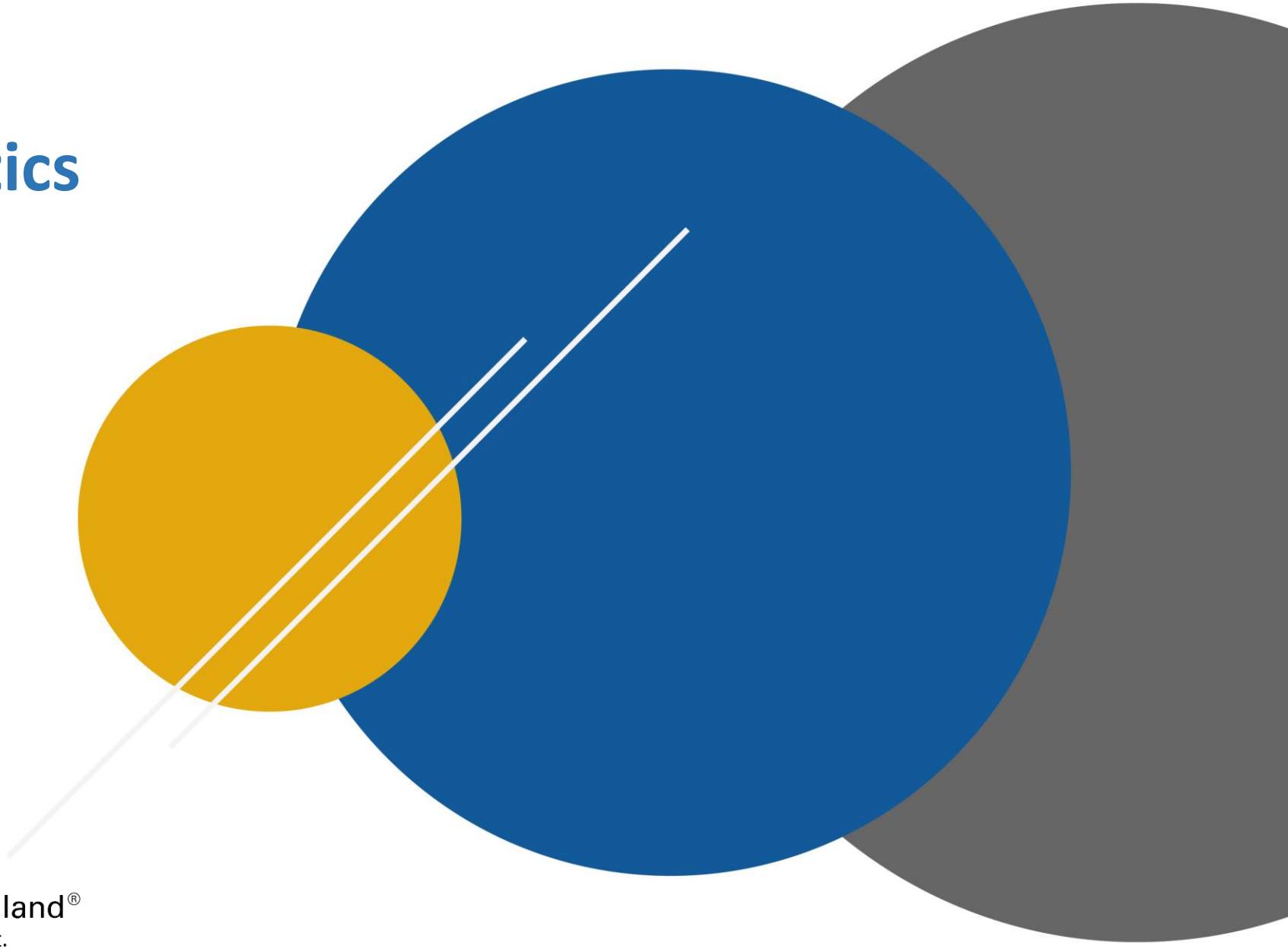
Graph Data Analytics
SNA Model /
Unstructured Data



