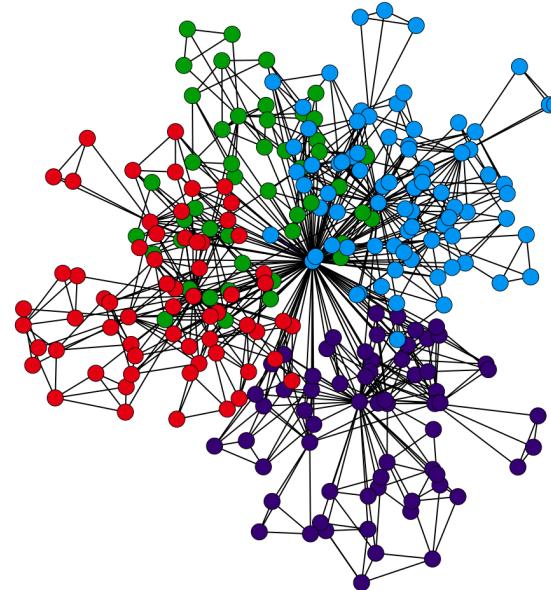


# Networks

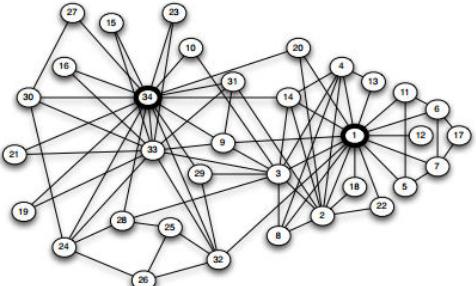
Networks: A set of objects (nodes) with interconnections (edges).

Why study networks?

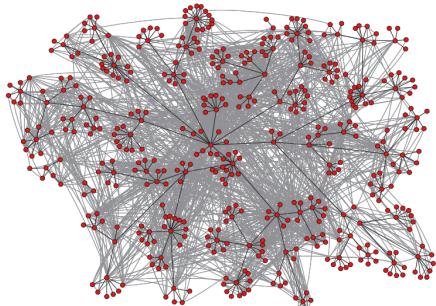
Because they are everywhere!



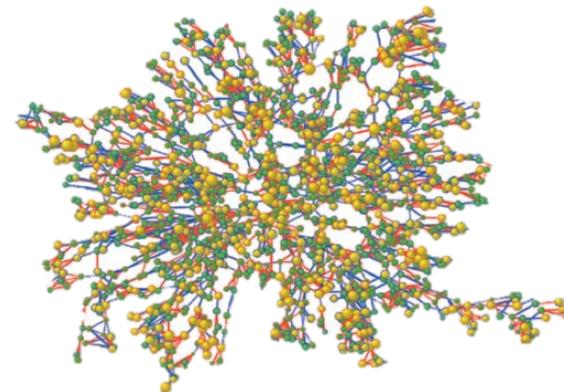
# Social Networks



Friendship network in a 34-person karate club  
[Zachary 1977]



E-mail communication network  
among 436 HP employees [Adamic & Adar 2005]



Network of friendship, marital tie, and  
family tie among 2200 people  
[Christakis & Fowler 2007]

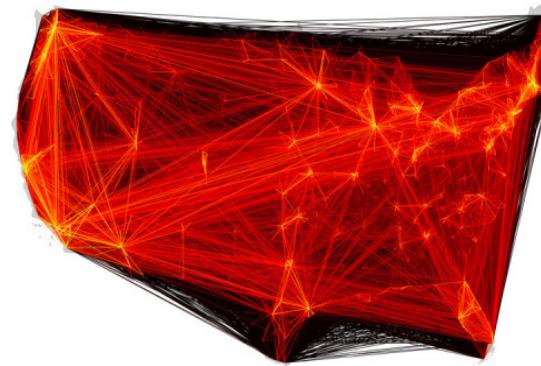
# Transportation and Mobility Networks



Network of direct flights around the world  
[Bio.Diaspora]

