Social Networking

الشبكات الاجتماعية

ITMC 413

إعداد

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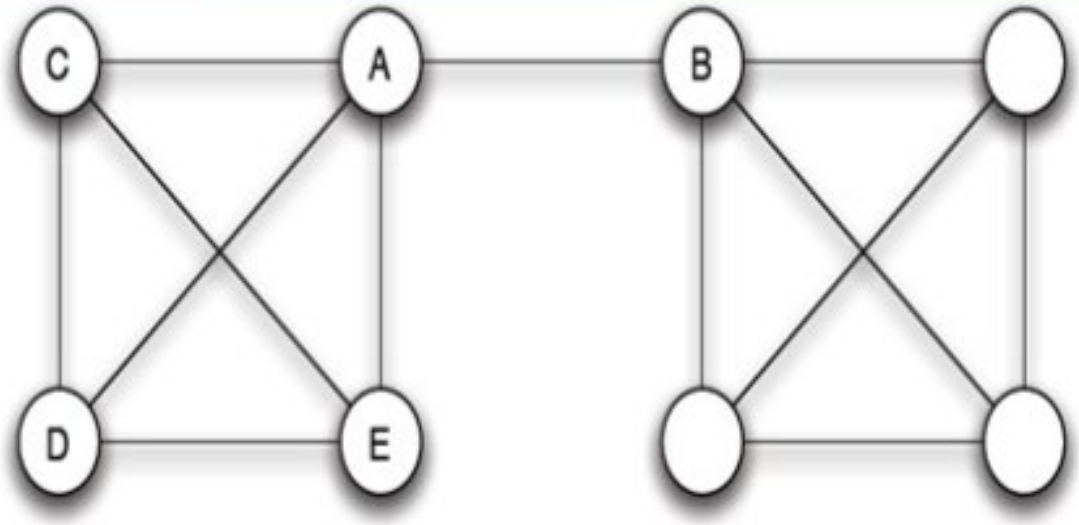
Strong and Weak Ties

Some fundamental SN issues that illustrate this theme :

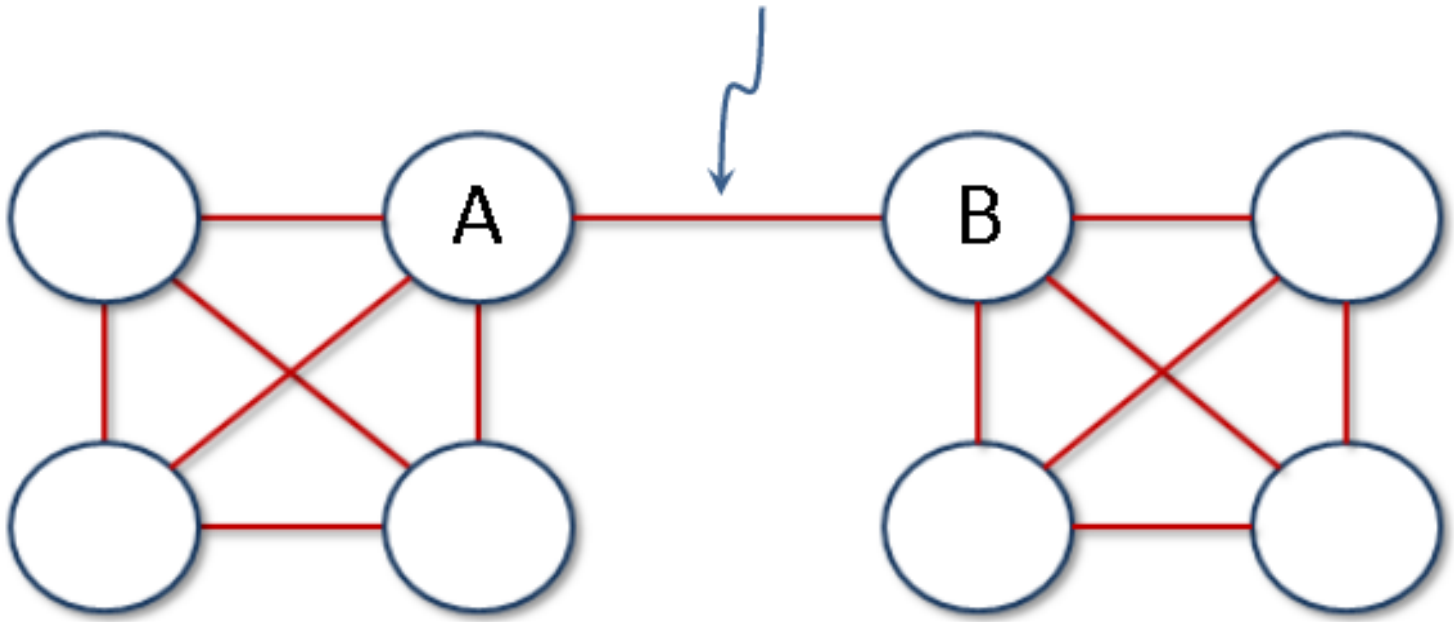
- how information flows through a social network
- how different nodes can play structurally distinct roles in this process
- how these structural considerations shape the evolution of the network itself over time

The Strength of Weak Ties



The A –B edge is a bridge, meaning that its removal would place A and B in distinct connected components, Bridges provide nodes with access to parts of the network that are unreachable by other means.

