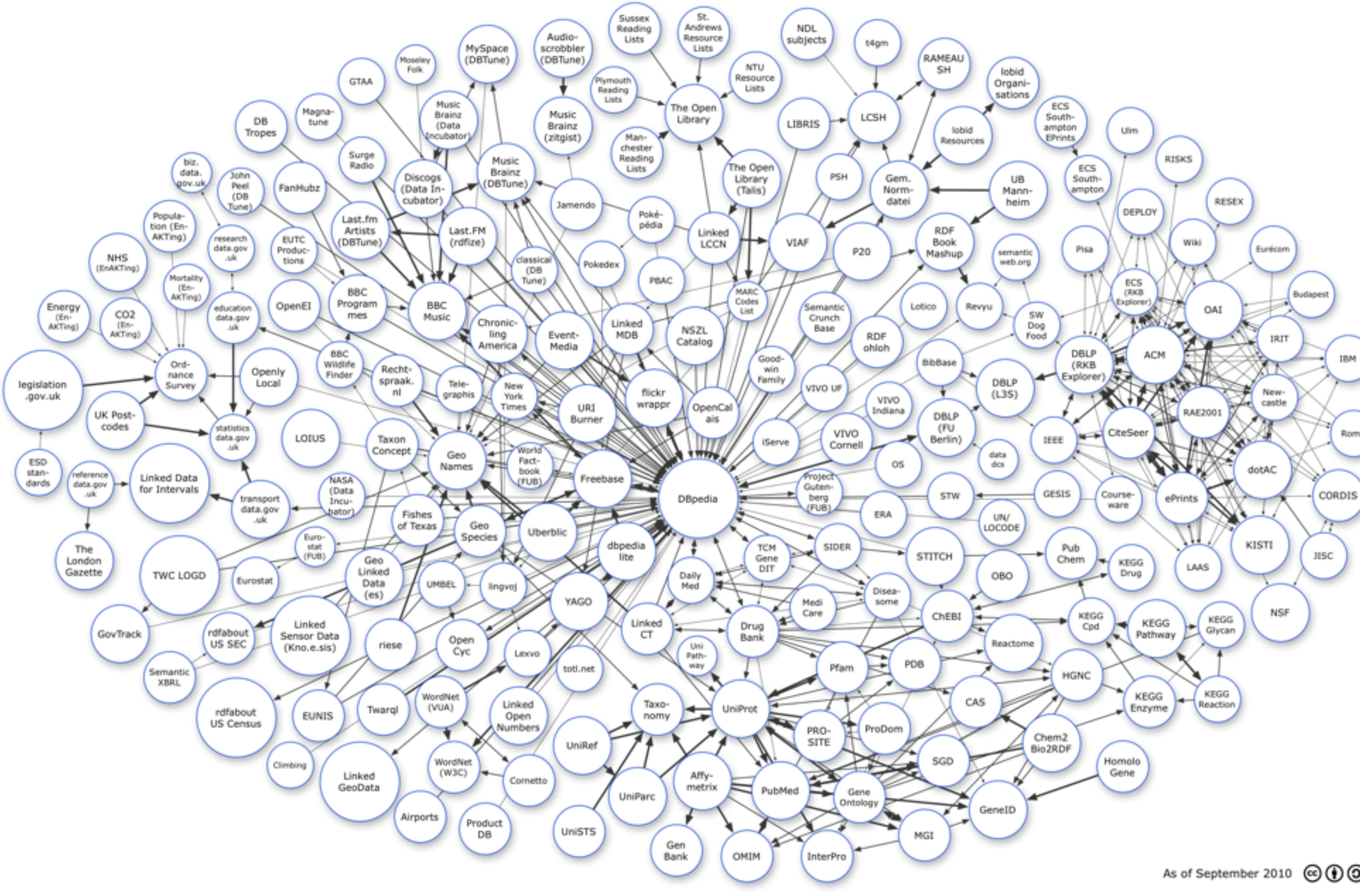
communities
[ncw ch. 3]


Sussex Reading Lists
St. Andrews Resource Lists
NDL subjects
t4gm
RAMEAU SH
lobid Organisations
MySpace (DBTune)
Audioscrobbler (DBTune)
Moseley Folk
GTAA
Plymouth Reading Lists
NTU Resource Lists
The Open Library
LIBRIS
LCSH
lobid Resources
ECS Southampton EPrints
Ulm
DB Tropes
Magnatune
Music Brainz (Data Incubator)
Music Brainz (zitgist)
Manchester Reading Lists
RISKS
biz. data. gov.uk
John Peel (DB Tune)
FanHubz
Surge Radio
Discogs (Data Incubator)
Music Brainz (DBTune)
Jamendo
The Open Library (Talis)
PSH
Gem. Normdatei
UB Mannheim
ECS Southampton
RESEX
Population (EnAKTing)
research data.gov .uk
EUTC Productions
Last.fm Artists (DBTune)
Last.FM (rdfize)
Poképédia
Linked LCCN
VIAF
P20
RDF Book Mashup
DEPLOY
NHS (EnAKTing)
Mortality (EnAKTing)
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Pokedex
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Pisa
Wiki
Eurécom
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BBC Music
Chronicling America
Event Media
Linked MDB
NSZL Catalog
MARC Codes List
Semantic Crunch Base
Lotico
Revyu
SW Dog Food
ECS (RKB Explorer)
OAI
Budapest
legislation .gov.uk
Ordnance Survey
Openly Local
BBC Wildlife Finder
Rechtspraak. nl
Telegraphis
New York Times
URI Burner
flickr wrappr
OpenCalais
Goodwin Family
VIVO UF
RDF ohloh
BibBase
DBLP (RKB Explorer)
ACM
IRIT
IBM
UK Postcodes
statistics data.gov .uk
LOIUS
Taxon Concept
Geo Names
World Factbook (FUB)
VIVO Indiana
DBLP (L3S)
New-castle
IEEE
CiteSeer
RAE2001
Roma
iServe
VIVO Cornell
DBLP (FU Berlin)
ESD standards
reference data.gov .uk
Linked Data for Intervals
transport data.gov .uk
NASA (Data Incubator)
Freebase
DBpedia
OS
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dotAC
Fishes of Texas
Geo Species
Uberblic
Project Gutenberg (FUB)
ERA
STW
GESIS
Courseware
ePrints
CORDIS
UN/ LOCODE
The London Gazette
TWC LOGD
Eurostat (FUB)
Eurostat
Geo Linked Data (es)
UMBEL
lingvoj
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YAGO
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Medi Care
Drug Bank
ChEBI
KEGG Cpd
KEGG Pathway
KEGG Glycan
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Reactome
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KEGG Enzyme
KEGG Reaction
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ProDom
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Linked GeoData
WordNet (W3C)
Cornetto
UniParc
Affymetrix
SGD
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PubMed
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GeneID
Airports
Product DB
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Gen Bank
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InterPro
MGI
As of September 2010

