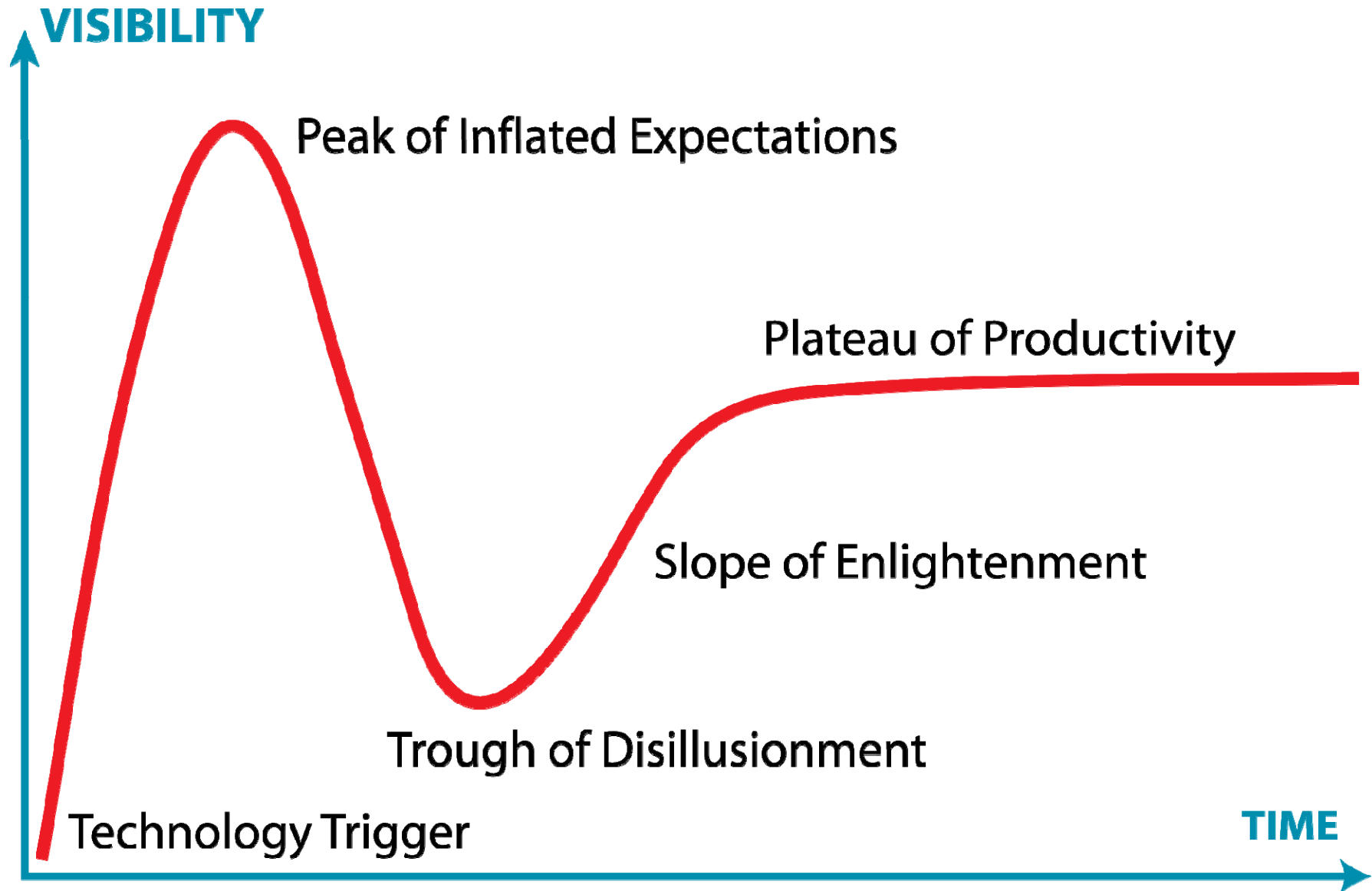


The image features a complex network graph visualization. The nodes are represented by semi-transparent circles in various shades of blue, green, and purple, with sizes varying from small to large. These nodes are interconnected by a dense web of thin, light-colored lines representing edges. The overall structure is highly interconnected and somewhat chaotic, with many nodes having multiple connections. The background is white, and the nodes and edges are distributed across the entire frame, with a central area where the text is overlaid.

# Approachable Network Analysis

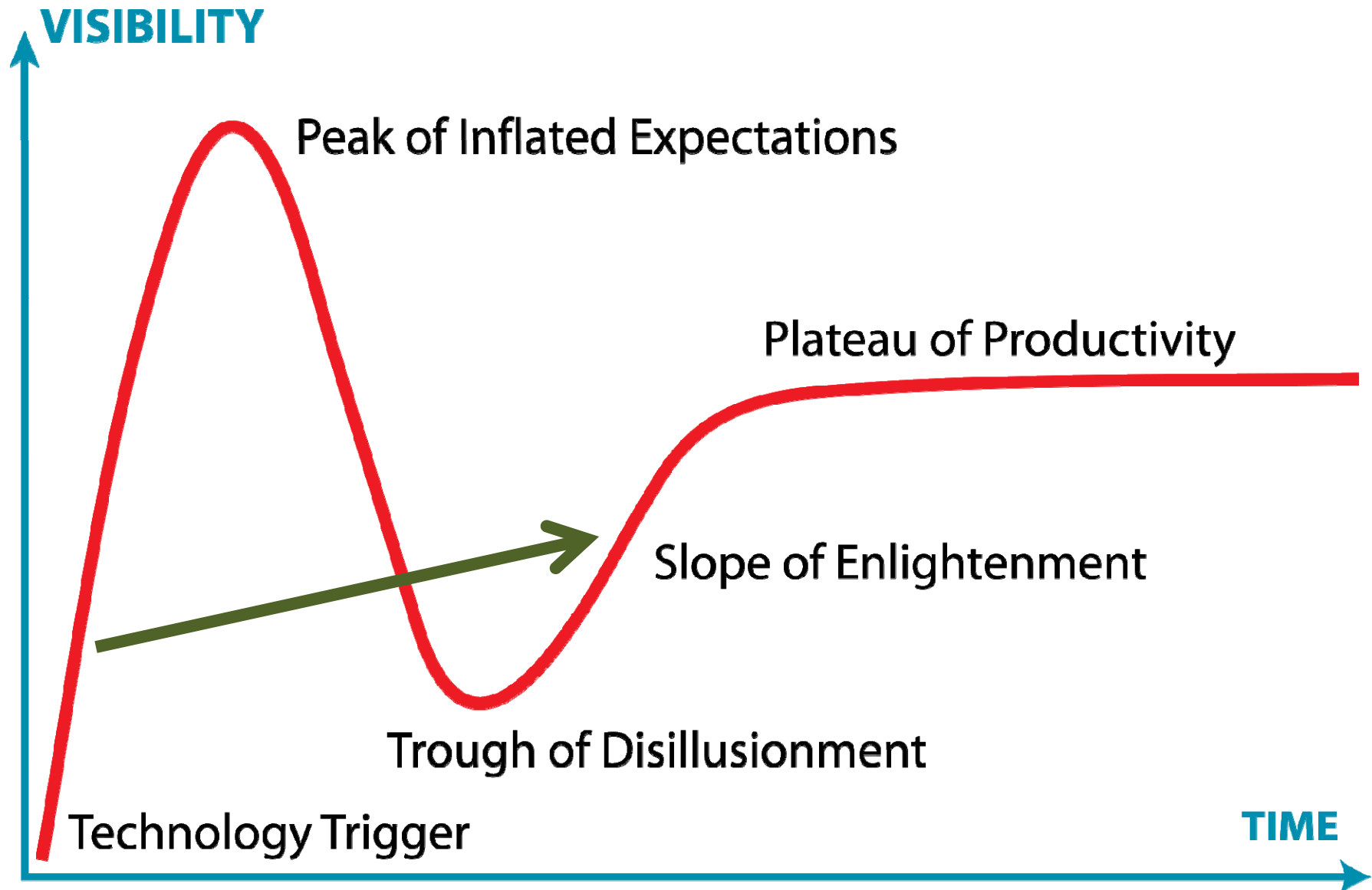
Jeff Horon

# Gartner's Hype Cycle



Source: [http://en.wikipedia.org/wiki/File:Gartner\\_Hype\\_Cycle.svg](http://en.wikipedia.org/wiki/File:Gartner_Hype_Cycle.svg)

# My Mission – Short Circuit the Hype Cycle



Source: [http://en.wikipedia.org/wiki/File:Gartner\\_Hype\\_Cycle.svg](http://en.wikipedia.org/wiki/File:Gartner_Hype_Cycle.svg)

**You** will leave here with the **knowledge, skills,**  
**resources, motivation,**  
and **ideas** you need to

**do network analysis**  
**today**

with **data you** probably  
**already have**

# [Social] Network Analysis

So, like Facebook? Sort of.

But networks are everywhere.

And they aren't necessarily "social."

