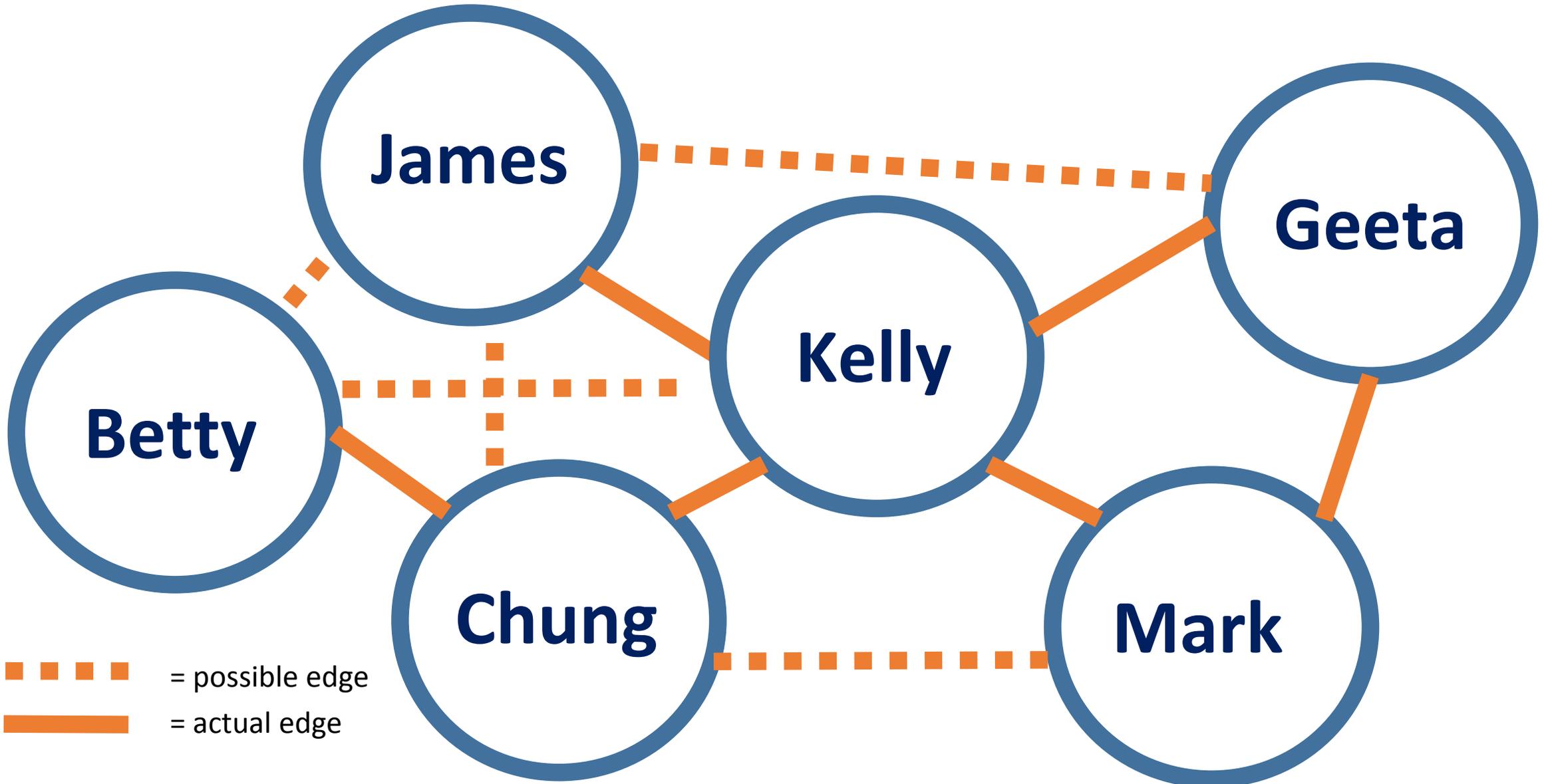


# Introduction to Network Visualization and Analysis: Part 2

Kelly Schultz, Data Visualization Librarian &  
Nich Worby, Government Information & Statistics Librarian

