How to build a community?

Yaniv Dover

The basic (non-trivial) question

- Why do people cooperate?

- How do they form groups, social structures?

The literature

- Vast… (mostly Sociology, Psychology, Anthropology, some Economics) literature.

- Collective action theory
  - (critical mass, increasing returns, interdependence)

- Physics/Comp. Science/Complex Systems:
  - Network formation models

Our research approach

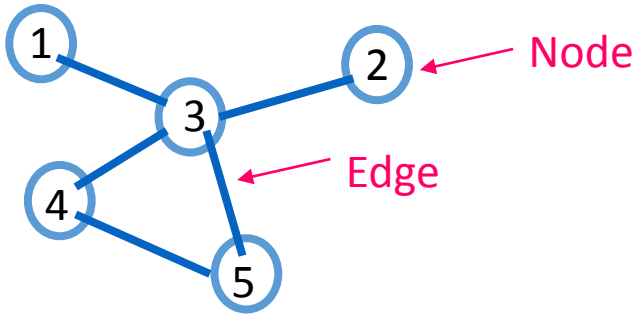
- We focus on online communities (mainly)
- Let’s observe what exists in the world
  - If the sample is big (and the world is ergodic) we can learn a lot
- What are the micro-macro forces that exist?
- What is the theory?
- What do we expect to see? How do we test it?

First: Networks, quick intro

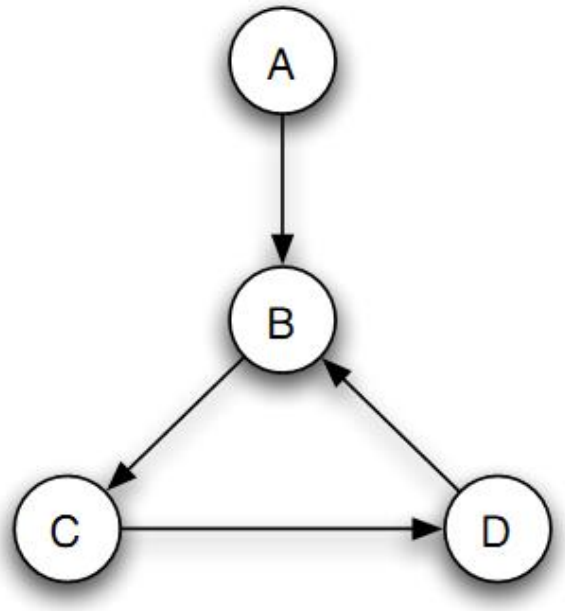
What are networks?

- Networks are collections of points joined by lines.

"Network" ≡ "Graph"



points	lines	
vertices	edges, arcs	math
nodes	links	computer science
sites	bonds	physics
actors	ties, relations	sociology



(b) *A directed graph on 4 nodes.*

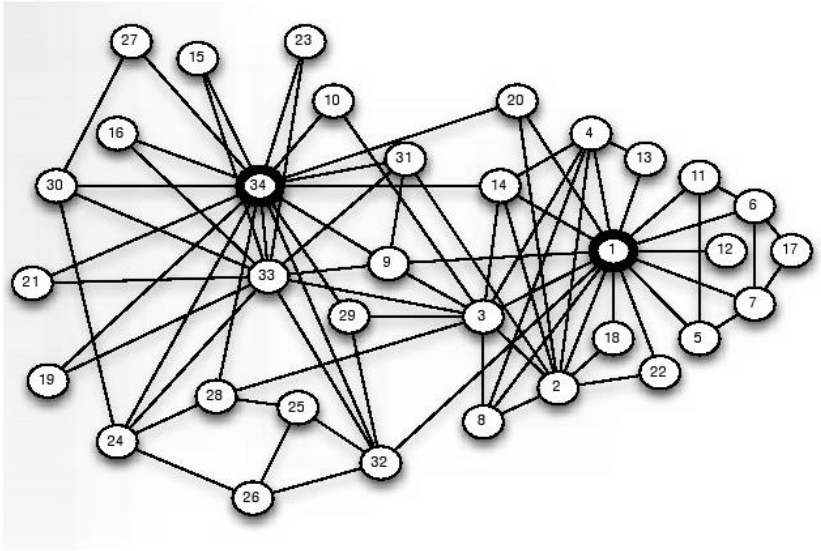
Asymmetric relationships — for example, that A points to B but not vice versa.

For this purpose, we define a directed graph to consist of a set of nodes, as before, together with a set of directed edges; each directed edge is a link from one node to another, with the direction being important.

Directed graphs(b), with edges represented by arrows. When we want to emphasize that a graph is not directed, we can refer to it as an undirected graph; but in general the graphs we discuss will be undirected unless noted otherwise.

Aspects of Networks:

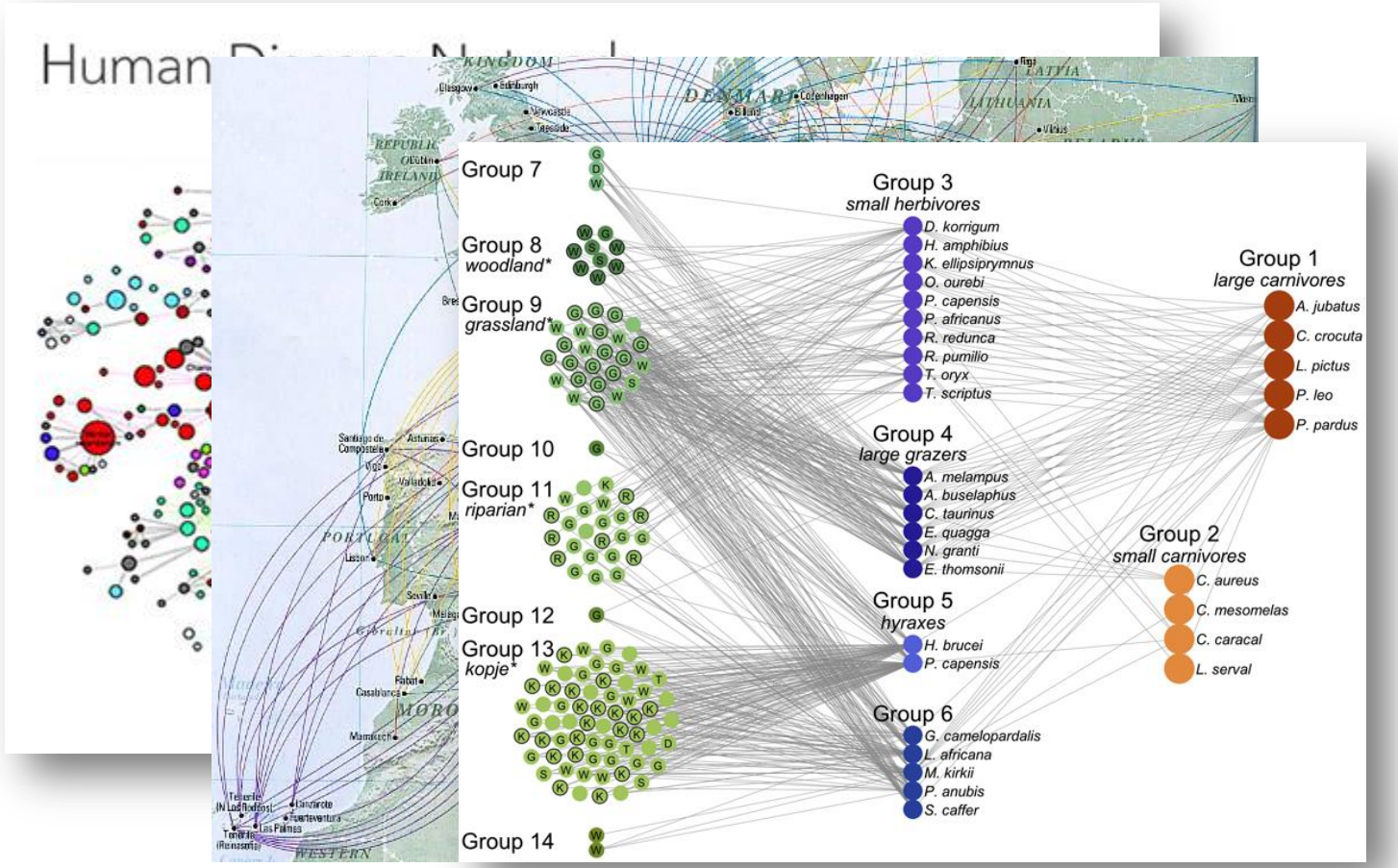
***Network**:* a pattern of interconnections among a set of things. A network is any collection of objects in which some pairs of these objects are connected by *links.*



The social network of friendships within a 34-person karate club. **Small circles** – represent people. **Lines** -joining the pairs of people who are friends outside the context of the club. -This is the typical way in which networks will be drawn, with lines joining the pairs of objects that are connected by links.

סוגי רשתות

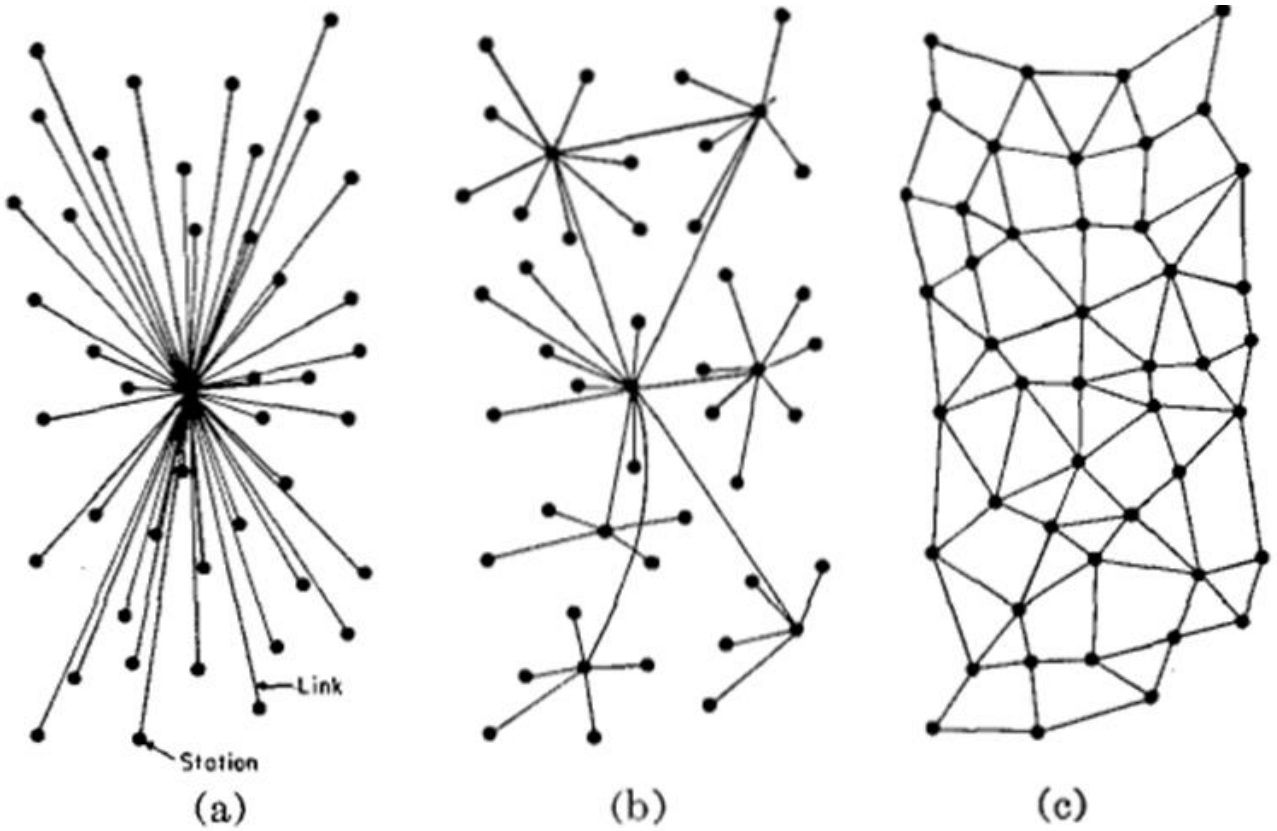
- חברתיות
- ביולוגיות
- הנדסיות (חשמליות, תקשורת, אספקת משאבים, כבישים וכו')
- אקולוגיות
- ועוד...



What do we know about networks?

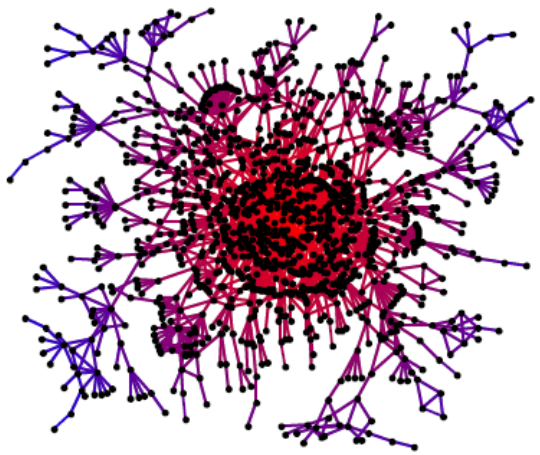
- Repeating patterns of structure
- Homophily
- Small world
- Clique/community structure
  - Weak ties, strong ties
- Patterns in the flow of influence
  - Central players
  - Brokers
- Some insight on fragility/robustness

Centralization

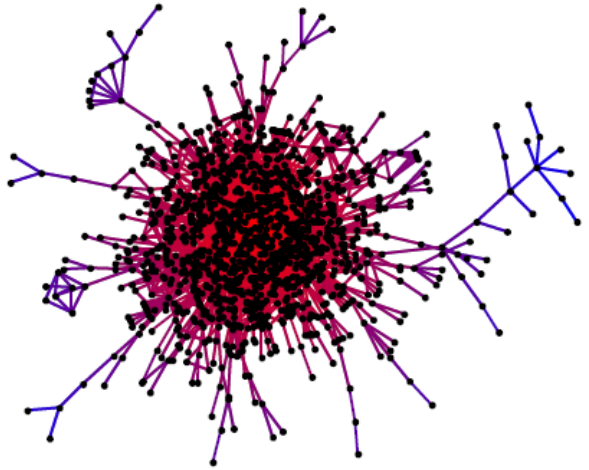


Which is centralized?