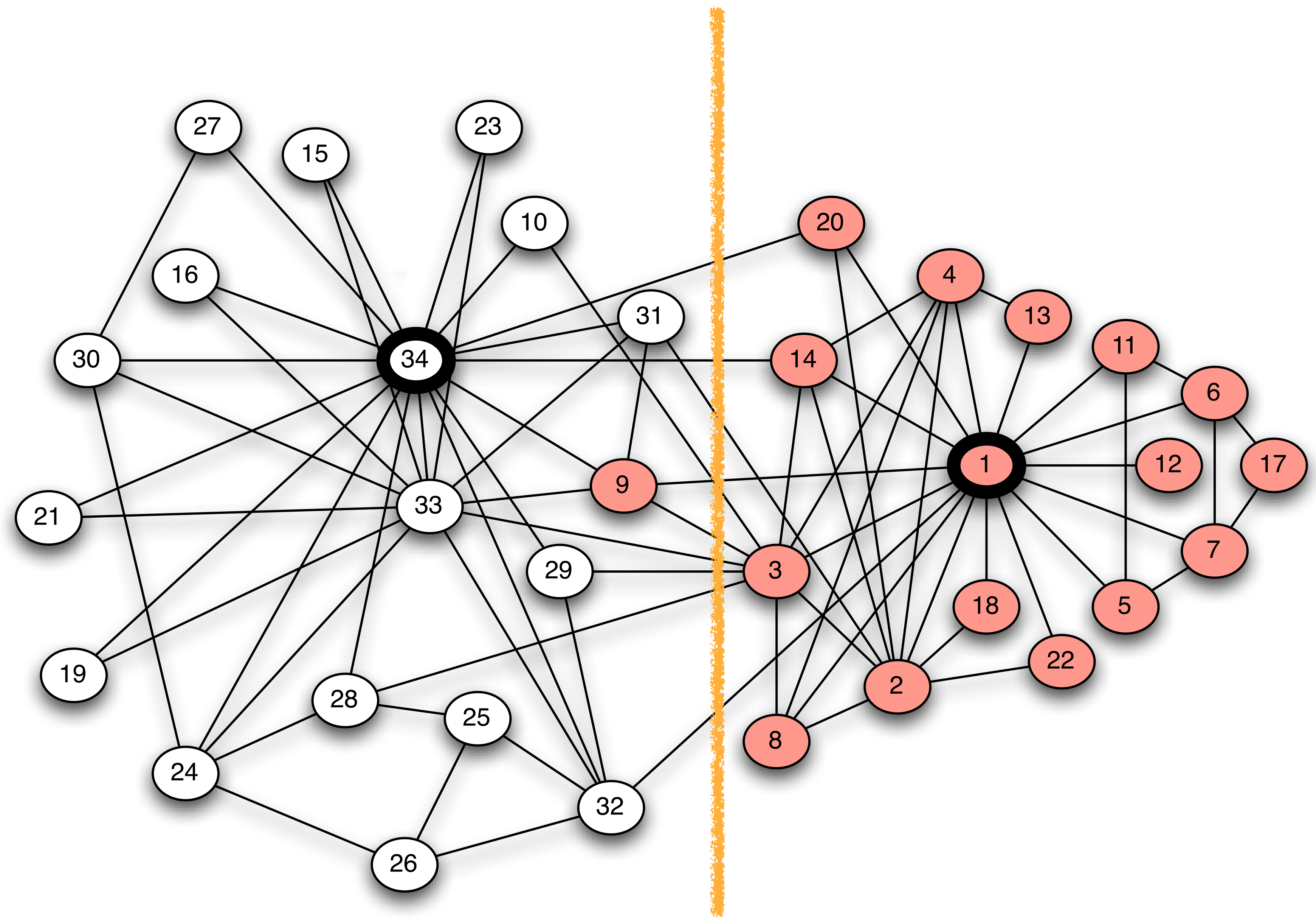
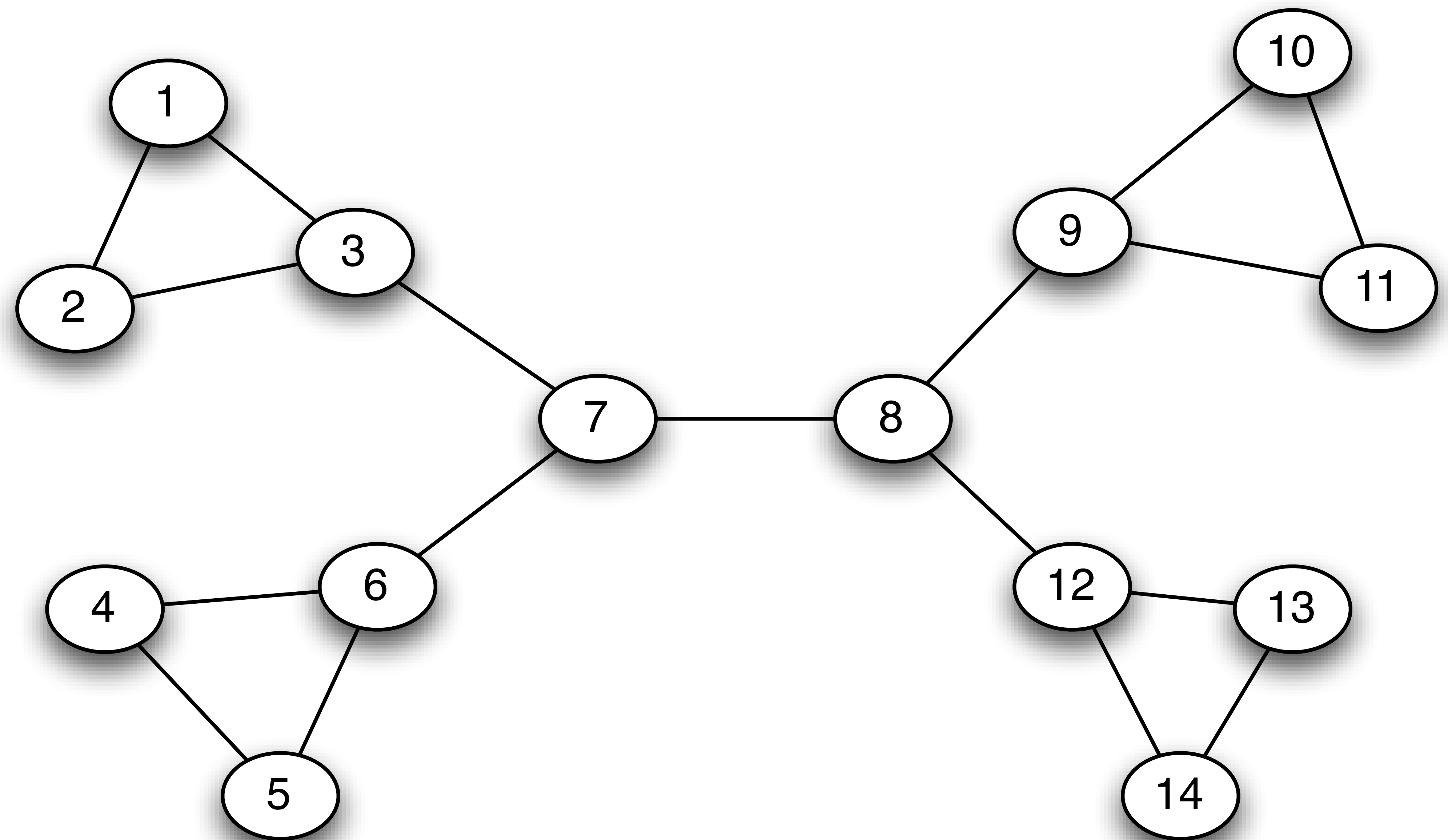


Figure 3.13: A karate club studied by Wayne Zachary [421] — a dispute during the course of the study caused it to split into two clubs. Could the boundaries of the two clubs be predicted from the network structure?

