Social Network Analysis

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Some pictures have been used from the following books:
(This is only for learning purpose)

Social Media Mining by Zafaranai et al,
Network Science by Barabasi
Networks, Crowd, Behaviour by Kleinberg et al

“For the last thirty years, empirical social research has been dominated by the sample survey. But as usually practiced, using random sampling of individuals, the survey is a sociological meatgrinder, tearing the individual from his social context and guaranteeing that nobody in the study interacts with anyone else in it. It is a little like a biologist putting his experimental animals through a hamburger machine and looking at every hundredth cell through a microscope; anatomy and physiology get lost, structure and function disappear, and one is left with cell biology....If our aim is to understand people’s behavior rather than simply to record it, we want to know about primary groups, neighborhoods, organizations, social circles, and communities; about interaction, communication, role expectations, and social control ”

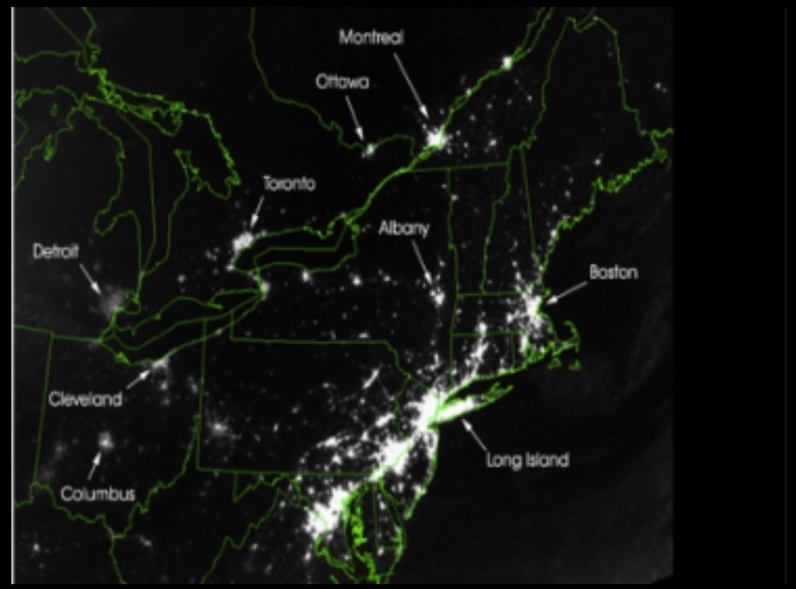
– Allen Barton (Sociologist)

Social Network Analysis

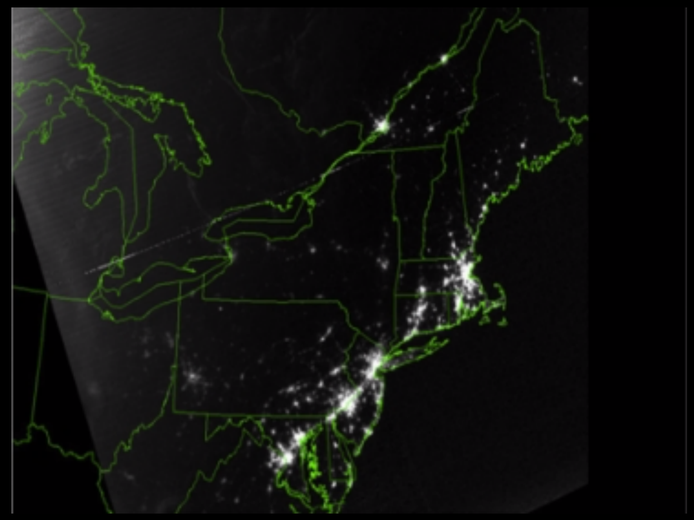
- Some social research has consistently focused on the social relationships linking individuals rather than on the individuals themselves. The kind of research that examines the links among the objects of study is called structural.
    - Astrophysicists, for example, study the gravitational attraction of each planet in the solar system on each of the others in order to account for planetary orbits.
    - Molecular chemists examine how various kinds of atoms interact together to form different kinds of molecules.
    - Electrical engineers observe how the interactions of various electronic components—like capacitors and resistors—influence the flow of current through a circuit.
    - Biologists study the ways in which each of the species in an ecosystem interacts with and impinges on each of the others.
- In social science, the structural approach that is based on the study of interaction among social actors is called social network analysis. The relationships that social network analysts study are usually those that link individual human beings.
- Important social relationships may link social individuals that are not human, like ants or bees or deer or giraffes or apes. Or they may link actors that are not individuals at all. Network analysts often examine links among groups or organizations—even among nation-states or international alliances.