Networks of personal homepages



Stanford



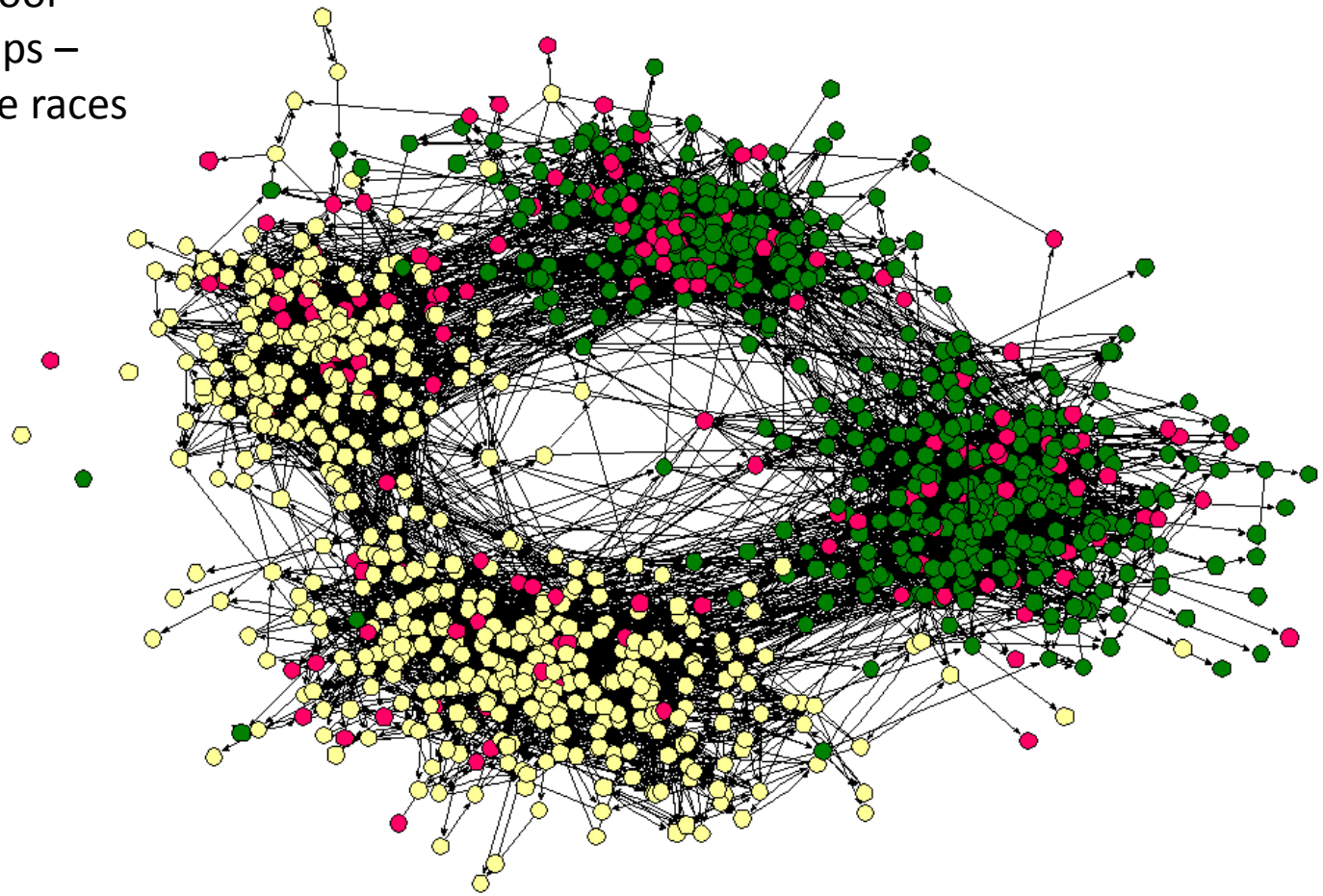
MIT

homophily: what attributes are predictive of friendship?
group cohesion

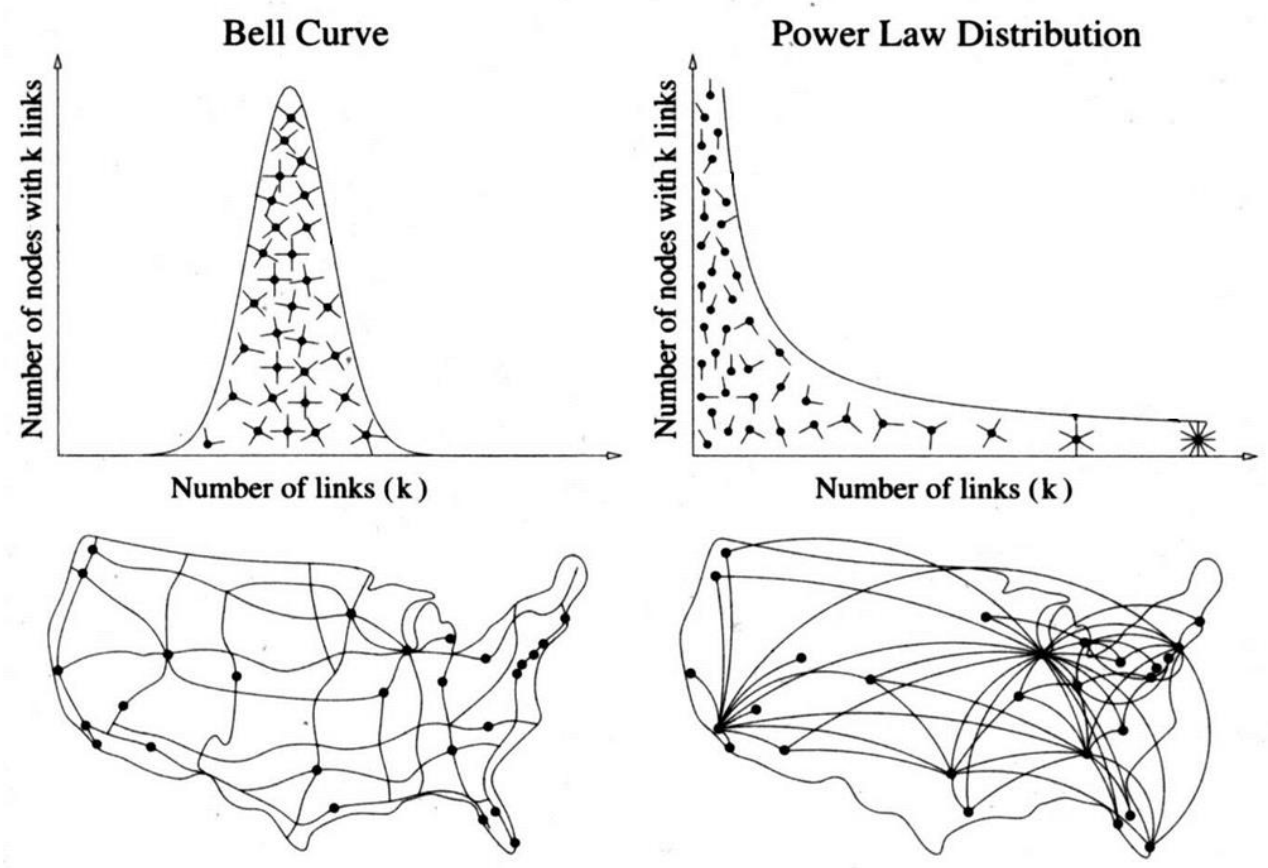
Lada A. Adamic and Eytan Adar, 'Friends and neighbors on the web', Social Networks, 25(3):211-230, July 2003.

Homophily

High School friendships – colors are races

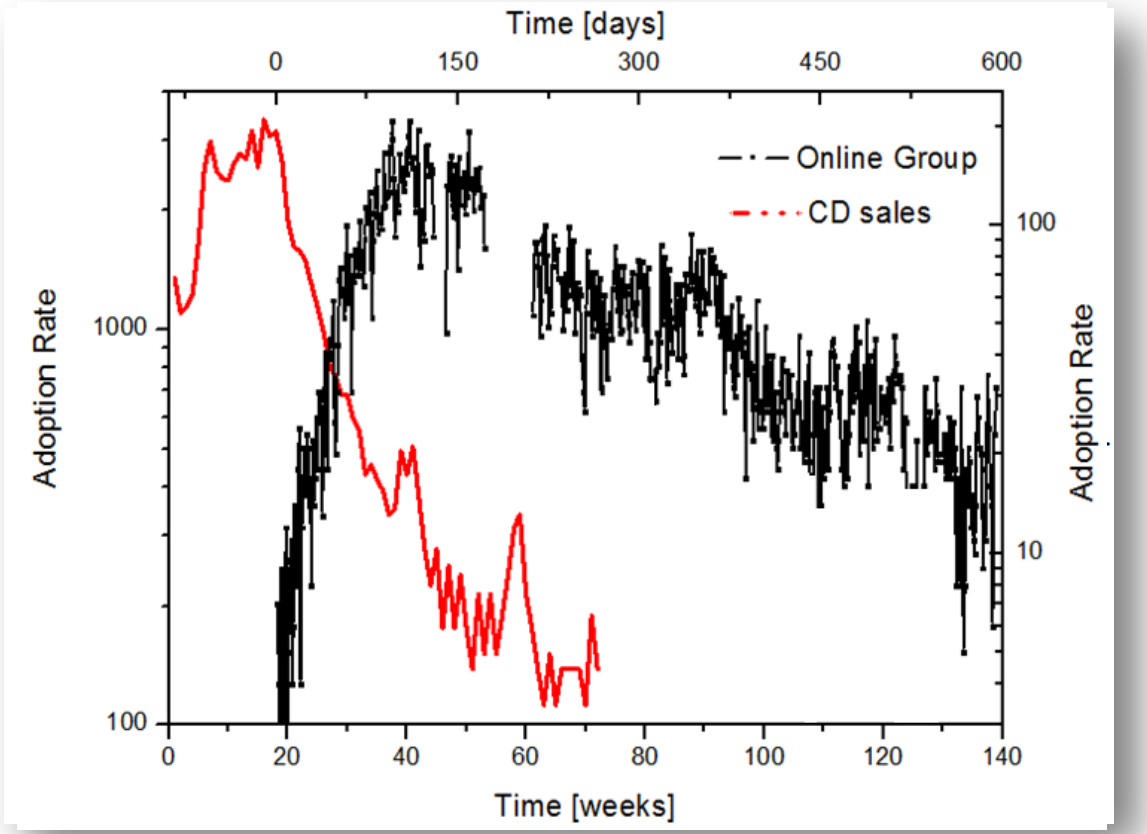


Distribution of Degree (num. of links)