Bridges



Edge is a **bridge** if removing the edge creates two components

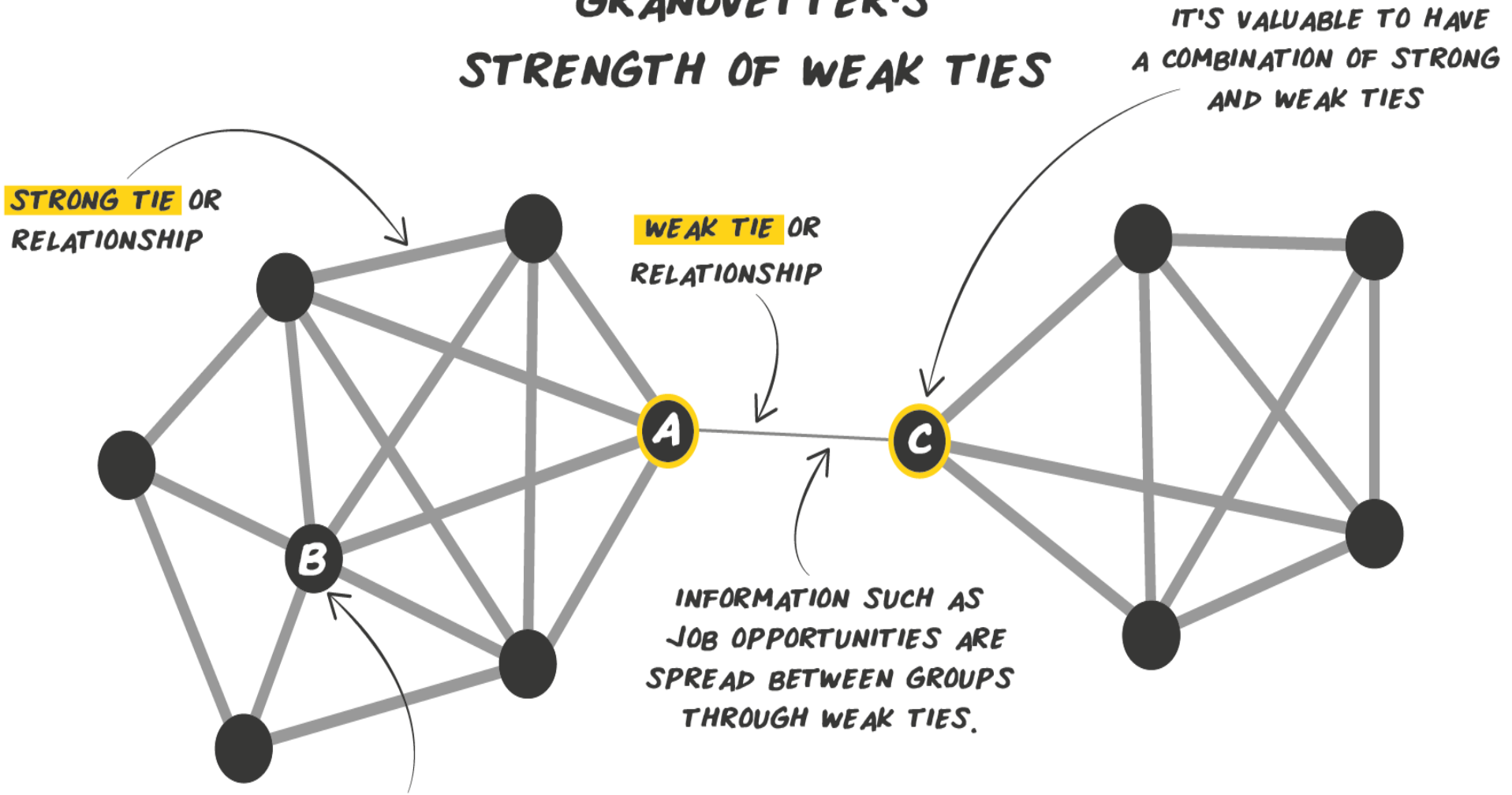
Bridges and Local Bridges

Let's say Node (B) shares information about a new product with one or more members of his group. (A) and (B) are directly connected to each other and have 4 mutual friends.

Chances are, Node A is going to find out about this new product at some point because they are a tight-knit group. However,

the only way that Node (C) will learn about this product is if his acquaintance Node A tells him. No one else in his tight-knit group is connected directly or indirectly to Node B, so there is no other way for this information to find it's way to him. The strength of this weak tie between A and C comes from the fact that they are part of different networks, and therefore have access to new and useful information.