2003 North American blackout

- Satellite image of the US Northeast on August 14, 2003
- An estimated 45 million people in eight US states and another 10 million in Ontario were without power
- Example of a Cascading failure



- Examples of cascading failures:
  - Internet - DoS attack
  - Cascading events in financial systems - Economic meltdown in 2009-2011



Pictures from Network Science by Barabasi

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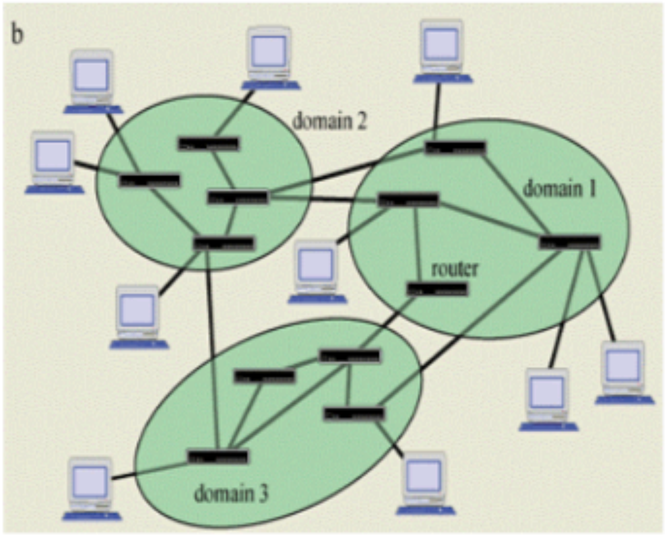
We got him!

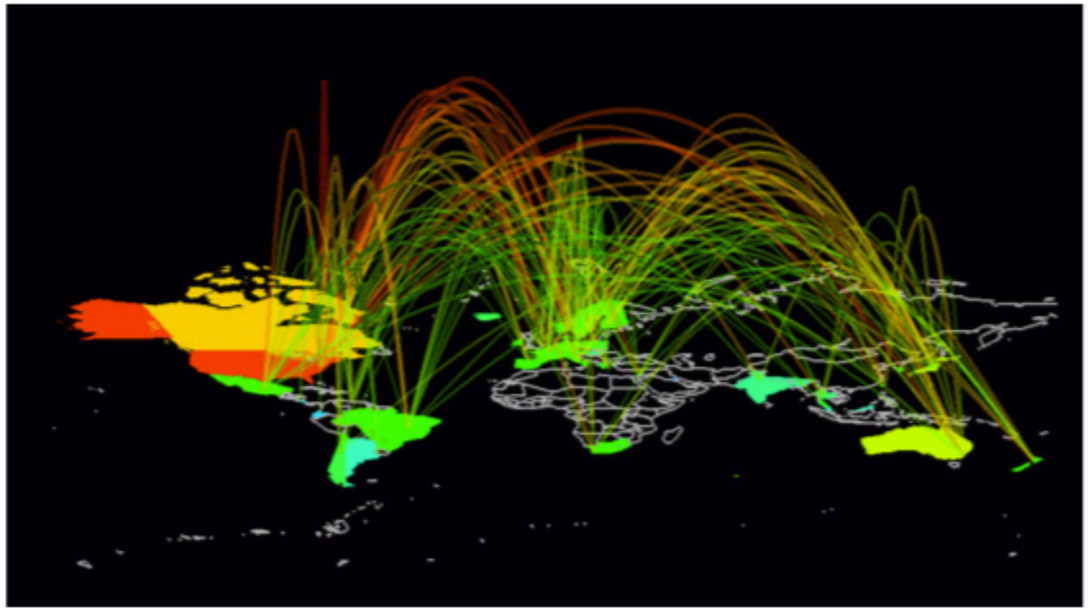
- The capture of Saddam Hussein — power of social networks!
- Importance of having an accurate network
- This example shows that the choice of network we focus is very important.
  - the hierarchical tree of official organization of the Iraqi government was of no use when it came to Saddam Hussein's whereabouts.
  - report shows that finding of the Fat man helped people to zero in on him!
- Refer: www.slate.com/id/2245228/