Agenda

- **Social Network Definition**
- History
- Why are we interested in network
- Practical Application
- Why and Where to use SNA
- SNA Basic Concept
- Graph Representation
- Directed / Undirected Graph

Social Network
Definition

- A social network is a **social structure** made up of a set of **social** actors (such as individuals or organizations), sets of **dyadic** ties, and other **social interactions** between actors.
- The social network perspective provides a set of methods for analyzing the structure of whole social entities as well as a variety of theories explaining the patterns observed in these structures.
- The study of these structures uses **social network analysis** to identify local and global patterns, locate influential entities, and examine network dynamics.

(Wikipedia)

Social Network
Definition

- A social network is a social structure, community or society-made of nodes which generally represent actors / individuals or organizations. It indicates the way in which they are connected via edges which represents various social familiarities, affiliations, and/or relationship ranging from casual acquintance to close familial bouds.

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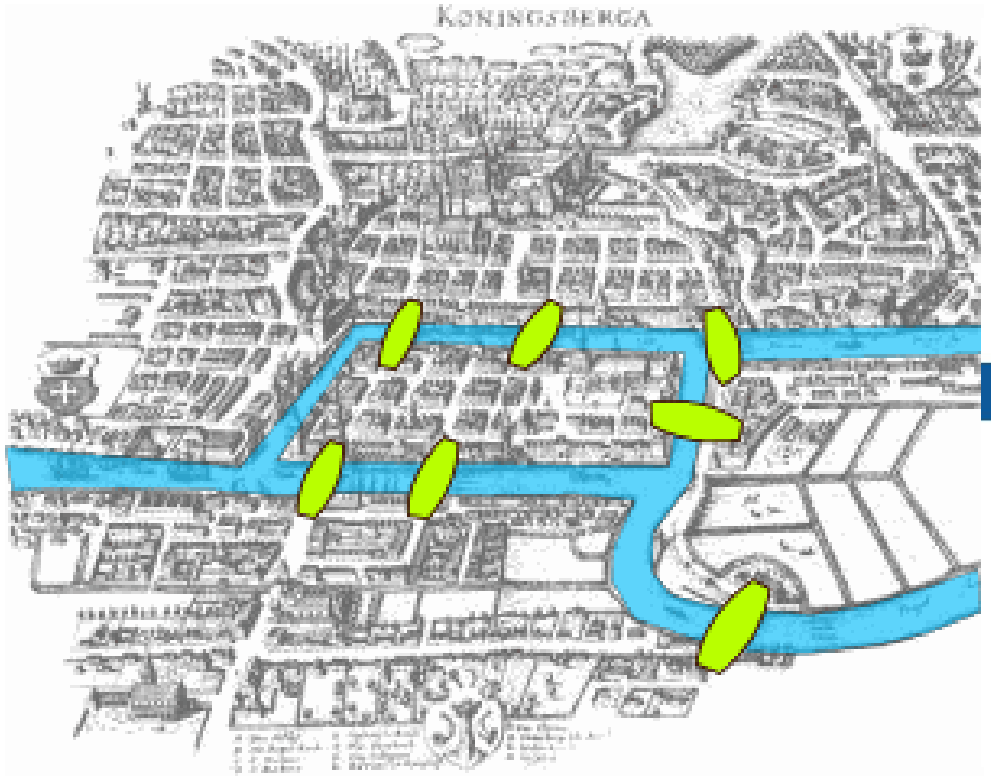
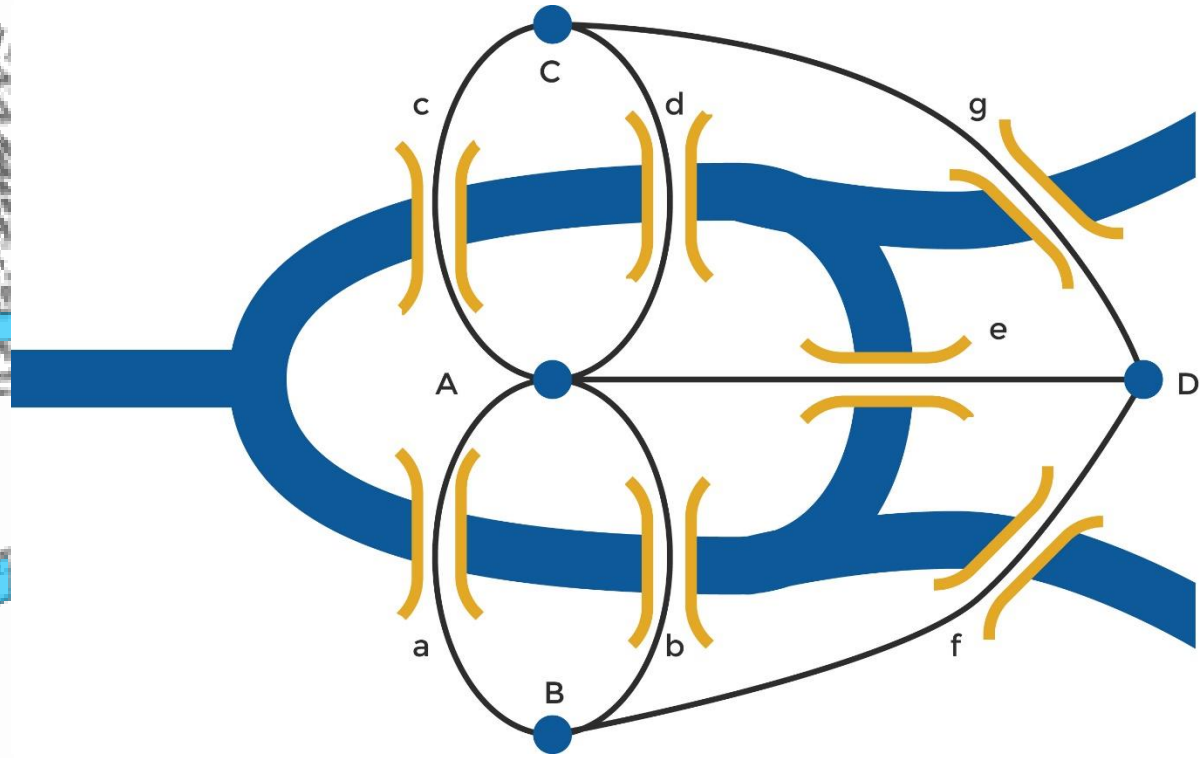
History :
Network Analysis