# Topics

Networks 101

*Your* Use Cases

Transforming *Your* Data

Free, User-Friendly Software

Examples

Q&A

# Networks 101

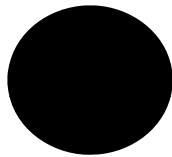
Building Blocks

Putting the Pieces Together – Visualization

Metrics

# Building Blocks

Nodes [Vertices] – People, Things, Ideas



Links [Edges] – Relationships

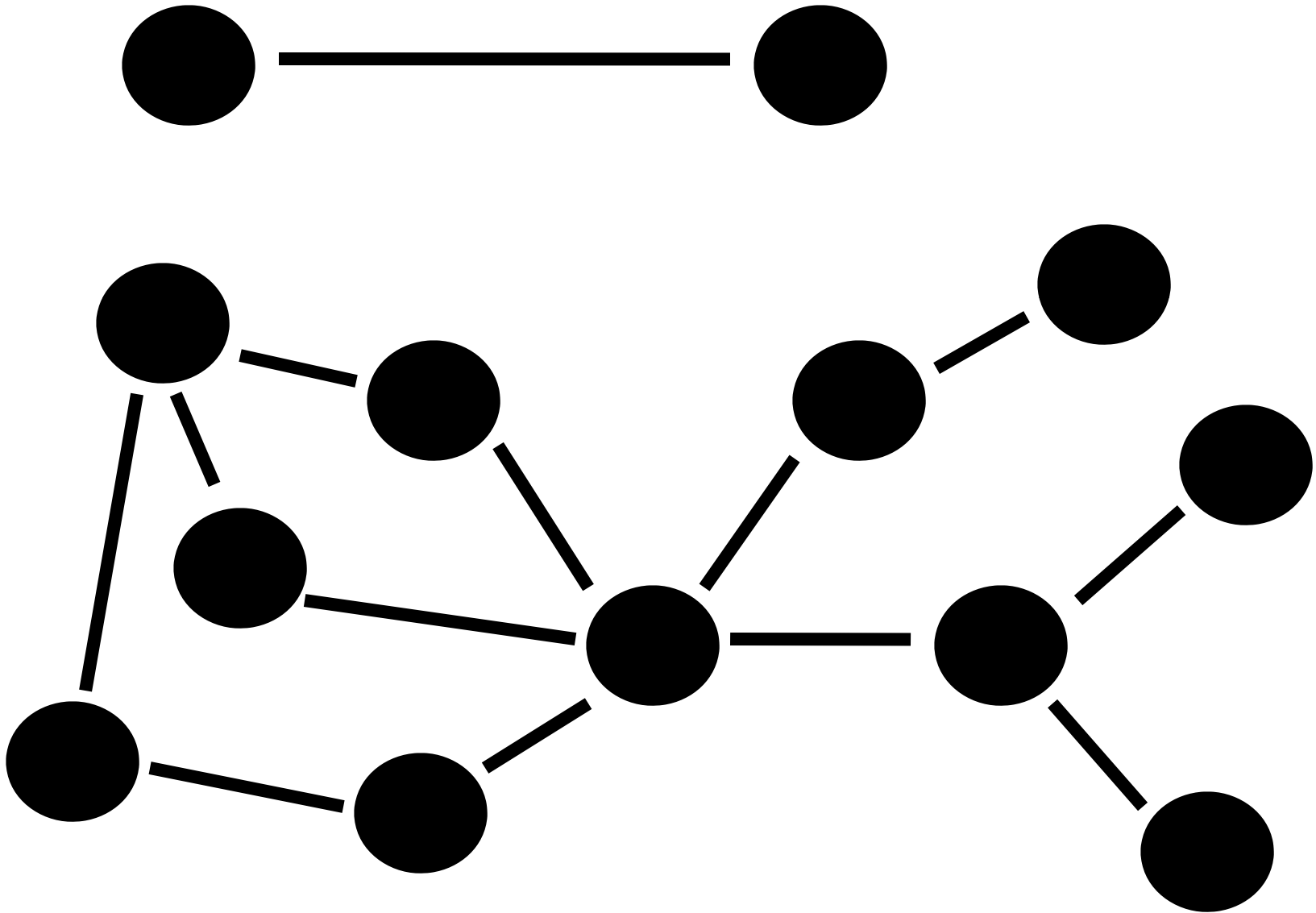