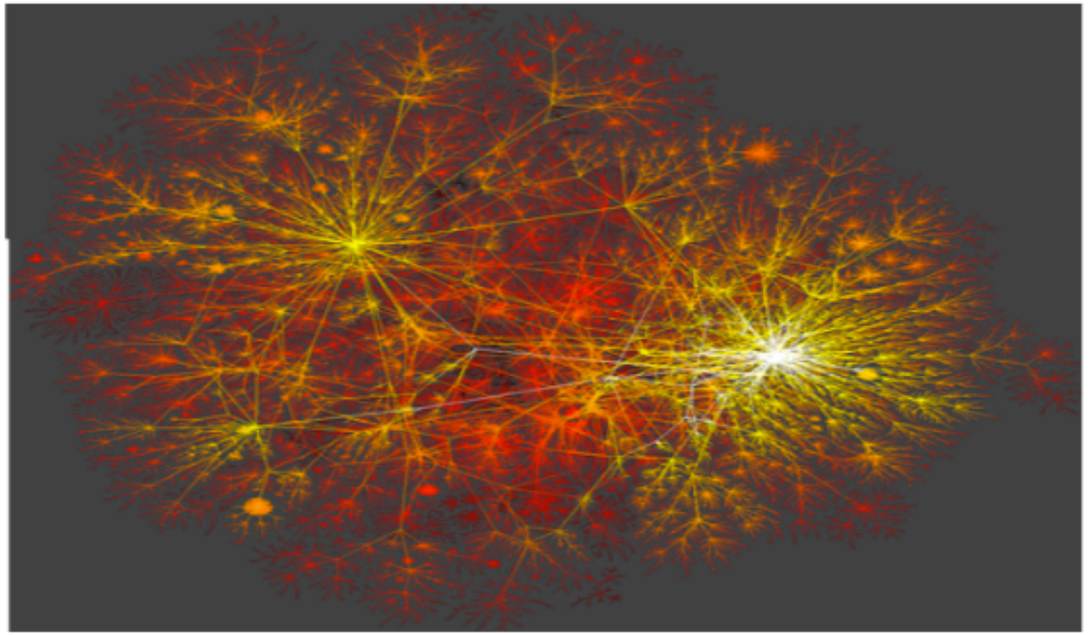
Interconnectivity

- Interconnectivity is good but due to interconnectivity a local failure may result in a global failure!
- Connectivity brings both benefits and vulnerabilities
- Cascading failures need not be always negative there are positive examples also:
    - World’s effort to drain the money supply for terrorist organisations
    - Cancer research for using cascading failures of cells in order to cut the cancer growth