Konigsberg Bridge

History :
Network Analysis

- SNA origins come from social science and network analysis (graph theory)
- Network analysis concerns with the formulation and solution of problems that have a network structure; such structure is usually captured in a graph
- Graph theory provides a set of abstract concepts and methods for the analysis of graphs. These, in combination with other analytical tools and with methods for the visualization and analysis of social networks, form the basis of what we call SNA methods.
- SNA is not just a methodology; it is a unique perspective on how society functions. Instead of focusing on individuals and their attributes, it centers on relations between individuals, groups, or social institutions

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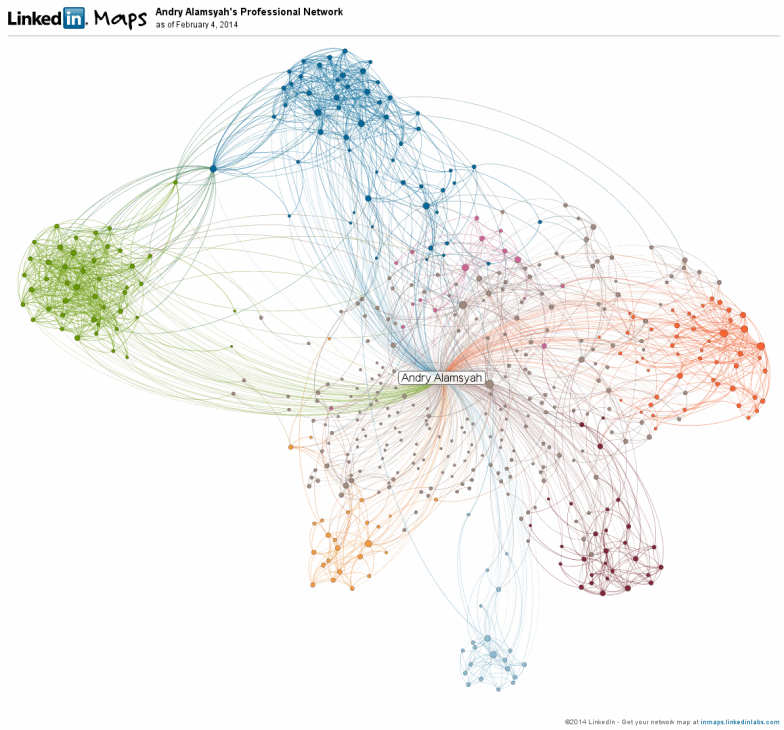
Why We Are
Interested in Network



An example an ‘ego network’, i.e a personal network. The different colours means different friendship group

Studying society from a network perspective is to study individuals as embedded in a network of relations and seek explanations for social behavior in the structure of these networks rather than in the individuals alone.

SNA has a long history in social science, although much of the work in advancing its methods has also come from mathematicians, physicists, biologists and computer scientists *(because they too study networks of different types)*

The idea that networks of relations are important in social science is not new, but widespread availability of data and advances in computing and methodology have made it much easier now to apply SNA to a range of problems

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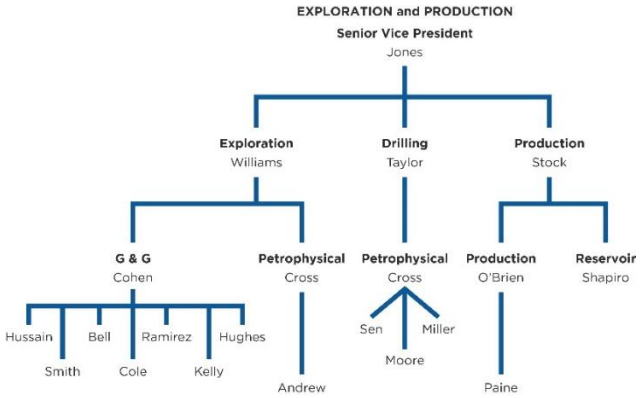
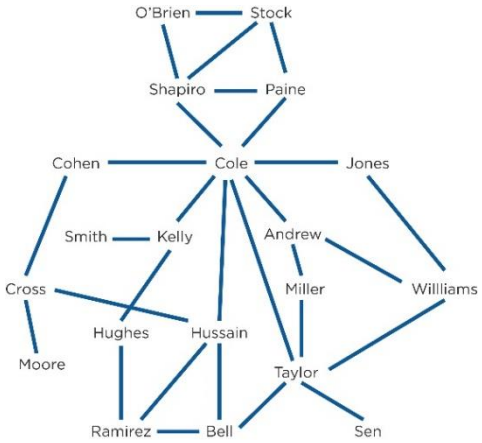
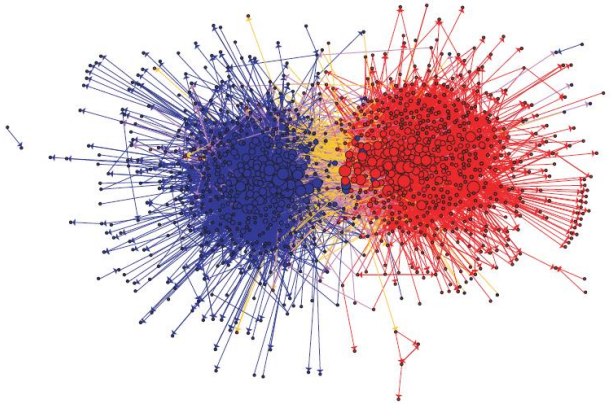
Example:
Social Network





