

The Complexity of Infrastructure Interdependencies

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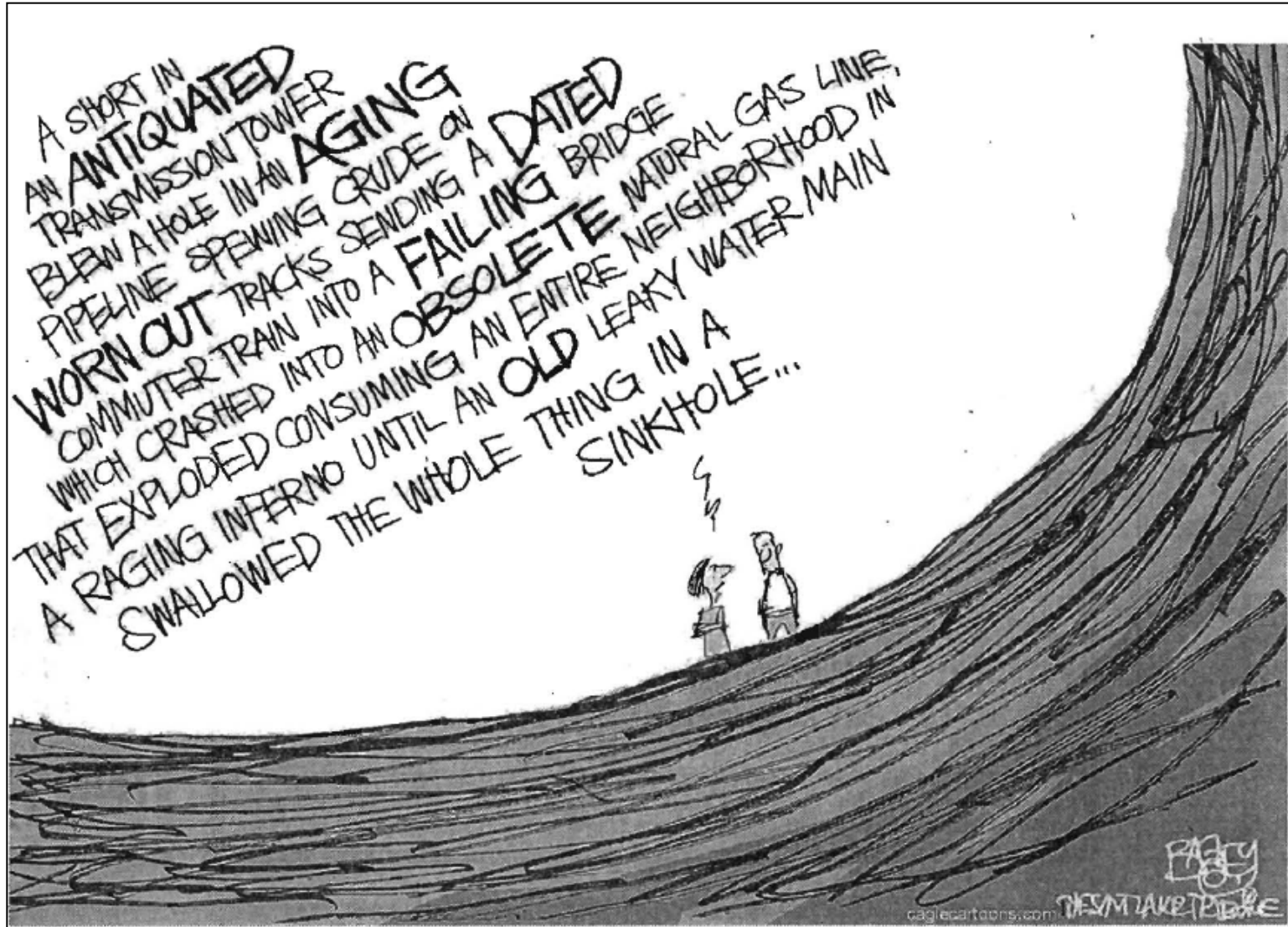
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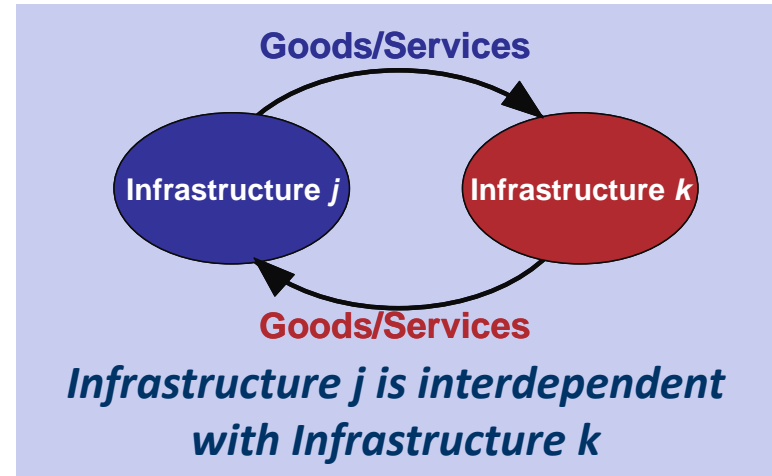
A Glimpse at the Problem



How Do We Define Interdependencies?