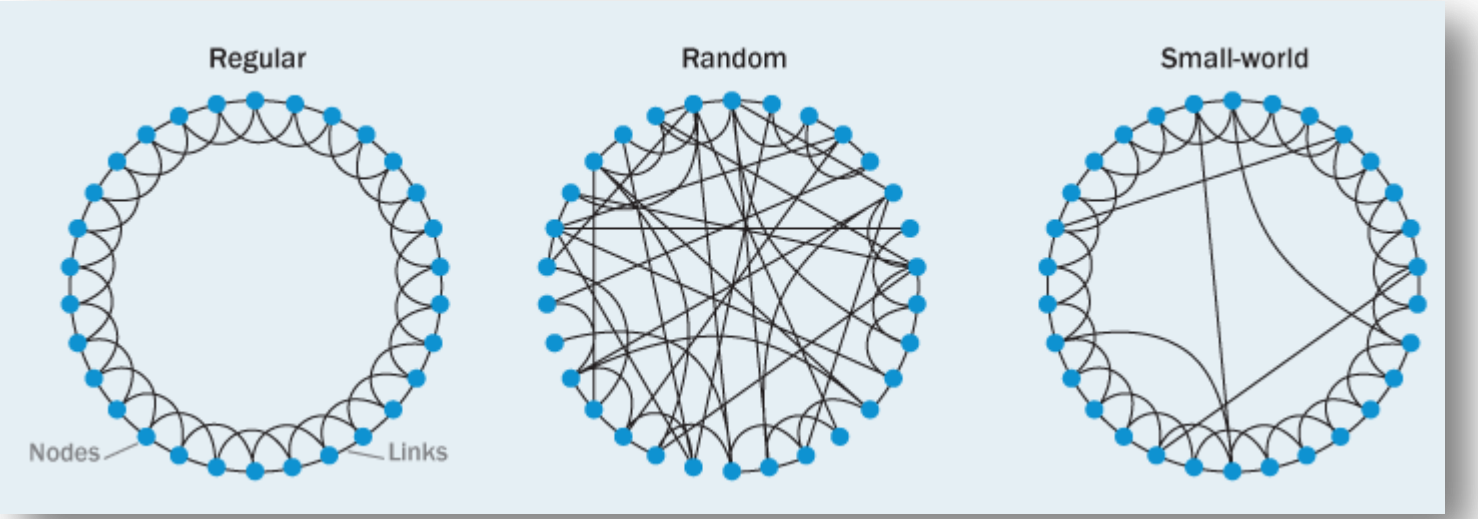


Diffusion On Networks

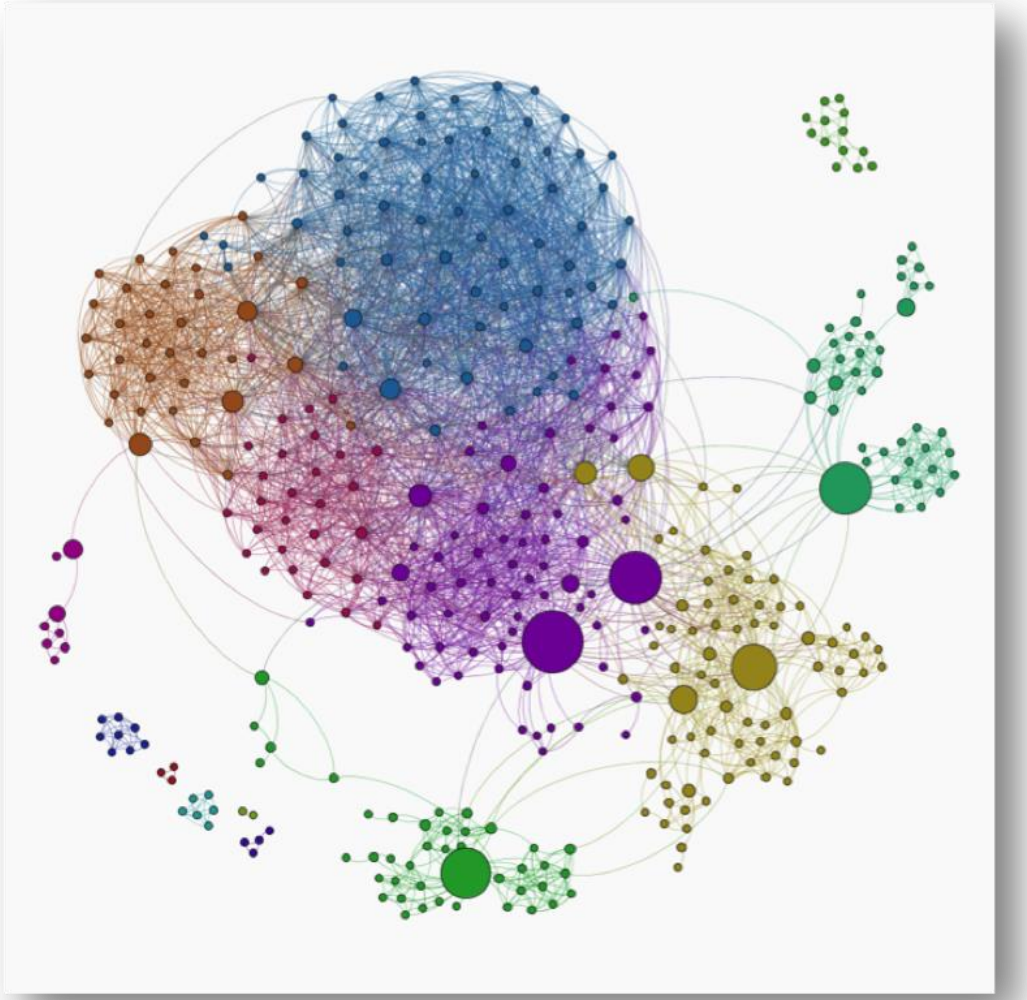
Structure affects diffusion



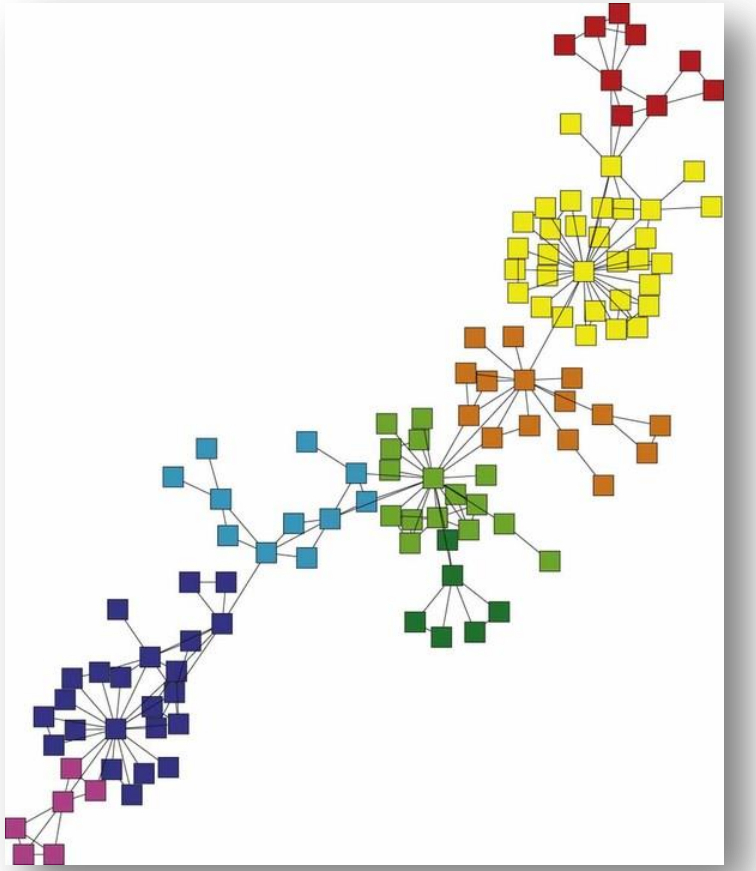
Small World



Community structure



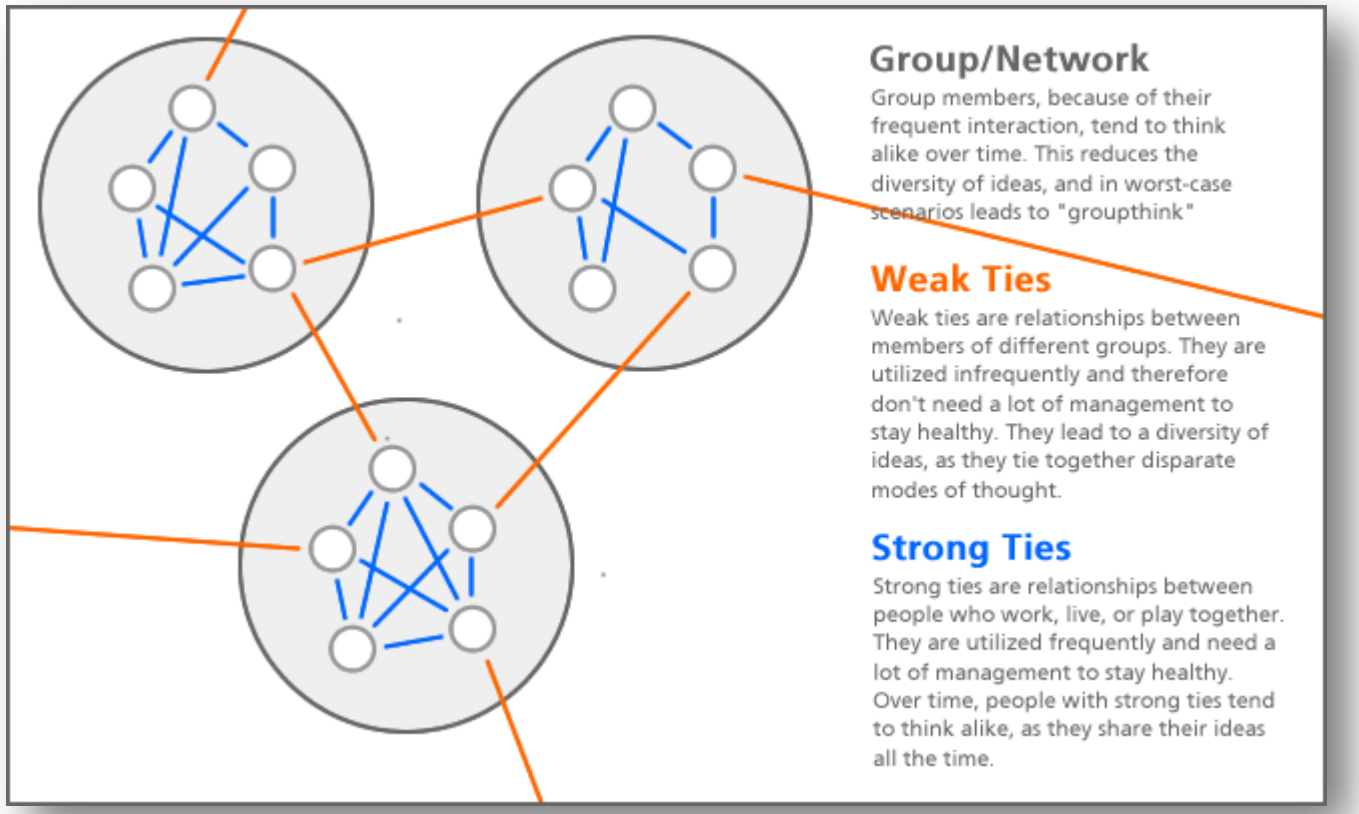
Facebook network



Scientists network

Community structure

The Strength of weak ties…



Strong Ties:
In-group (family, friends, co-workers).
High maintenance.

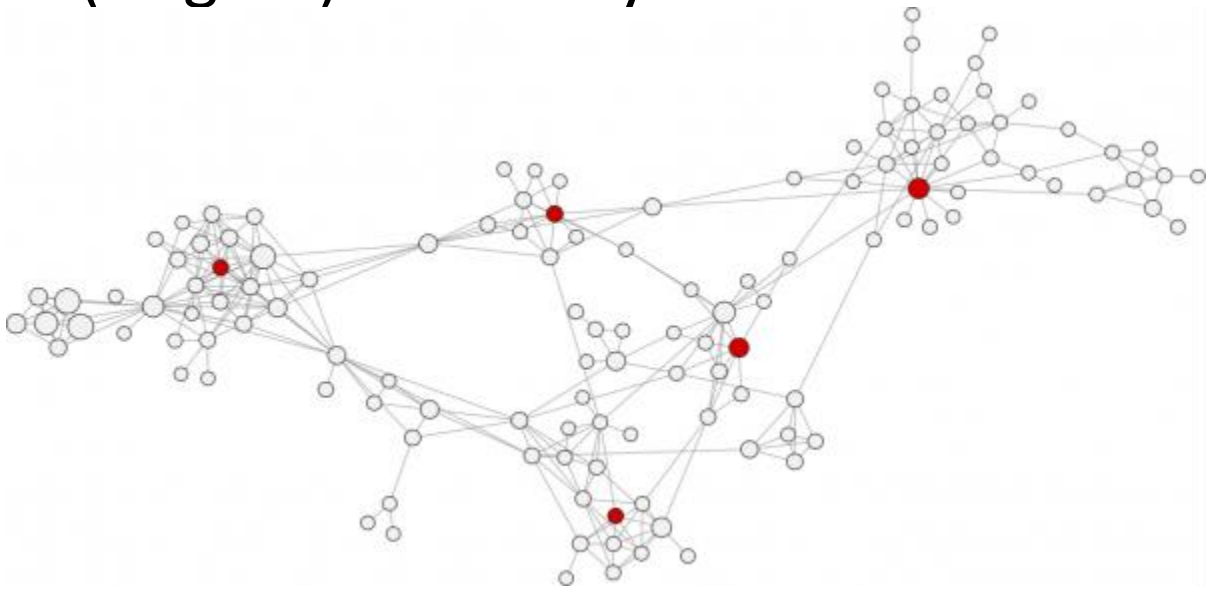
Weak Ties:
Low frequency – idea diversity, outside opportunities
Low maintenance

(Granovetter 1973)

Roles on the network

Closeness centrality
Who is in the "center? Close to most others…

(Degree) Centrality



Hubs, centrals, etc.

Roles on the network

Betweenness centrality
Brokers – social capital…

Social-capital centrality

Brokers, High social capital, bottlenecks

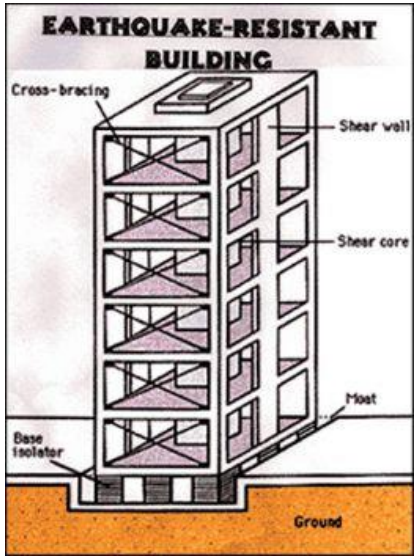
Roles on the network

Betweenness centrality
Brokers – social capital…

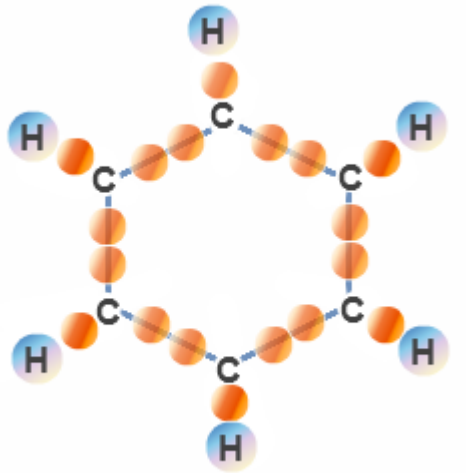
Social-capital centrality

Brokers, High social capital, bottlenecks

Our theory? (simplified)



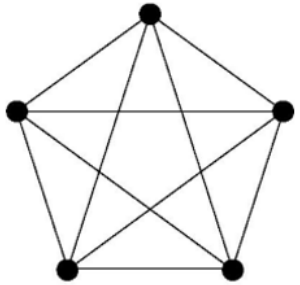
Physical Structures – stable as a result of balance between forces



How do you build a large community?

Assumption – bottom up

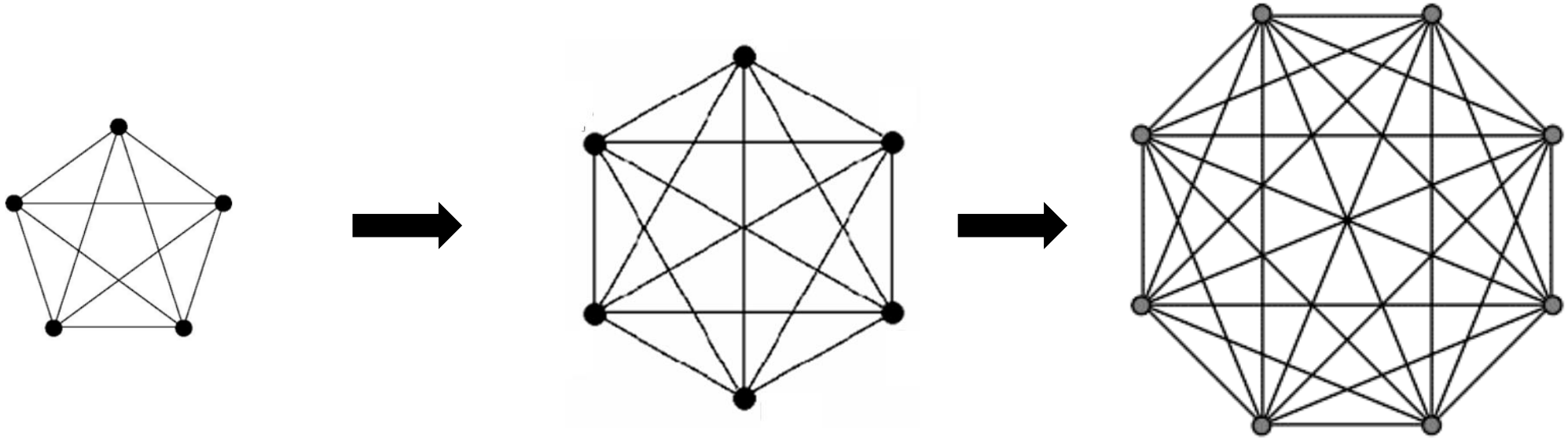
Dyads and small cliques (highly cohesive groups) form



Relatively stable – but how do they grow?