Vizualisation of hierarchical structure organization and knowledge flow of informal organization (Alamsyah, 2013)



A visualization of US bloggers shows clearly how they tend to link predominantly to blogs supporting the same party, forming two distinct clusters (Adamic and Glance, 2005)

Relations between people and the place they are checking in using foursquare at Vienna, Austria

Practical Applications

- Businesses use SNA to analyze and improve communication flow in their organization, or with their networks of partners and customers
- Law enforcement agencies (and the army) use SNA to identify criminal and terrorist networks from traces of communication that they collect; and then identify key players in these networks
- Social Network Sites like Facebook use basic elements of SNA to identify and recommend potential friends based on friend-of-a-friend
- Civil society organizations use SNA to uncover conflicts of interest in hidden connections between government bodies, lobbies and businesses
- Network operators (telephony, cable, mobile) use SNA-like methods to optimize the structure and capacity of their networks

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Why and When
to use SNA

- Whenever you are studying a social network (offline or online), or when you wish to understand how to improve the effectiveness of the network
- When you want to visualize your data so as to uncover patterns in relationships or interactions
- When you want to follow the paths that information (or basically anything) follows in social networks
- When you do quantitative research, although for qualitative research a network perspective is also valuable
    - The range of actions and opportunities afforded to individuals are often a function of their positions in social networks; uncovering these positions (instead of relying on common assumptions based on their roles and functions, say as fathers, mothers, teachers, workers) can yield more interesting and sometimes surprising results
    - A quantitative analysis of a social network can help you identify different types of actors in the network or key players, whom you can focus on for your qualitative research
- SNA is clearly also useful in analyzing SNS's, OC's and social media in general, to test hypotheses on online behavior and CMC, to identify the causes for dysfunctional communities or networks, and to promote social cohesion and growth in an online community

