Strong and weak ties

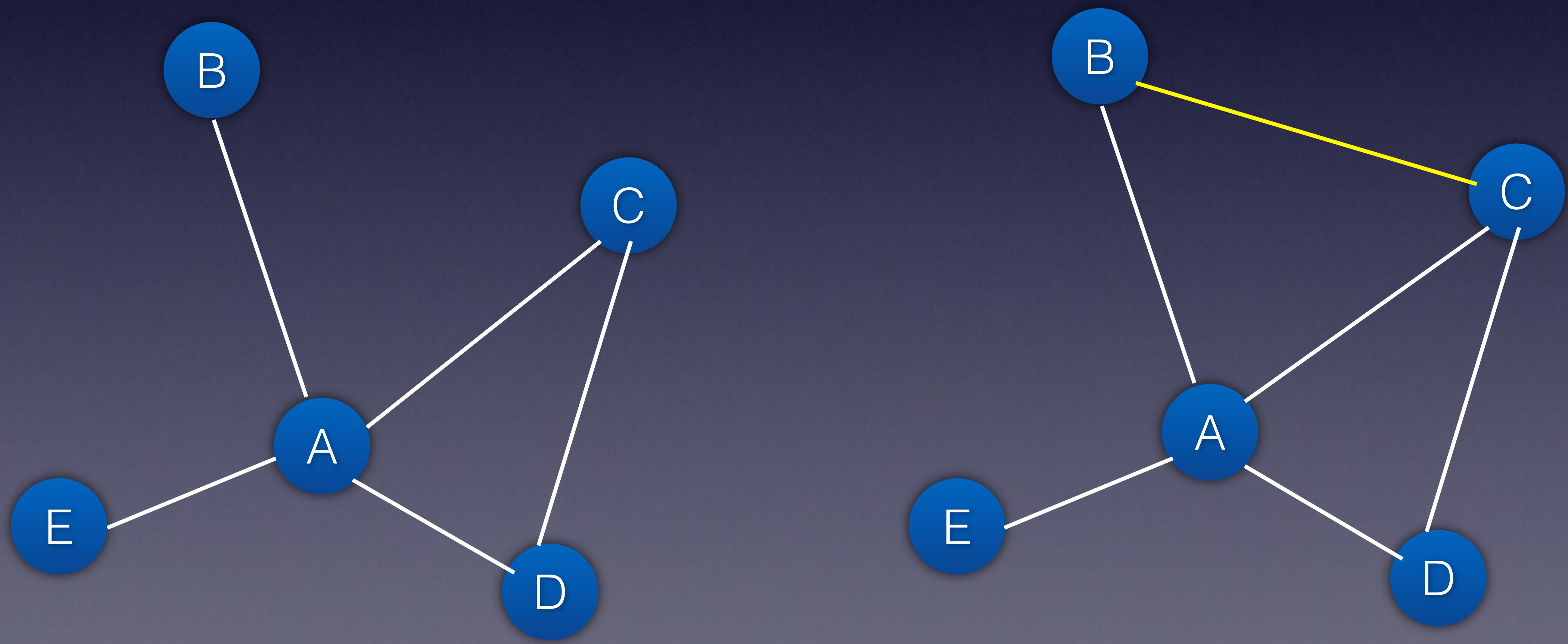
Seminars in Social Networks and Markets

How many people find their job

- Based on interviews (in the late 1960s):
    - Many people reached their current job through personal contacts
    - But: often through “acquaintances”, and not close friends
- Why?
- Mark Granovetter (1943–), US sociologist