- **Definition:** mutually reliant relationship between entities (objects, individuals, or groups)
- Eighteen Critical Infrastructure and Key Resources (CIKR) to consider
- CIKR includes physical, cyber, and/or human elements
- A series of incidents (natural or man-made) could interact (cascade) across critical infrastructures to degrade the service upon which all depend

Infrastructure Interdependencies



Critical Infrastructure and Key Resources

Critical Infrastructure Sectors

- Energy
- Transportation Systems
- Banking and Finance
- Chemical
- Postal and Shipping
- National Monuments and Icons
- Agriculture/Food
- Water
- Public Health
- Emergency Services
- Defense Industrial Base
- Information Technology
- Telecommunications
- Critical Manufacturing

Key Resources

- Commercial Nuclear Reactors
- Dams
- Government Facilities
- Commercial Facilities

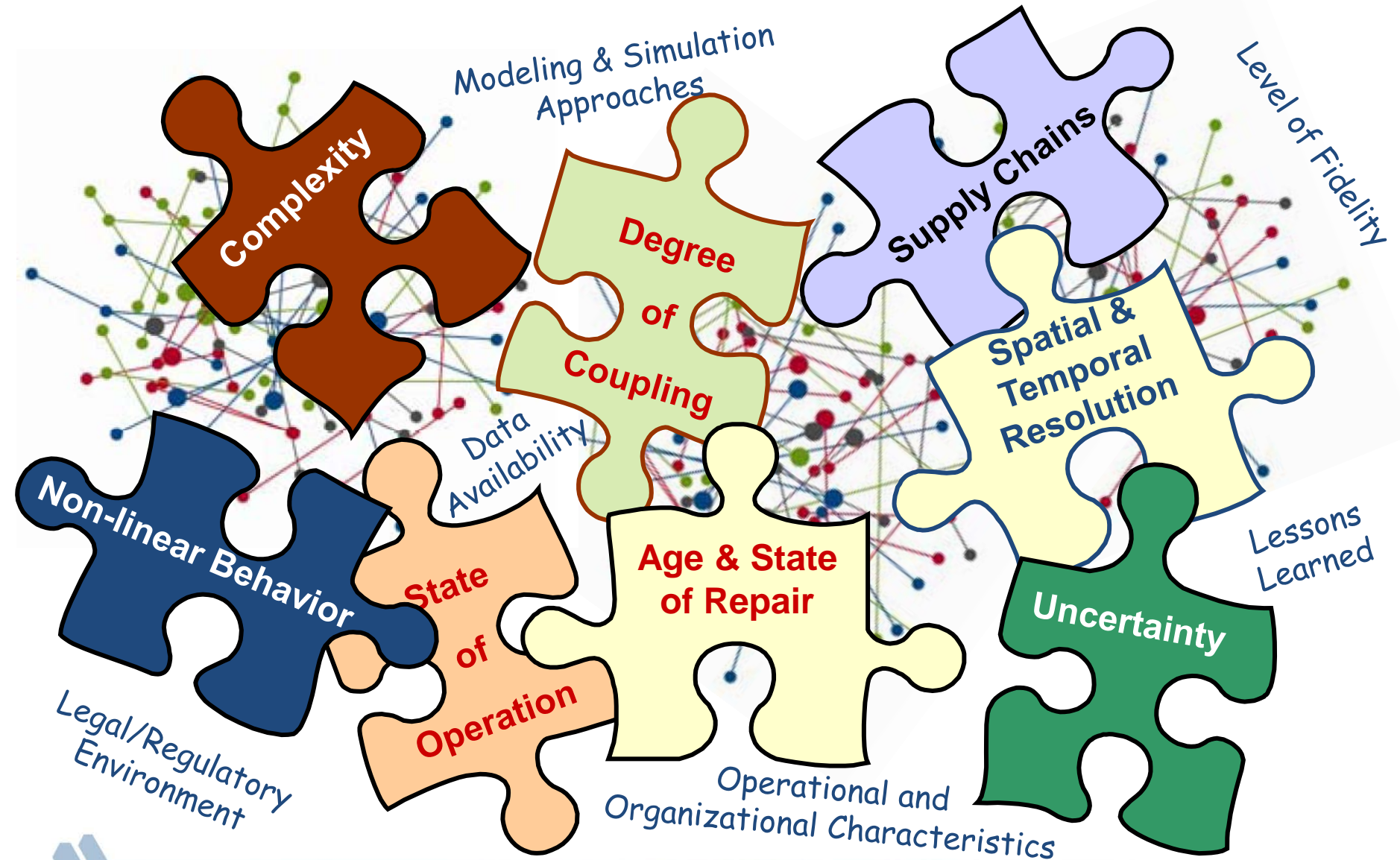
What Do We Know About Infrastructure Interdependencies?

- **Interdependencies are intuitive, but often not easily identified and without well-defined borders**
- **Our increasing reliance on information technology and telecommunications has increased interdependencies**
- **Interdependencies transcend individual public and private-sector organizations**
- **Infrastructure linkages vary significantly in scale and complexity — local, regional, national, global**
- **Despite progress, gaps exist in our capability to analyze multiple contingency events involving interdependent infrastructures**
- **Data are often limited and sensitive/proprietary**

Understanding interdependencies requires a “system-of-systems” perspective



What Factors Need to be Considered When Addressing Infrastructure Interdependencies?



What Actions Can Be Taken to Mitigate Potential Interdependency Problems?

- **Identify internal and external infrastructure assets, systems, and networks that, if lost or degraded, could adversely affect performance – and how they are connected**
- **Study natural disasters and incidents to gain insight into interdependencies problems and solutions**
- **Develop contingency plans to deal with cascading outages (conduct “what if” analysis)**
- **Identify how backup systems and other mitigation mechanisms can reduce interdependencies problems**
- **Address security in contractual arrangements (you are only as secure as your suppliers and distributors)**
- **Collaborate, cooperate, participate, and exercise**
- **Avoid “failure of imagination”**



What Are Possible Next Steps?

- **The problem is difficult**
- **We all agree that we need to consider interdependencies in making CIKR protection and resilience investment decisions, but there is no silver bullet**
- **Data and modeling issues are complex**
- **Where do we start?**