or

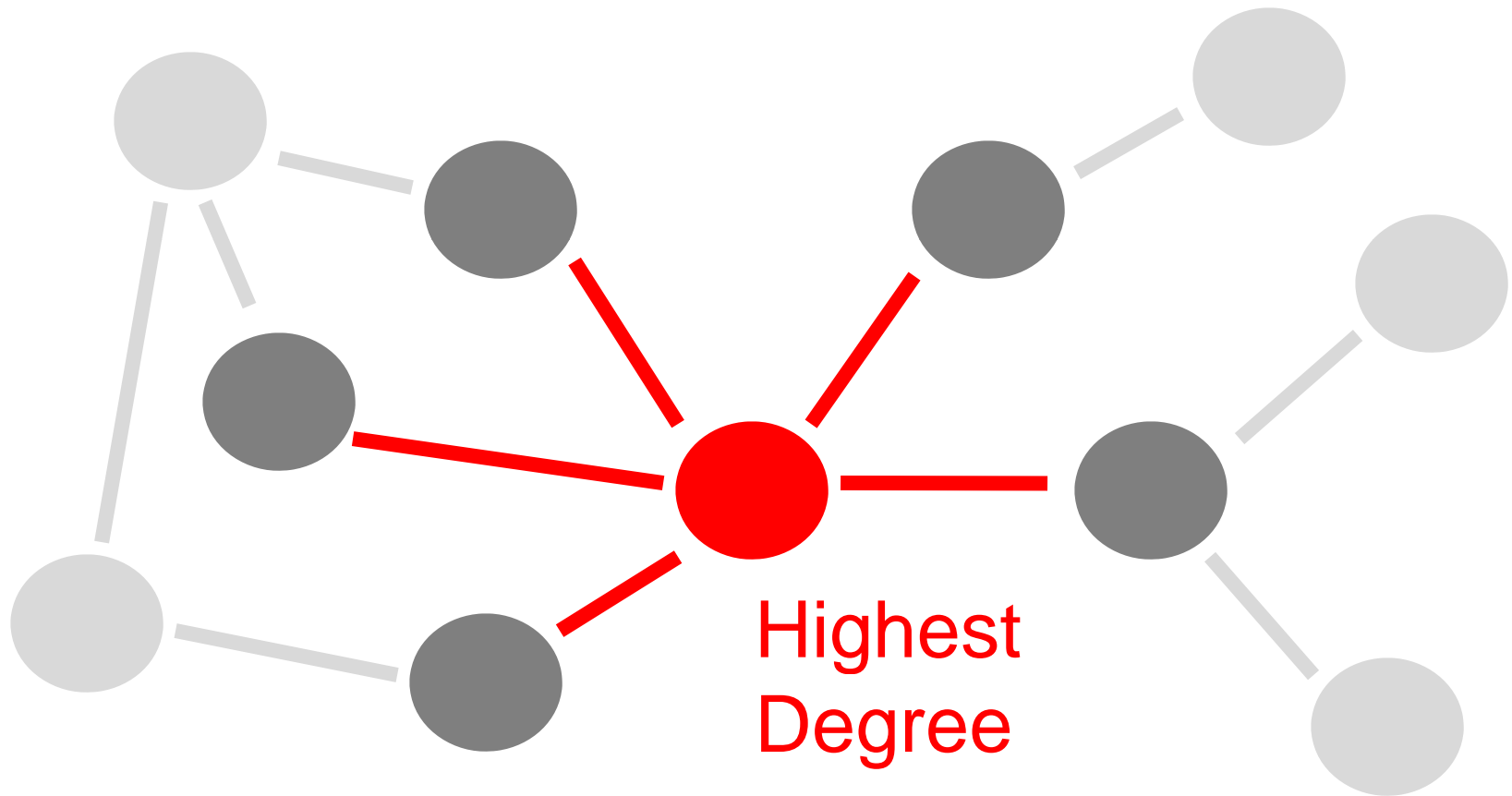




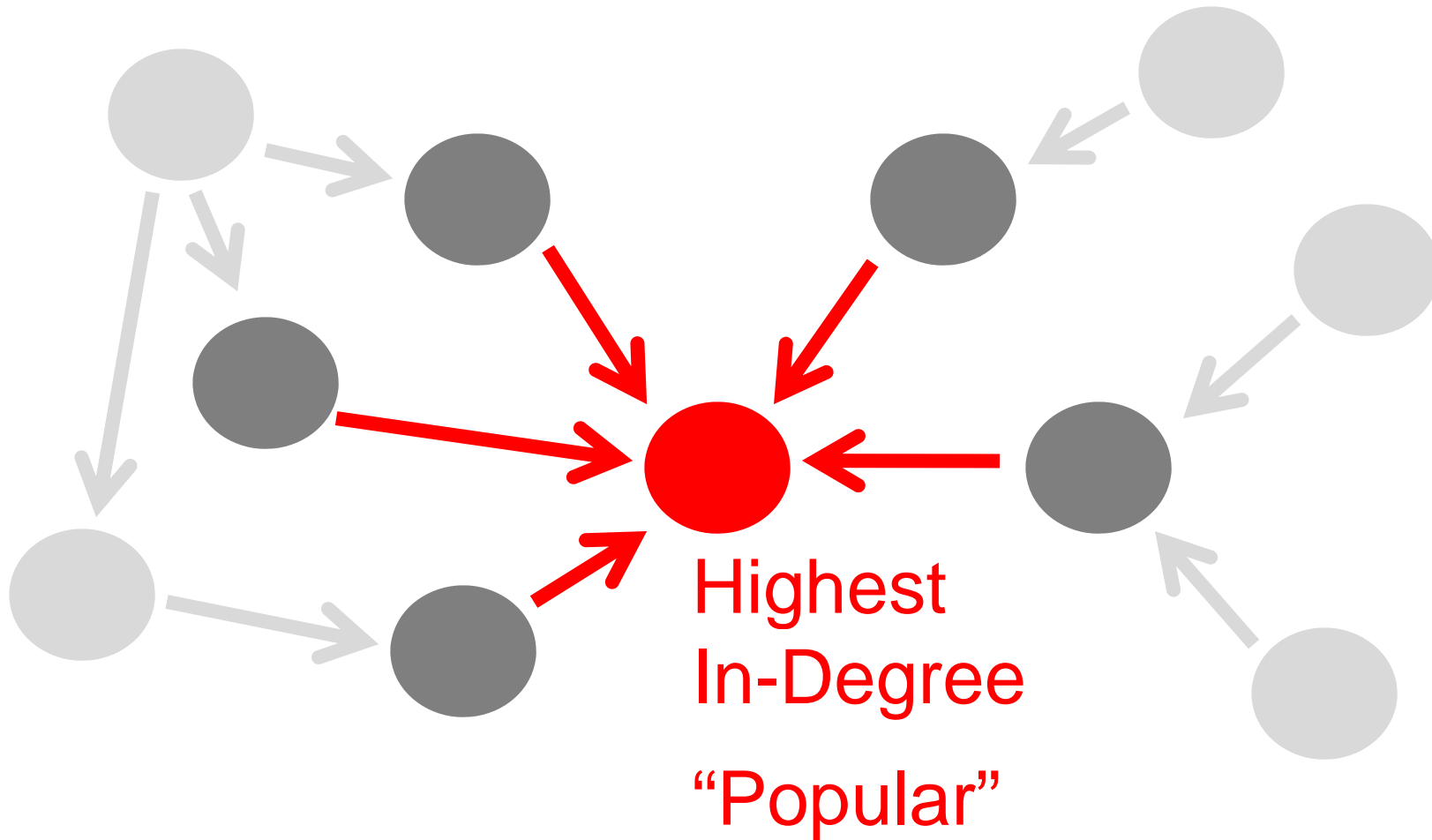
# Visualization



# Metrics – Degree

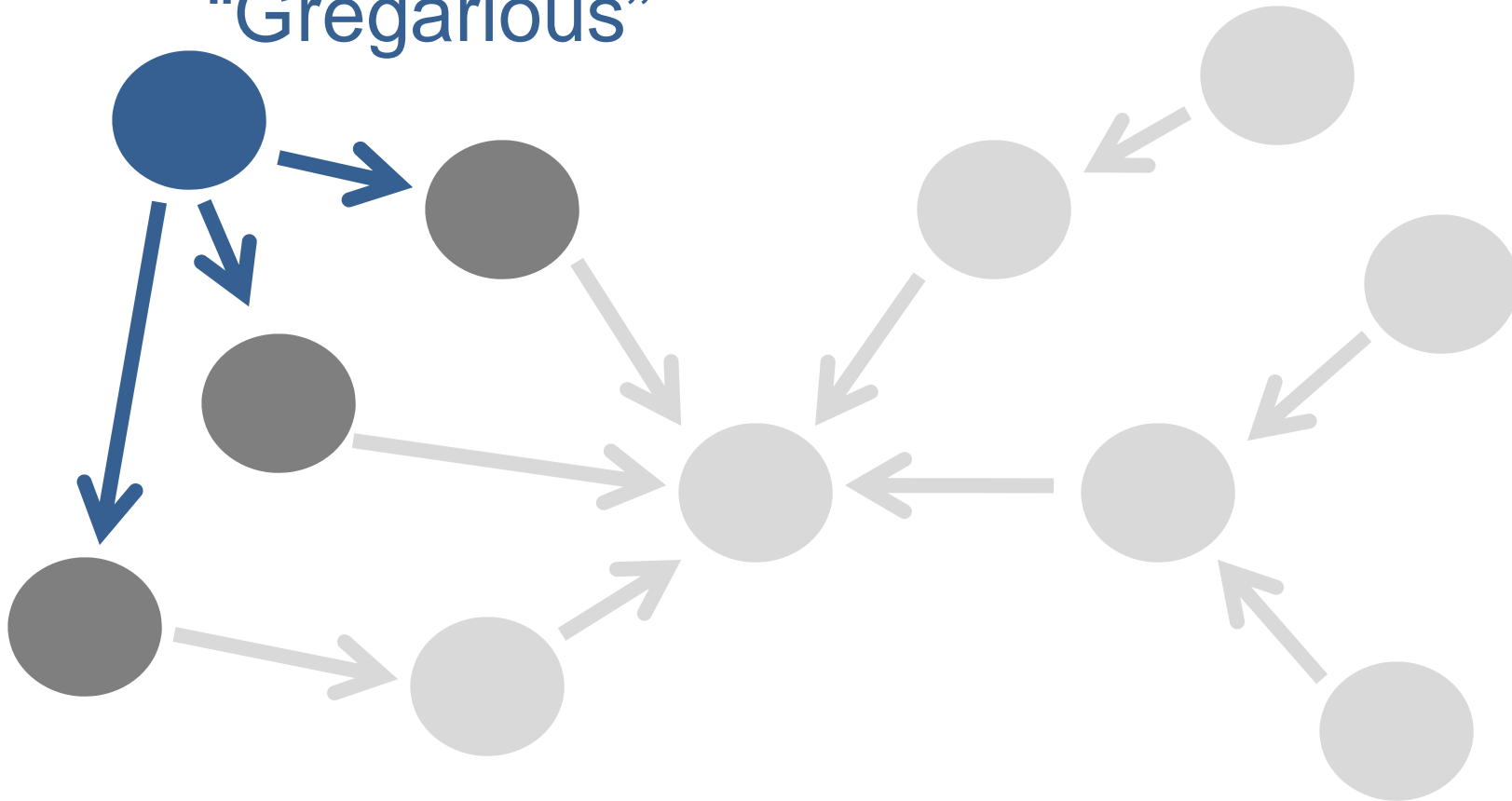


# Metrics – Degree – In-Degree

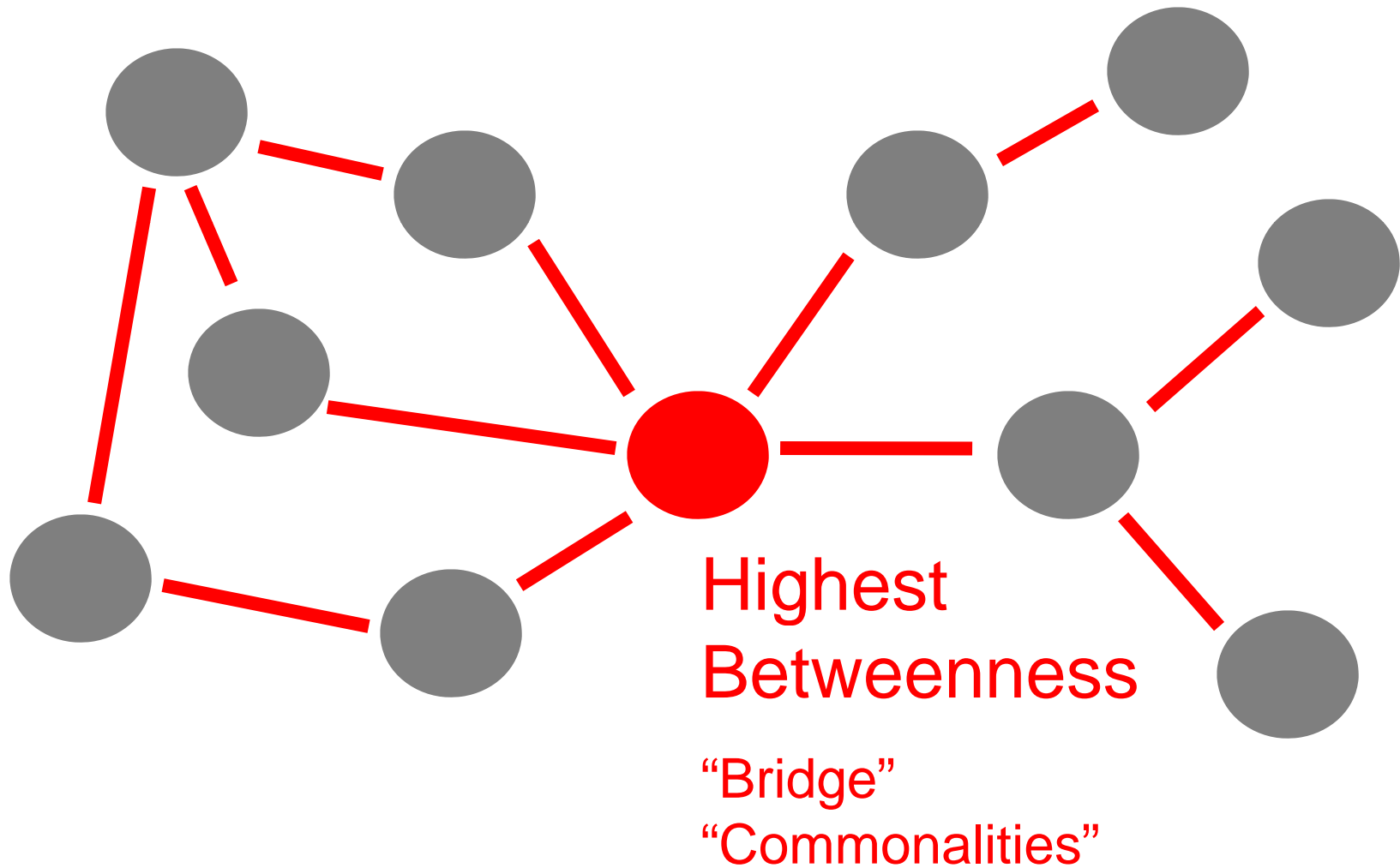


# Metrics – Degree – Out-Degree

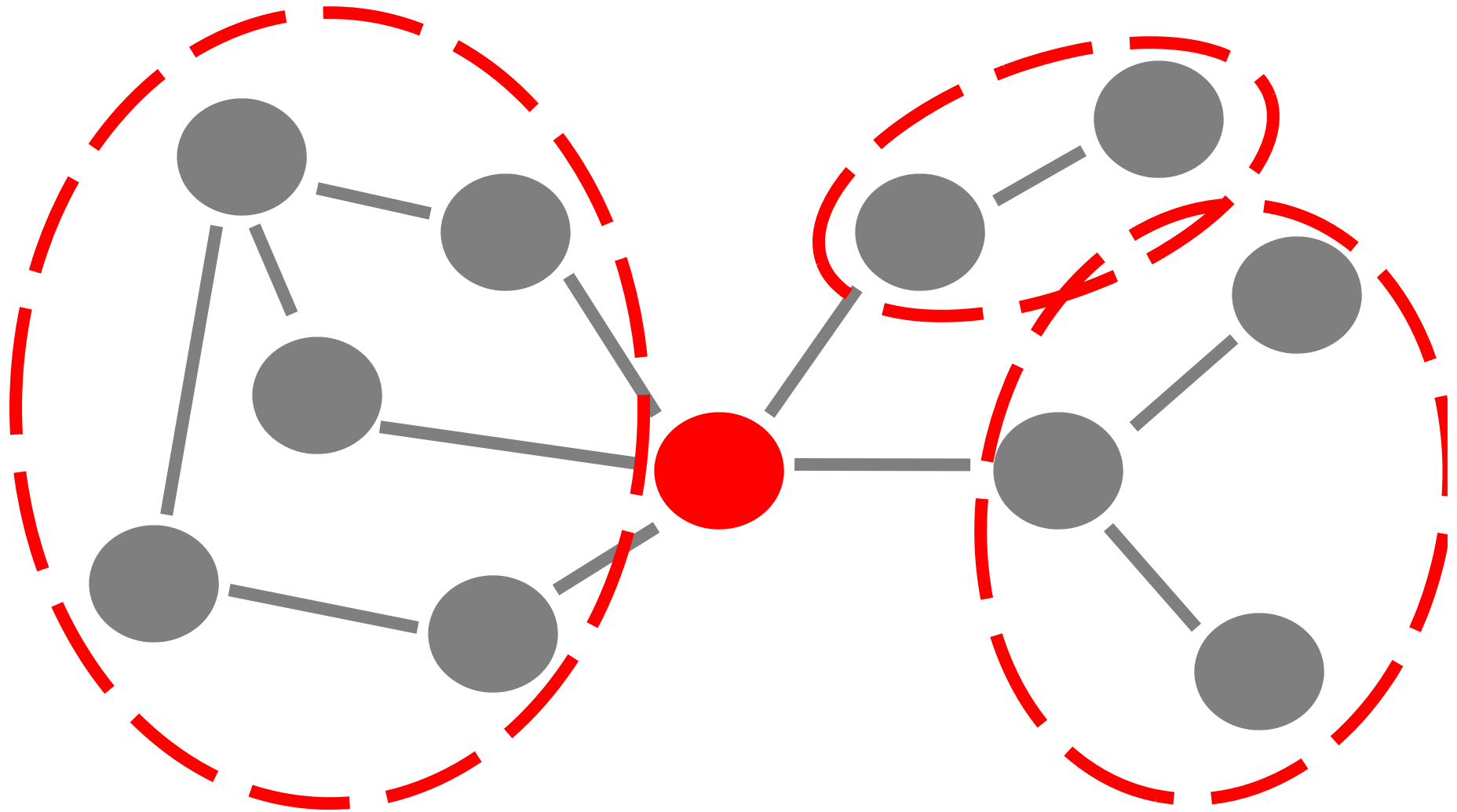
Highest Out-Degree  
“Gregarious”