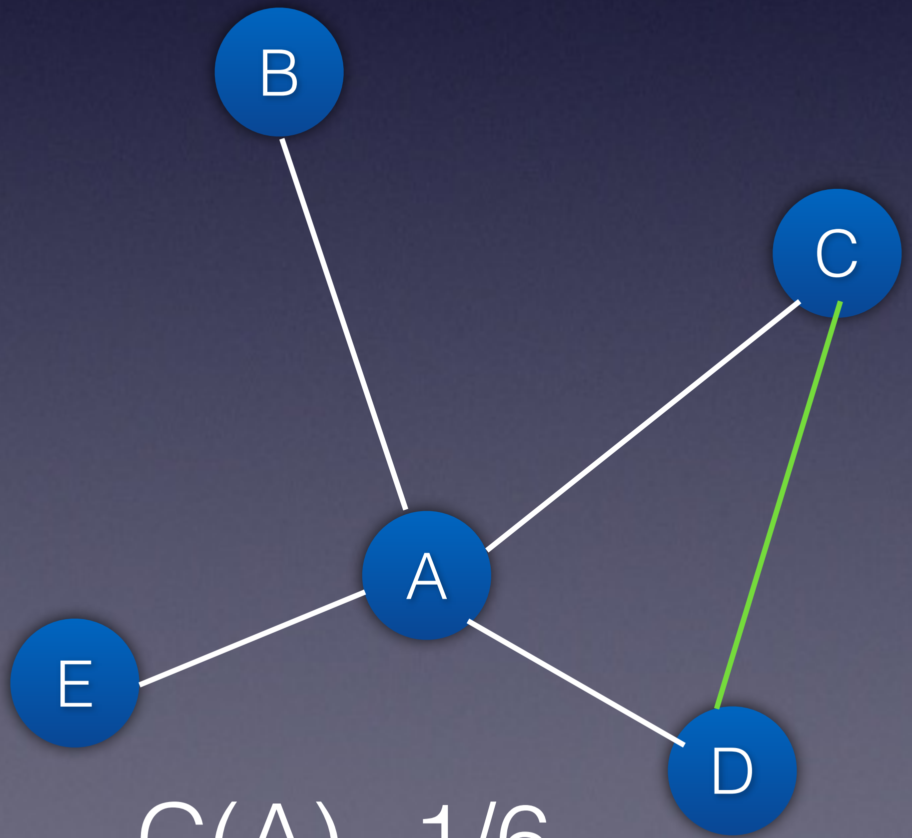
Triadic Closure

- *"If two people in a social network have a friend in common, it is more likely that they will become friends themselves in the future"*

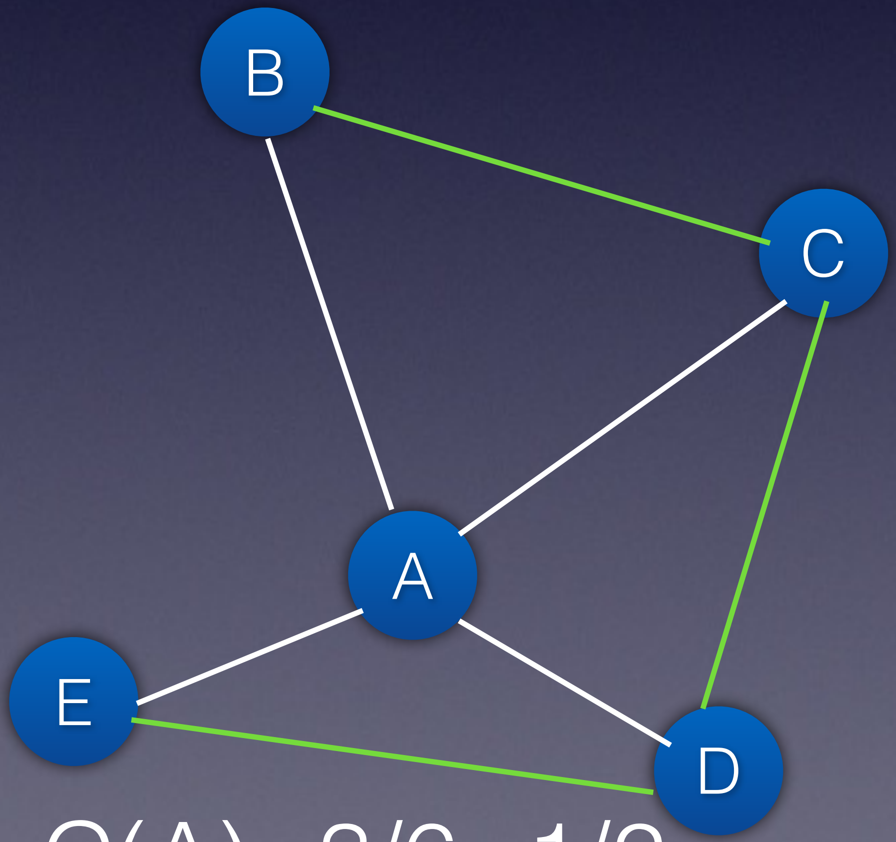


Clustering Coefficient

- *C(A) := probability that two random friends of A are friends with each other*
- Measures the prevalence of triadic closure