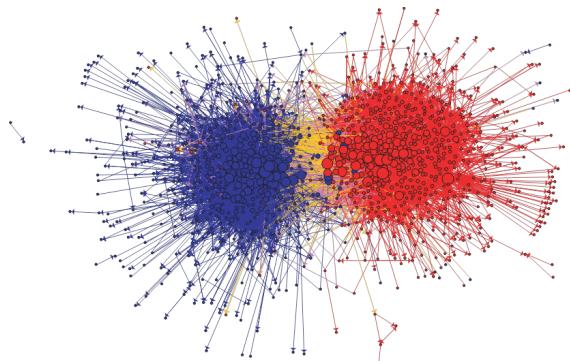


Ann Arbor bus transportation network

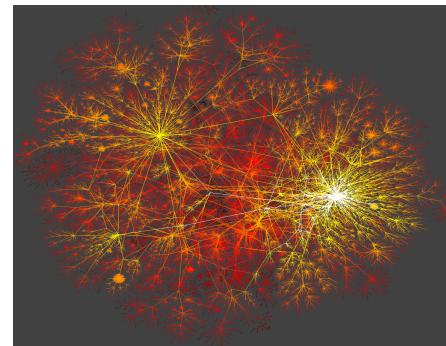


Human mobility network based  
on location of dollar bills (Where's George)  
[Thiemann et al. 2010]

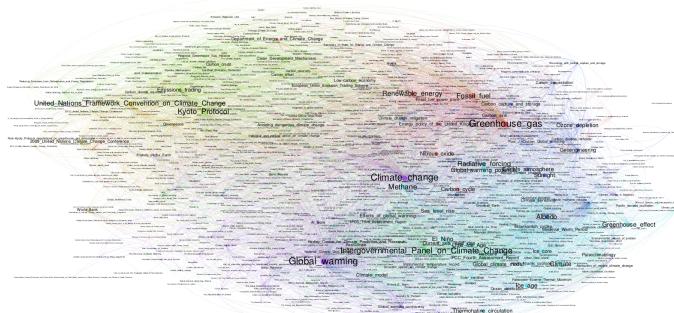
# Information Networks



Communication between left-wing and right-wing political blogs [Adamic & Glance 2005]

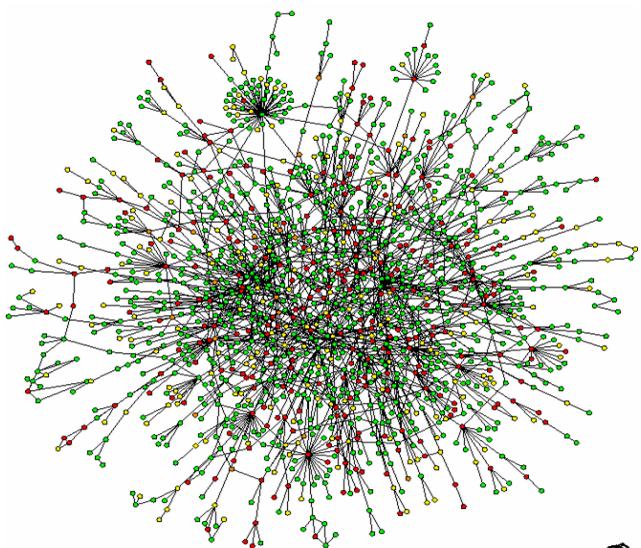


Internet Connectivity [K. C. Claffy]

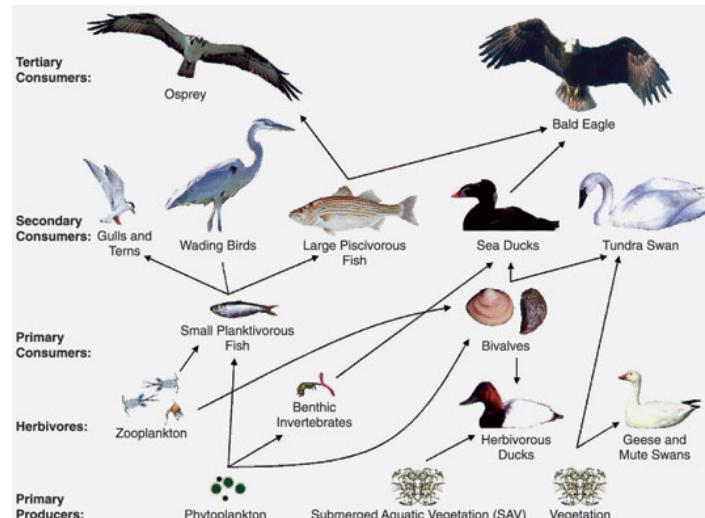


## Network of Wikipedia articles about climate change [EMAPS]

# Biological Networks



Protein-protein interactions  
[Jeong et al. 2001]