Internet







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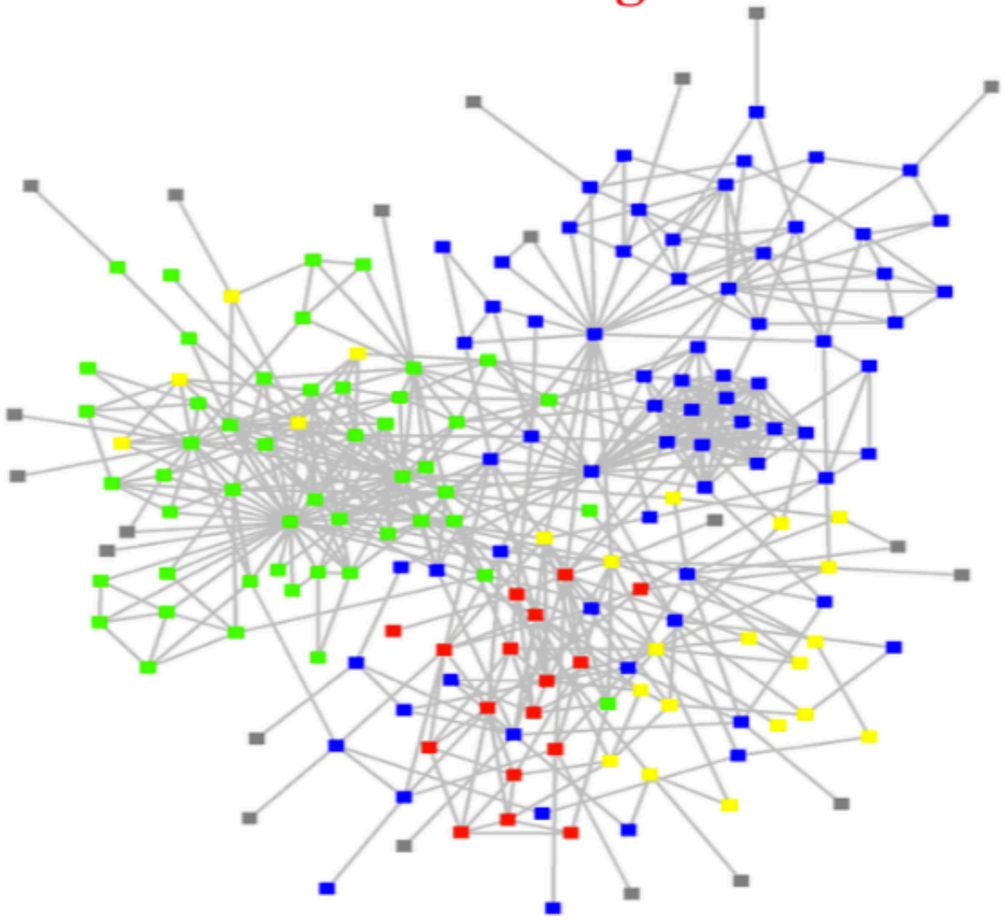
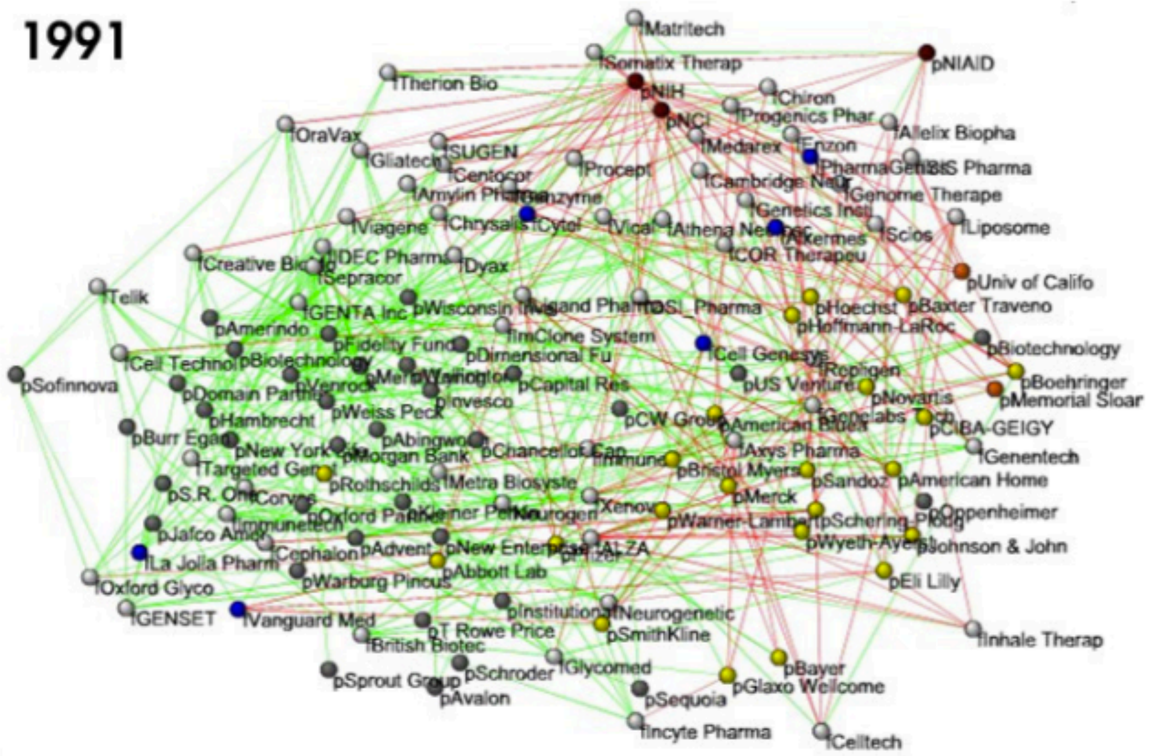
Structure of an organization