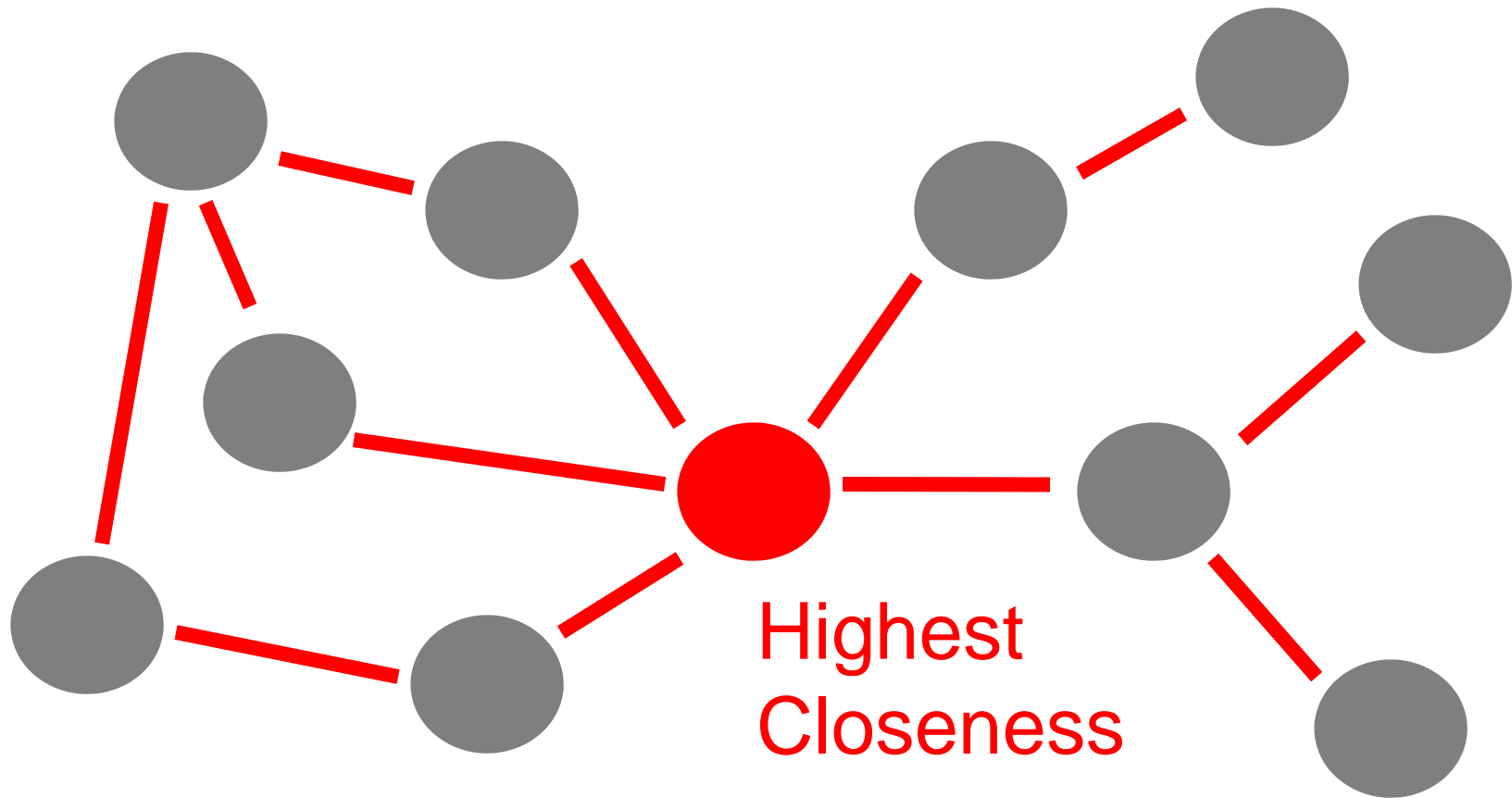
# Metrics – Betweenness



# Metrics – Betweenness



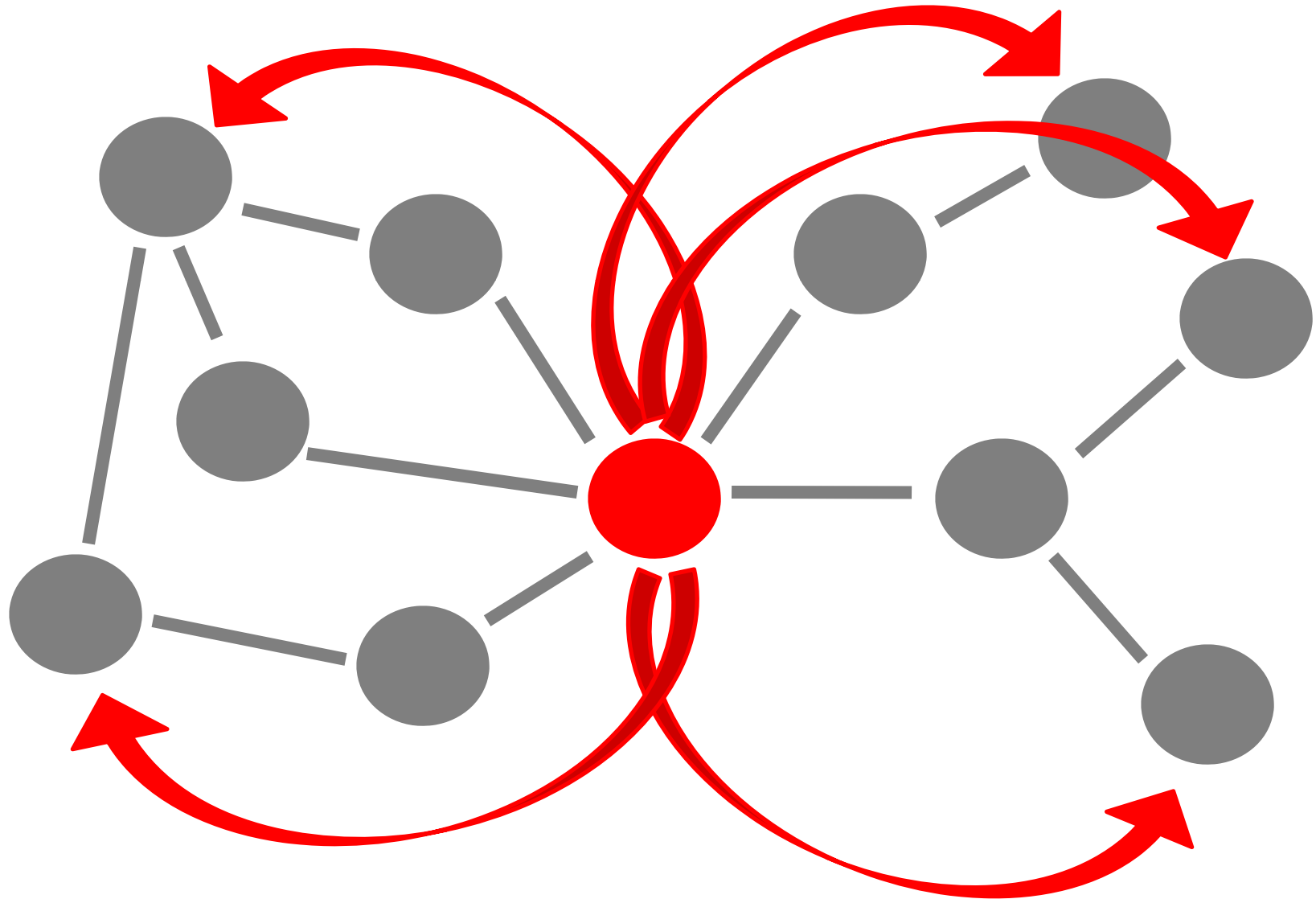
# Metrics – Closeness



Highest  
Closeness

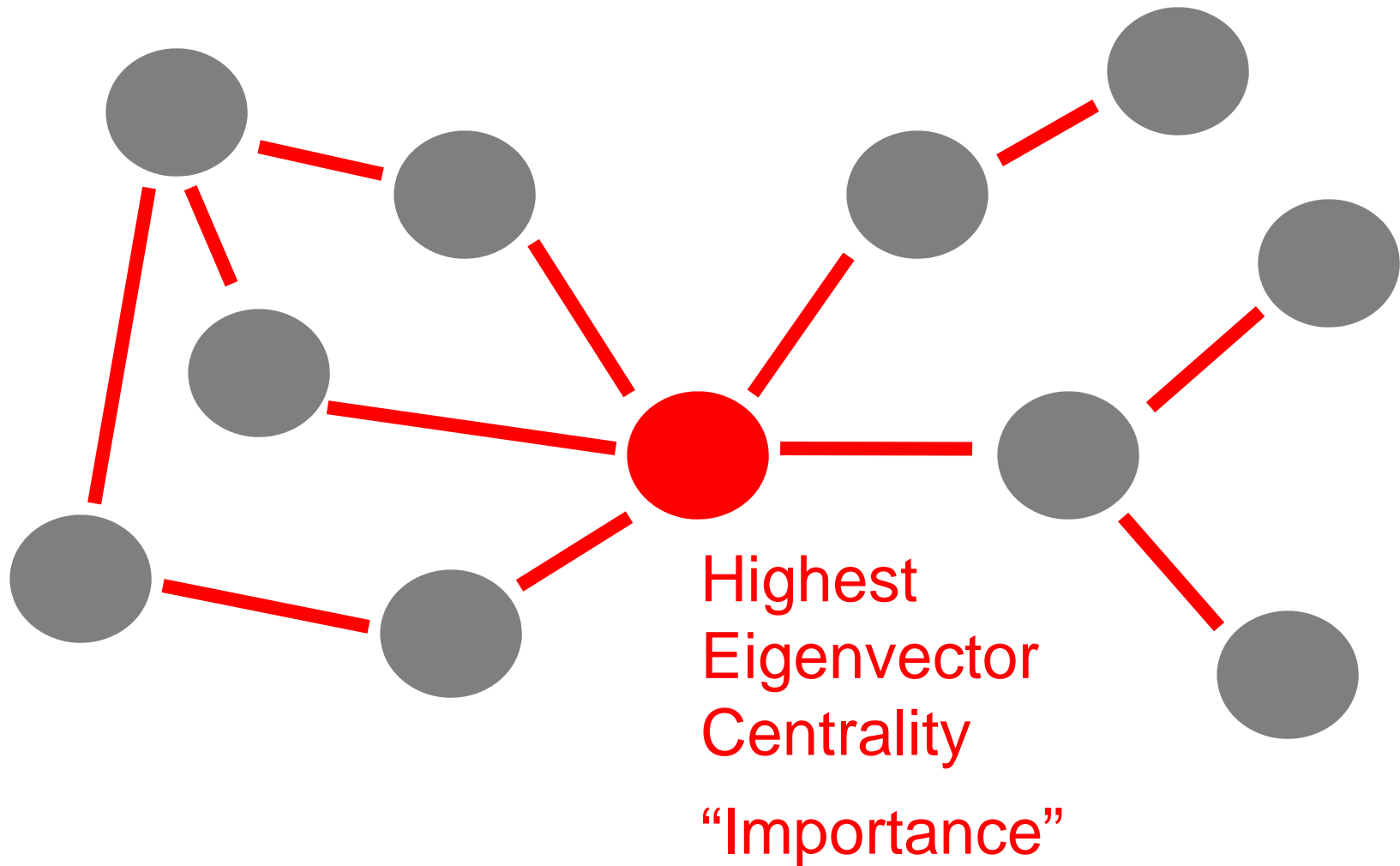
“Who could spread  
a rumor?”

# Metrics – Closeness

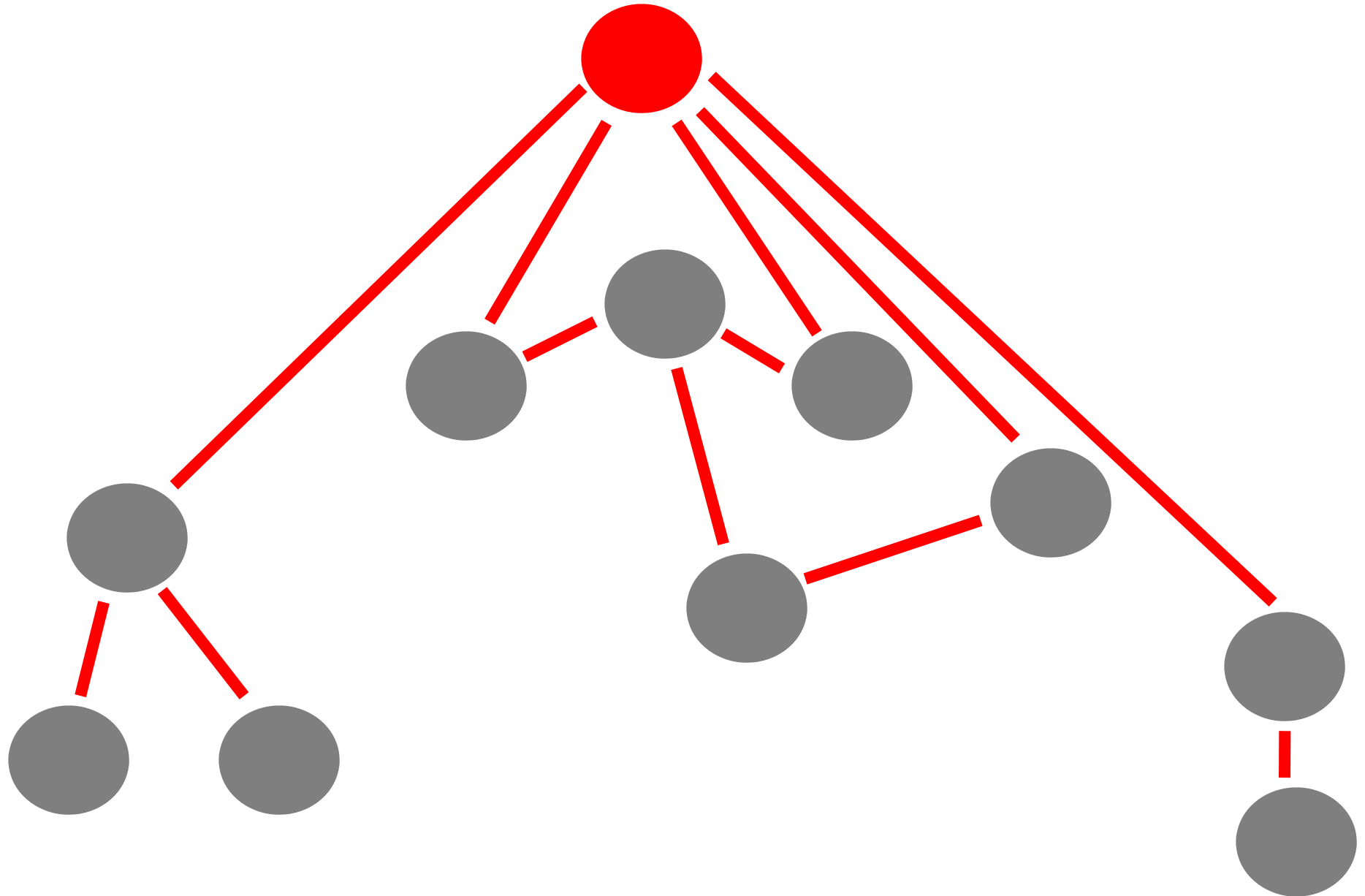




# Metrics – Eigenvector Centrality



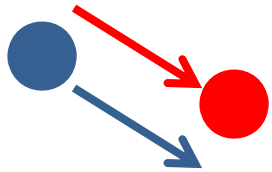
# Metrics – Eigenvector Centrality



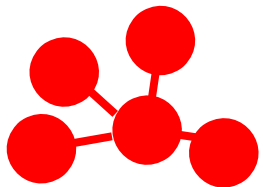
# Recap



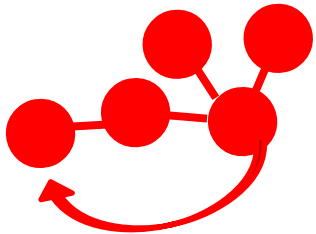
**Degree** (undirected): Number of connections



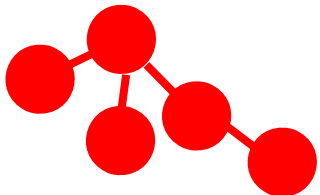
**In- / Out-Degree** (directed): “Popular” / “Gregarious”