How do you build a large community?

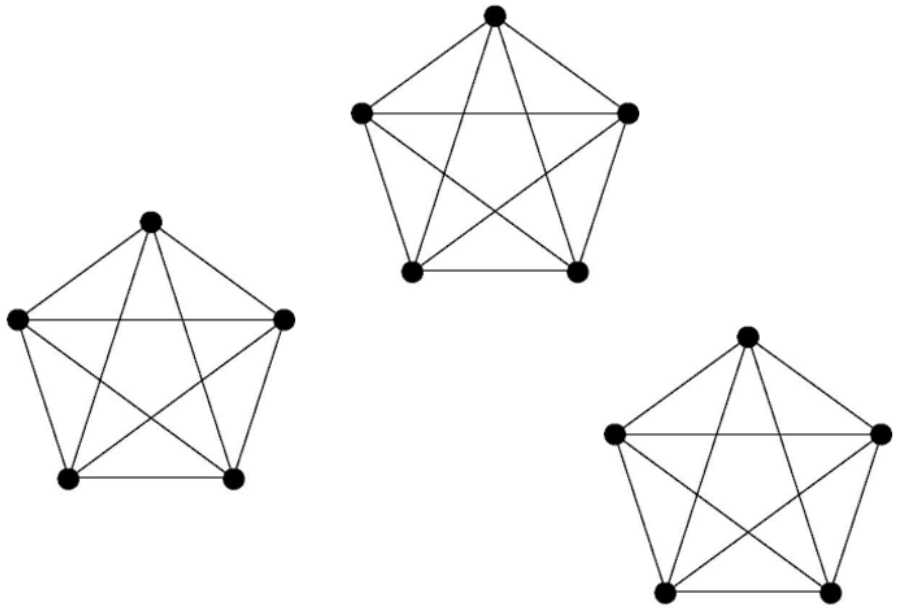
Can they grow and remain cohesive and stable?



Capacity issues

How do you build a large community?

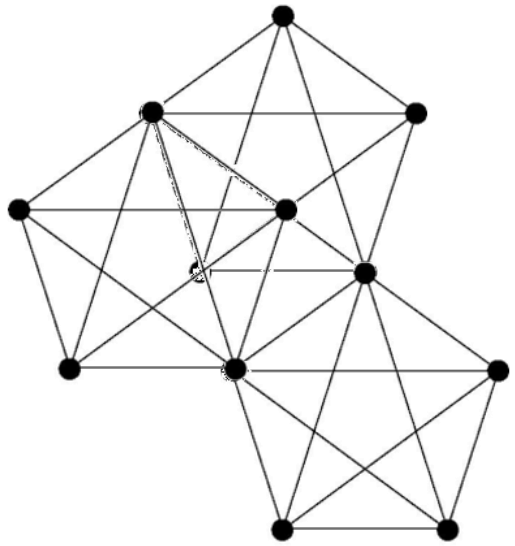
Can they just live, side by side?



Conflicts of interests issue

How do you build a large community?

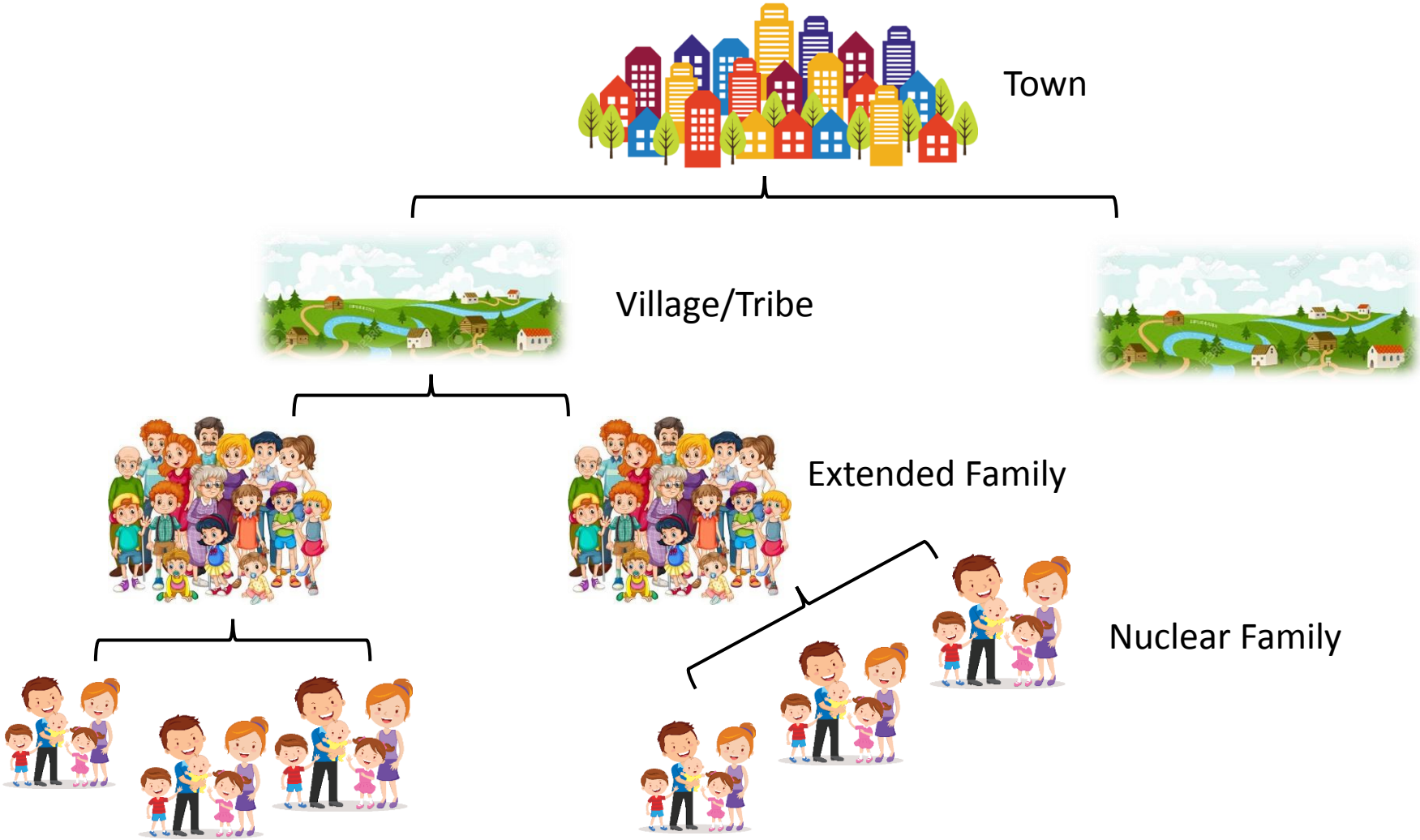
They have to overlap, but not too much, not too little



Balance between:

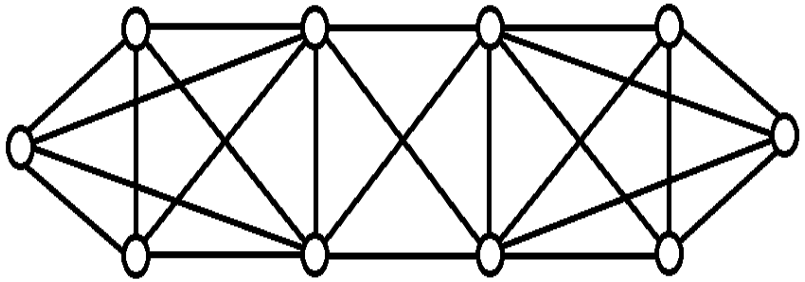
- Strong ties (clique) needs
- Weak ties needs

But, this should happen, across scales

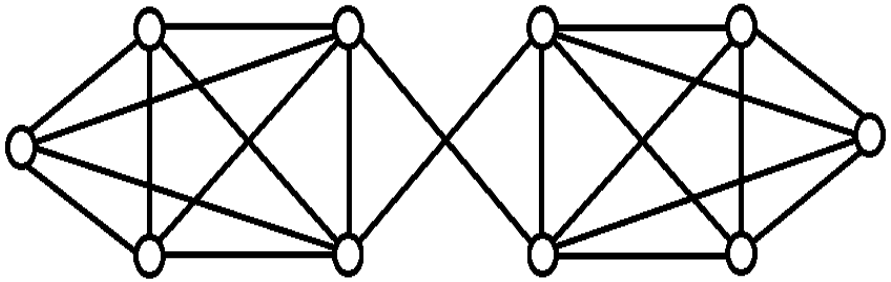


How to quantify?

Simple Example:



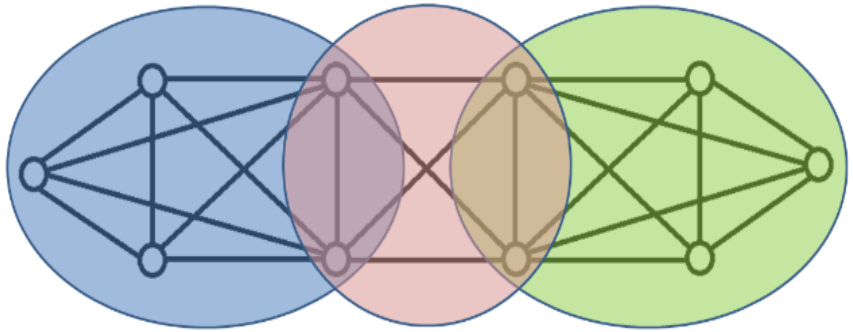
Network 1



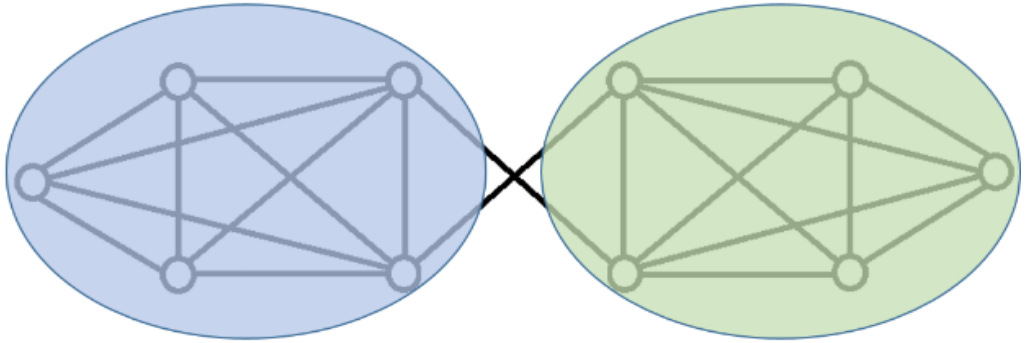
Network 2

S=1 (cohesiveness -> one hop)

How to quantify?



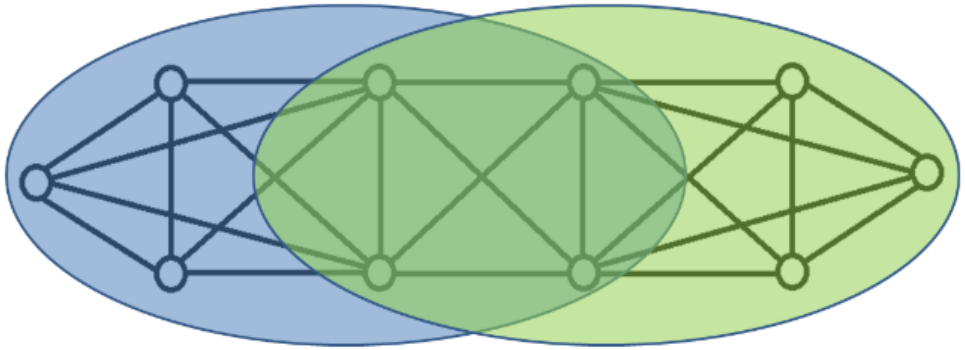
Network 1



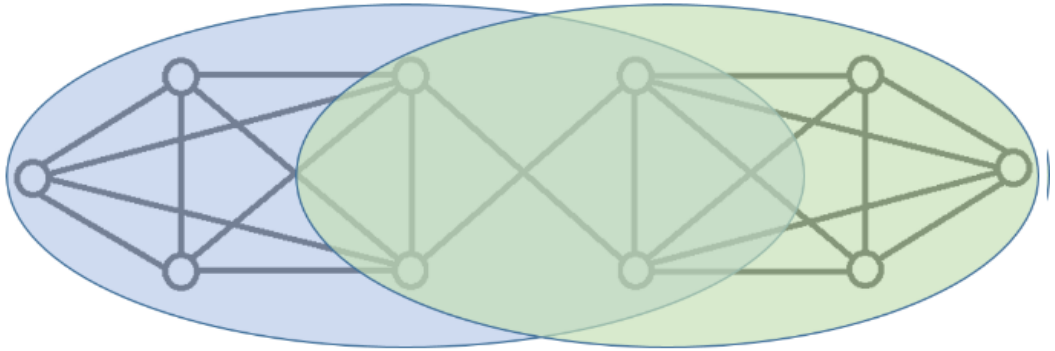
Network 2

S=2 (cohesiveness -> two hops)

How to quantify?