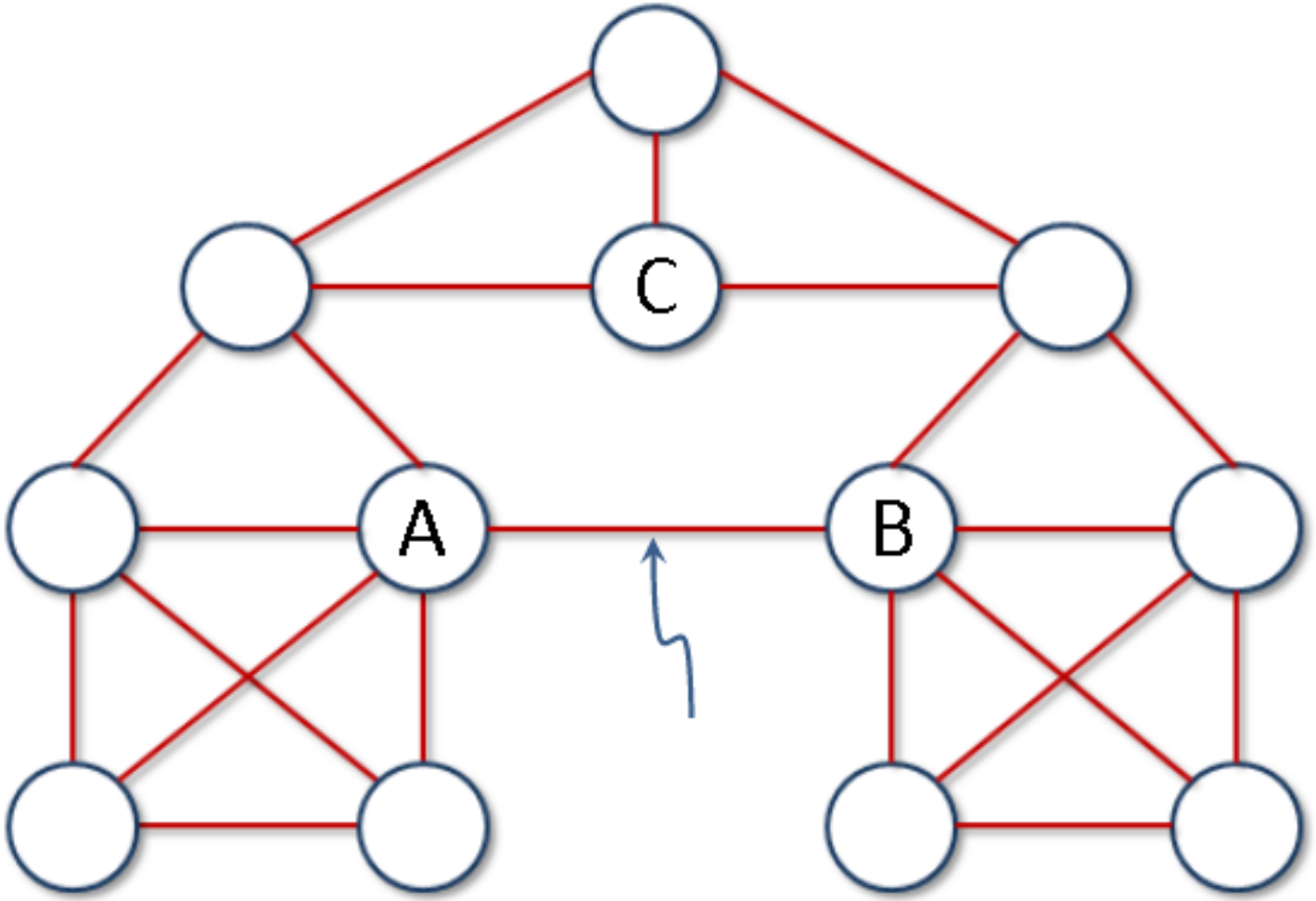
GRANOVETTER'S STRENGTH OF WEAK TIES



Definitions
local bridge and span

We say that an edge joining two nodes A and B in a graph is a *local bridge* if its endpoints A and B have no friends in common in other words, if deleting the edge would increase the distance between A and B to a value strictly more than two. We say that the *span* of a local bridge is the distance its endpoints would be from each other if the edge were deleted

Bridges and Local Bridges



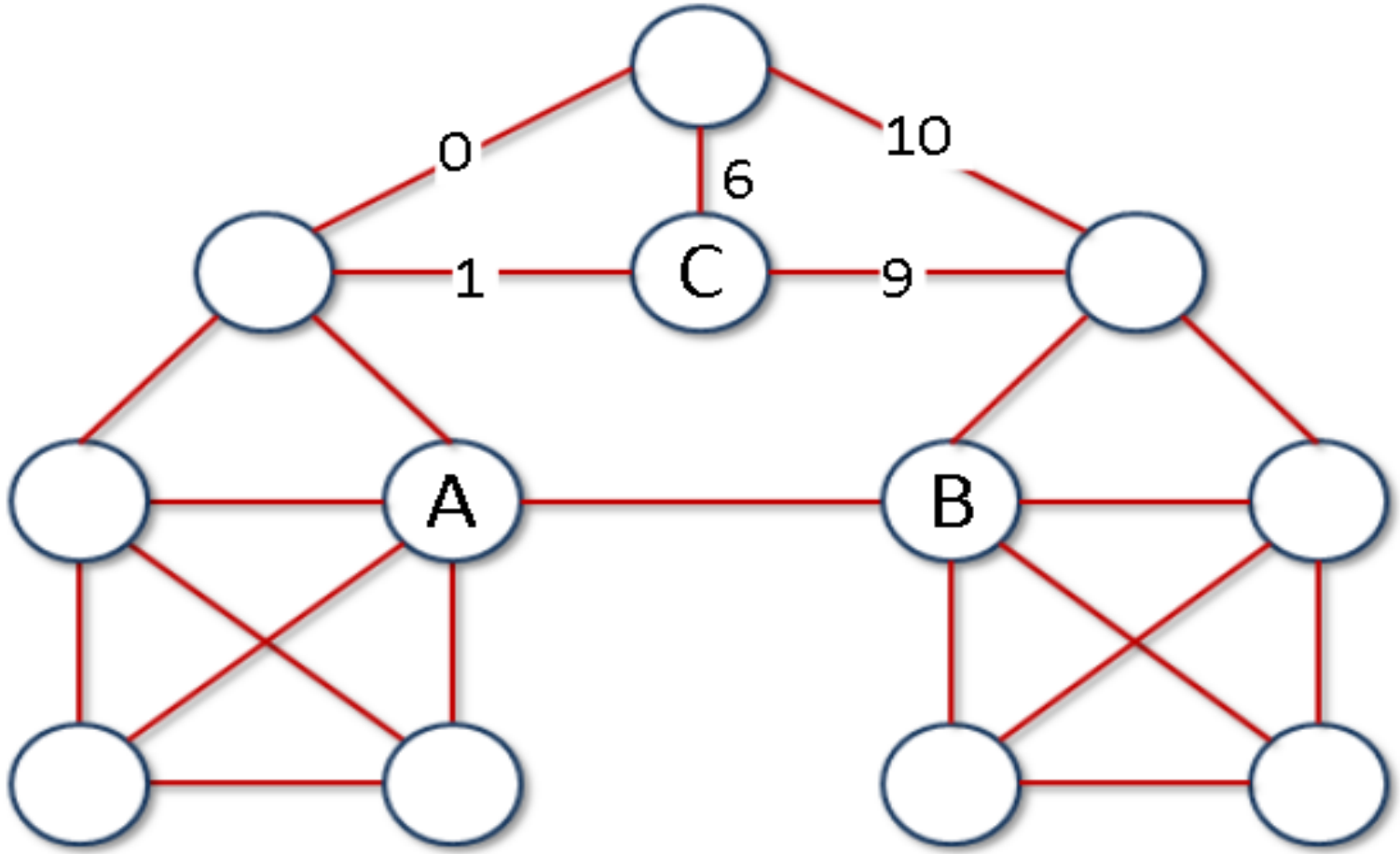
Edge is a **local bridge** if endpoints have no friends in common

Weighing Edges

In some cases, there is a need to not only represent the relationship between vertices, but also some way to quantify the relationship (edge).