**Betweenness**: “Bridges” / “Commonalities”



**Closeness**: “Rumor starting point”



**Eigenvector Centrality**: “Importance”

# *Your* Use Cases – Connect:

**People to Other People**



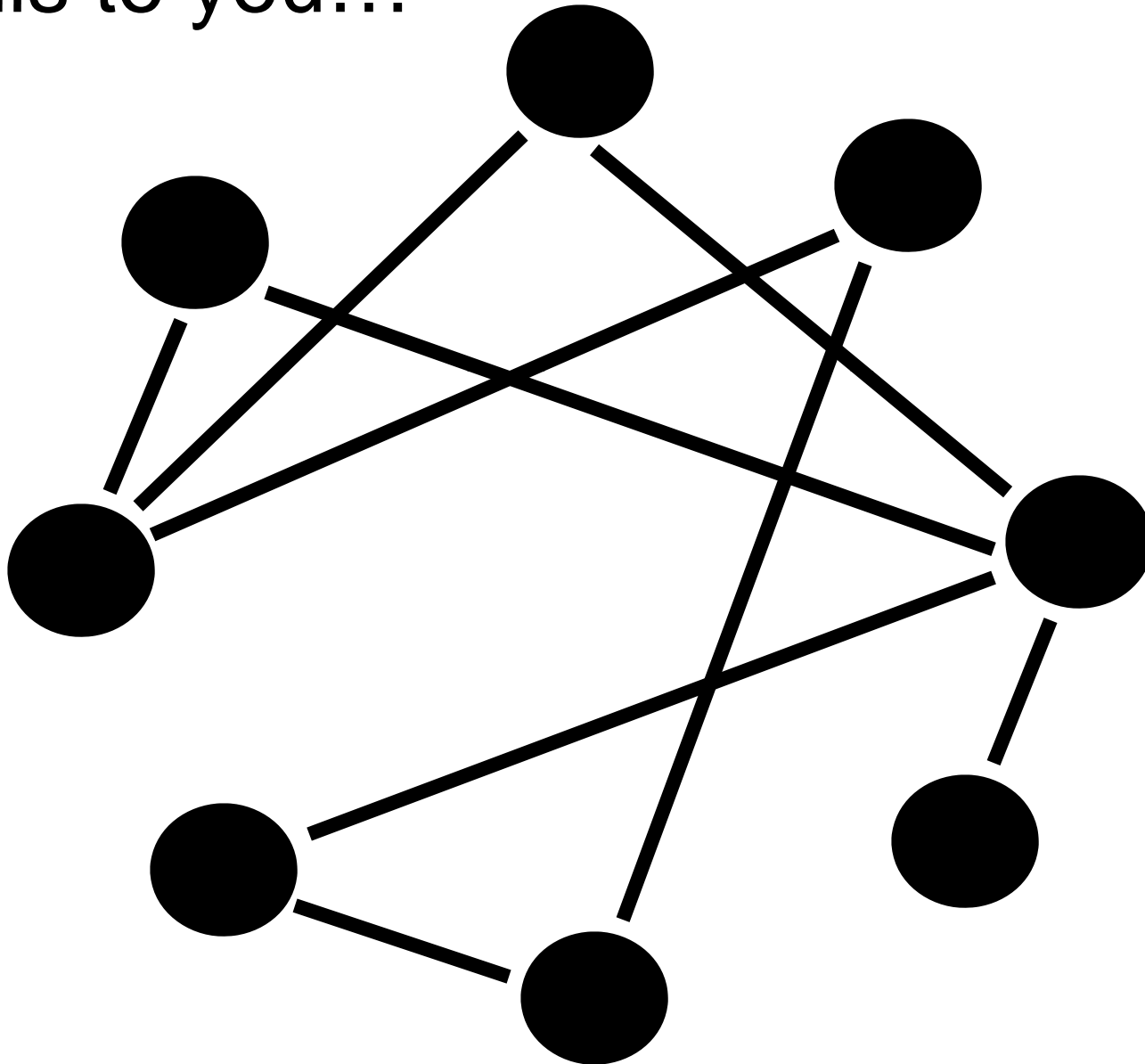
**Things/Ideas to Other Things/Ideas**



**People to Things/Ideas**



If the other attendees are starting to look like this to you...



# Transforming *Your* Data

Common Network Data Structures

Relational Database

Unstructured Text

# Edge List

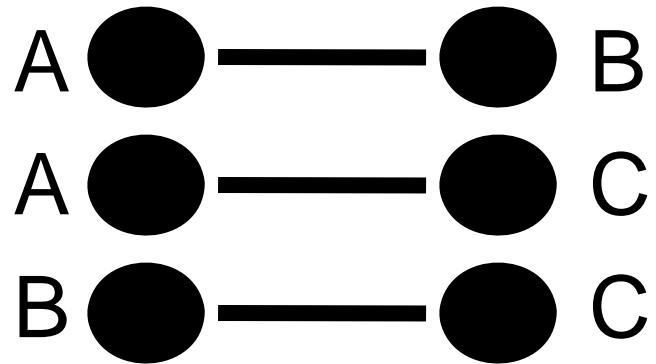
A list of edges (links)!

<b>A</b>	<b>B</b>
<b>A</b>	<b>C</b>
<b>B</b>	<b>C</b>

# Edge List

A list of edges (links)!

**A**    **B**  
**A**    **C**  
**B**    **C**

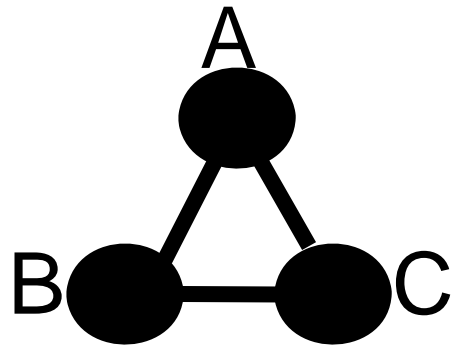
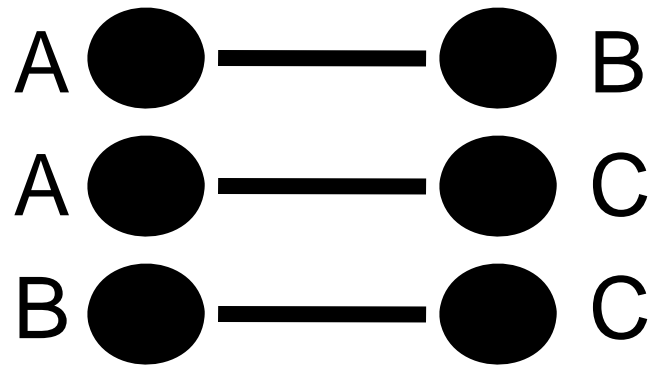




# Edge List

A list of edges (links)!

A B  
A C  
B C



# Data You May Already Have

Faculty/Staff and Appointing Departments

Faculty/Staff and Groups

Principal Investigators and Sponsored  
Projects

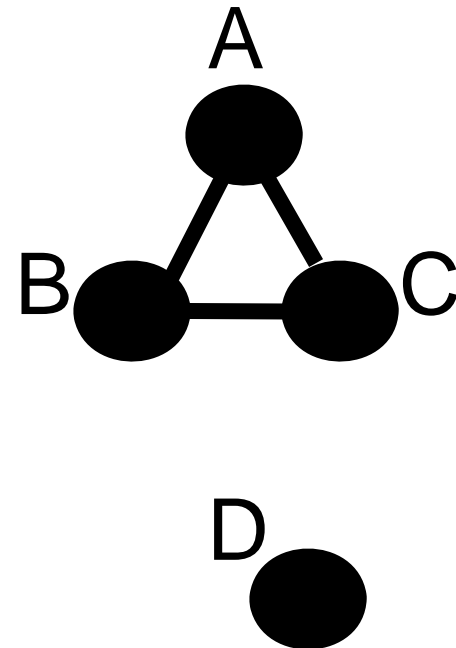
Sponsored Projects and Participants

Authors and Publications

# Adjacency Matrix

A table of each node by each node

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
A	x	1	1	0
B	1	x	1	0
C	1	1	x	0
D	0	0	0	x



# Transforming Relational Database Data

Where your data has unique identifiers and features associated with them, such as:

<u>Unique ID</u>	<u>Feature</u>
1	A
1	B
1	C
2	D
2	E
2	F
3	A
3	D

# Transforming Relational Database Data

Join two instances of your table by the unique identifier:

<u>Table</u>				<u>Table</u>
Unique ID	—	=	—	Unique ID
Feature				Feature

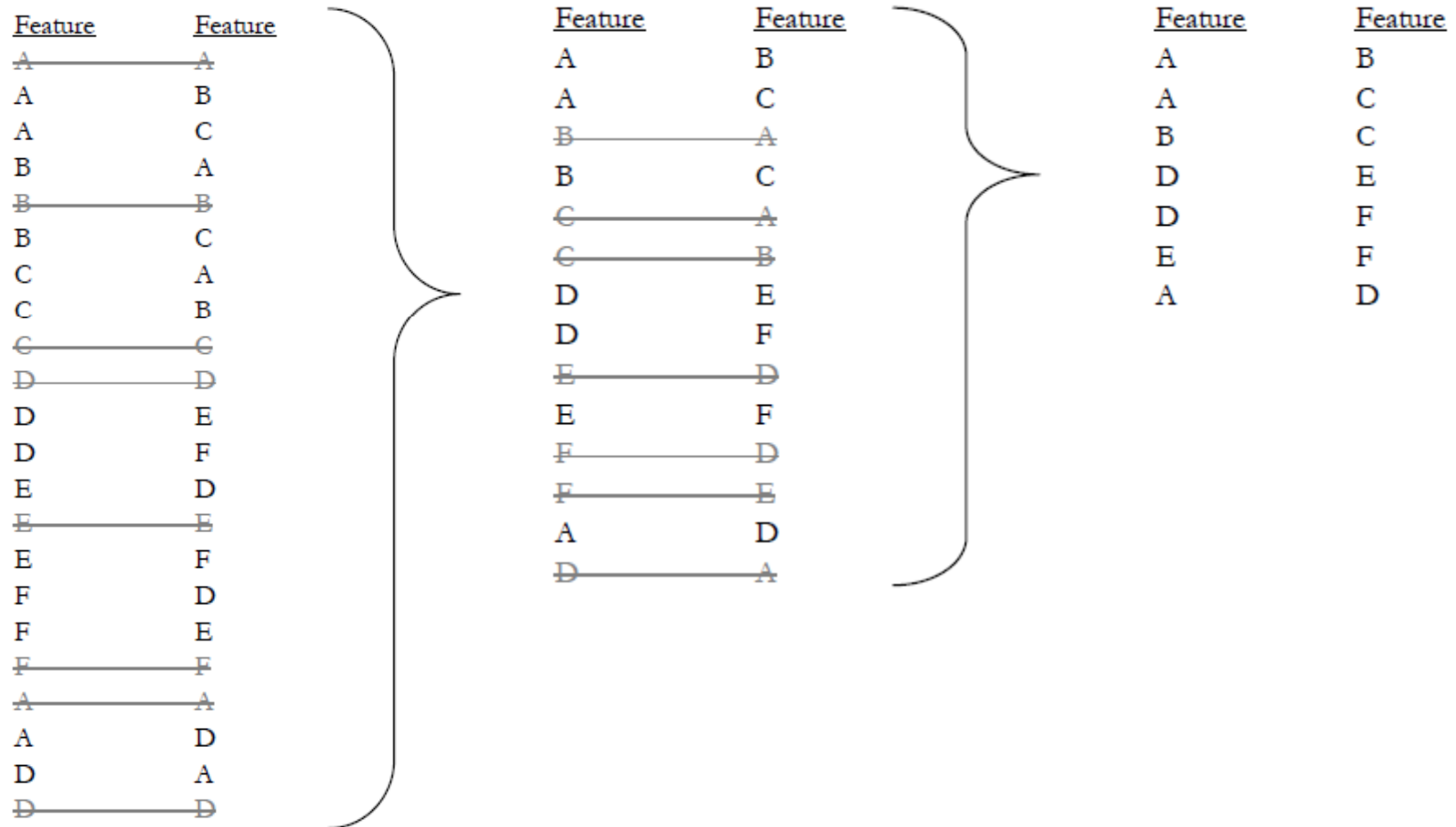
# Transforming Relational Database Data

Query for both instances of the feature,  
returning:

<u>Feature</u>	<u>Feature</u>	
A	A	(Feature-Feature adjacency for Unique ID = 1)
A	B	
A	C	
B	A	
B	B	
B	C	
C	A	
C	B	
C	C	
D	D	(Feature-Feature adjacency for Unique ID = 2)
D	E	
D	F	
E	D	
E	E	
E	F	
F	D	
F	E	
F	F	
A	A	(Feature-Feature adjacency for Unique ID = 3)
A	D	
D	A	
D	D	

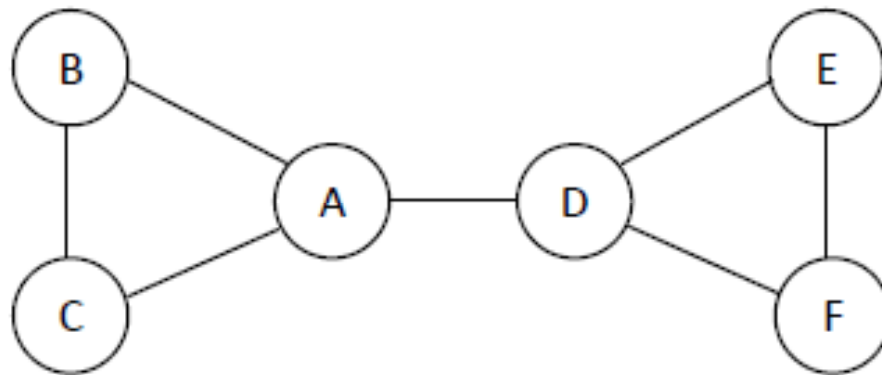
# Transforming Relational Database Data

Network analysis software will remove “self-loops” and duplicate edges:



# Transforming Relational Database Data

And the resulting visualization might look like:





# Unstructured Text

Node: Word or phrase

Link: Co-occurrence within a block of text

Suppose we wanted to find co-occurrences among words in unstructured text and words of interest included “network” and “text.”

You can construct a **network** based upon word co-occurrence in unstructured **text**.

# Unstructured Text

You can construct a **network** based upon word co-occurrence in unstructured **text**.

A red circular arrow is drawn around the words 'network' and 'text' in the paragraph above. The arrow starts at the word 'text' and points to 'network', then loops back from 'network' to 'text', indicating a bidirectional relationship or process.

## Edge List

**network**    **text**

**text**        **network**

# Free, User-Friendly Software

NodeXL [<http://nodexl.codeplex.com/>]

- Microsoft Research / University Collaborators

- Installs as an Excel 2007 Template

- Free, easy, and powerful with top-notch visualization

# Free, User-Friendly Software

Simple Text/Network Mining

-Homegrown Excel/Visual Basic Package

-Tech Transfer

[<http://techfinder.techtransfer.umich.edu/> -  
Search for # 4730]

# Live Demo

# Specific Examples

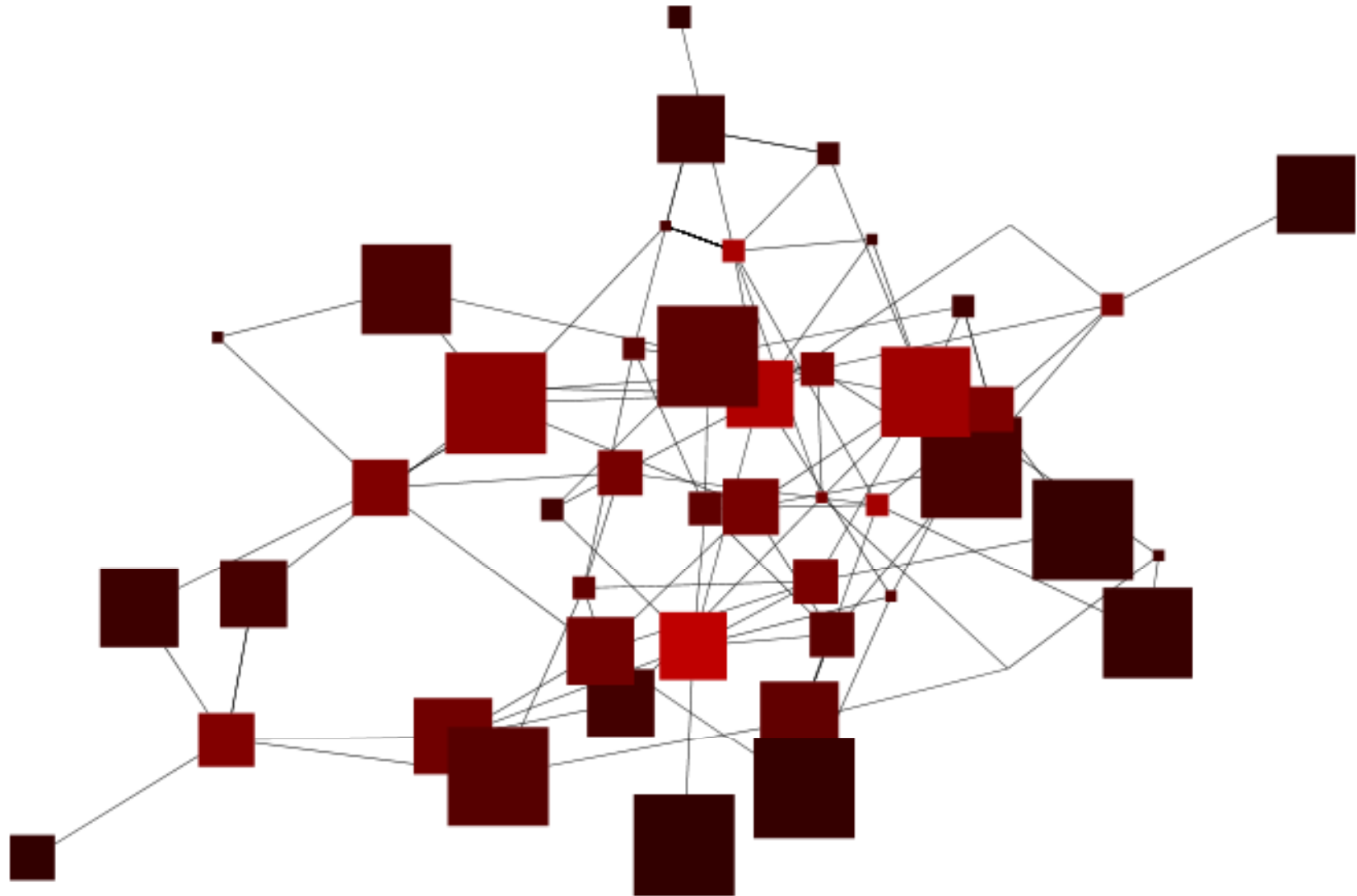
**Things/Ideas and Other Things/Ideas**



Concepts and Other Concepts in  
Publications and Sponsored Project  
Proposal / Award Data