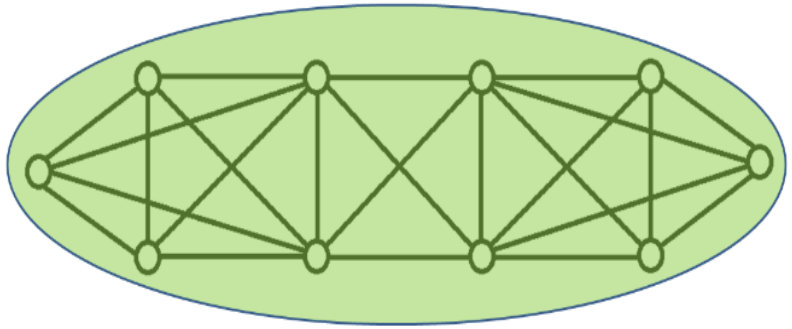
Network 1



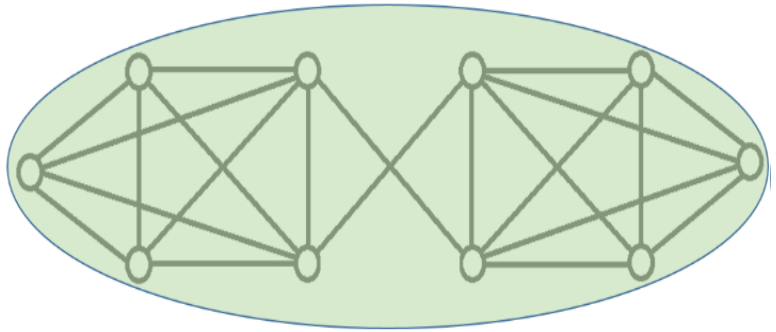
Network 2

S=3 (cohesiveness -> three hops)

How to quantify?



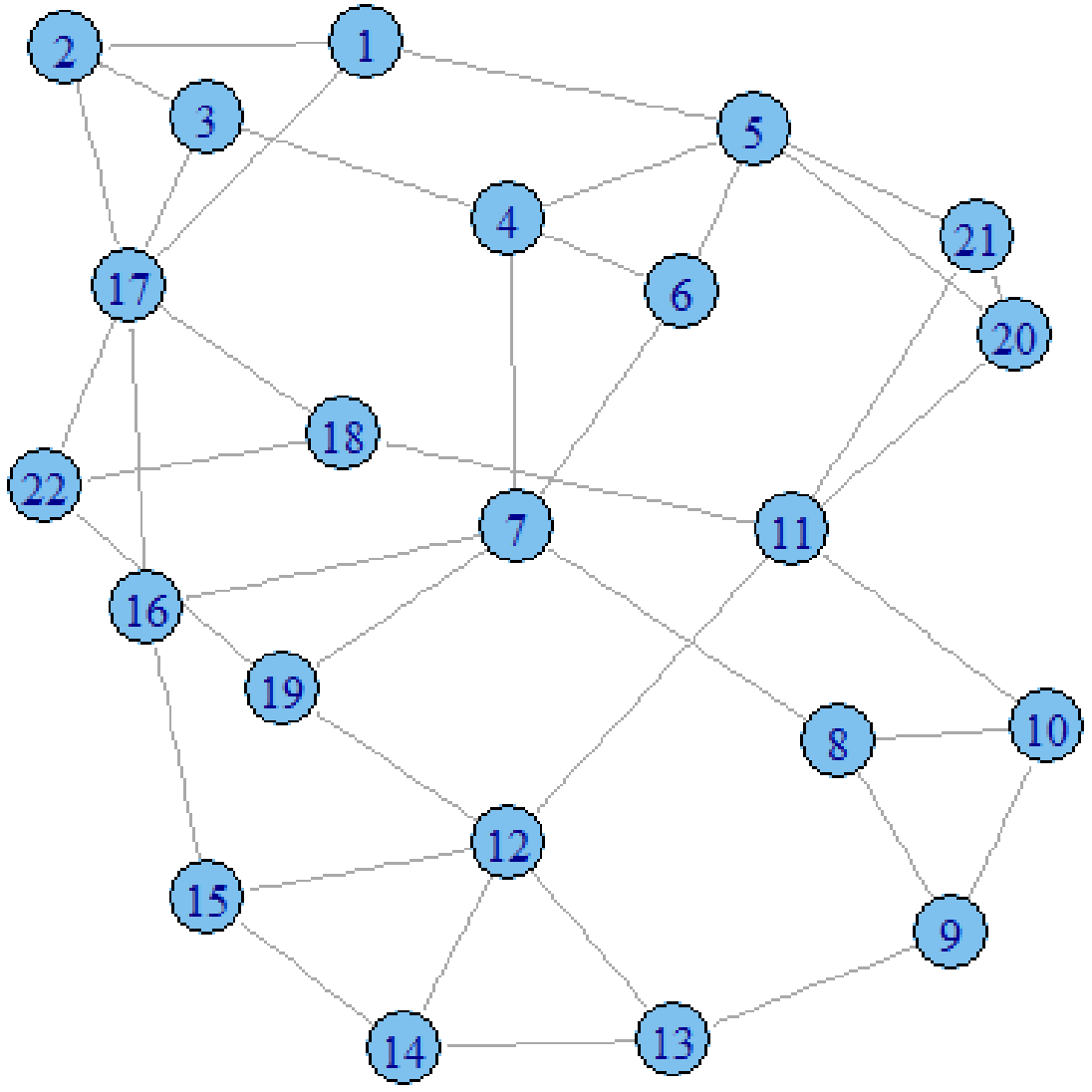
Network 1

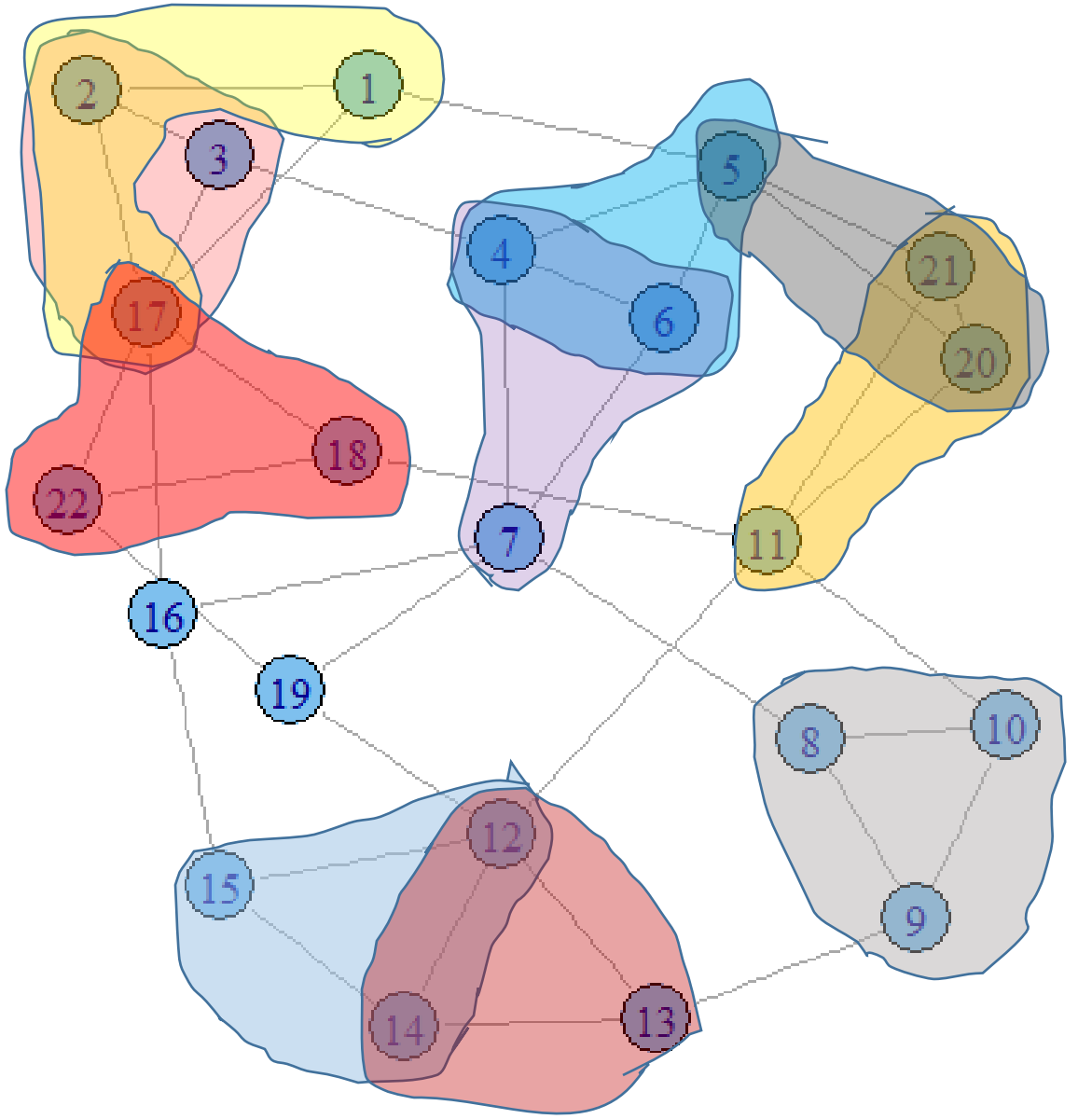


Network 2

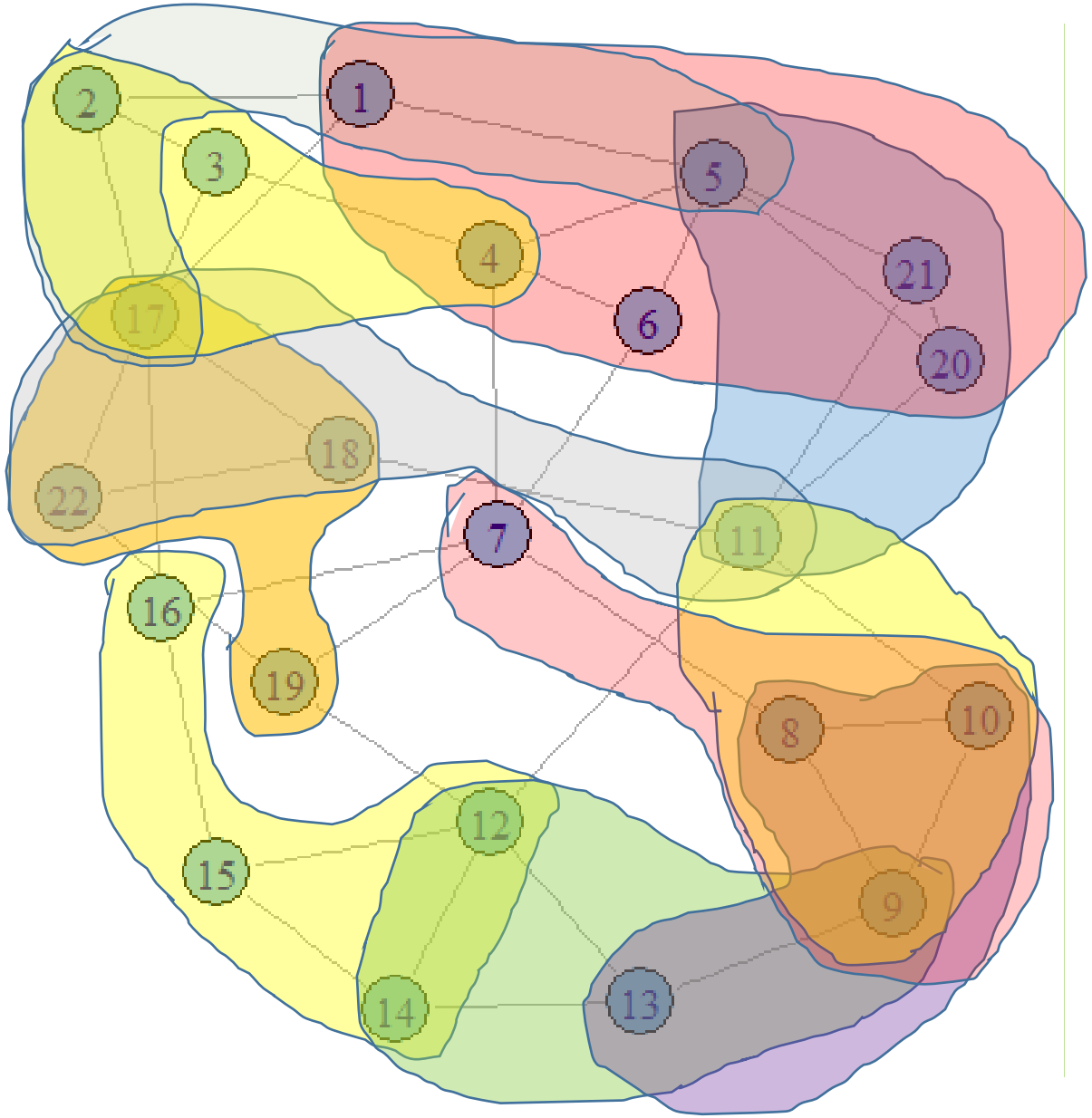
S=4 (cohesiveness -> four hops)