# Network Theory: Density



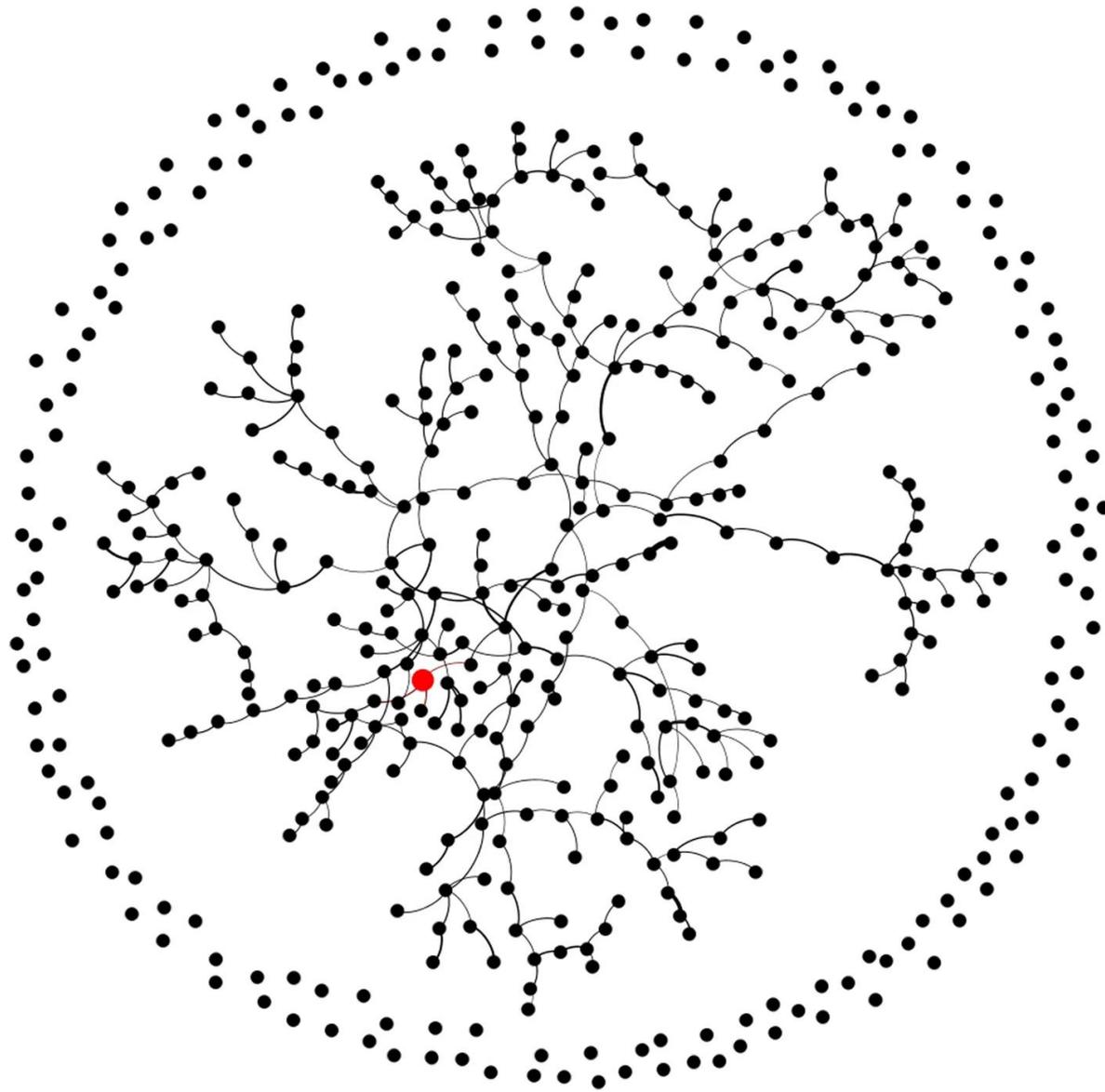