In SNA, we introduce the concept of strong and weak ties. This allows us to quantify the relationship that edges represent.

Variable Tie Strength



Can use more fine-grained methods to determine tie strength, like number of Facebook messages exchanged

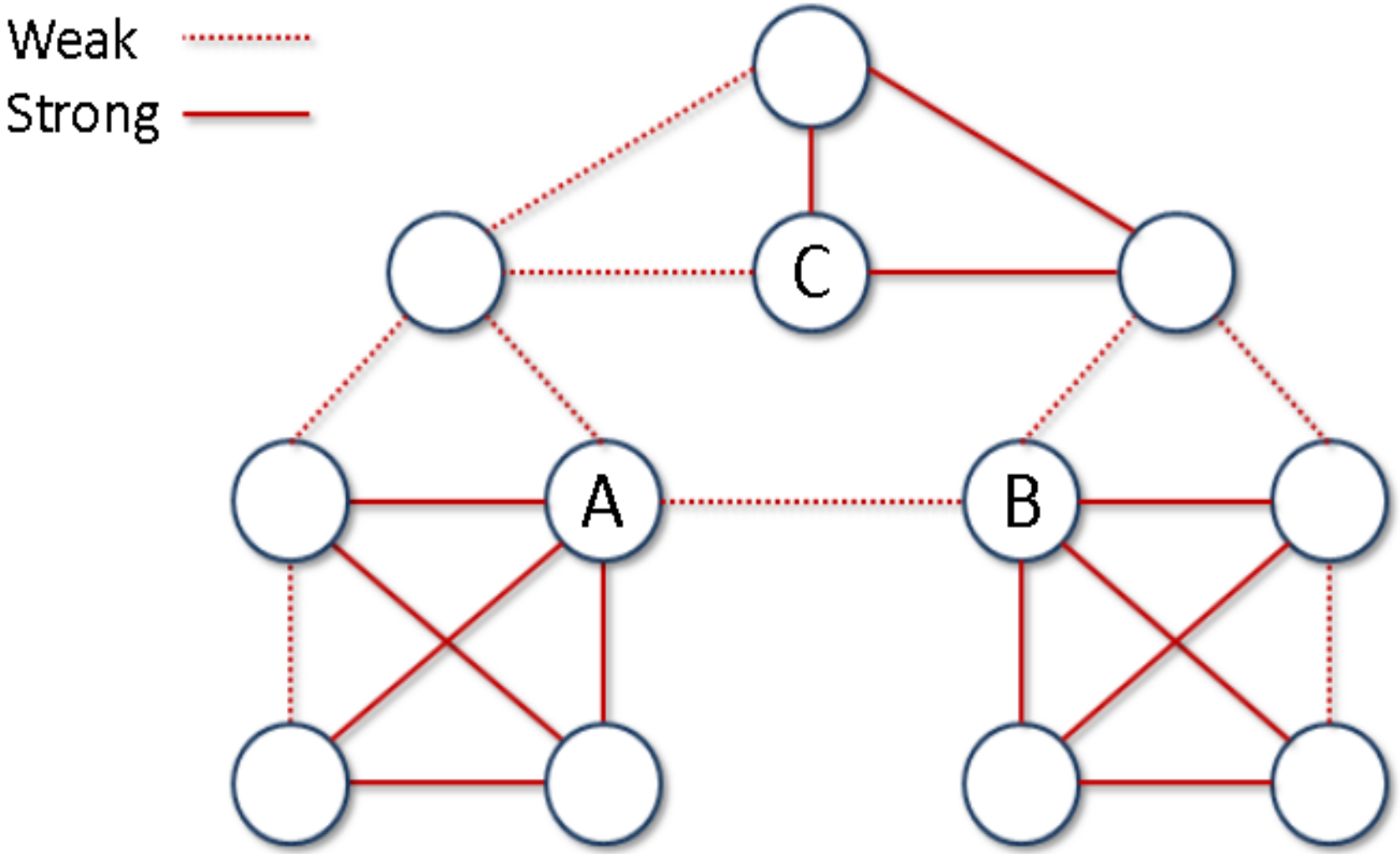
Ties represent connections between individuals or groups.

A connection of any kind—whether in the form of an acquaintance, friend or family member—is a tie. The nature of that connection determines whether the tie is weak or strong.

It is important to note that there is no definitive formula for determining whether a tie is weak or strong. As you may have experienced in your personal life, one person's perception of a connection does not necessarily always align with the perception of the person on the other end of that connection.

Distinguishing weak ties from strong ties is discretionary. There is no right or wrong answer, because the difference between strong and weak ties is wholly dependent on subjective judgement.

