

Network Science

Barabási: Ch. 1 — Introduction

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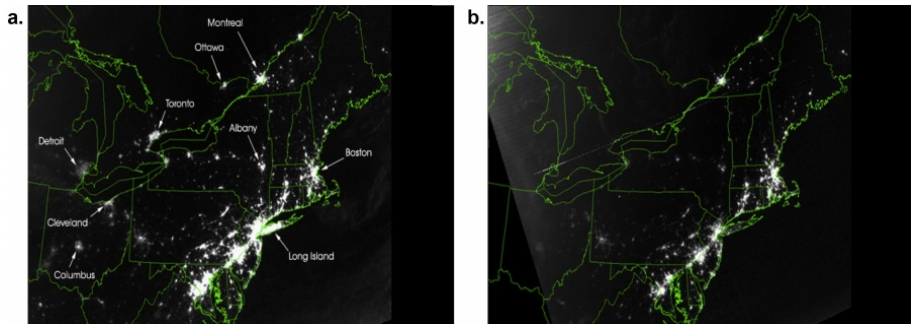
Summary

- 1 Vulnerability from Interconnectivity
- 2 Networks at Heart of Complex Systems
- 3 Two Forces Helped Emergency of Network Science
- 4 Characteristics of Network Science
- 5 Impact of Network Science
 - In Society
 - In the Scientific Community

Vulnerability from Interconnectivity

2003 Blackout in North America

a. Previous night; **b.** Blackout night.



Interconnectivity:

- Efficient use of resources
- Failure may affect far away places

Networks at Heart of Complex Systems

- Society: billions of individuals
- Communication: billions of cell phones, computers, satellites
- Brain: billions of neurons
- Biology: thousands of genes and metabolites

Hard to grasp whole looking at components

Goals toward complex systems:

- understand
- describe (mathematically)
- predict
- control

Networks Behind Complex Systems

There are networks behind every complex system:

- Cellular network: cells
- Neural network: brain
- Social network: society
- Communication networks: communication
- Power grid: electricity
- Trade network: exchange of goods and services

Common set of fundamental laws and principles

Two Forces Helped Emergency of Network Science

Two Forces Helped the Emergence of Network Science

Data availability:

- Maps
- Visual and non visual
- Complete description
- Usually in digital form

Universality:

- Similar characteristics
- Same organizational principles

Characteristics of Network Science

Characteristics of Network Science

Interdisciplinary Nature

Data Driven Nature

Quantitative Nature

Computational Nature

Impact of Network Science

Impact of Network Science in Society

- Economic
- Health
- Security
- Epidemics
- Neuroscience
- Management
- Scientific

Scientific Impact of Network Science in Society

- Highly cited papers, funding, journals, books