# Concepts and Other Concepts in Publications and Sponsored Project Proposal / Award Data

- Concept
- ■ ■ Increasing Betweenness Centrality



# Specific Examples

**People and Things/Ideas**



People and Sponsored Projects

Authors and Publication Concepts



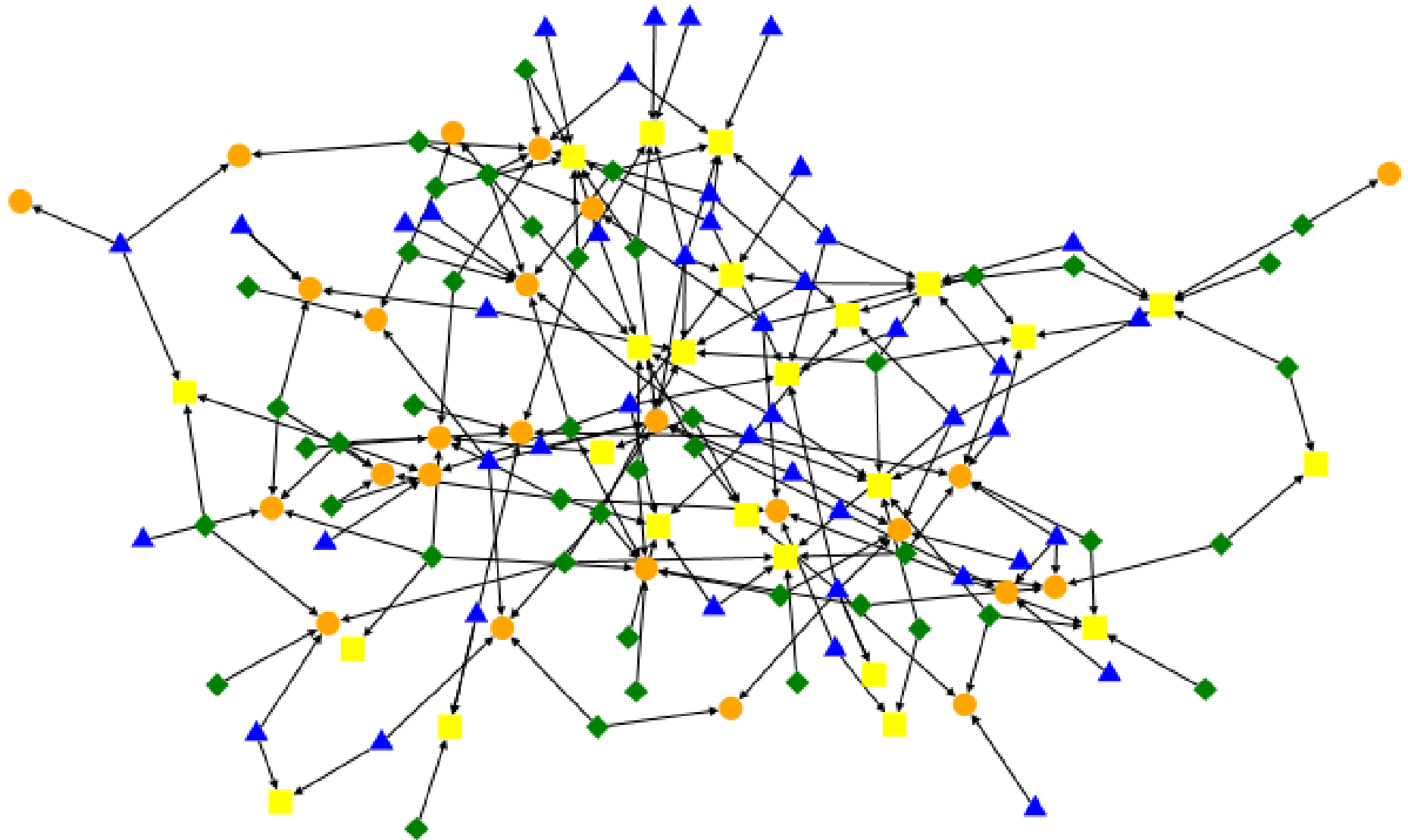
# People and Sponsored Projects

▲ Medical School PI

◆ Engineering PI

■ Medical School Project

● Engineering Project



# Specific Examples

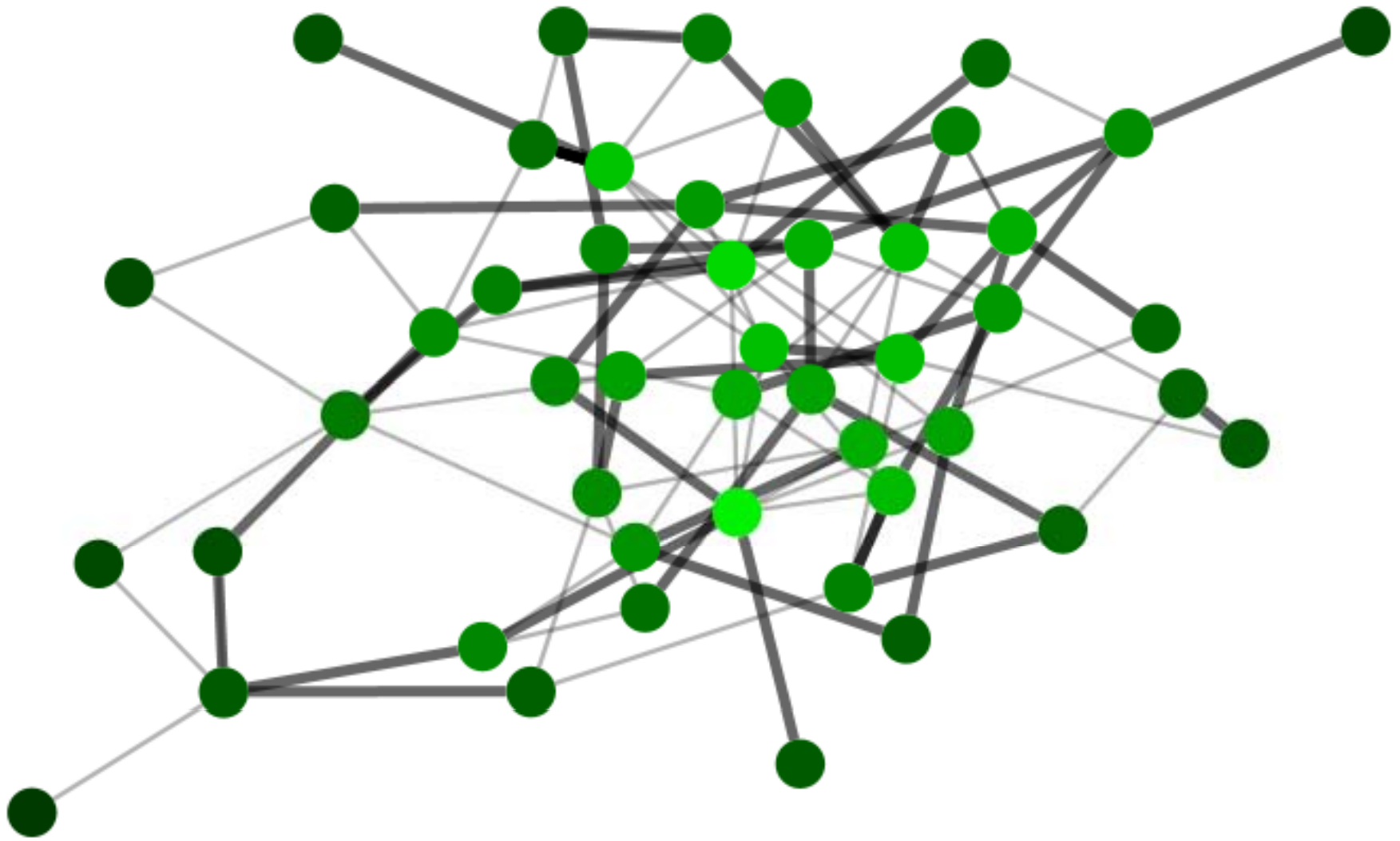
## **People** and Other **People**



Co-Participation on Sponsored Projects,  
Co-Authorship

# Co-Participation on Sponsored Projects, Co-Authorship

- Researcher / Author
- ● ● Increasing Eigenvector Centrality
- ▬ Active Project + Publication
- ▬ Active Project
- ▬ Publication

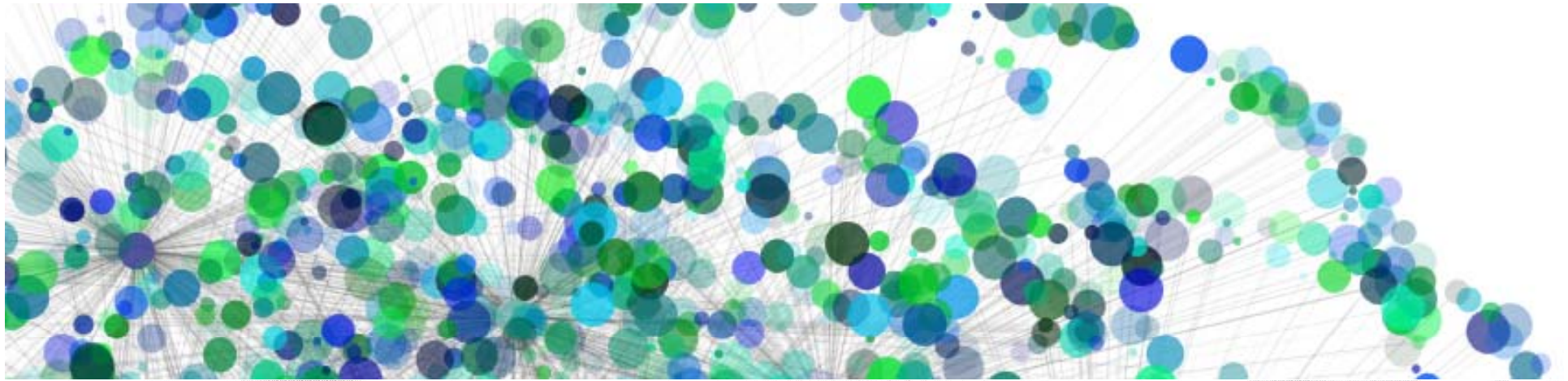


# Strategies for Communication

## Visualization

- Pay attention to node layout
- Subtly encode as much data as you can
- Include a really simple key

You understand the network data,  
visualization, and metrics + your audience  
doesn't = hand deliver





# Resources

<http://nodexl.codeplex.com/>

<http://www.umich.edu/~jhoron>

Tech Transfer # 4730

On Campus: School of Information, Center for Positive Organizational Scholarship, Interdisciplinary Group for Research on Innovation