Reliability of Physical Systems and Trustworthy Information

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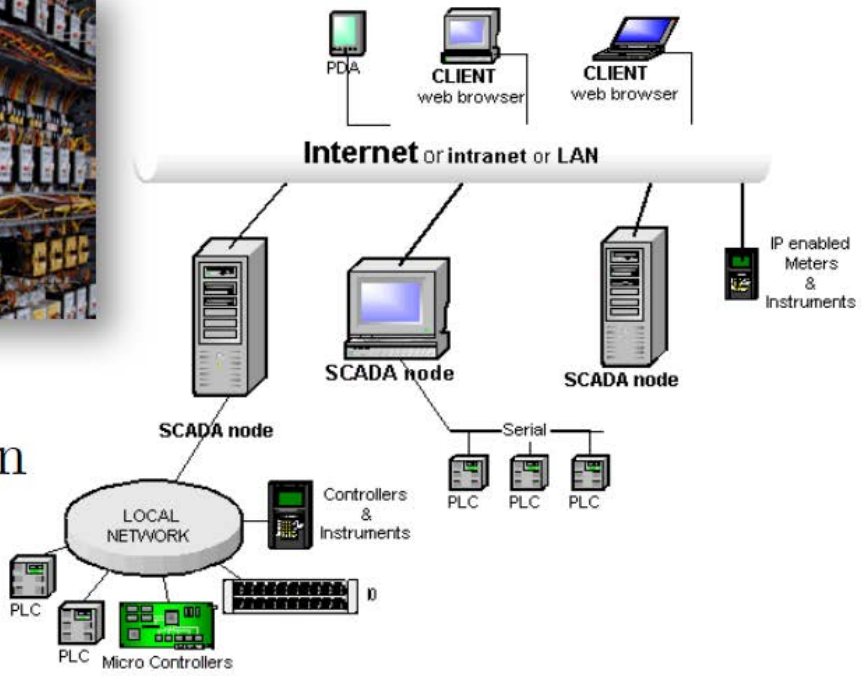
Information and Control

Industrial Automation



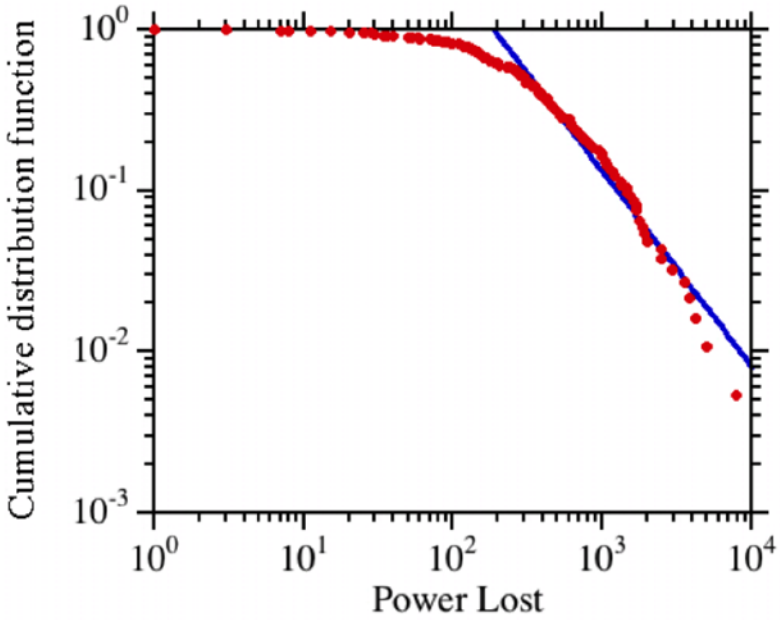
- Electric Power Systems, Pipelines (Water, Fuel), Building Control, Manufacturing plants use Ethernet + Internet to gather information
- Hacking has not been a factor in their design

Examples of networked control

- Transportation Networks
  - Flow control (traffic lights, tolls) and myopic driver decisions
  - Feedback to the users → service latency
- Communication Networks
  - Resource allocation → decentralized
    - Internet, cellular, Wireless Local Area Networks
  - Feedback to the users → service latency
- Power Systems Networks
  - Resource allocation centralized at large (>100mW) and long term scales (15 min.)
  - Feedback to the users → black out

The scale of power lost in an event

- Cascading failures have a heavy tail distribution



The system has reserves for one large failure We do not have good technology to island the system

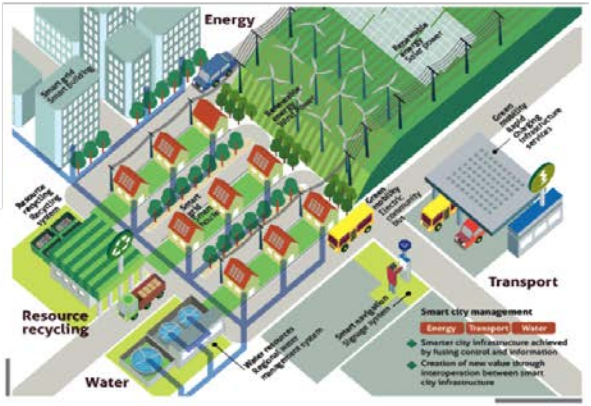
NERC Version 5 Critical Infrastructure Protection (CIP) Reliability Standards (ORDER NO. 791)

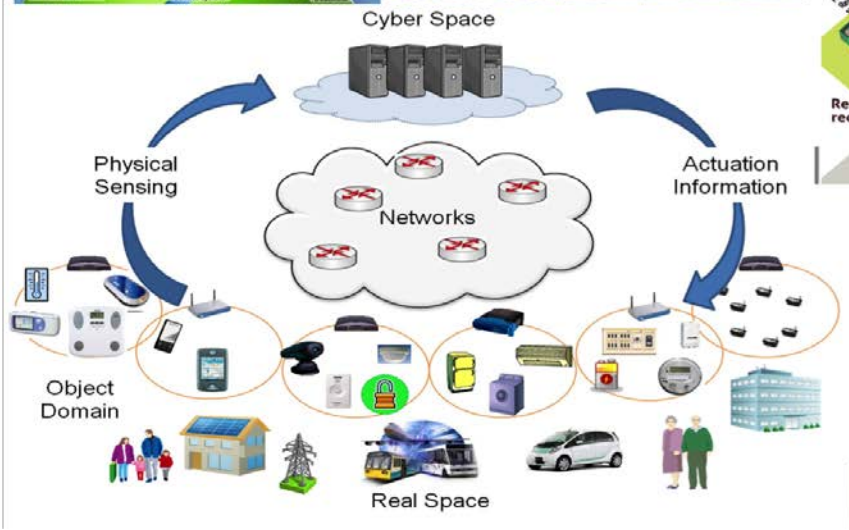
Phases of a cyber-physical attacks:

1. Target and position to breach network
2. Leverage breach and expand reach
3. Execute malicious commands & impair restoration

- NERC Rules to manage safely and isolate from external attacks “Electronic Security Perimeter”
  - Could have prevented the recent Ukraine attack, diminishing spearfishing threat
- Conceived for the bulk power system….

Trend: Smart infrastructures





Placing intelligence in the edges:

- Greater situation awareness and control
- Attack surface larger