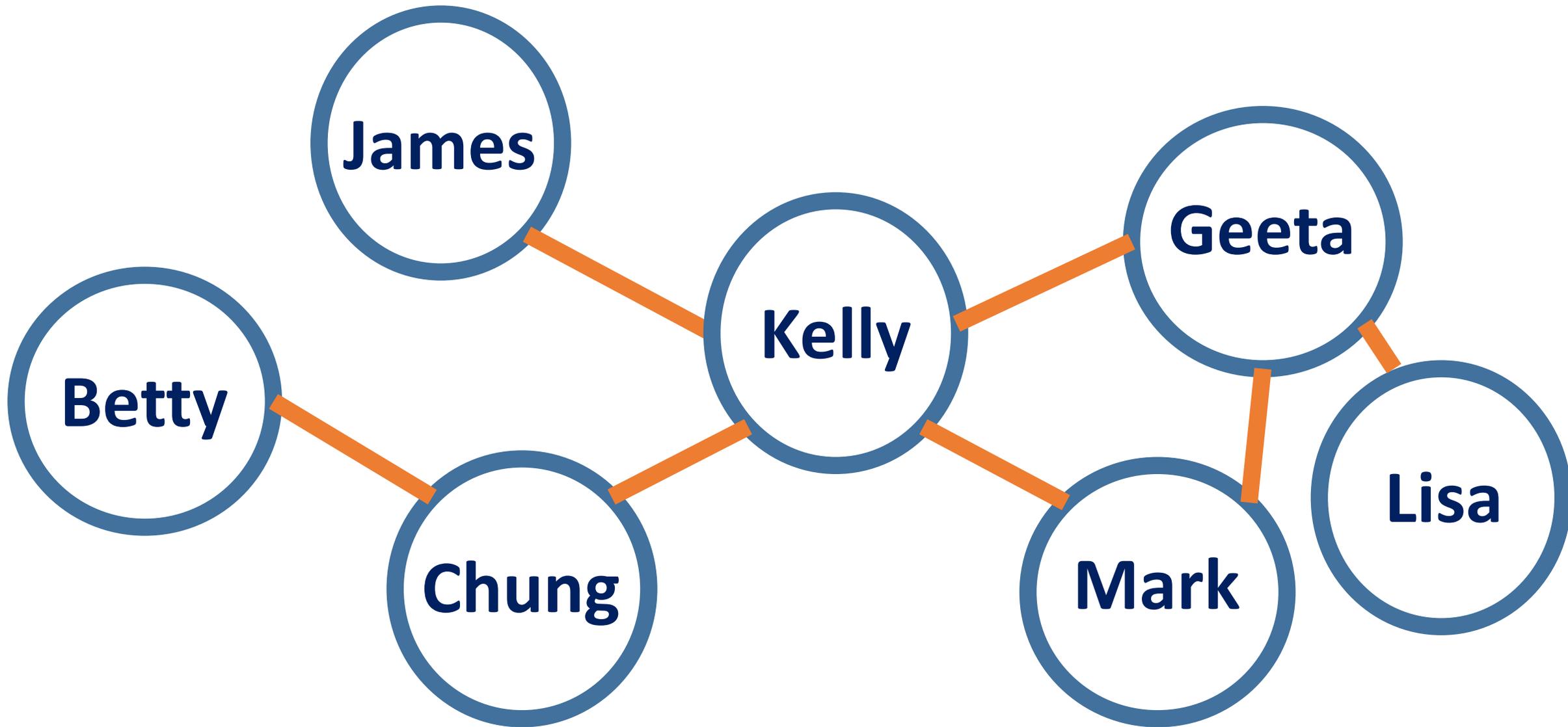
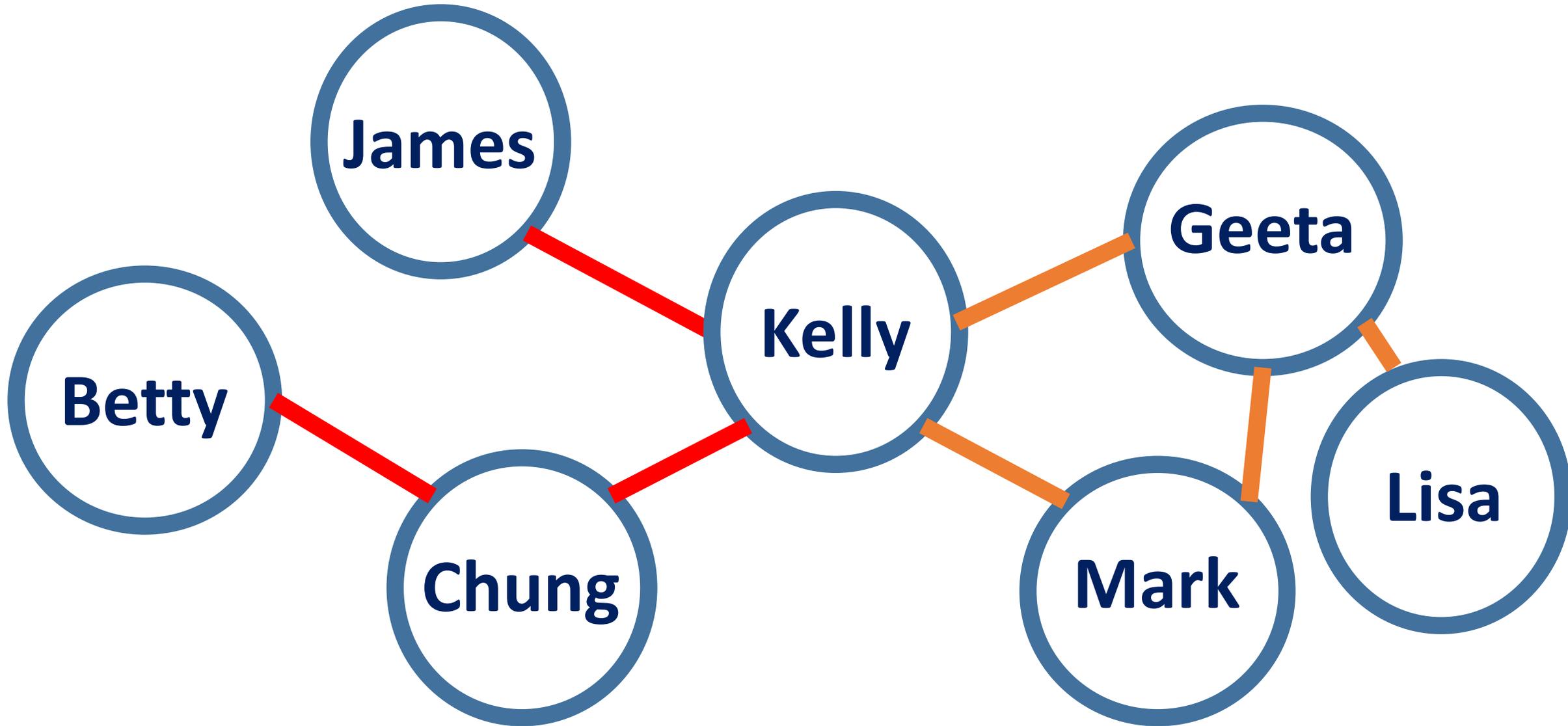