Define the *between-ness* of a node u, written $\beta(u)$, as the number of shortest paths of G containing u - that is to say:

$$
\begin{aligned}
\beta(u) &= \textstyle\sum_{x \in V} \varphi_x(u) \\
\varphi_x(u) &= \textstyle\sum_{y \in V} |\{\gamma \in sp(x, y) \mid u \in \gamma\}|
\end{aligned}
$$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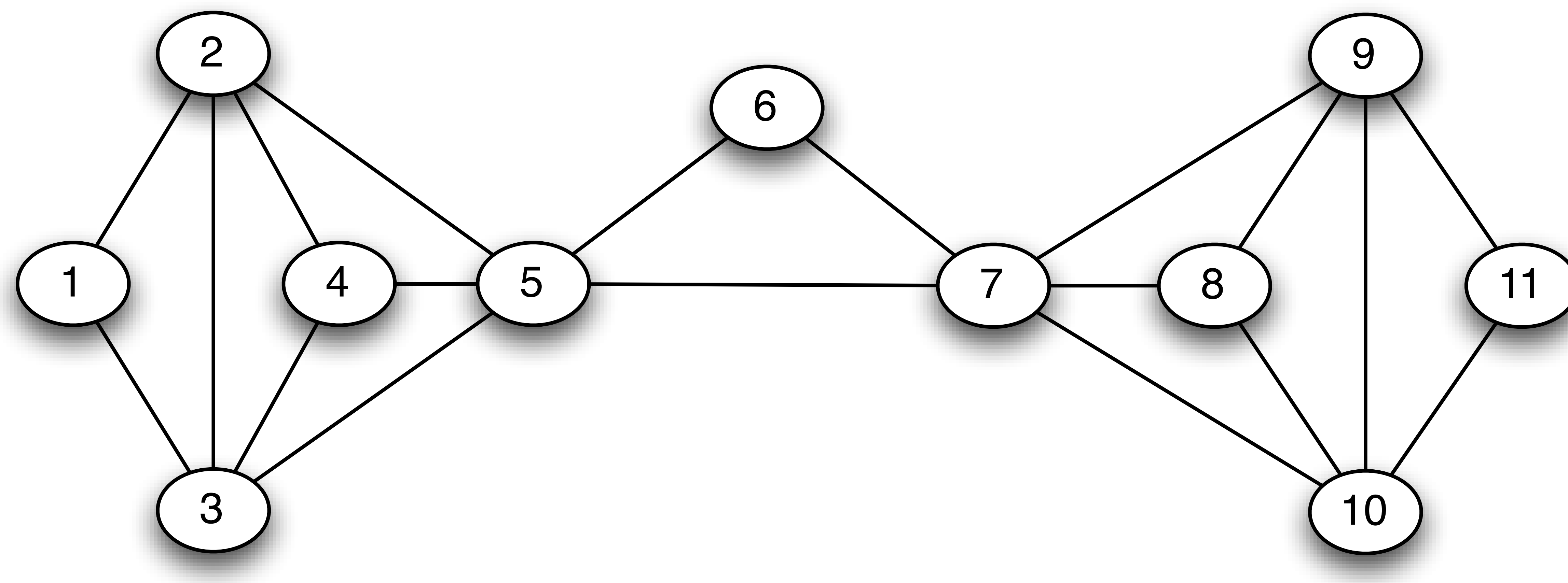
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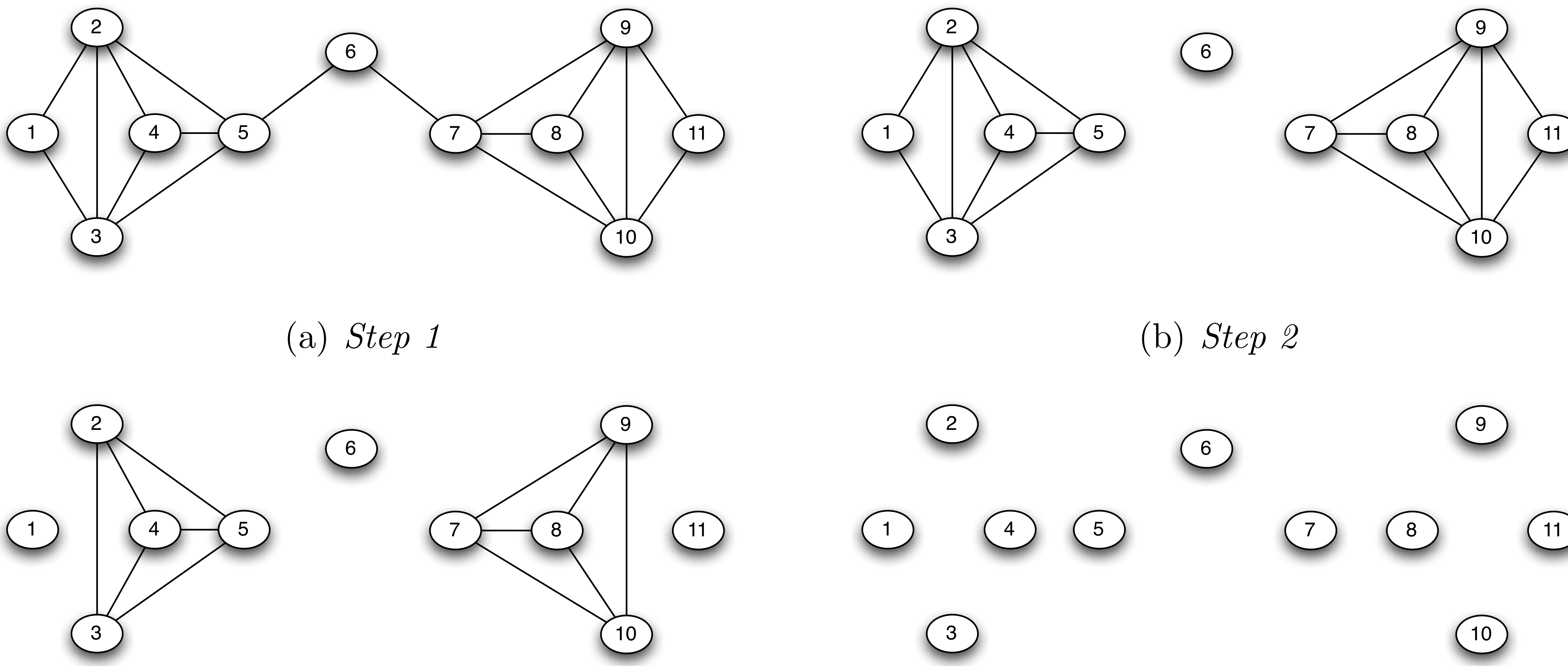
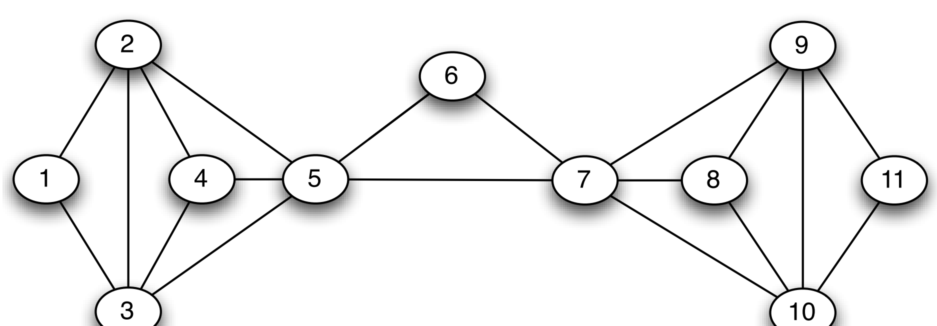