C(A)=1/6



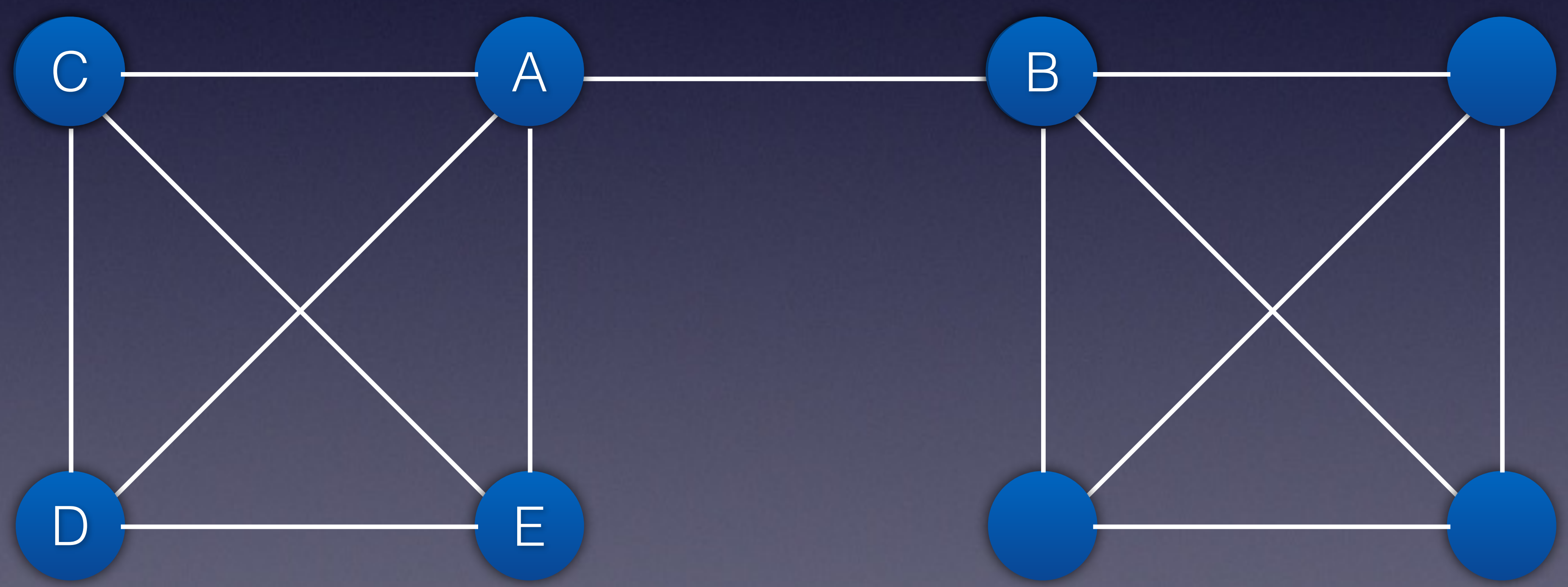
C(A)=3/6=1/2

Reasons for Triadic Closure

- *Opportunity*: if A spends time with B and C, there is a higher chance that B and C will meet
- *Trust*: if B and C are friends with A, they can more easily trust each other
- *Incentive*: if B and C are not friends, it can become a source of stress in the relationships with A
  - For example, teenage girls with low clustering coefficient in their friendship network are more likely to contemplate suicide (Bearman & Moody)