Image: Guo, Z., Xu, S., Tong, L., Dai, B., Liu, Y., & Xiao, D. (2020). An artificially simulated outbreak of a respiratory infectious disease. *BMC Public Health*, 20(1), 135.

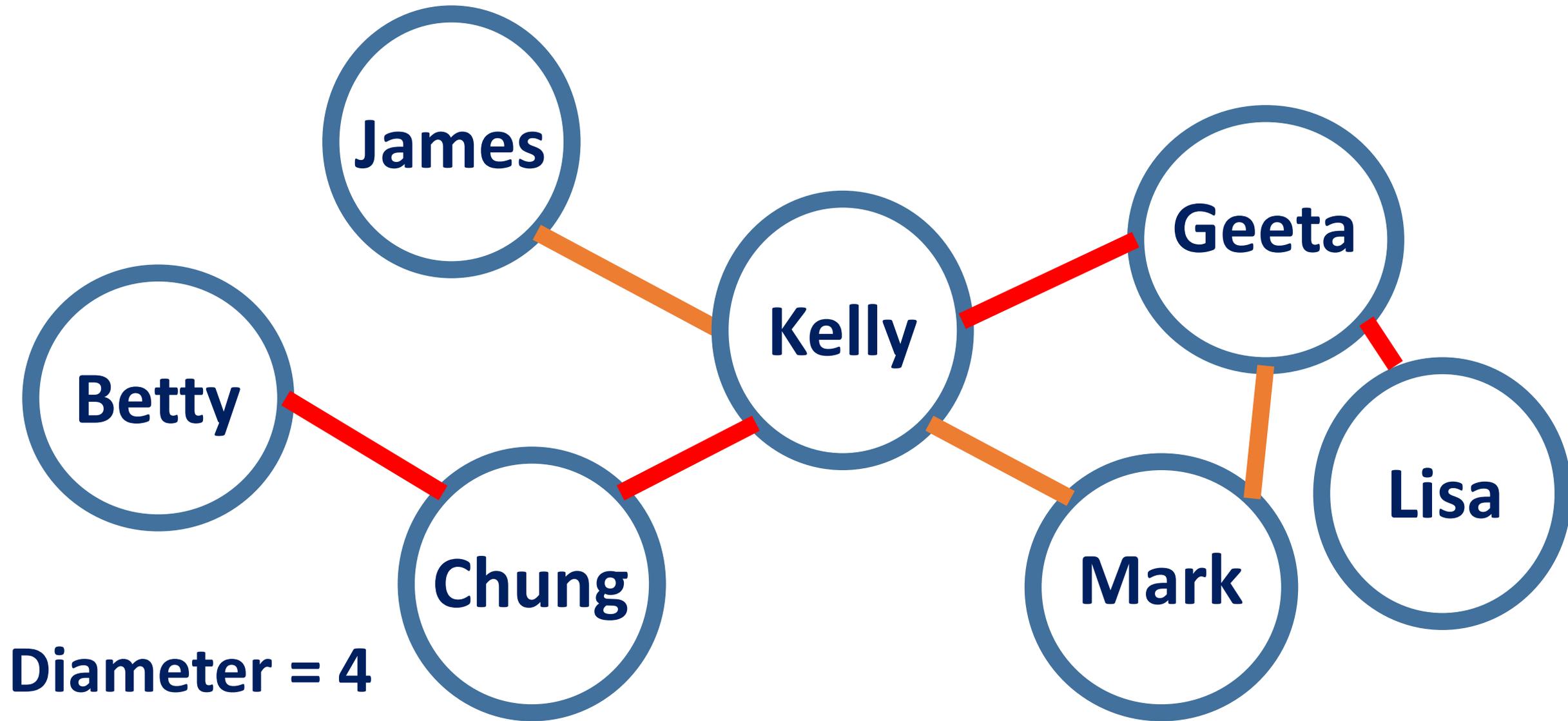
# Network Theory: Distance



# Network Theory: Shortest path



# Network Theory: Diameter





# Subway Map



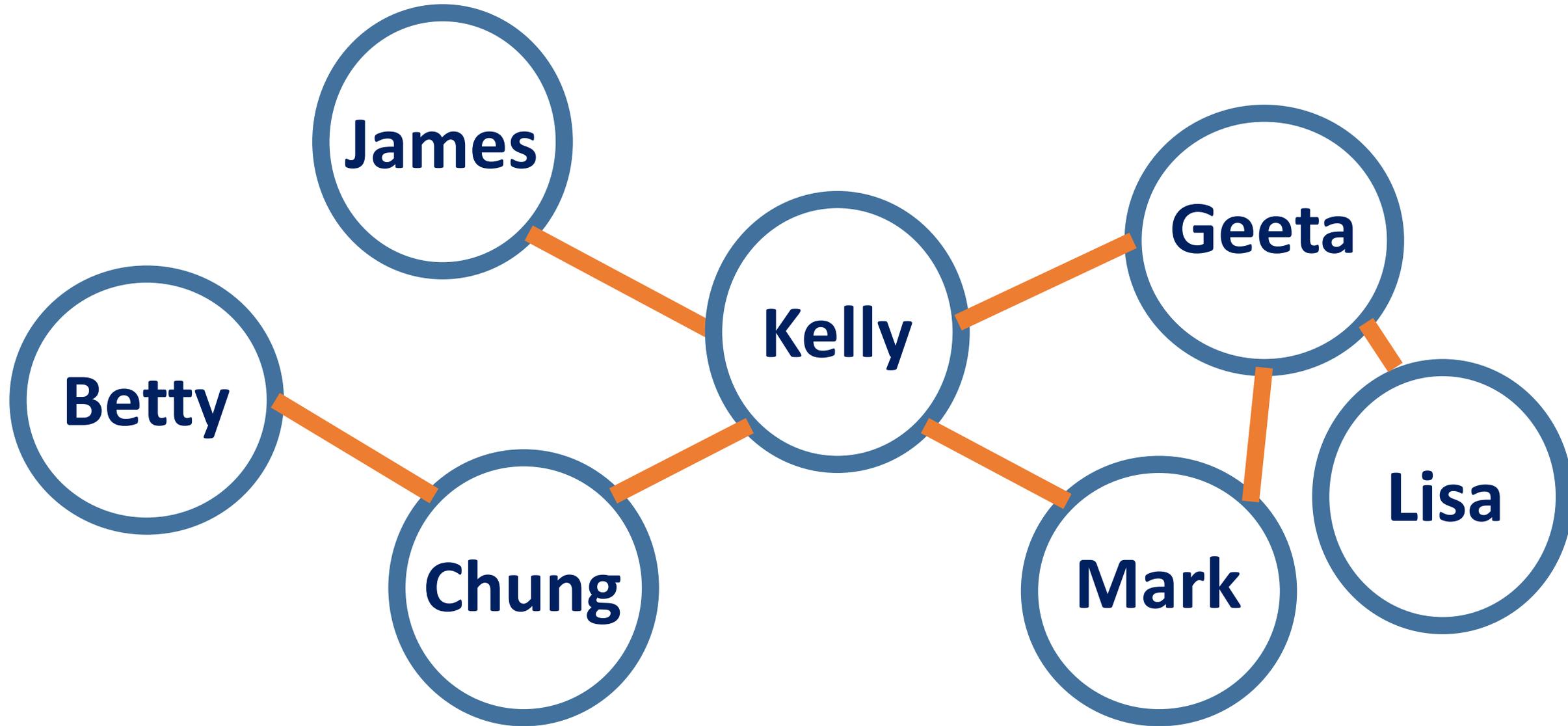
- 1** Yonge-University Line
- 2** Bloor-Danforth Line
- 3** Scarborough Line
- 4** Sheppard Line
- Interchange station
- Accessible station

## Hours of operation

Weekday and Saturday service approximately 6 a.m. to 1:30 a.m.  
 Sunday service approximately 8 a.m. to 1:30 a.m.  
 Holiday start times vary

ttc.ca | Information: 416-393-4636 | Customer Service: 416-393-3030  
 Toronto Transit Commission @TTCnotices @TTChelps

# Network Theory: Average path length

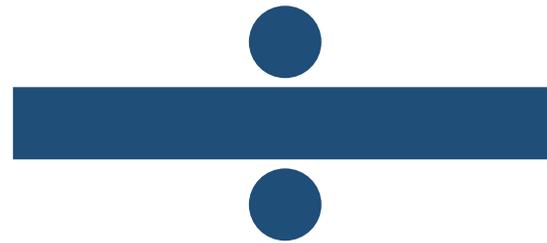


# Network Theory: Average path length

Betty → Chung = 1  
Betty → Kelly = 2  
Betty → James = 3  
Betty → Geeta = 3  
Betty → Mark = 3  
Betty → Lisa = 4  
James → Kelly = 1  
etc.