(a) *Step 1* (b) *Step 2*

(c) *Step 3* (d) *Step 4*

Figure 3.17: The steps of the Girvan-Newman method on the network from Figure 3.15.



Write $BF(x)$ for the ranked graph induced by a *breadth-first* search from x in G, where each node y in V is mapped to $d(x, y) \in \mathbb{N}$ its distance to x. Write $sp(z, y)$ for set of shortest paths from z to y in G.

(i) Show that neighbours in G are at most one rank remote in $BF(x)$.

Show that deleting all edges (y, z) such that $d(x, y) = d(x, z)$ (edges of constant rank) in $BF(x)$ obtains a directed acyclic graph $BF^{-}(x)$.

Since, $d(x, y)+d(y, z) \leq d(x, z)$, if $d(y, z) = 1$, then $|d(x, y)-d(x, z)| \leq 1$. Directedness and acyclicity follow from the fact that all paths are now strictly rank-increasing.

Write $ri(z, y)$ for set of paths from z to y in $BF(x)$ with a strictly increasing rank; equivalently, the set of directed paths from z to y in $BF^{-}(x)$.

Write:
- y^{-} for the set of immediate parents of y in $BF^{-}(x)$
- z^{+} for the set of immediate successors of z in $BF^{-}(x)$

We have $y^{-} = \varnothing$ iff y is the root x of $BF^{-}(x)$, $z^{+} = \varnothing$ iff z is a leaf in $BF^{-}(x)$.

(ii) Set $\sigma(x, y) = |ri(x, y)|$, and show that this is the number of shortest paths from x to y.

Show that $\sigma(z, z) = 1$, and, conversely, $\sigma(z, y) > 0$, $\sigma(y, z) > 0 \Rightarrow z = y$.

(iii) Show that $\sigma(x, y) > 0$, and $\sigma(x, z) \leq \sigma(x, y)$ if $z \in y^-$.

(iv) Show that σ verifies:

$$\begin{array}{rcl} \sigma(x,x) & = & 1 \\ \sigma(x,y) & = & \sum_{z \in y^-} \sigma(x,z) \quad \text{if } x \neq y \end{array}$$

(vi) Define the *between-ness* of a node u, written $\beta(u)$, as the number of shortest paths of G containing u - that is to say:

$$\begin{array}{rcl} \beta(u) & = & \sum_{x\in V} \varphi_x(u) \\ \varphi_x(u) & = & \sum_{y\in V} |\{\gamma \in sp(x,y) \mid u \in \gamma\}| \end{array}$$

Show:

$$\varphi_x(u) \quad = \quad \sigma(x,u) + \sum_{v\in u^+} \varphi_x(v) \cdot \sigma(x,u)/\sigma(x,v)$$

For every x, build $BF(x)$ and compute for each node y the number $\sigma(x, y)$ using the top-down formula of subquestion *(iv)*; then use the bottom-up formula just above, to compute $\varphi_x(u)$; to obtain $\beta(u)$, sum over x; the complexity is linear in the number of edges and linear in the number of nodes, so quadratic in G, hence cubic if one wants to pick up nodes of maximal betweeness.

is between-ness a good notion?

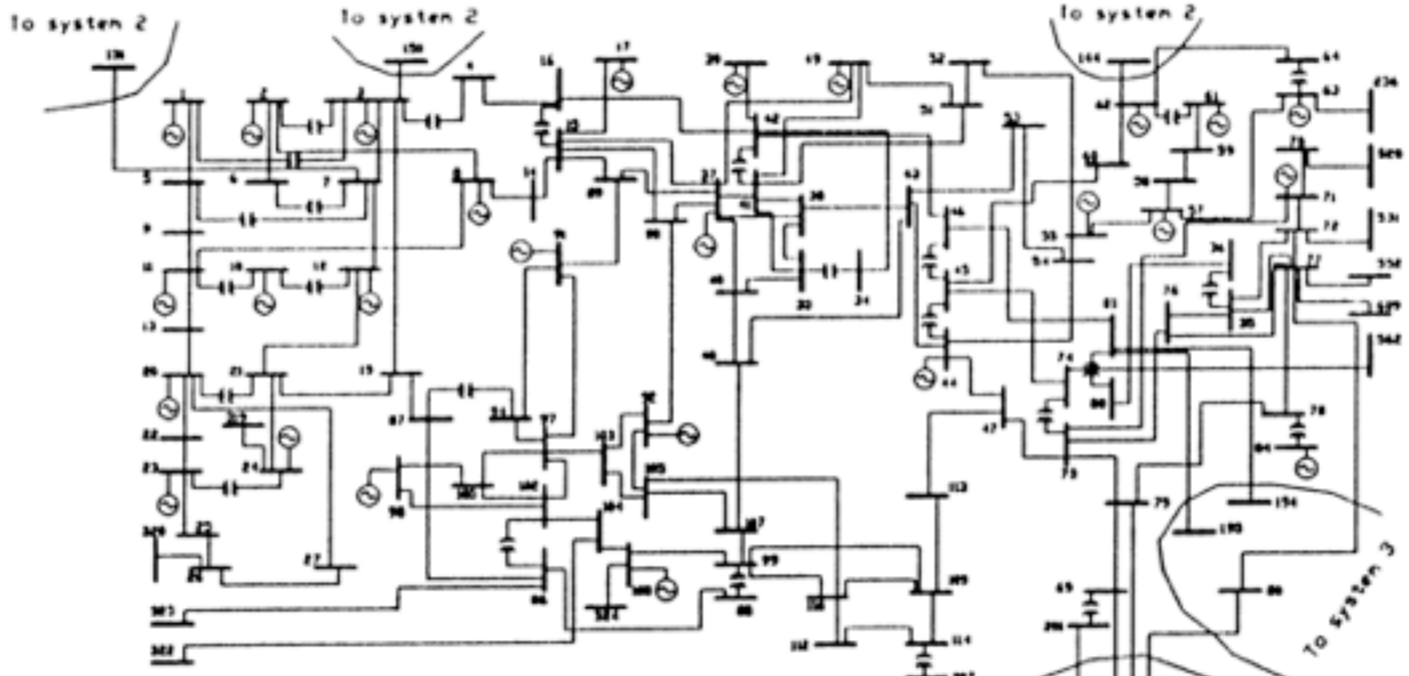


Figure 1. 300-BUS TEST SYSTEM - SYSTEM 1.