Online Interactions example

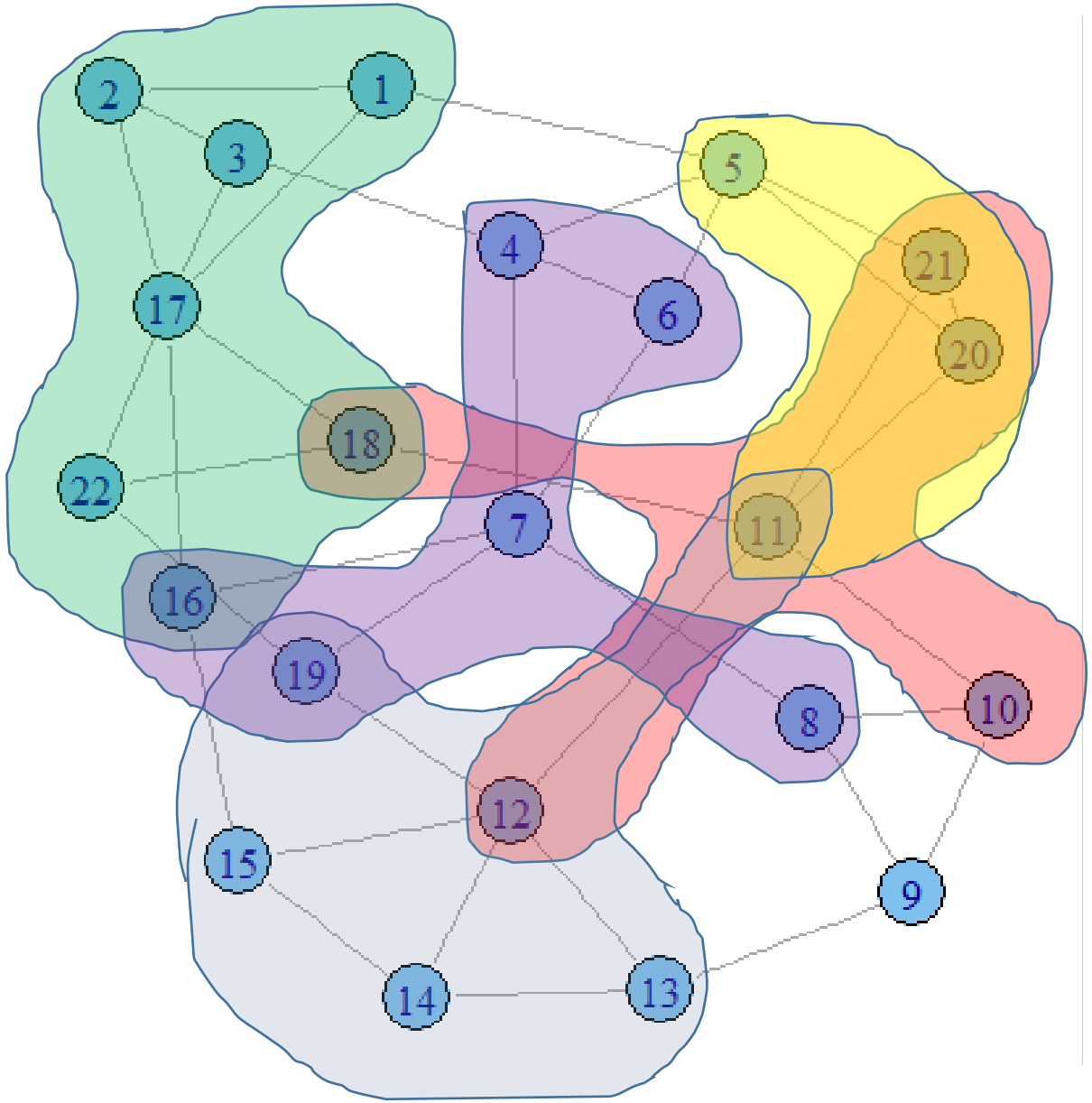




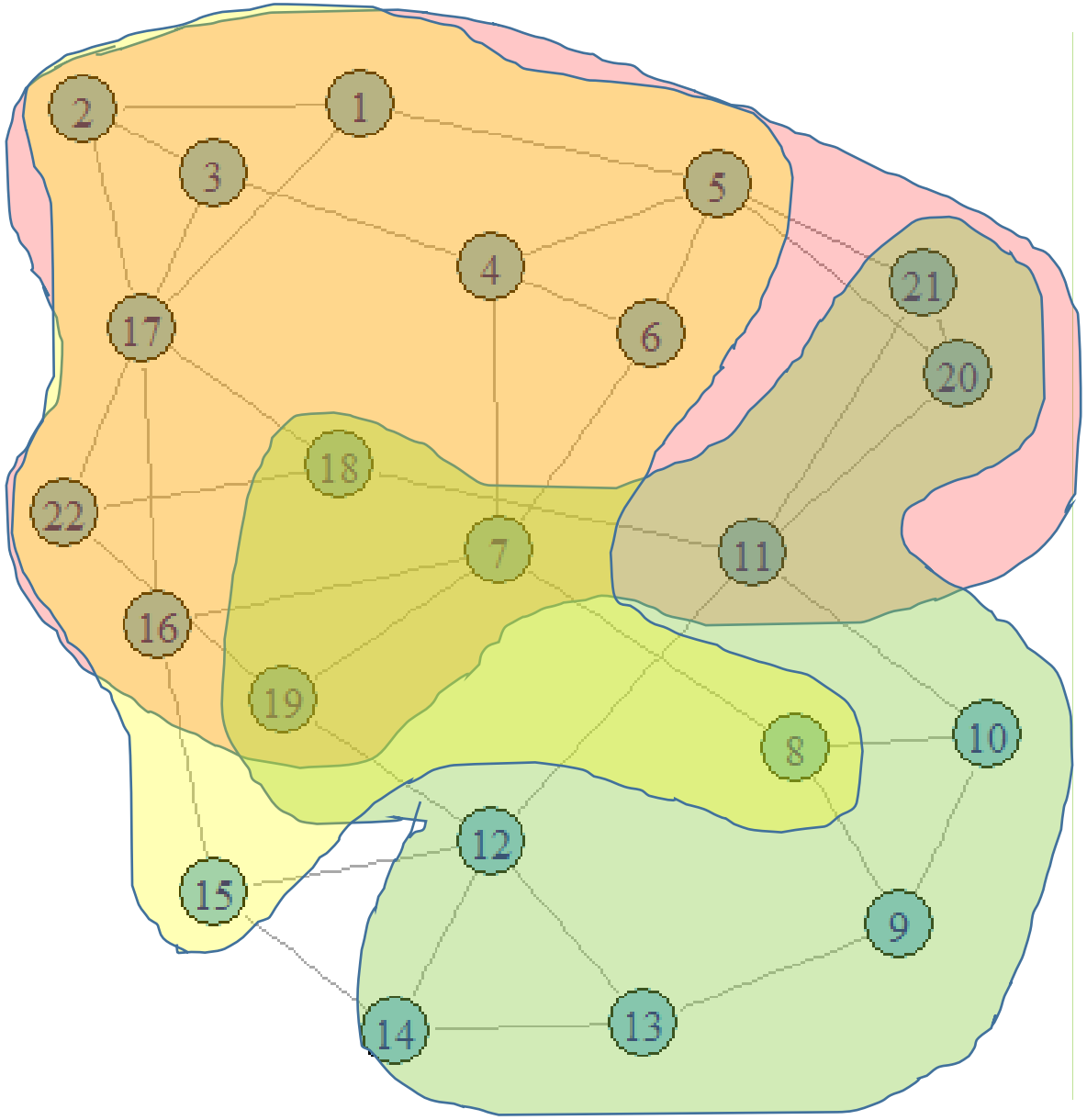
T=1



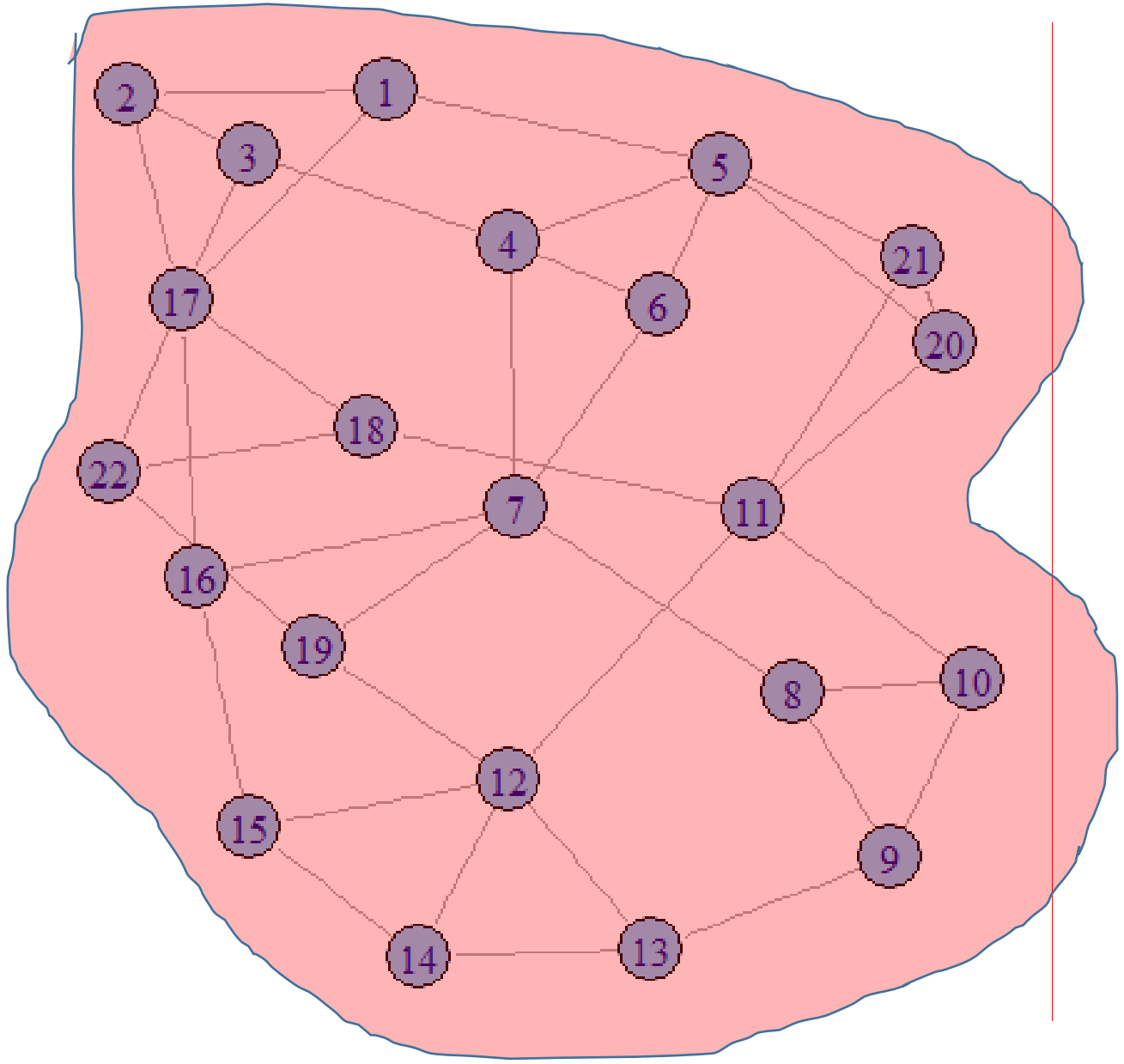
T=1.16



T=1.6



T=2.2



T=2.5

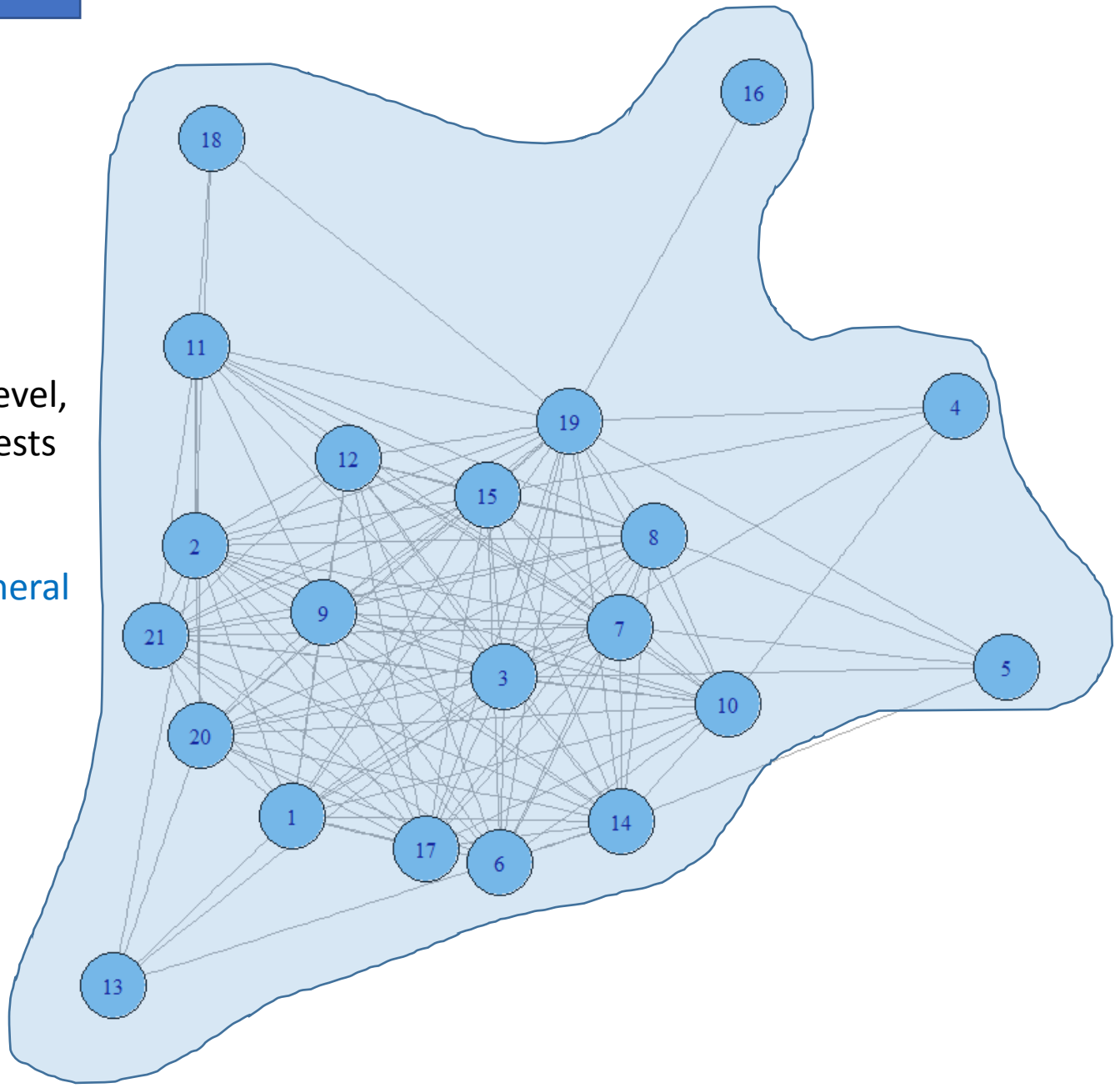
Weak Cohesion

At this blue community level, the top interests are:

