Naming, Twinning, and Observing—Towards Cyber-Physical Systems Spanning Administrative and Geographical Boundaries

**Challenge:**
Lack of fundamental CPS network services results in:
- no application flexibility (hard-wired IP addresses)
- difficult service discovery across application and system domains
- unclear data storage, query processing, and access control model

**Solution:**
Design network services to enable CPS applications that are cross-domain, handle evolving infrastructure, and span geographical and administrative boundaries.

**Contributions:**
1. Cross-domain directory for device metadata
2. Naming model & resolver for large-scale CPS
3. Decentralized storage service for sensor data

**Scientific Impact:**
Common network services could improve dependability and longevity of applications interacting with large-scale, evolving and heterogeneous CPS systems.
Service-oriented architecture allows faster design, software development at scale, and an ability to test against various network and environment conditions.

**Broader Impact:**
Help developers design dependable CPS systems and allow third-parties to test such systems. Dependability and testing is increasingly important as CPS/IoT systems become pervasive.

Example: Power grid infrastructure with secure device metadata and sensor data storage services could be black-started in days rather than weeks in case of a network-based cyber attack.

Education & outreach: The project supports 2 PhD students and two REU students (summer 2021).

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