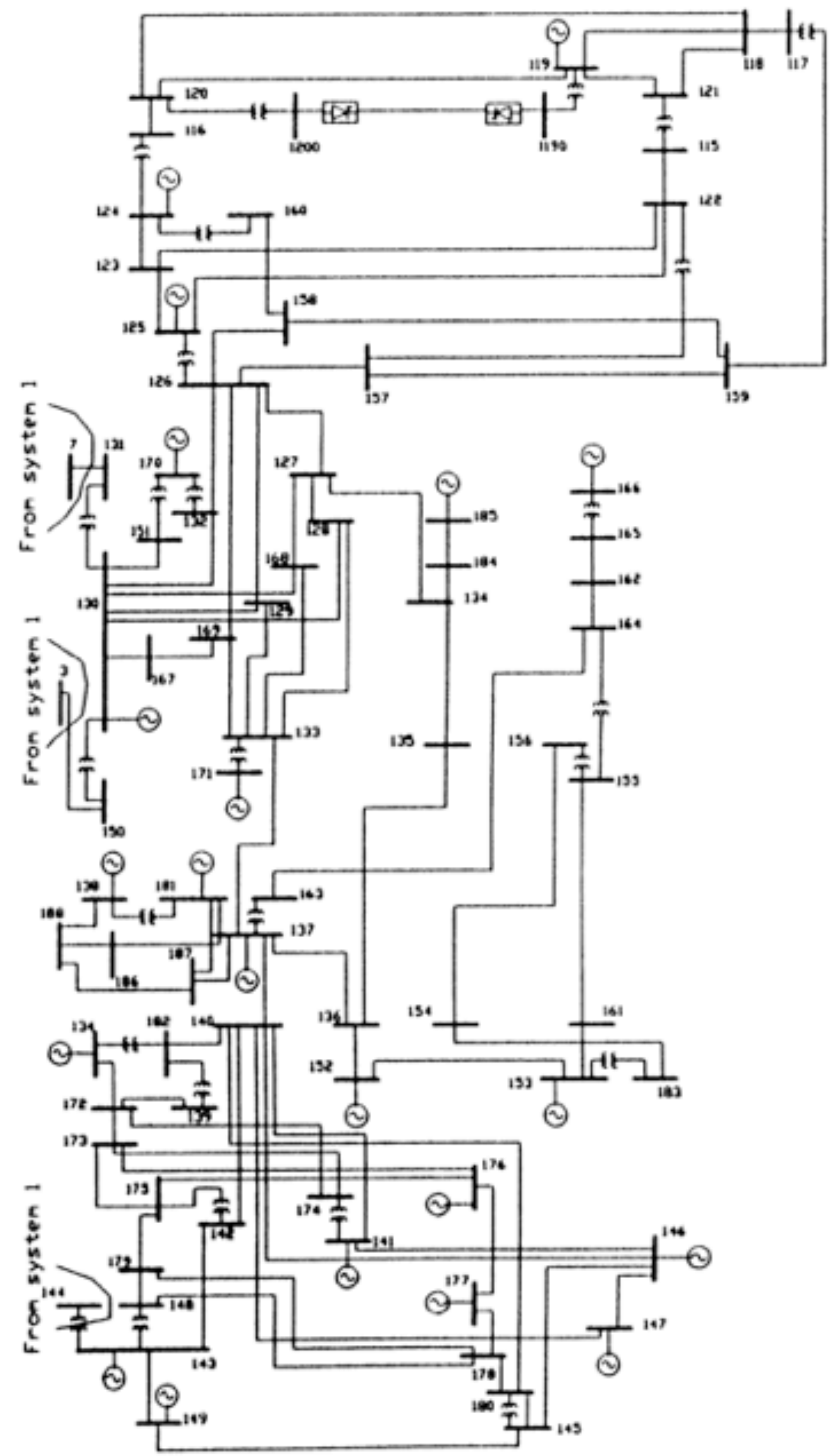


Figure 2. 300-BUS TEST SYSTEM - SYSTEM 2.