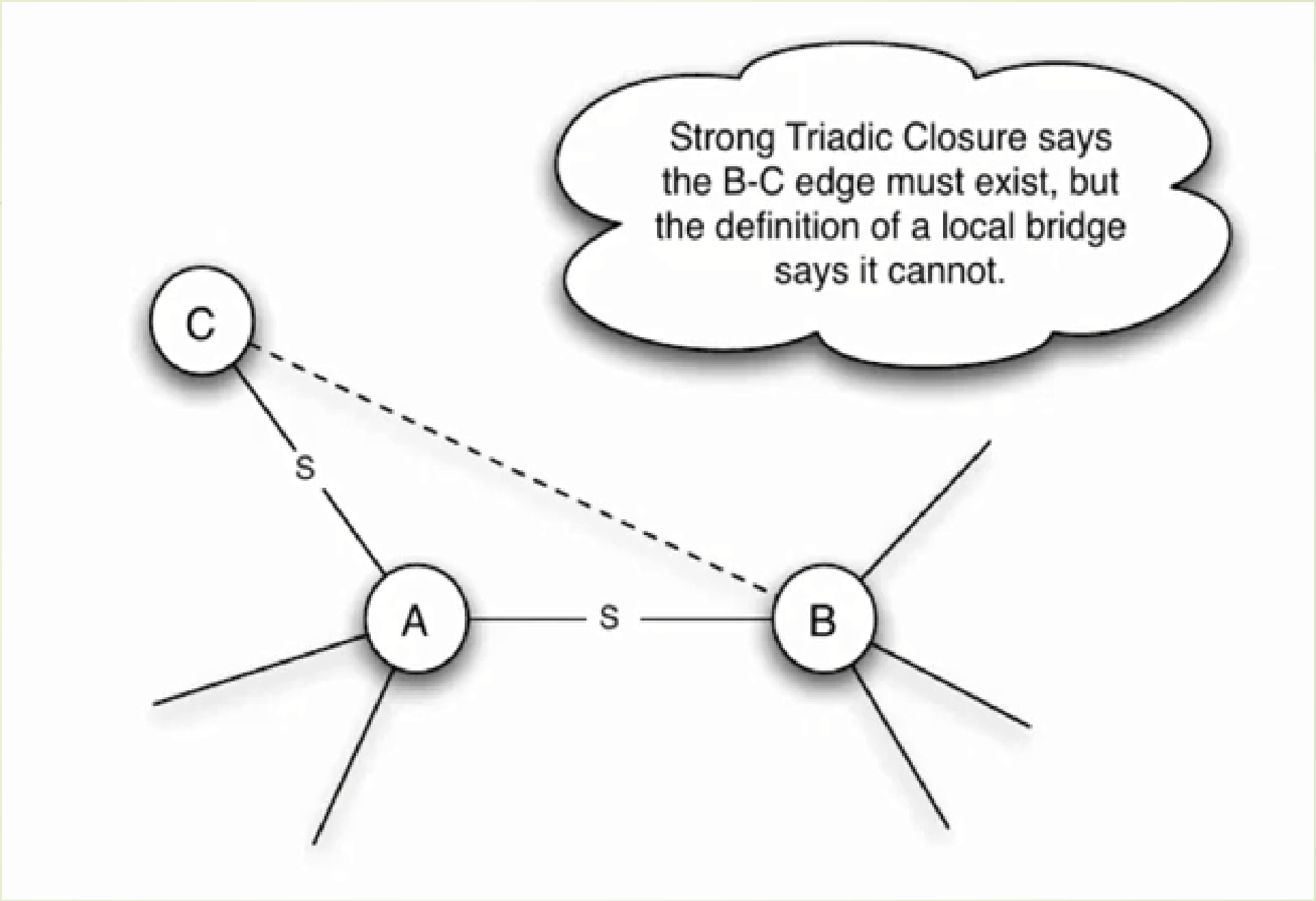
Strong and Weak Ties



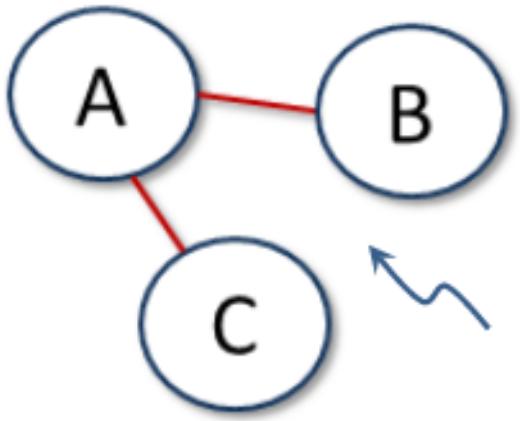
Local Bridges and Weak Ties

Claim: If a node A in a network satisfies the Strong Triadic Closure Property and is involved in at least two strong ties, then any local bridge it is involved in must be a weak tie.

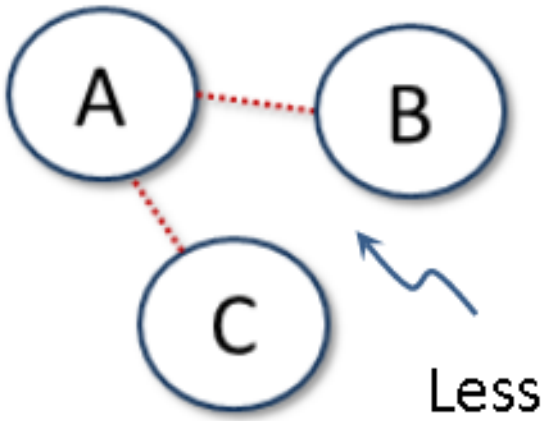
(In other words, assuming the Strong Triadic Closure Property and a sufficient number of strong ties, the local bridges in a network are necessarily weak ties.)


Strong Triadic Closure says the B-C edge must exist, but the definition of a local bridge says it cannot.
C
S
A
S
B

Tie Strength and Triadic Closure



More likely to form



Less likely to form

Triadic closure is more likely to form when initial edges are **strong**

The Strong Triadic Closure Property

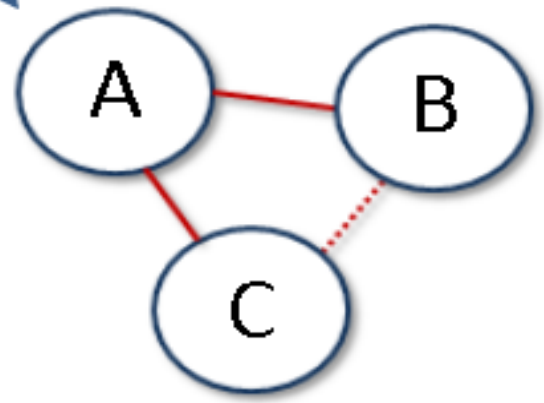
If a node A has edges to nodes B and C, then the B-C edge is especially likely to form if A's edges to B and C are both strong ties.

We say that a node A violates the Strong Triadic Closure Property if it has strong ties to two other nodes B and C, and there is no edge at all (either a strong or weak tie) between B and C. We say that a node A satisfies the Strong Triadic Closure Property if it does not violate it.