Recreation

Games in general

Humor

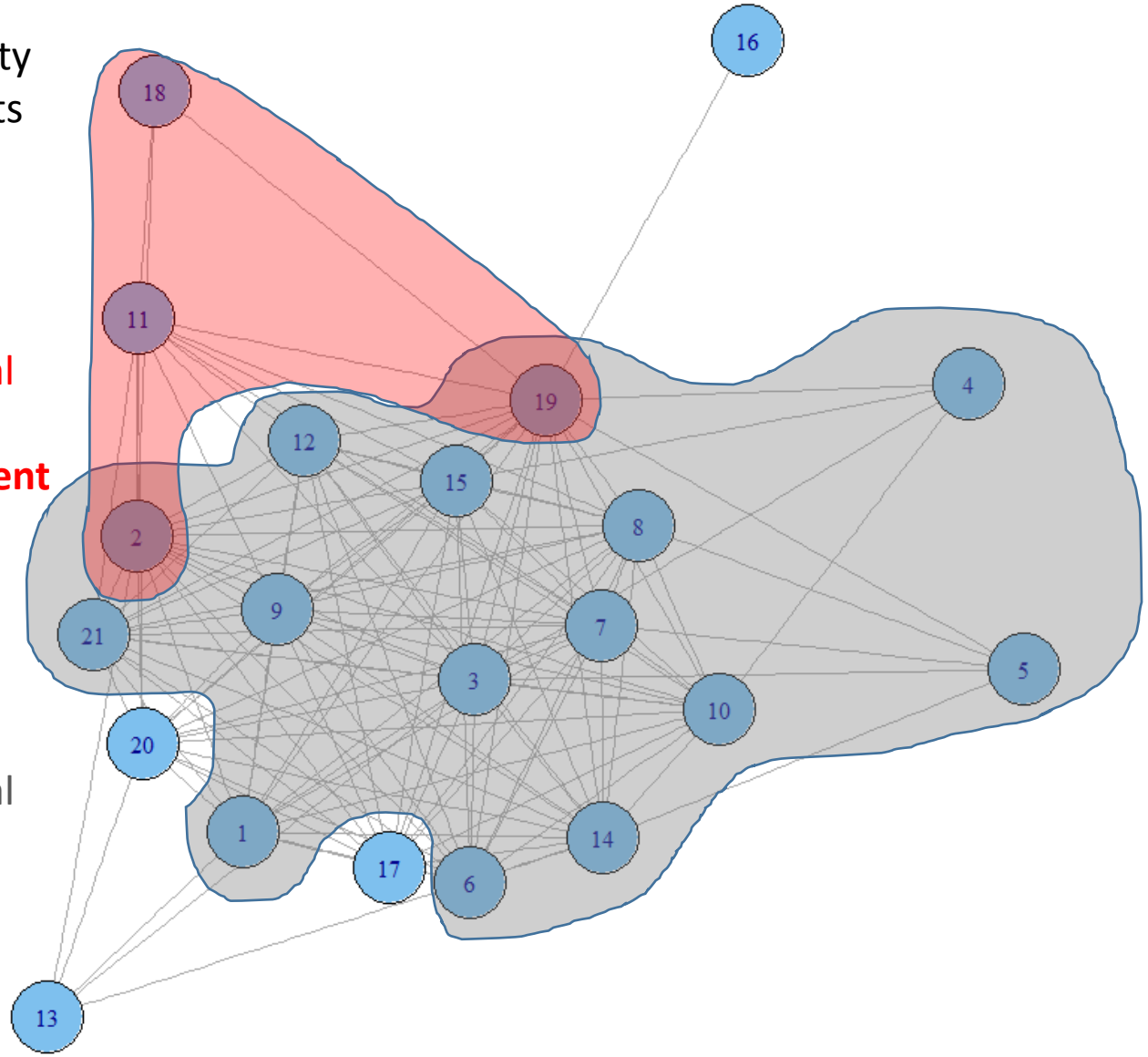


Medium Cohesion

At this community level top interests are:

Red:
Recreation
Games in general
Humor
Tech. development of forums

Grey:
Recreation
Games in general
Humor
Music



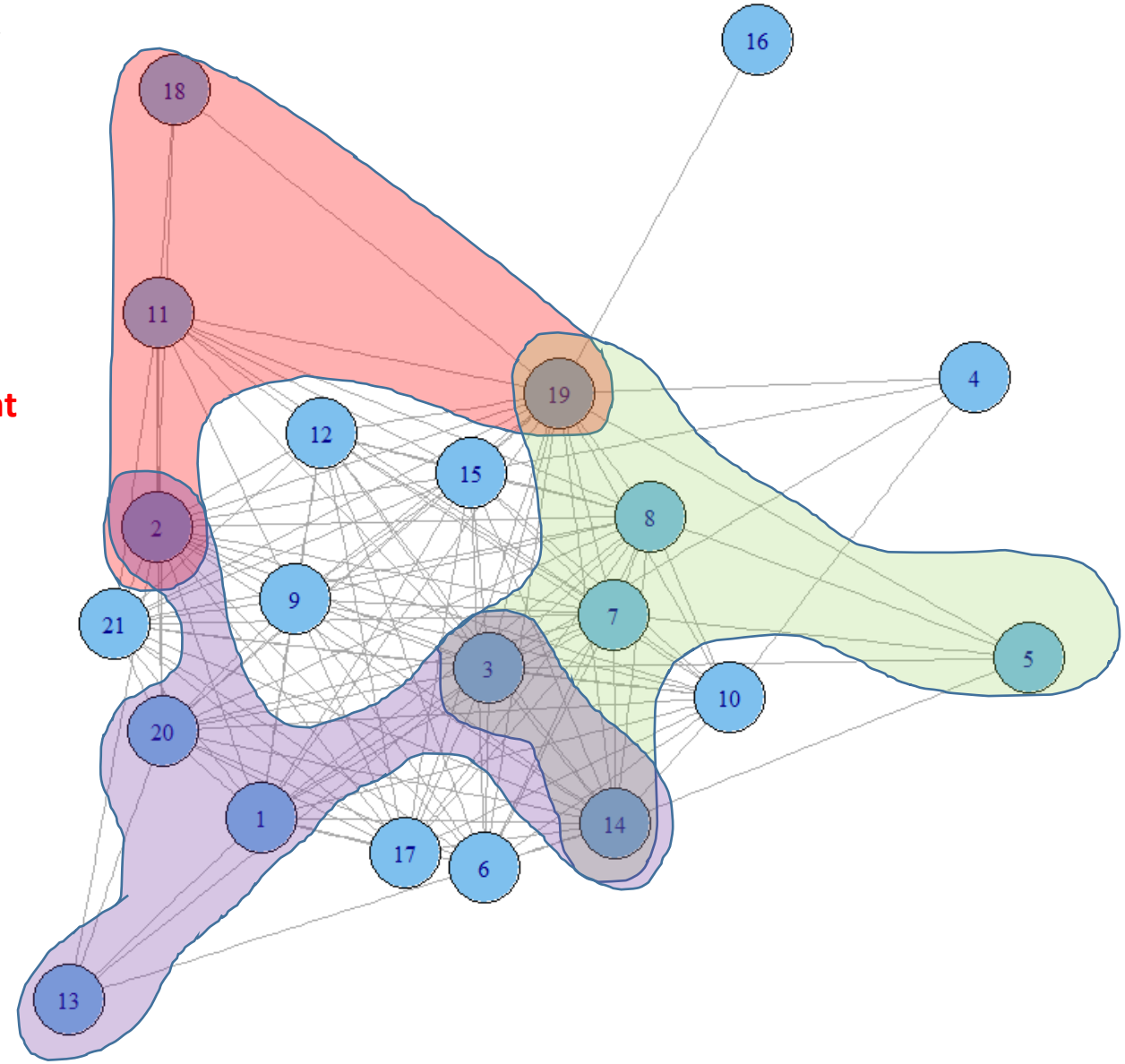
Strong Cohesion

At this community level top interests are:

Red:
Recreation
Games in general
Humor
Tech. development of forums

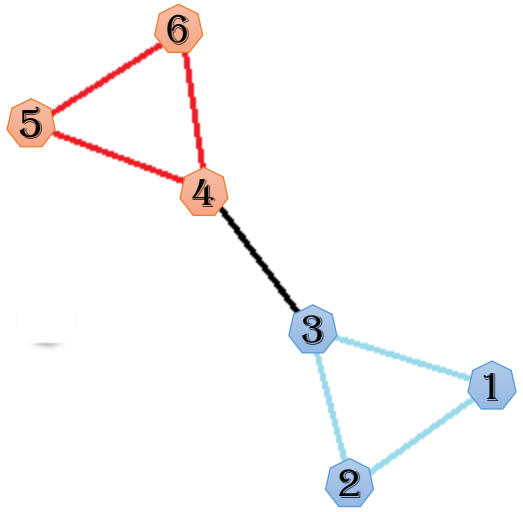
Purple:
Recreation
Games in general
Humor
Music
Game of Quake

Green:
Recreation
Games in general
Humor
Music
Game of Half Life



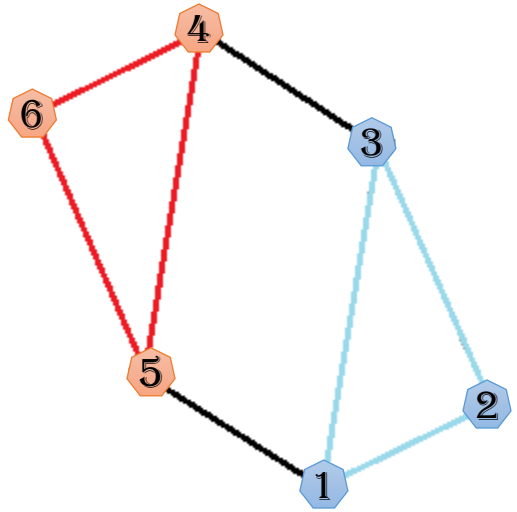
What does the data say?

Six-member Network



$Sparseness = 1.8$

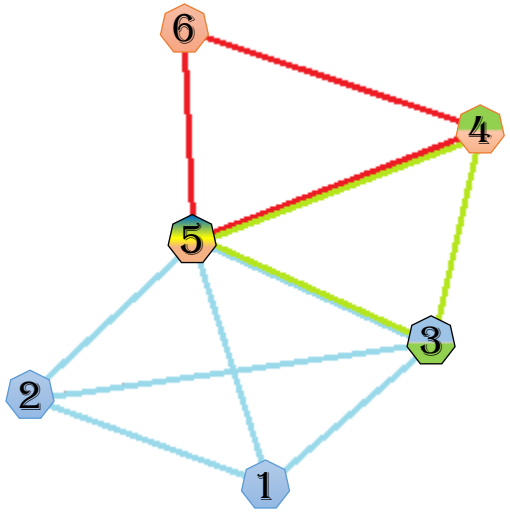
$\tau = 17.1\ weeks$



$Sparseness\ = 1.5$

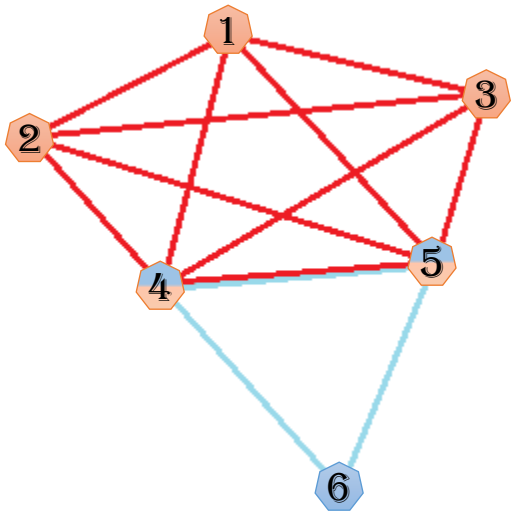
$\tau = 24.3\ weeks$

What does the data say?
Six-member Network



$Sparseness = 1.3$

$\tau = 38.9\ weeks$

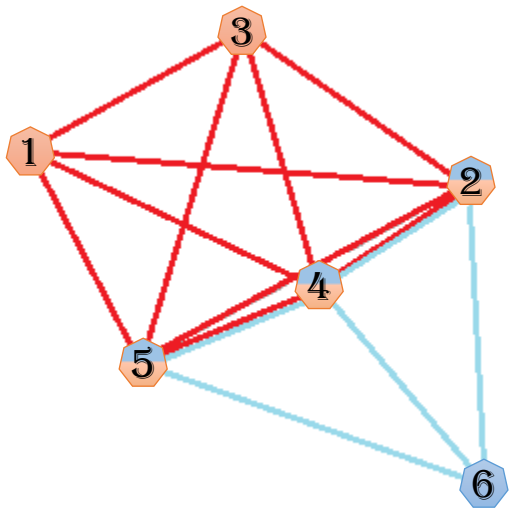


$Sparseness = 1.2$

$\tau = 45\ weeks$

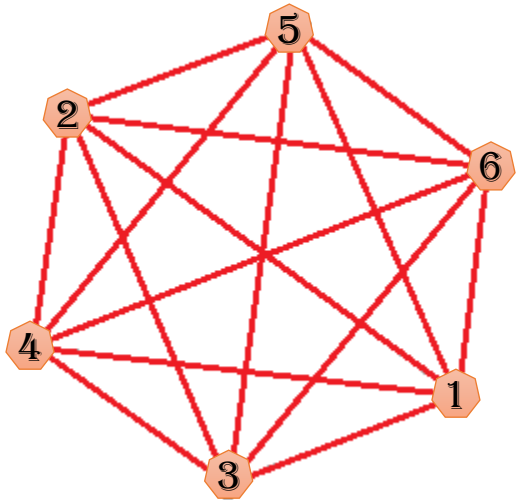
What does the data say?