Bridges

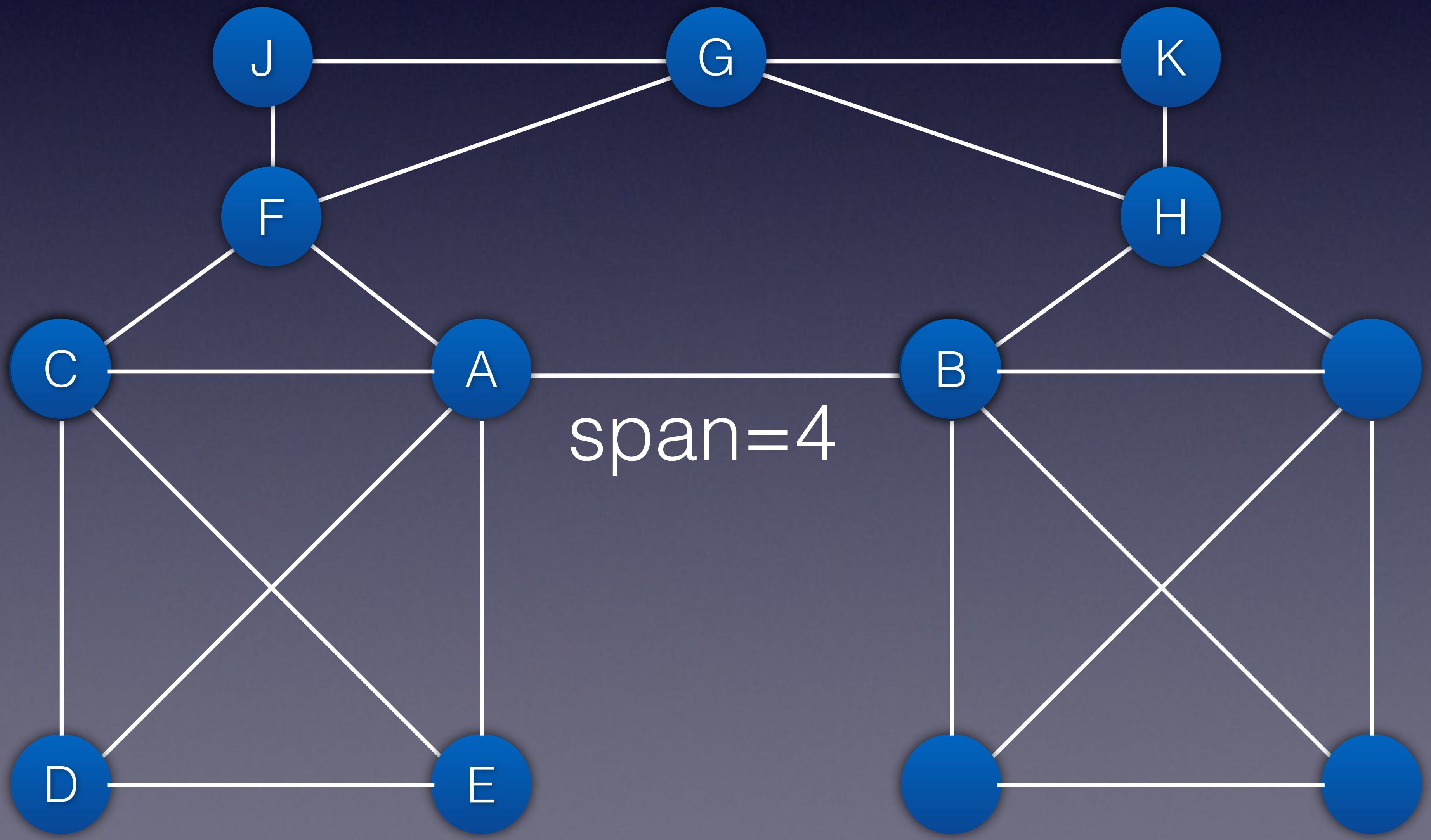
- An edge *e* is a **bridge** if deleting *e* disconnects the graph
- But, bridges are rare in real social networks



Local bridges

- An edge *A-B* is a **local bridge** if A and B do not have a common neighbor

- Its **span** is the distance between A and B after removing the edge A-B



Strength of Weak Ties

- Assume that information about good jobs is scarce
- Then the information might come unusually often through a **local bridge**…
- …because your closer group of friends knows roughly the same things that you do

Levels of strength of ties

- “Stronger link” = closer friendship, higher frequency of interaction
- Let’s simplify and classify links as **strong ties** (close friends) and **weak ties** (acquaintances)