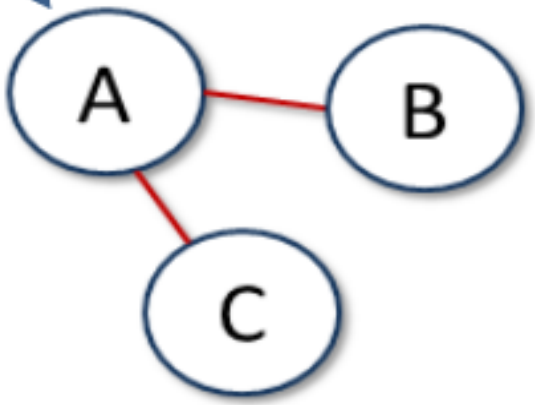
Strong Triadic Closure Property

Node A satisfies the **Strong Triadic Closure Property** if it has strong ties to two other nodes B and C, and there is some edge between B and C

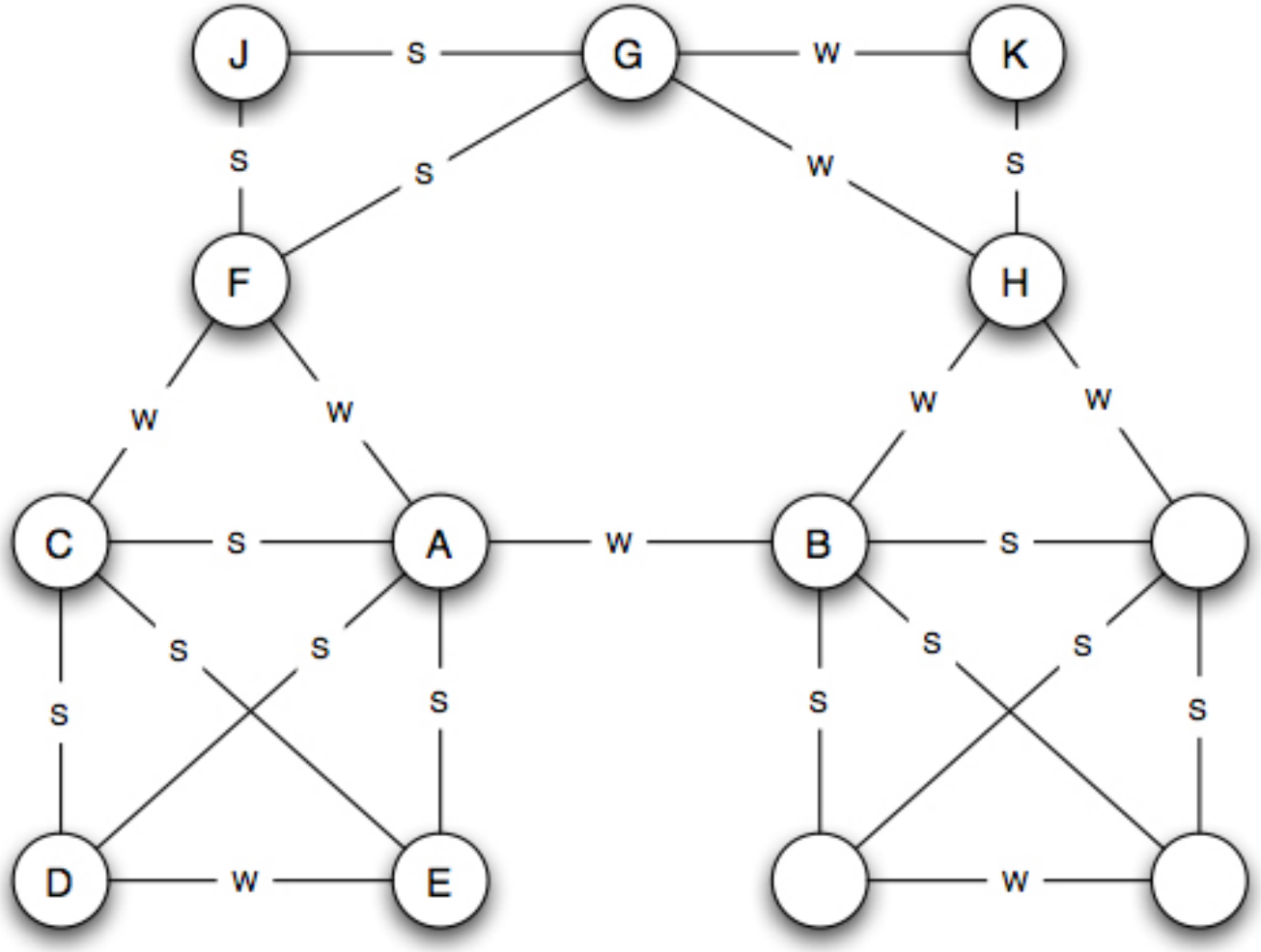
satisfies



violates



Strong/Weak Ties



Strong Triadic Closure and Bridges

- STC property says edge must form when two strong edges emanate from the same node
- Therefore a network that satisfies the STC property and has a sufficient number of string ties will likely have *only weak* local bridges
- Does not always hold in real social networks, but useful theoretical framework in which to understand connections and test theories

The Strong Triadic Closure Property

Note: The Strong Triadic Closure Property is too extreme for us to expect it hold across all nodes of a large social network. But it is a useful step as an abstraction to reality, making it possible to reason further about the structural consequences of strong and weak ties.