Six-member Network



$Sparseness = 1.1$

$\tau = 70.7\ weeks$

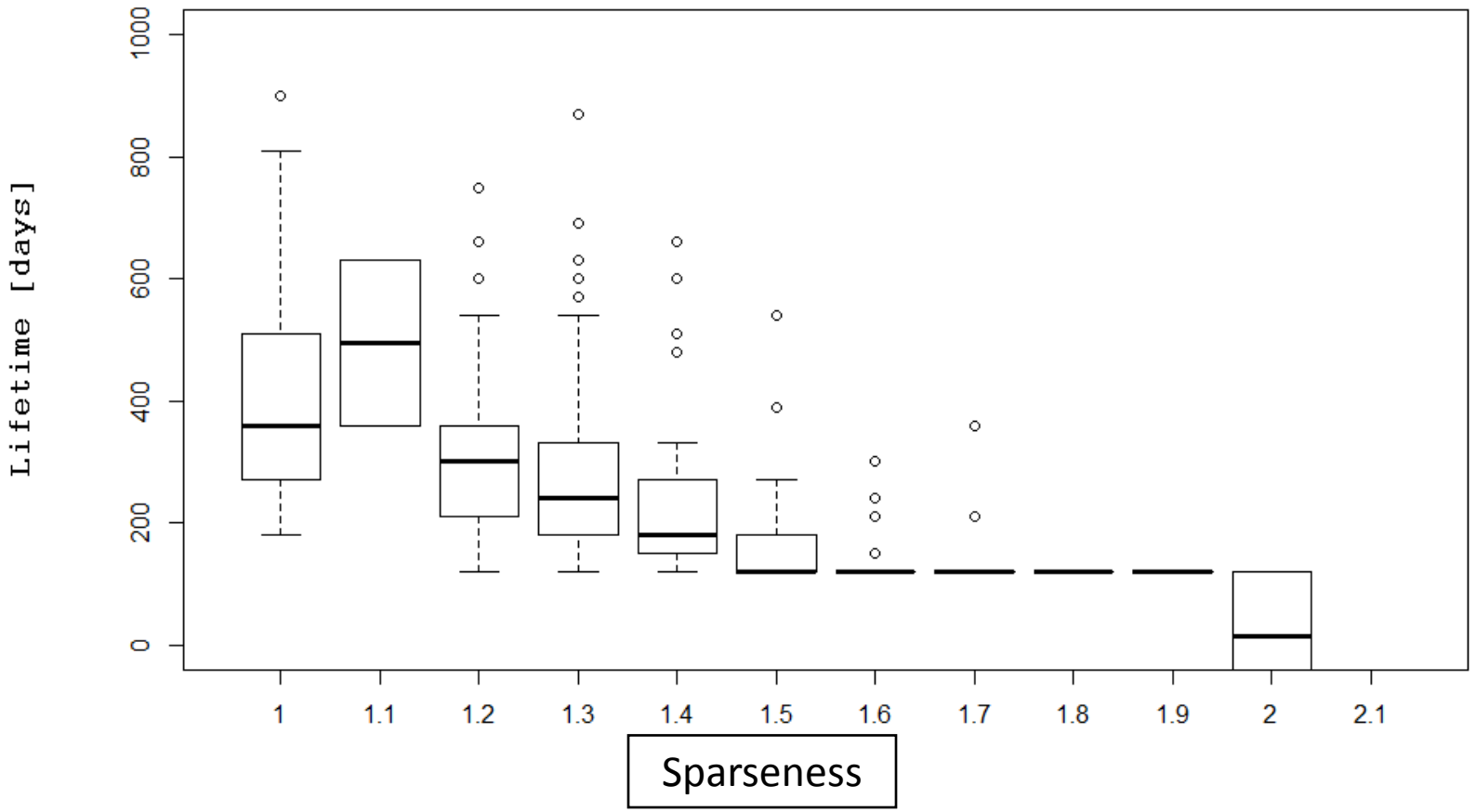


$Sparseness = 1$

$\tau = 58.6\ weeks$

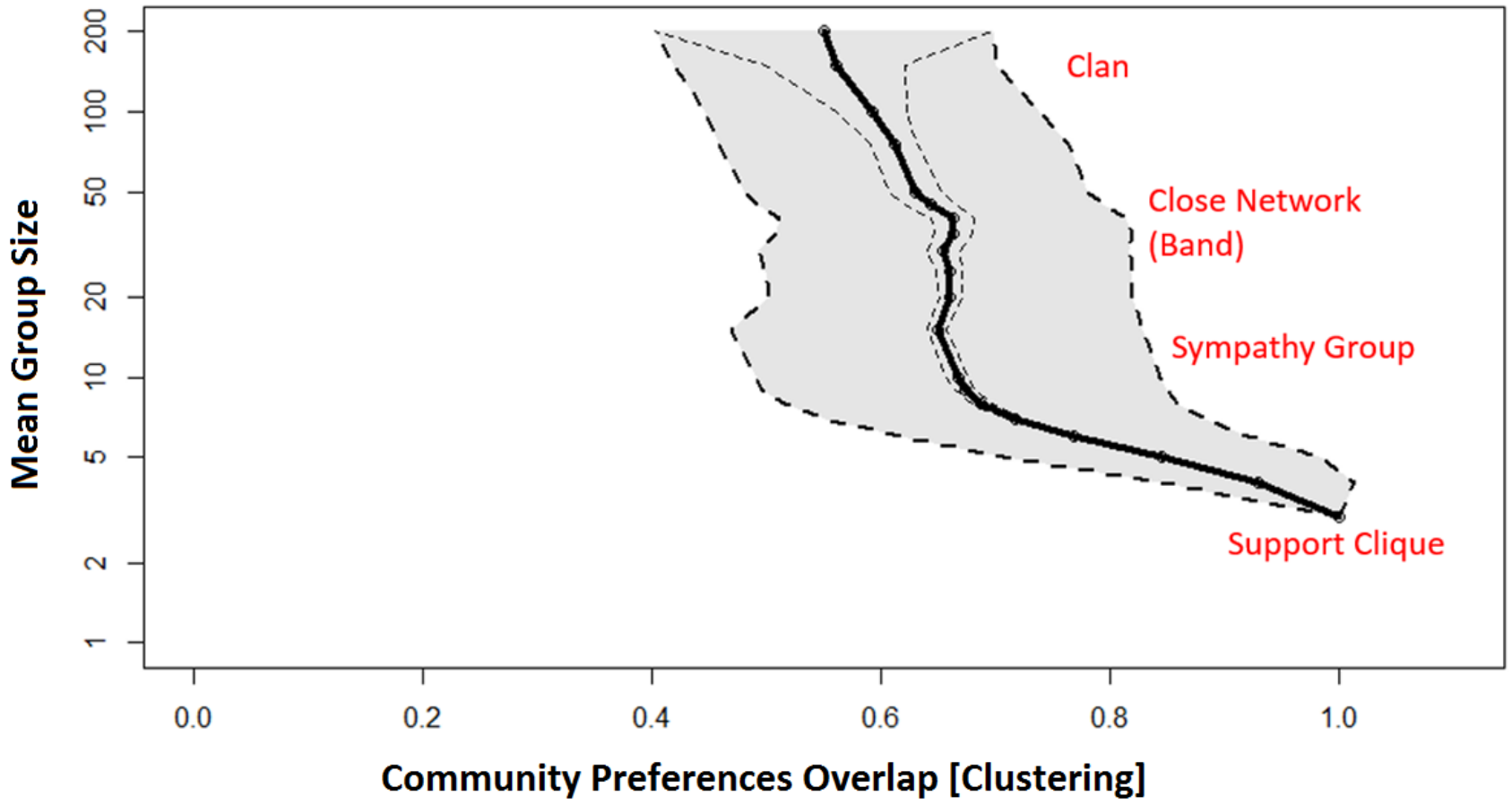
Six-member Network

Lifetime – Cohesiveness Box Plot



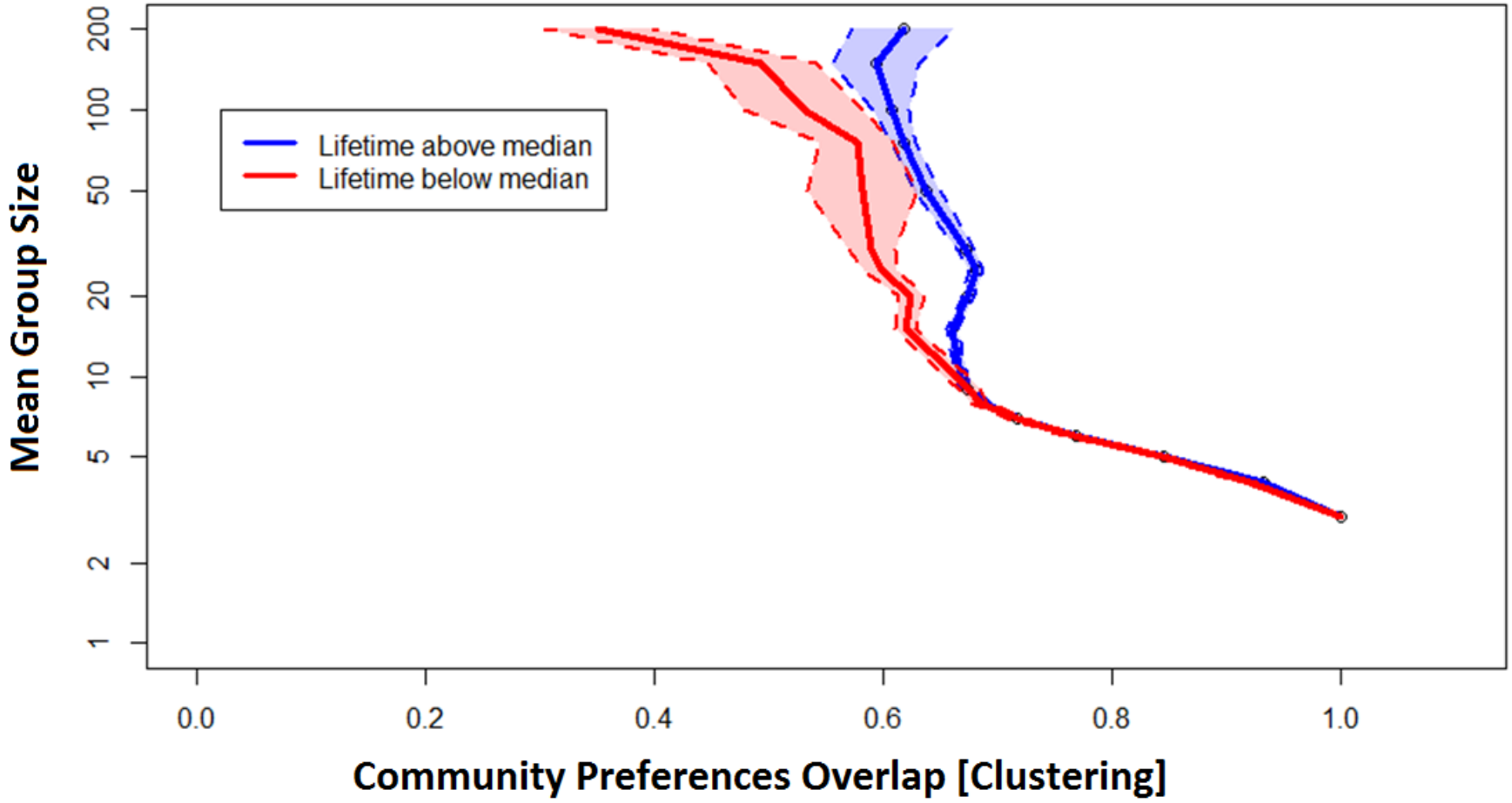
Cohesiveness – Size profile

Online Interactions (12K communities)



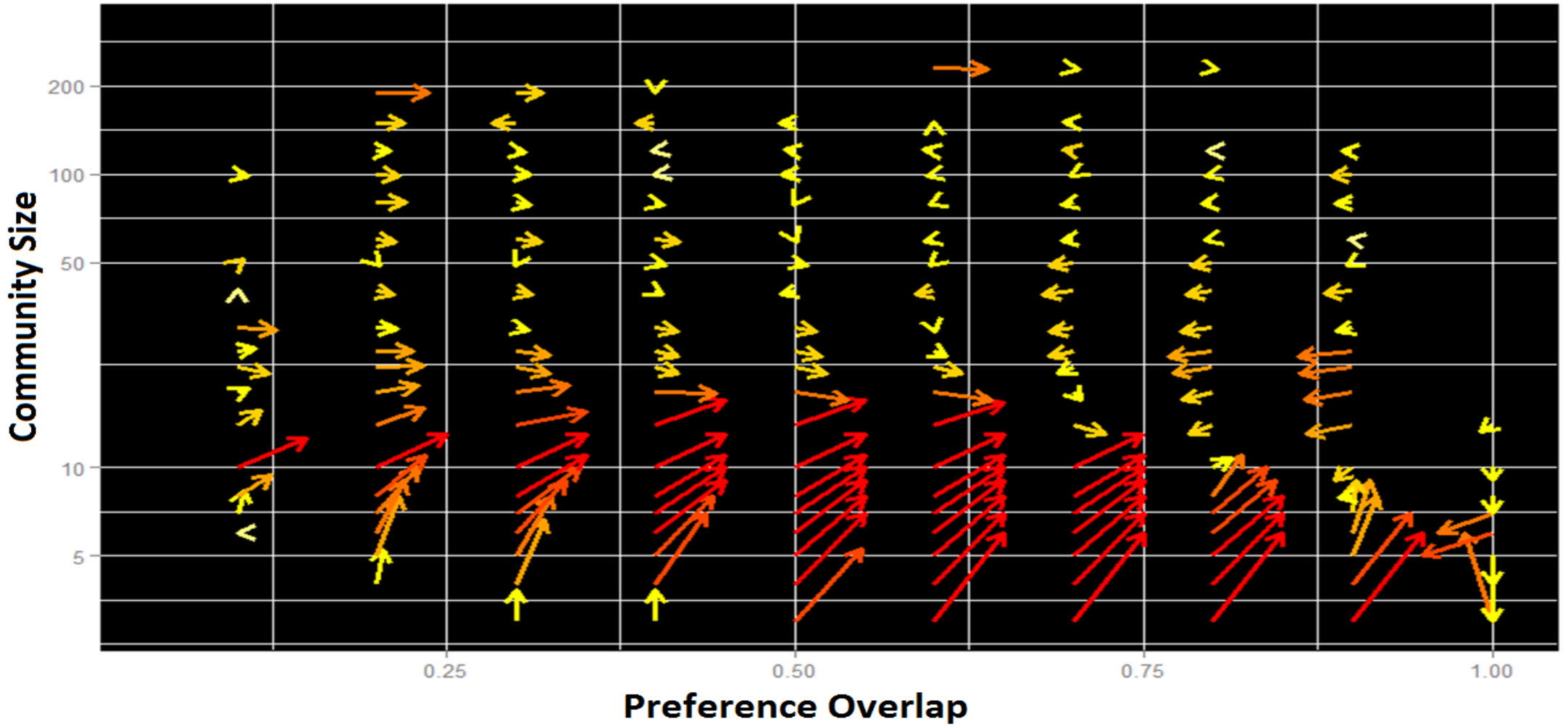
Cohesiveness – Size profile

Connection to life times?



Cohesiveness – Size profile

Dynamic Field



Cohesiveness – Size profile

Prediction

Horizon of prediction	Success rates: Benchmark model	Success rates: Social circles approach
60 days	41.1%	45.1%
90 days	38.3%	42.0%
120 days	36.6%	43.5%
1 year	1.8%	42.9%
5 years	25.1%	39.8%
10 years	25.1%	38.6%