Strong Triadic Closure

- Granovetter proposed a “strong triadic closure” (**STC**) property:

- Definition.
  Node A violates the STC property if it has strong ties to B and C, but there is <u>no edge</u> (strong or weak) between B and C

- *Node A satisfies the STC if it does not violate it.*

Local bridges and weak ties

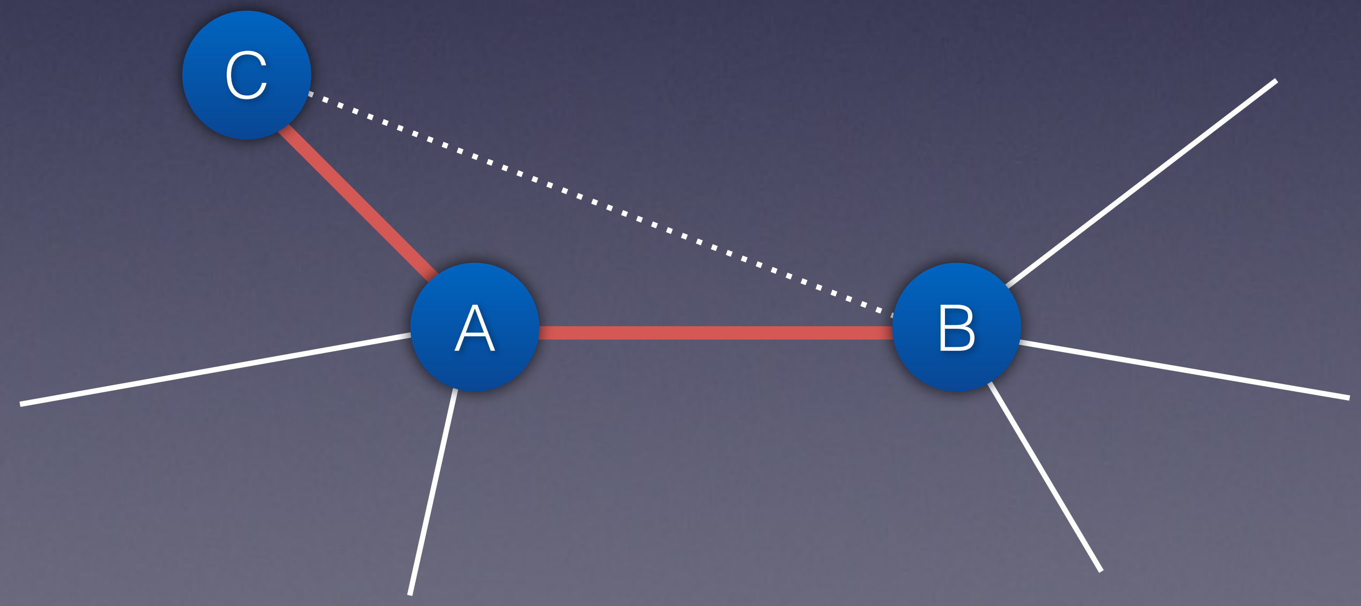
- Claim:
  If a node A satisfies the STC and is involved in at least 2 strong ties, then any local bridge involving A **must be a weak tie**
- Thus, with a sufficient number of strong ties, all local bridges in a network are weak ties!
- We can prove the claim formally

Proof of the Claim

- Claim:
  If a node A satisfies the STC and is involved in at least 2 strong ties, then any local bridge involving A **must be a weak tie**

- Assume A-B is a local bridge and a **strong** tie

- Impossible: edge B-C should exist by STC, but local bridge definition says it cannot exist!



Was the assumption reasonable?

- The Strong Triadic Closure property is too extreme to hold in real social networks
- However, the qualitative conclusion still holds under relaxed assumptions
- A precise assumption can be tested; in this case, the data confirm the conclusions
- Useful conceptual framework

Neighborhood overlap

- We can generalize the idea of local bridge
- The **neighborhood overlap** of an edge A-B is the ratio

$$\frac{|N(A) \cap N(B)|}{|N(A) \cup N(B)|}$$

  where N(x) is the set of neighbors of x
  (an example of **Jaccard coefficient**)

- Local bridges are edges with **zero** overlap