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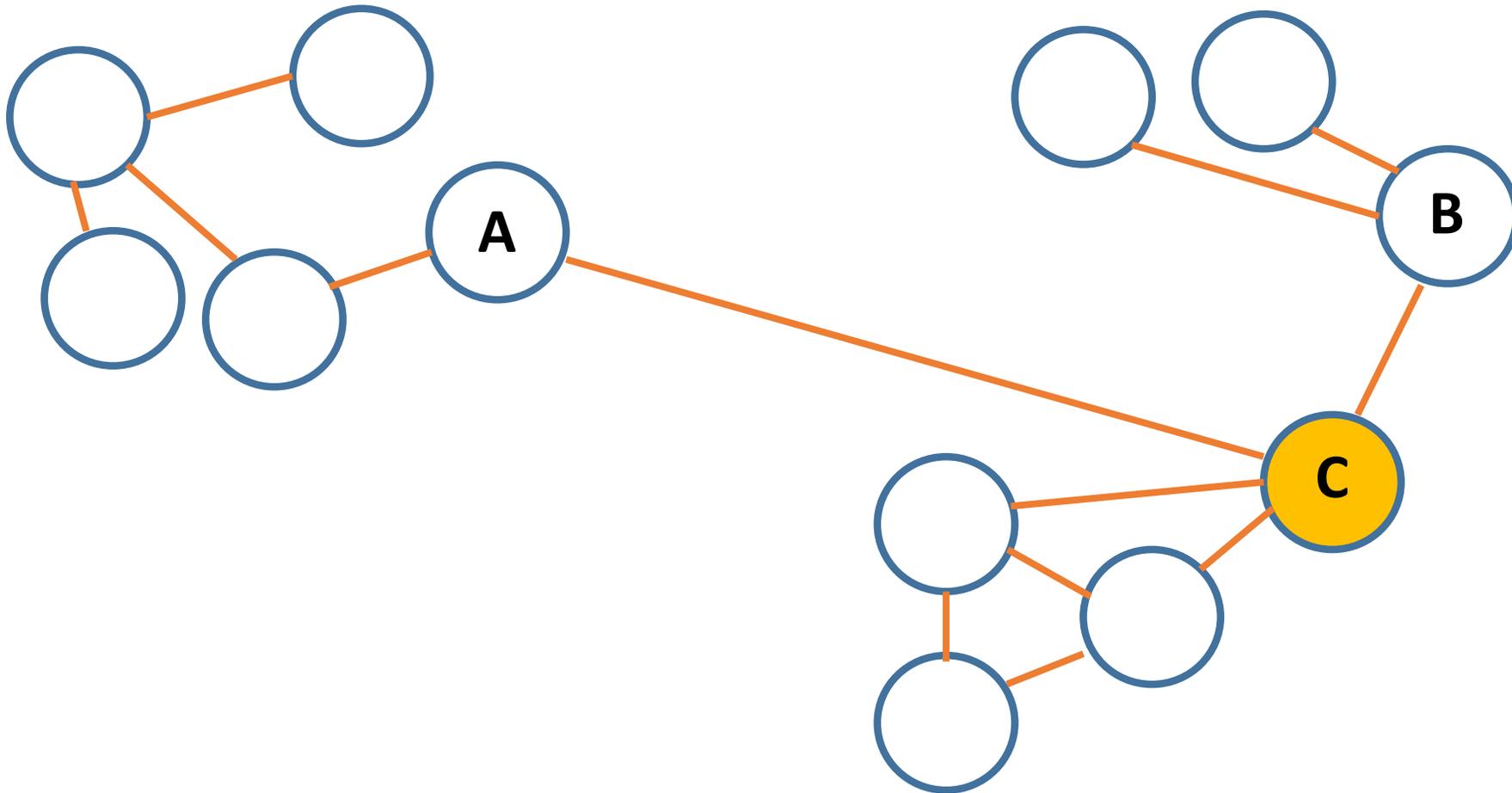
Sum shortest paths btw pairs



