways of information Detect anomalies by only sharing sharing, applicable to the model non-sensitive information Oil / Gas Compressor Station **Fuel Supply** Electric Power Power Plant

#### Communications Switching Office Substation End Office Transportation Water Emergency Banking & Services Finance Fire Station ATM Federal Check Government Services Pension/Service

ayments Treasury Dept.

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#### **Scientific Impact:**

- The project offers the ability to identify coordinated attacks on heterogeneous systems and understand how damage spreads between layers
- Sharing of information within and among layers improves detection efforts, all while preserving privacy
- The project lays the path for extending single-network security algorithms to multi-layer networks.

### **Broader Impact:**

- The unified view of many cyber and physical critical systems can increase the protection of national infrastructure
- The project introduces algorithms and models with the potential to evolve into applied protocols
- The project introduces undergraduate CS students to cybersecurity and network http://www.empcommission.org/docs/A2473-EMP Commission-7MB.pdf science research