Large-Scale Data Studies

- Put new concepts to work by examining several large-scale studies
- Examples:
  - Cell phone usage
  - Facebook
  - Twitter

Cell Phone Social Network

- Onnela et al., Structure and tie strengths in mobile communication networks (2007)
- 18 weeks of cell phone data covering 20% of country's population
- Node = cell phone user
- Edge = if two nodes called each other (both directions)
- Tie strength = duration of calls

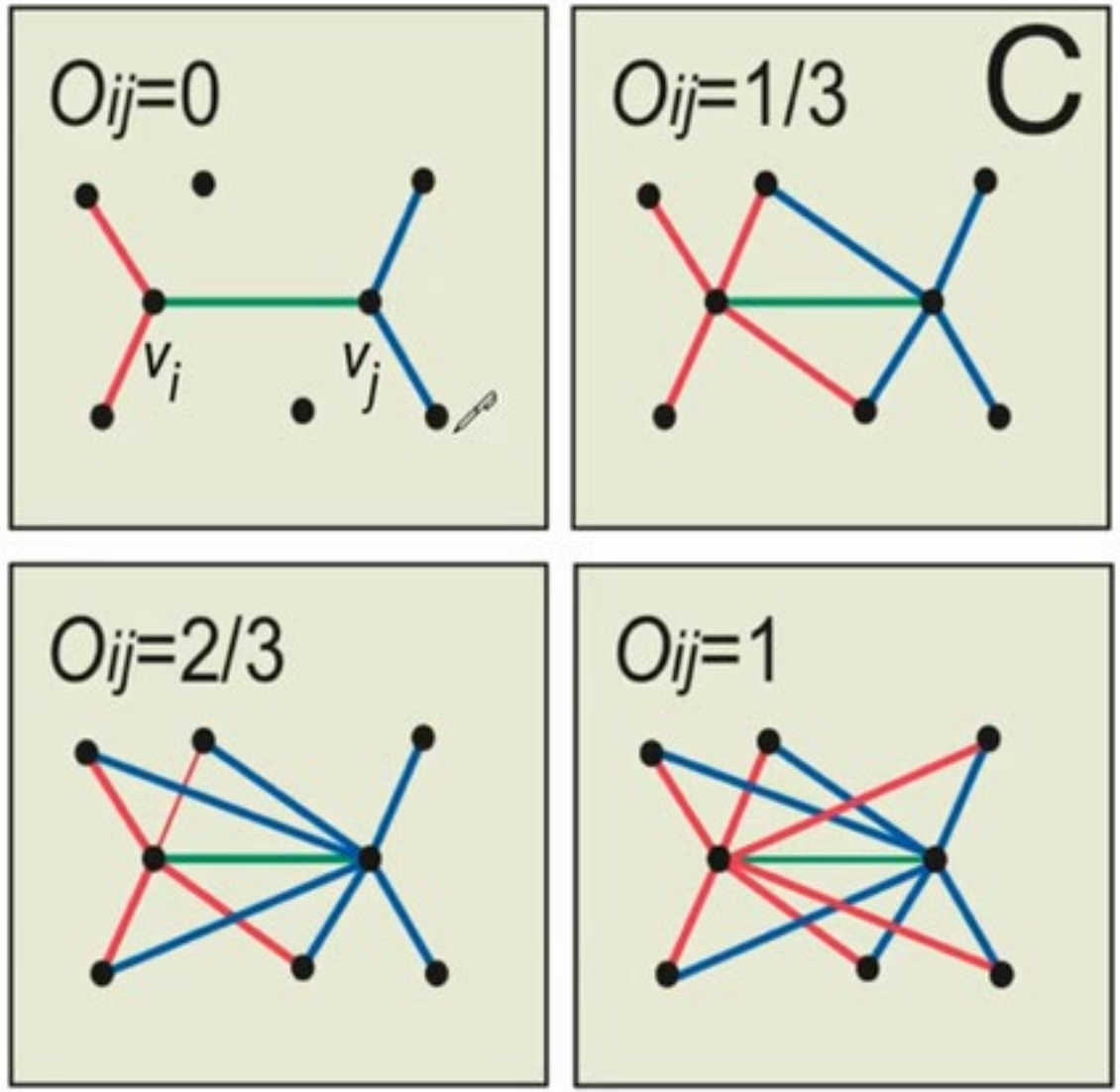
Cell Phone Social Network

To study large scale networks, we need a flexible definition than that of local bridges

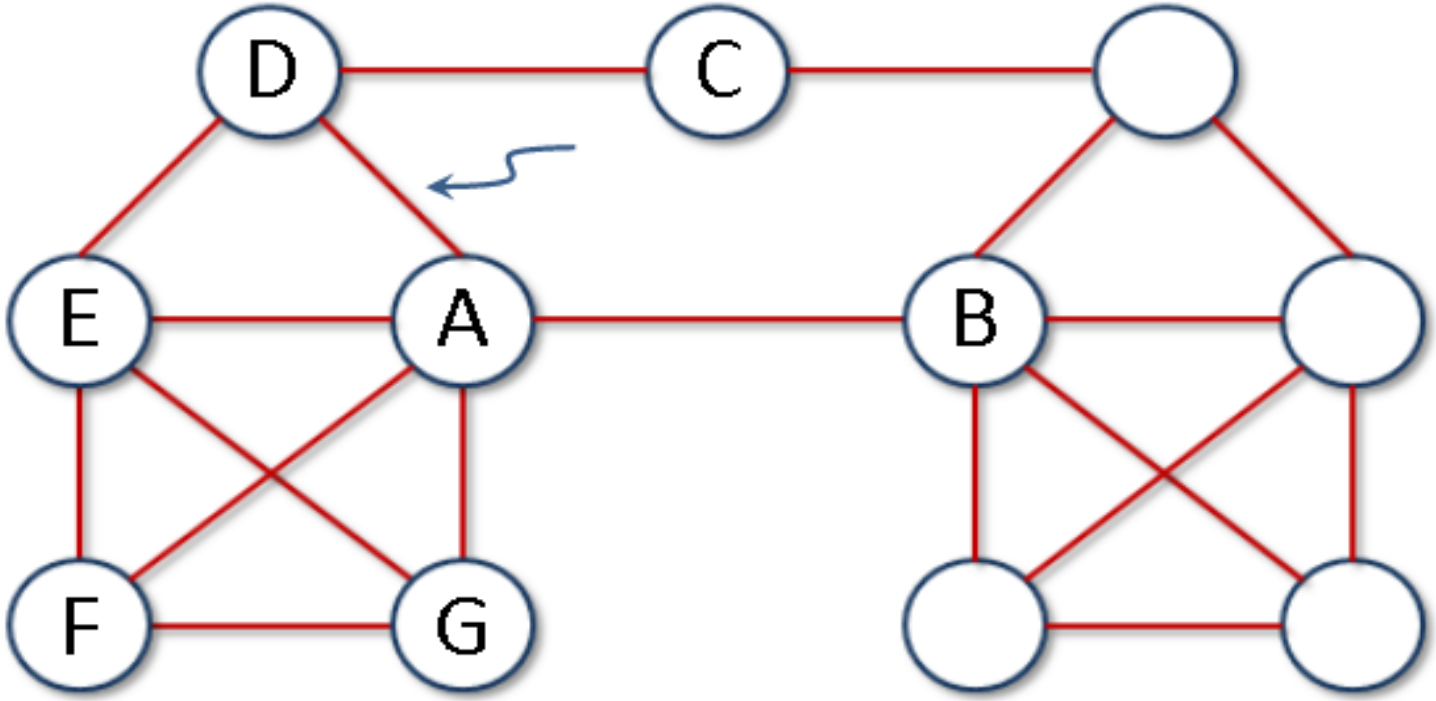
Neighborhood overlap measures the overlap among the neighbors of a pair of nodes