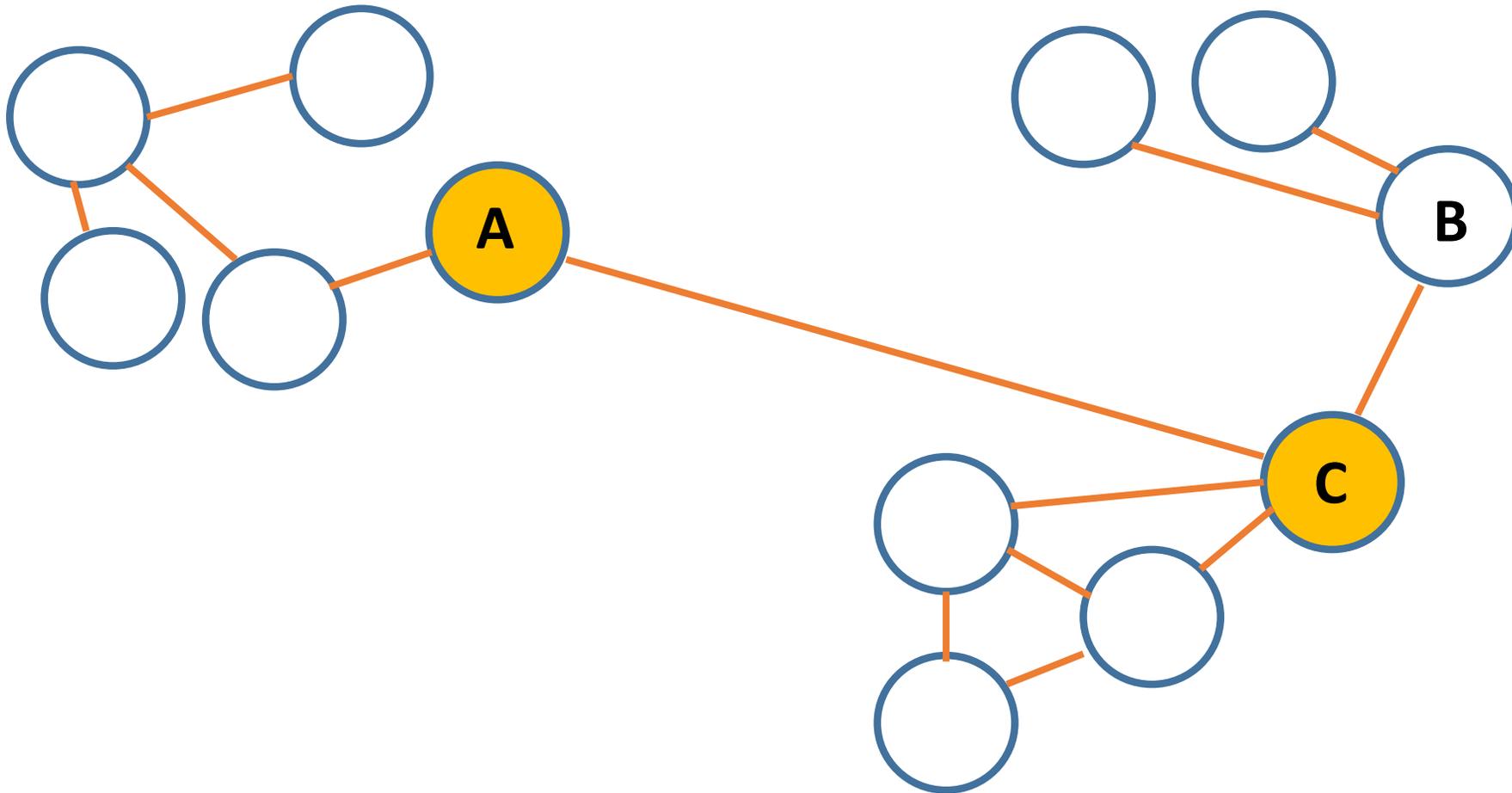
Total number  
of pairs

= average distance between  
nodes

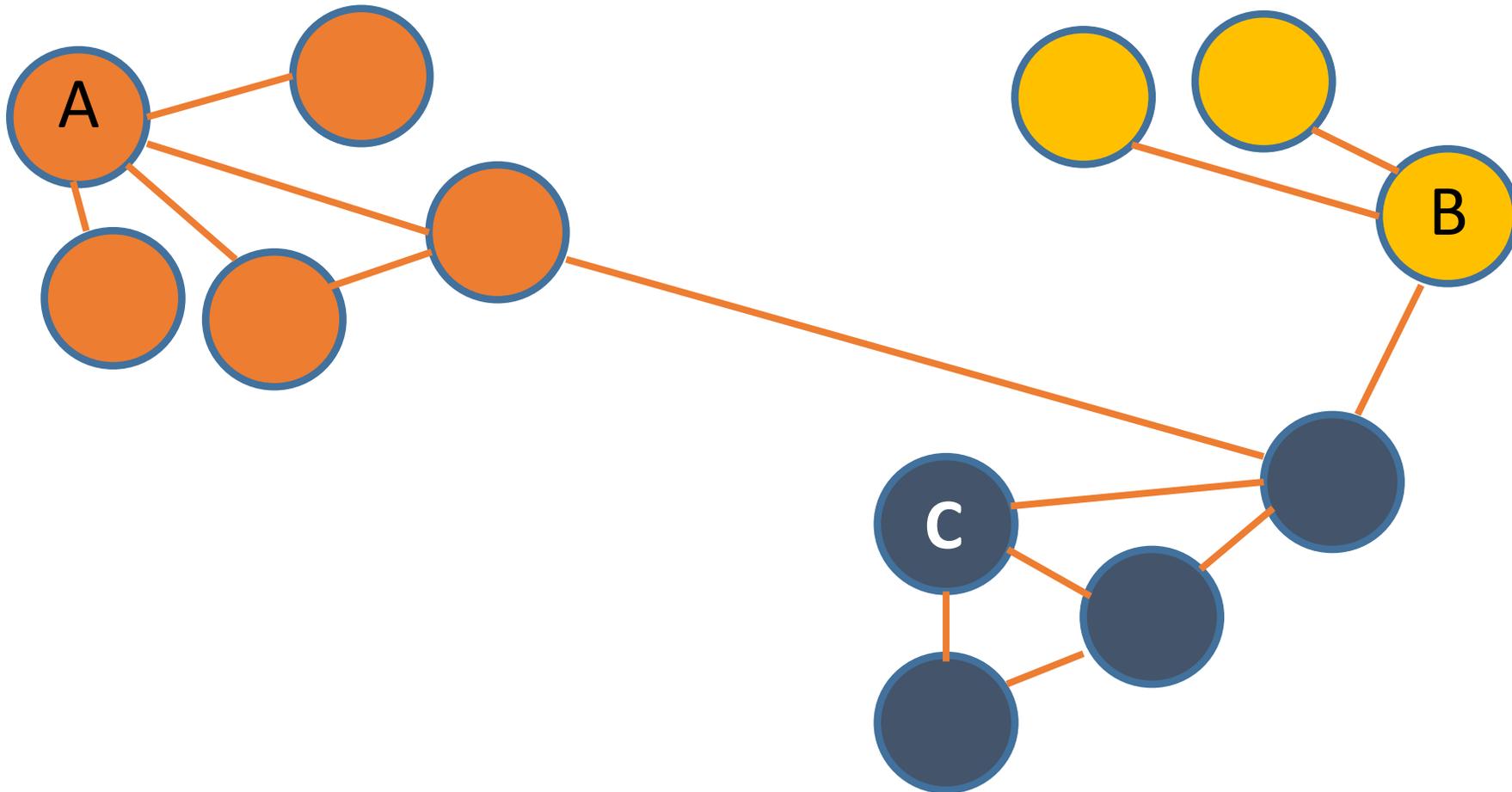
# Network Theory: Betweenness centrality