Red, blue, or green: departments
Yellow: consultants
Grey: external experts

www.orgnet.com

Business ties in US biotech-industry



Nodes: companies

investment

pharma

research labs

public

biotechnology

Links: collaborations

financial

R&D

http://ecclectic.ss.uci.edu/~drwhite/Movie

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http://www.orgnet.com

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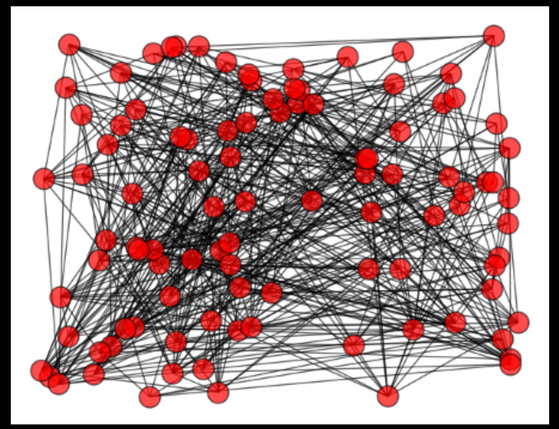
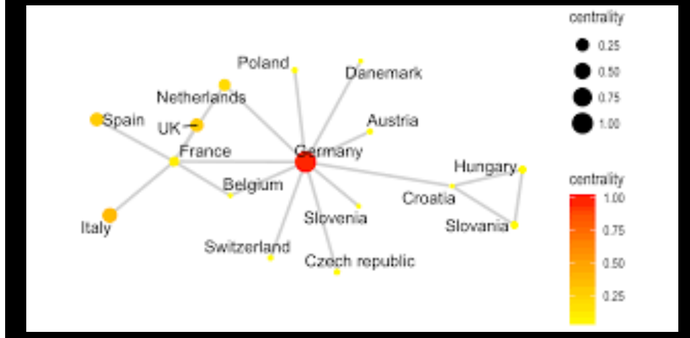
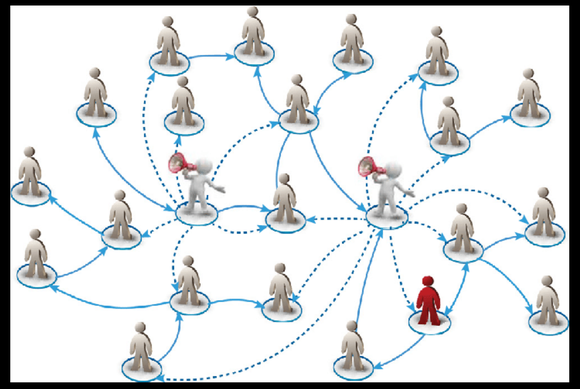
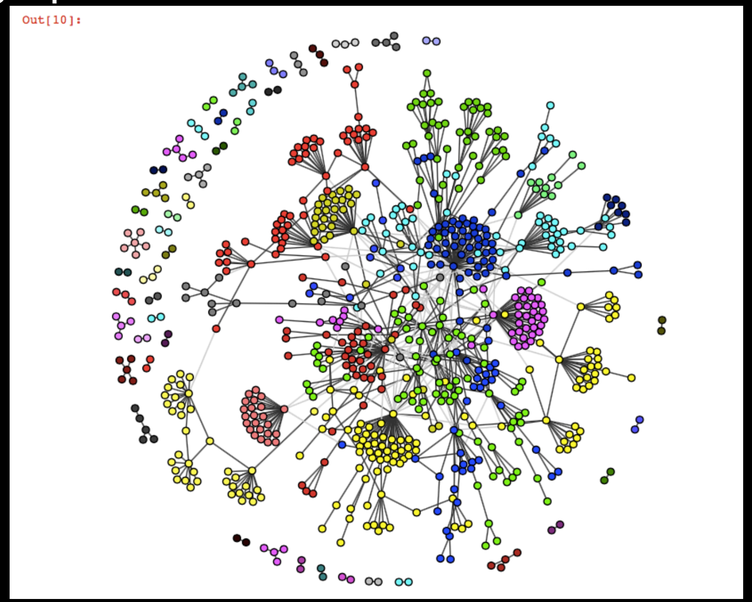
What are we going to study?

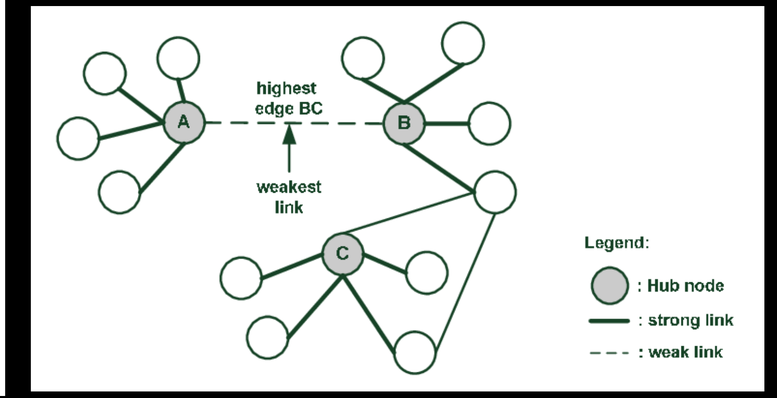
- Random graphs
- Is social network graphs really random?
- What exactly is the pattern of these graphs?
- Strong ties, Weak ties — Triadic closure
- Centrality measures of the graphs
- Small-world phenomena
- Preferential Attachment
- Information diffusion
- Community detection











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