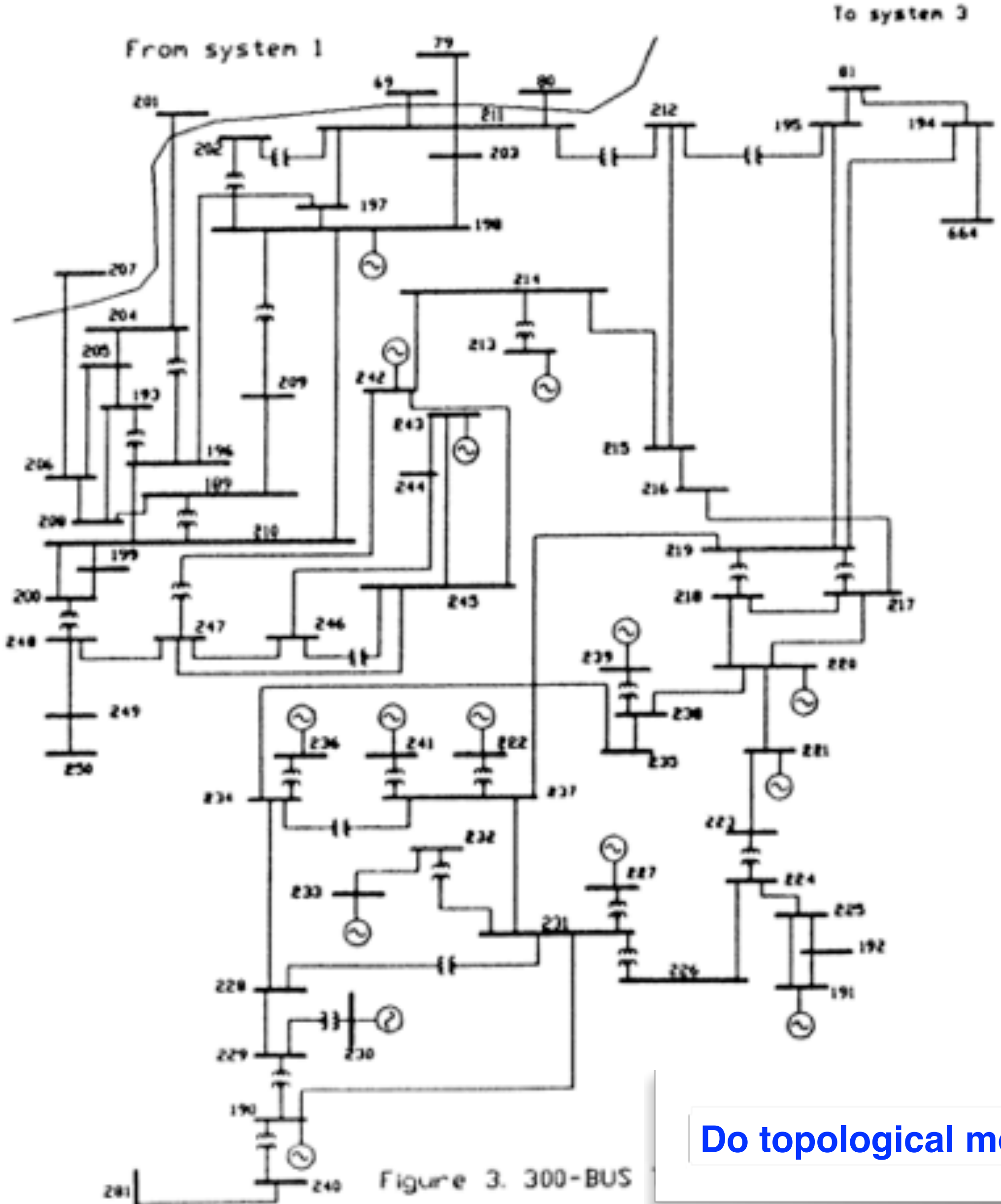


Figure 3. 300-BUS

Do topological models provide good information about electricity infrastructure vulnerability?

3 measures of disruption/5 attack modes

Mean distance between nodes

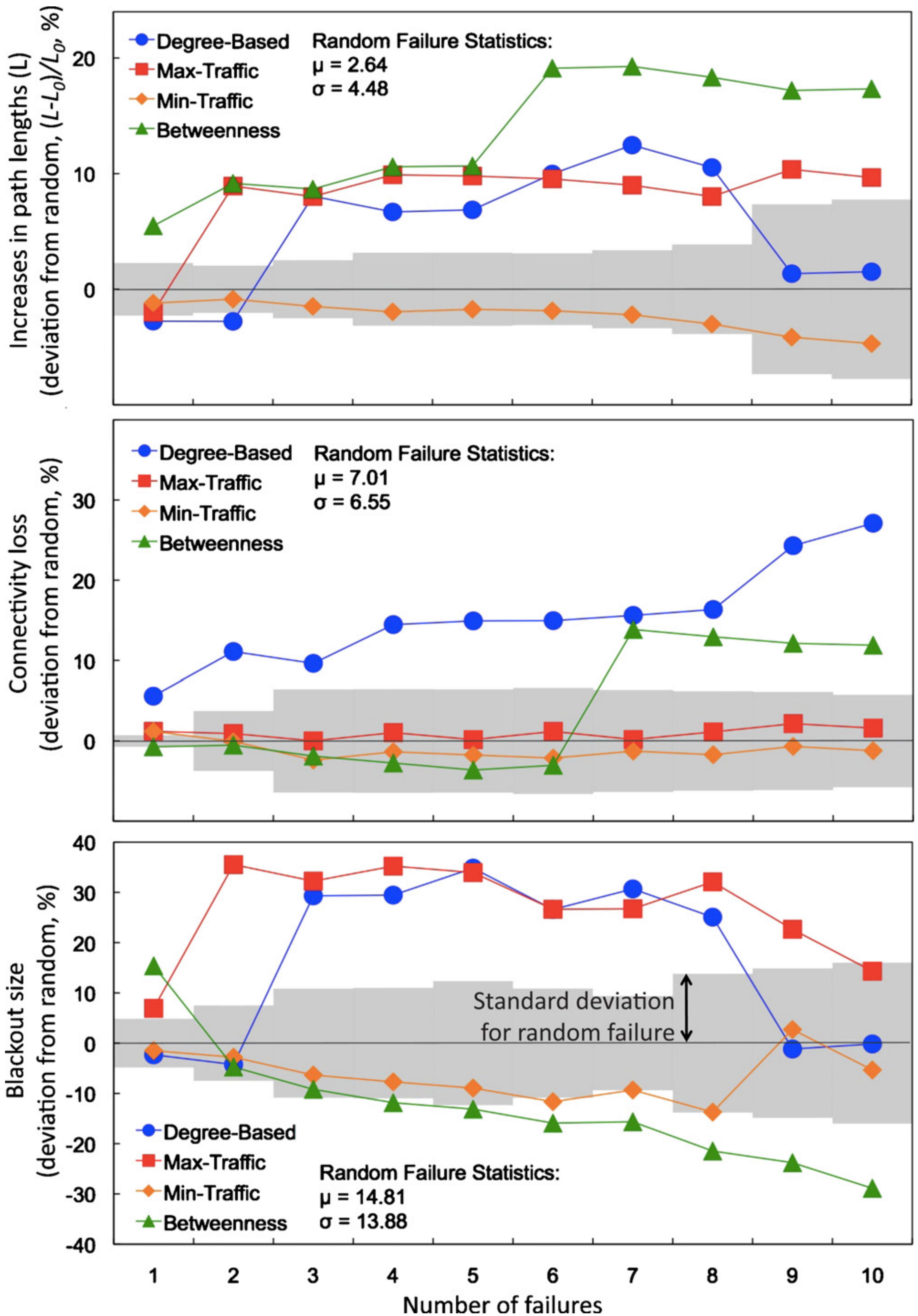
Connectivity loss

C = 1 - <n(x,g)/n(g)>

n(g) = total number of generators
n(x,g) = number of generators connected to x

Blackout sizes
as calculated from a model of cascading failure in a power system

$$P_i = \sum_{j=1}^{n} (\theta_i - \theta_j)/X_{ij}$$



CHAOS **20**, 033122 (2010)

Simulated response of the IEEE 300 bus network to directed attacks

top: mean path length
middle: connectivity loss
bottom: size of blackout

random failures are averaged over 20 trials

differences between attack results and random failures

Shading ±σ for random failures

previously ...

between-ness a measure of the flow through a node (or edge)