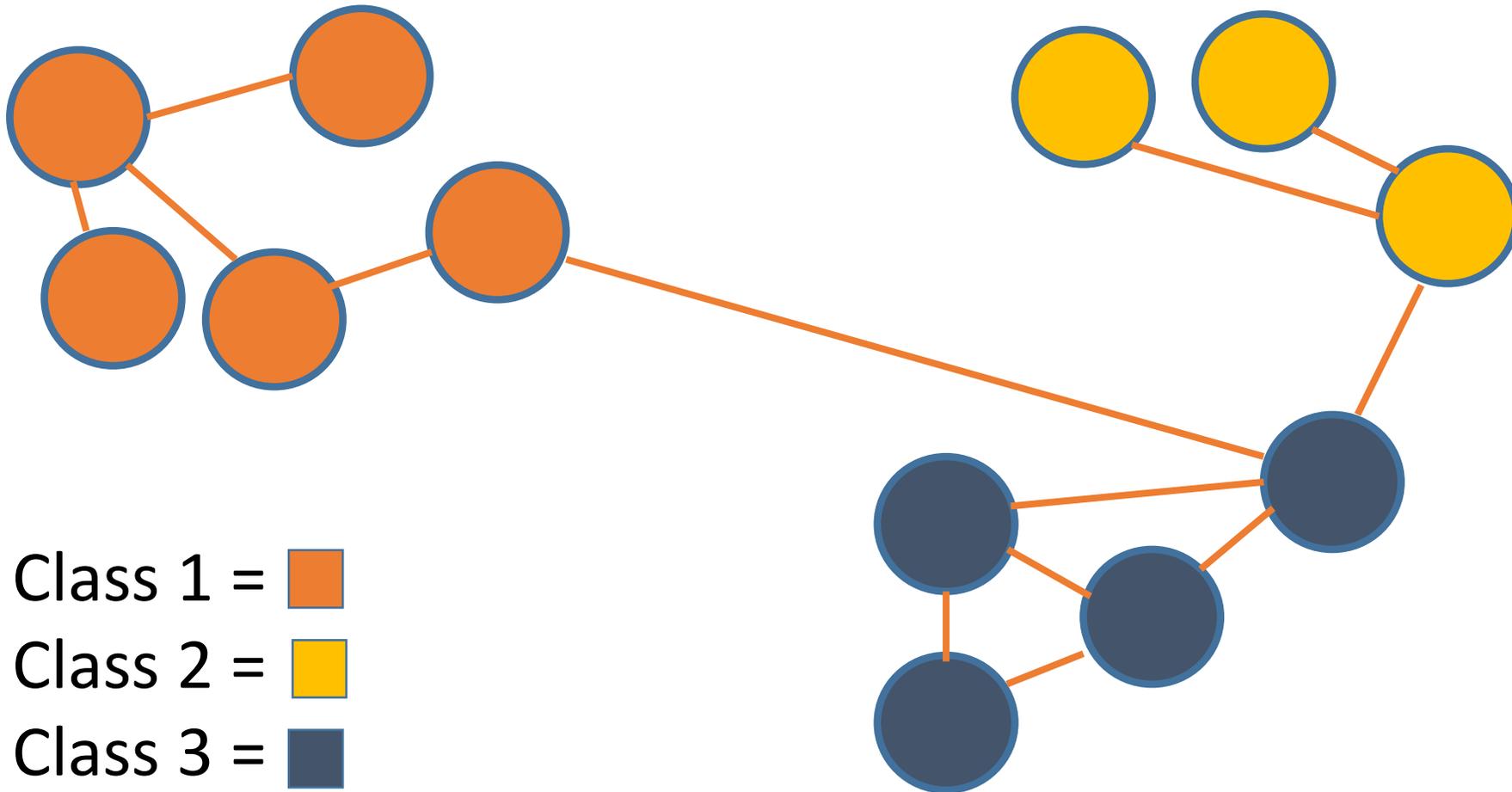
# Network Theory: Closeness centrality



# Network Theory: Clustering coefficient



# Network Theory: Modularity



# Troubleshooting

- Stay on top of Gephi updates
- Filter networks to improve performance
- Allocate more memory to Gephi if filtering is not an option:  
<https://github.com/gephi/gephi/wiki/Troubleshooting>