$$\frac{\text{number of nodes who are neighbors of } \textit{both } A \text{ and } B}{\text{number of nodes who are neighbors of } \textit{at least one of } A \text{ or } B}$$

= 1 If all Neighbors of A and B are connected
= 0 if no Neighbors are connected (local bridge)

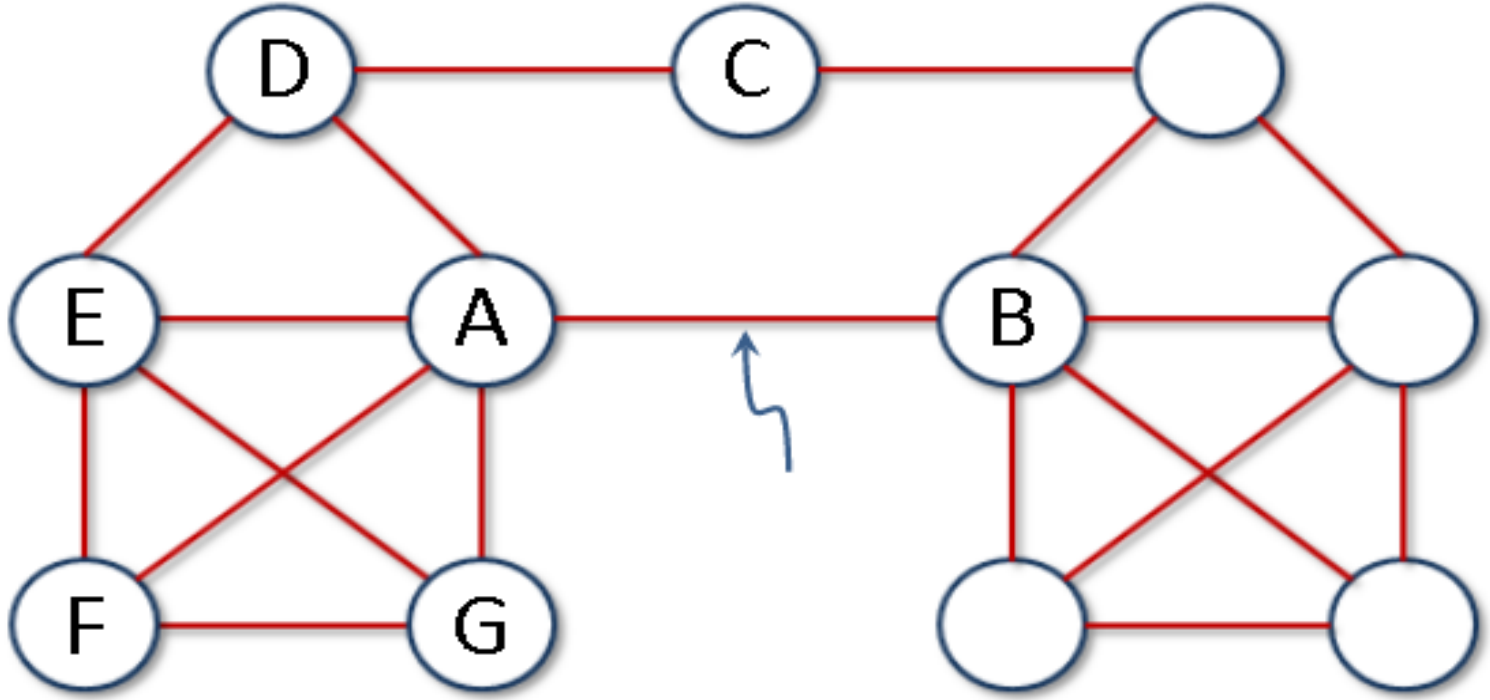

Oij=0
vi
vj
Oij=1/3
C
Oij=2/3
Oij=1

Neighborhood Overlap



$$\text{Neighborhood overlap of AD} = \frac{E}{C, E, F, G, B} = 1/5$$

Neighborhood Overlap



$$\text{Neighborhood overlap of AB} = \frac{-}{\text{D, E, F, G, etc.}} = 0$$

H.W

ماهي الدراسات التي تمت لمعرفة (STC) وقوة العلاقات و الروابط في الشبكات الاجتماعية ومعرفة وكيف يمكن أن تؤثر الروابط إذا كانت قوية أو ضعيفة.

وهل يؤثر هذا الترابط على قوة الشبكة أو لا؟

وضح ذلك بالرجوع إلى مراجع ودراسات واضحة على شبكات مثل (الفيس بوك ، تويتر ،.....)

شكـرًا للمشاركة والاستماع