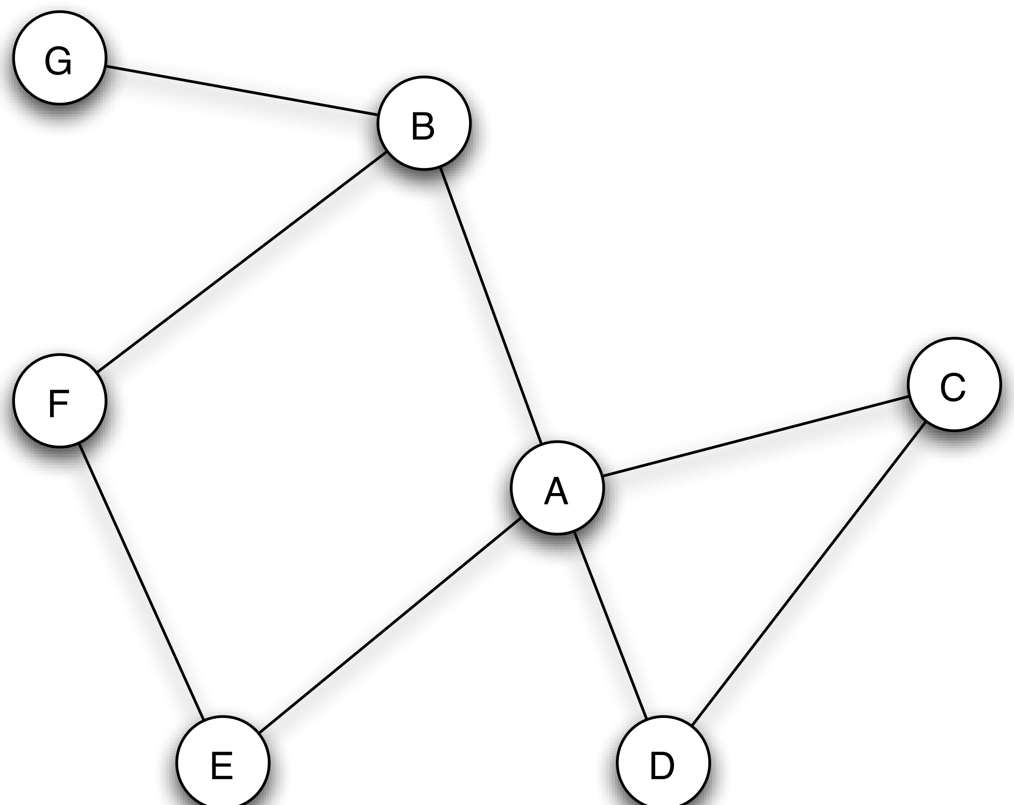
today ...

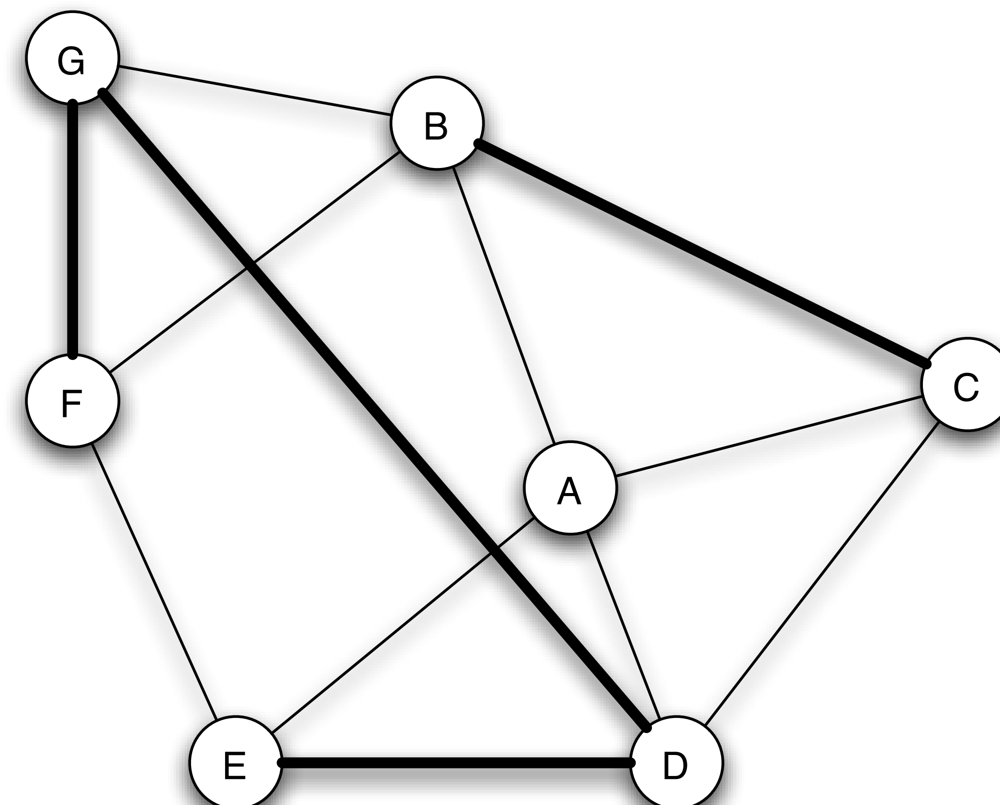
- triadic closure ...
- strength of weak ties
- architecture of social networks
- how a network evolves over time
- interpreting between-ness

triadic closures ...

Clustering Coefficient(A) = fraction of A's friends who are friends

compute cc(A) before and after





opportunity

trusting

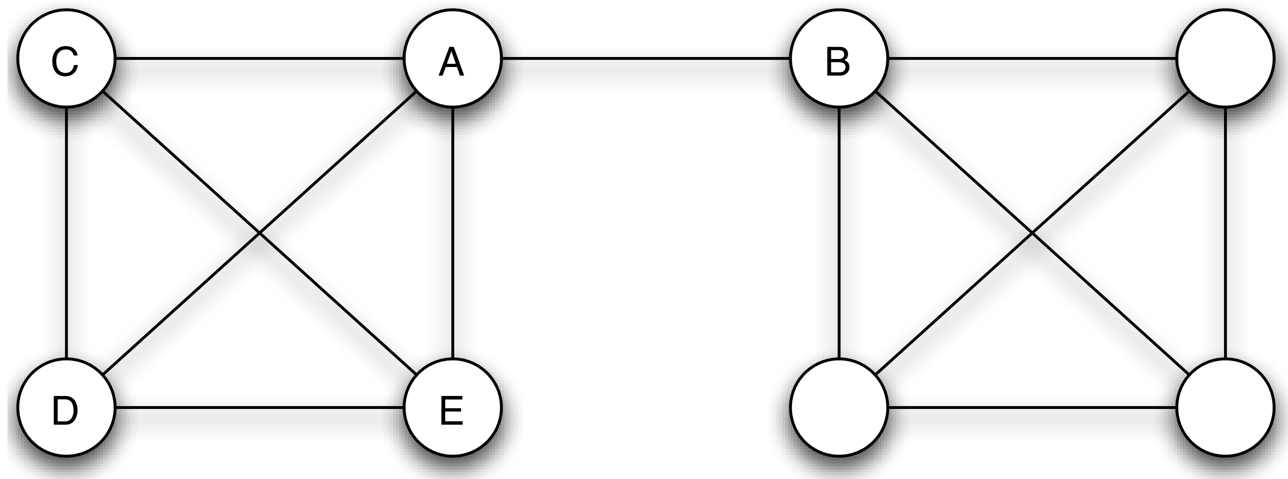
stress

cc is genetically inherited

attach-and-introduce model

espistemo point: recreate the process behind a feature - see Miguel's lectures; also Panconesi's lecture on web compressibility bridges

interpreting between-ness: where does info come from; different time scales and steady states?