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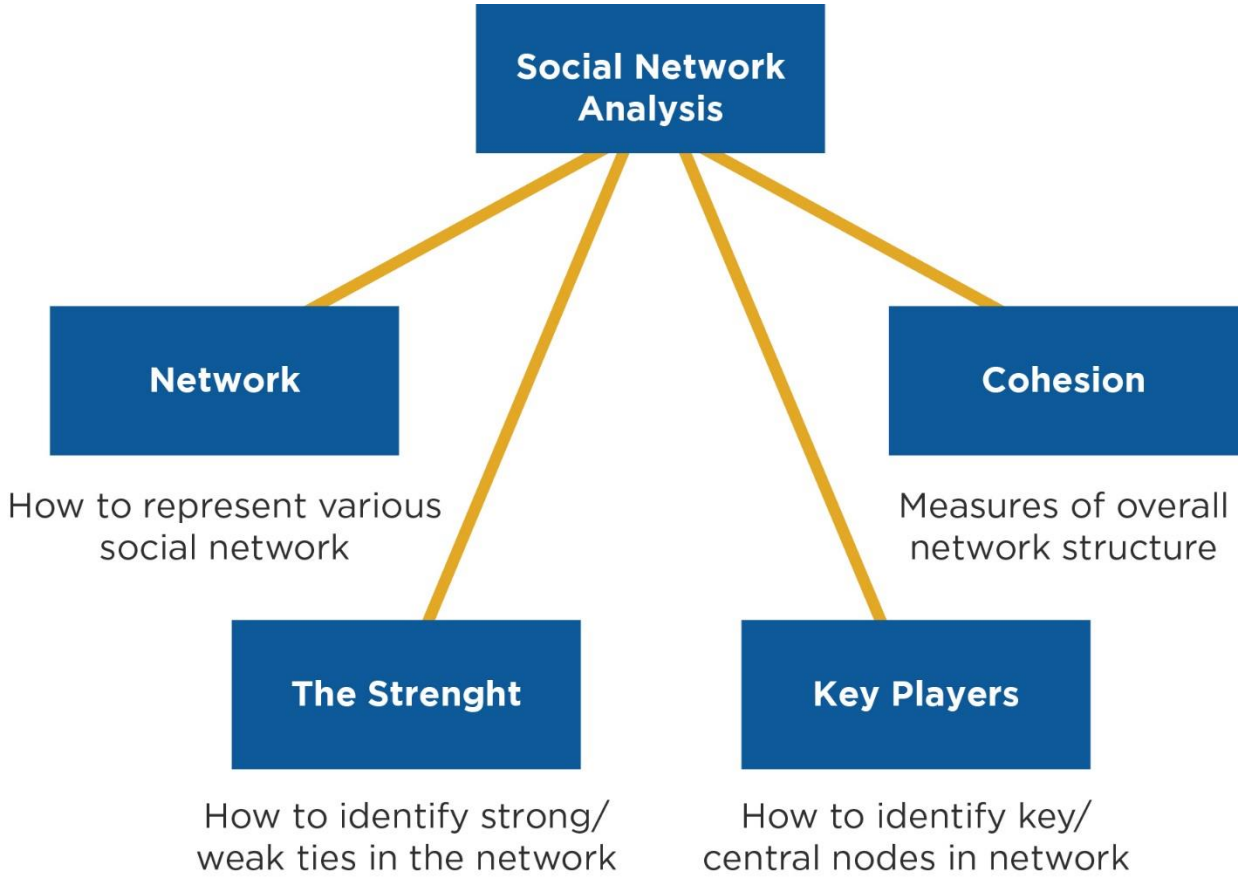
SNA Basic
Concept



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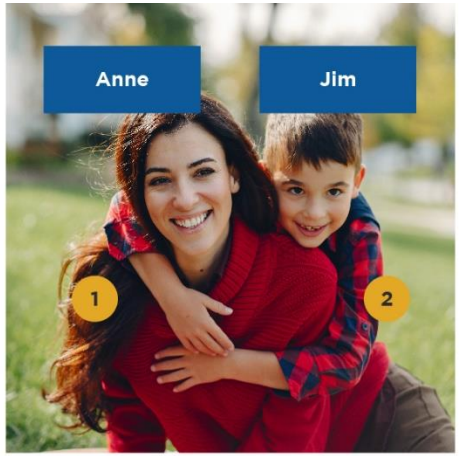
Representing
Relations as Networks



Communication

Anne : Jim, tell Mary and John they're invited

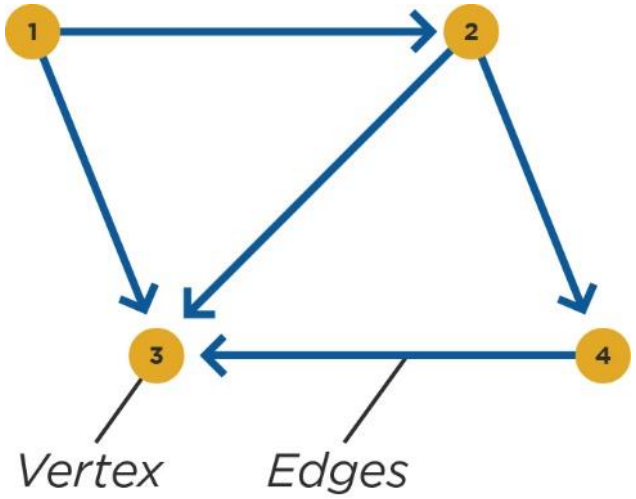
Jim : Mary, you and your dad should come for dinner

Jim : Mr. John, you should both come for dinner

Mary : Dad, we are invited for tonight

Anne : John, did Jim tell you about the dinner? You must come

Can we study their interactions as a network ?