Chesapeake Bay Waterbird Food Web  
[Perry et al. 2005]

# And More...

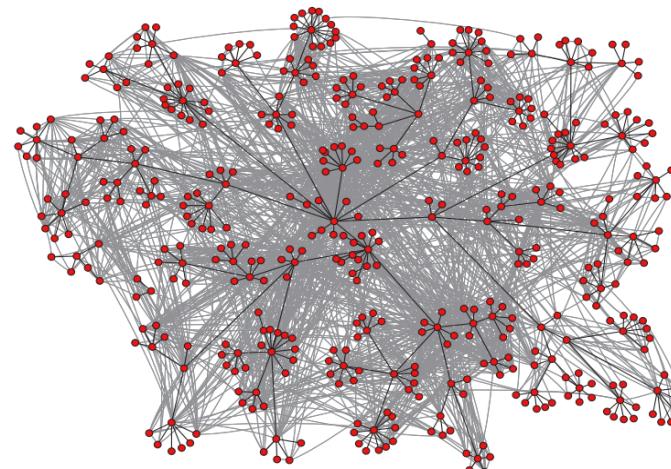
- Financial networks
- Co-authorship networks
- Trade networks
- Citation networks

# Networks Applications

Networks are everywhere, but  
what can we do with them?

Is a rumor likely to spread in  
this network?

Who are the most influential  
people in this organization?



E-mail communication network  
among 436 HP employees

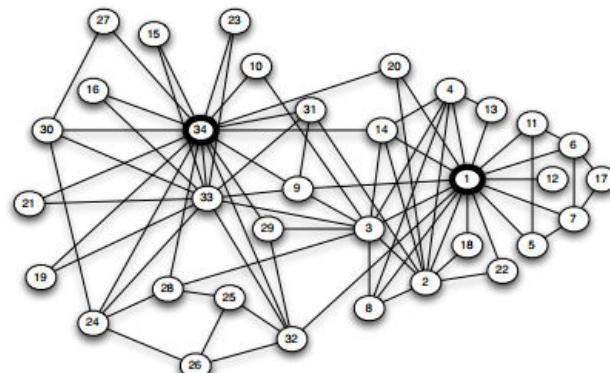


# Networks Applications

Networks are everywhere, but what can we do with them?

Is this club, likely to split into two groups?

If so, which nodes will go to which group?



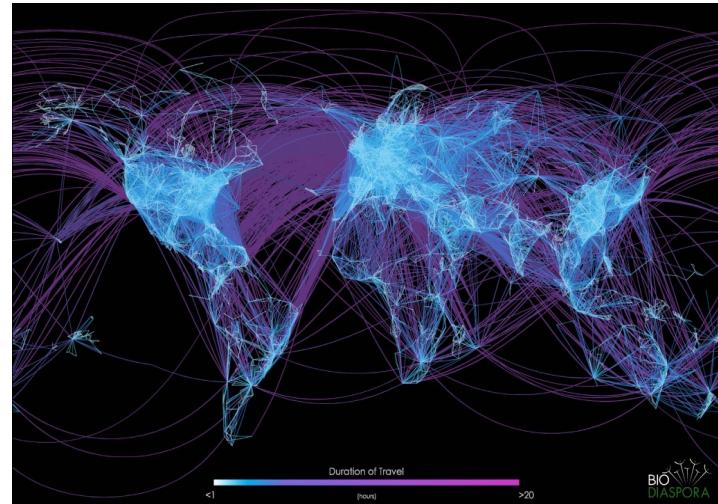
Friendship network in a 34-person karate club

# Networks Applications

Networks are everywhere, but what can we do with them?

Which airports are at highest risk for virus spreading?

Are some parts of the world more difficult to reach?



Network of direct flights around the world

# Summary

Many complex structures can be modeled by networks.

Studying the structure of a network can allow us to answer questions about complex phenomena.

In this course, we will explore different network techniques to study the structure of social networks.