local bridges

no friends in common

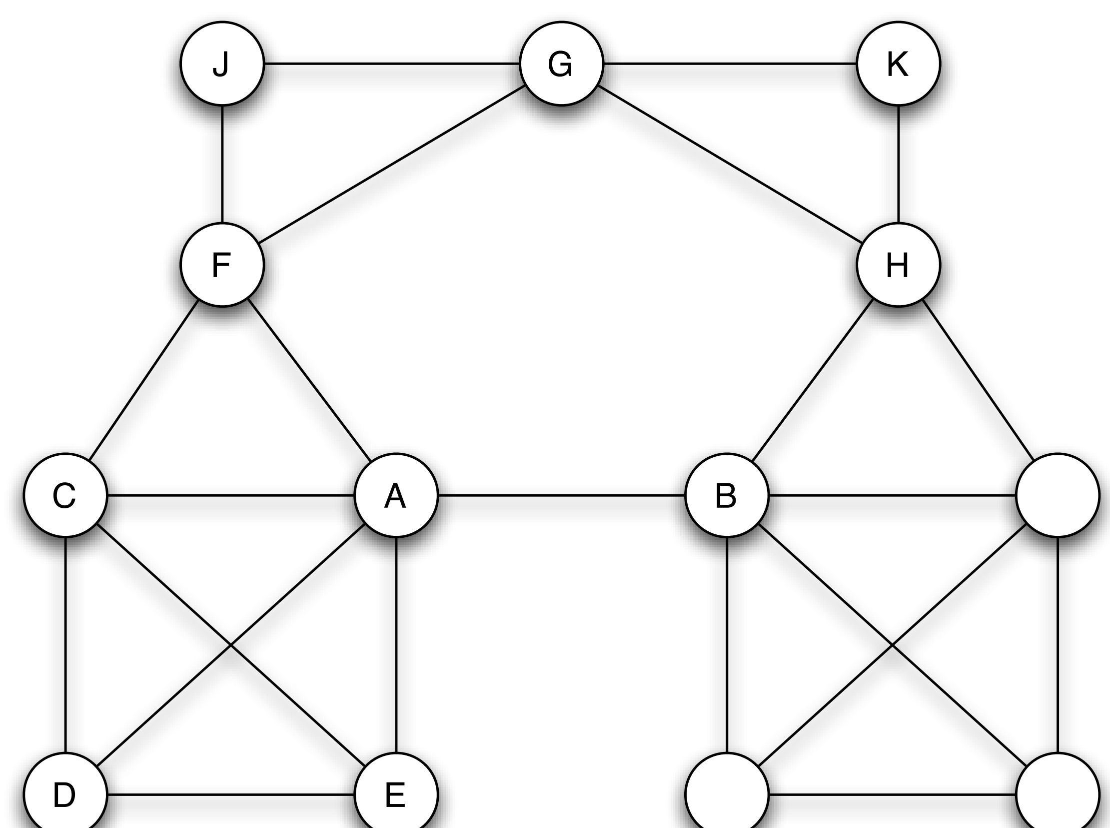
low cc

distance contraction, curvature?

compute the derivative of gossip upper bounds?

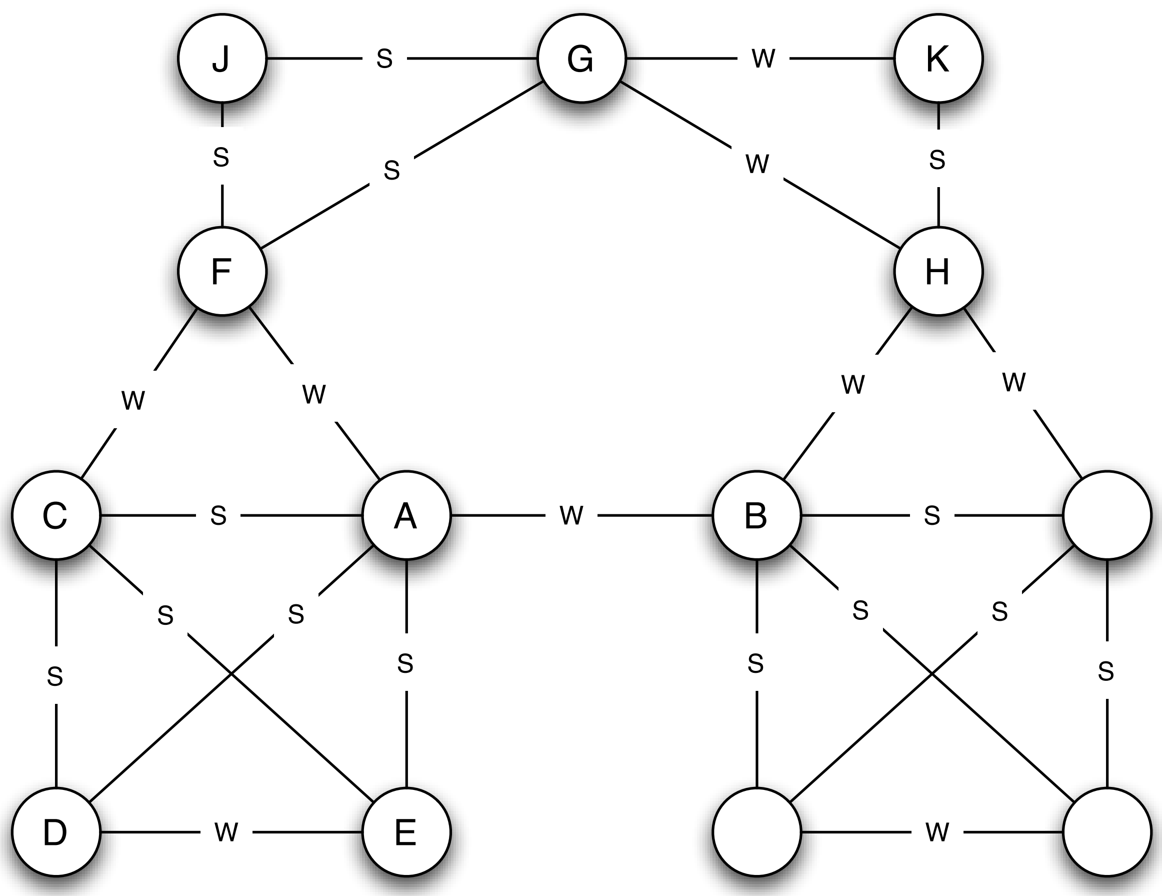
what is propagating?

philosophical stake: fine time-structure of information propagation



strong ties (the stronger links, corresponding to friends), and weak ties

strong triadic closedness



local bridge on A (2 s) is weak <= STC