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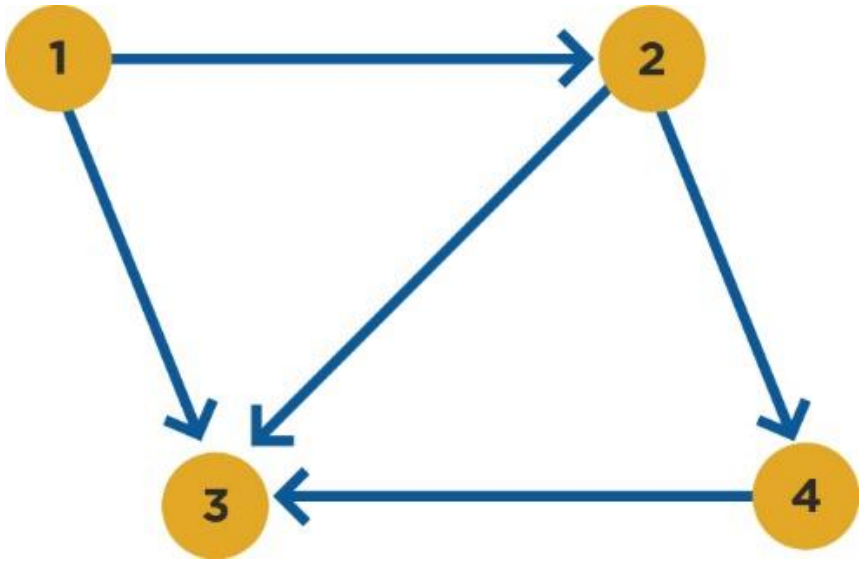
Graph Formulation
on Directed Graph



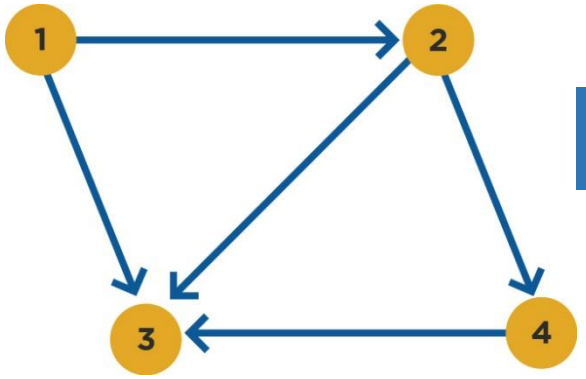
Edge List

Vertex	Vertex
1	2
1	3
2	3
2	4
4	3

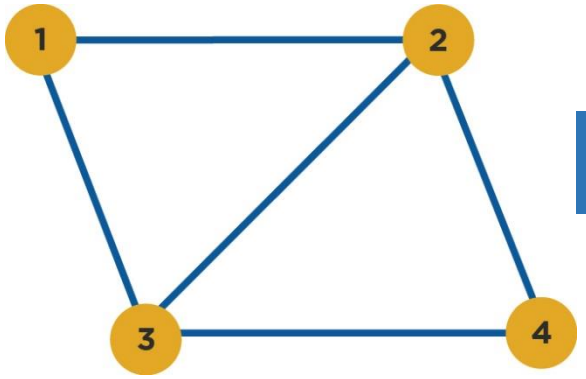
Adjacency Matrix

Vertex	1	2	3	4
1	-	1	1	0
2	0	-	1	1
3	0	0	-	0
4	0	0	1	-

Graph Formulation
on Undirected Graph



Directed
(who contact whom)



Undirected
(who knows whom)

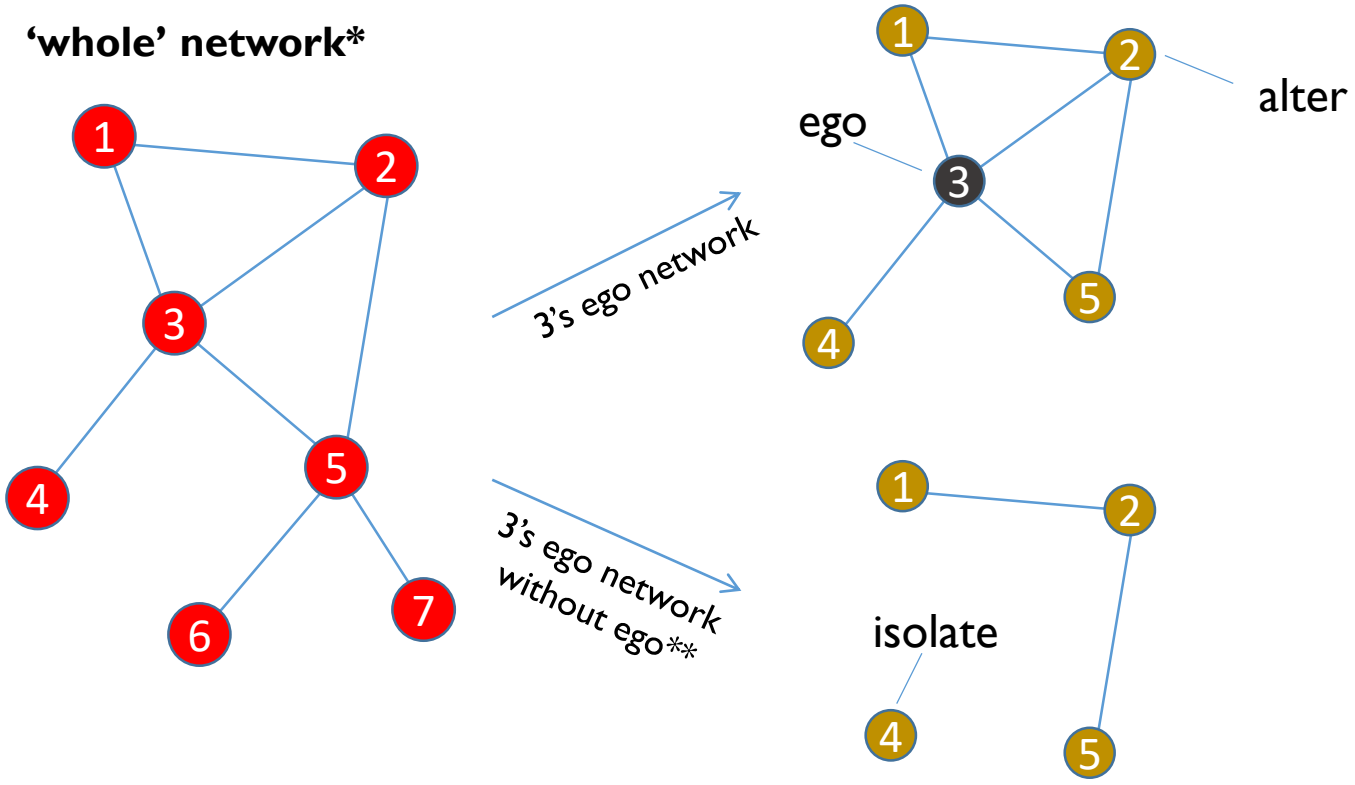
Edge List

Vertex	Vertex
1	2
1	3
2	3
2	4
4	3

***Adjacency Matrix* become symmetric**

Vertex	1	2	3	4
1	-	1	1	0
2	1	-	1	1
3	1	1	-	0
4	0	1	0	-

Ego Networks
and “Whole” Networks



* no studied network is ‘whole’ in practice; it’s usually a partial picture of one’s real life networks (*boundary specification problem*)
** ego not needed for analysis as all alters are by definition connected to ego