

Intrducción a Ciencia de Redes

2021-1

Diego Caro

Abril 2021

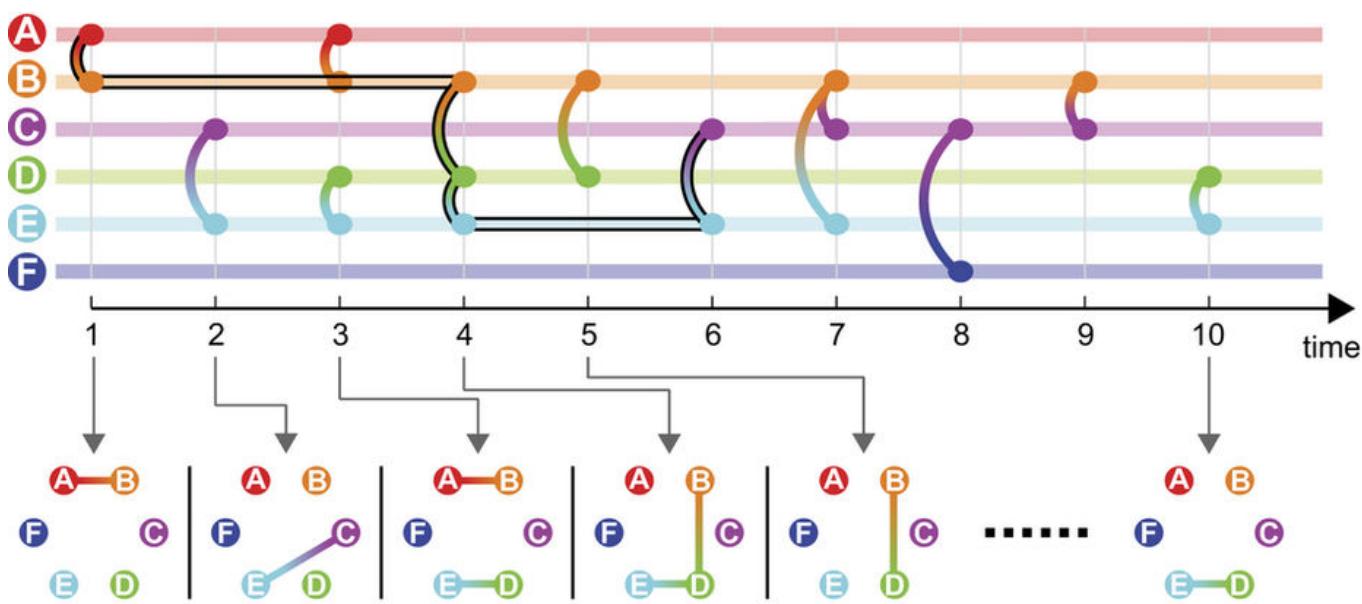
Presentación



Diego Caro

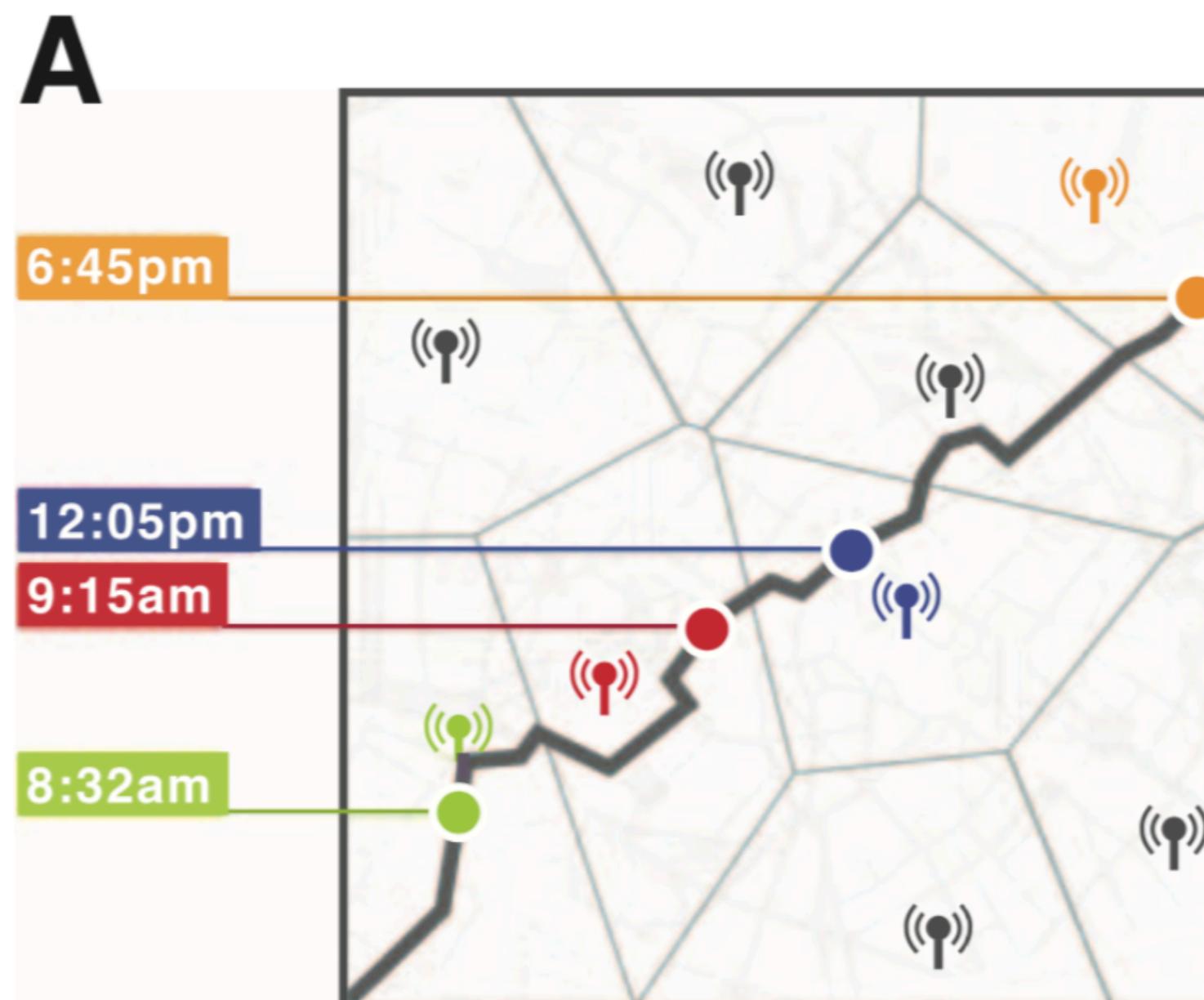
diego.caro.a@usach.cl

Ramona

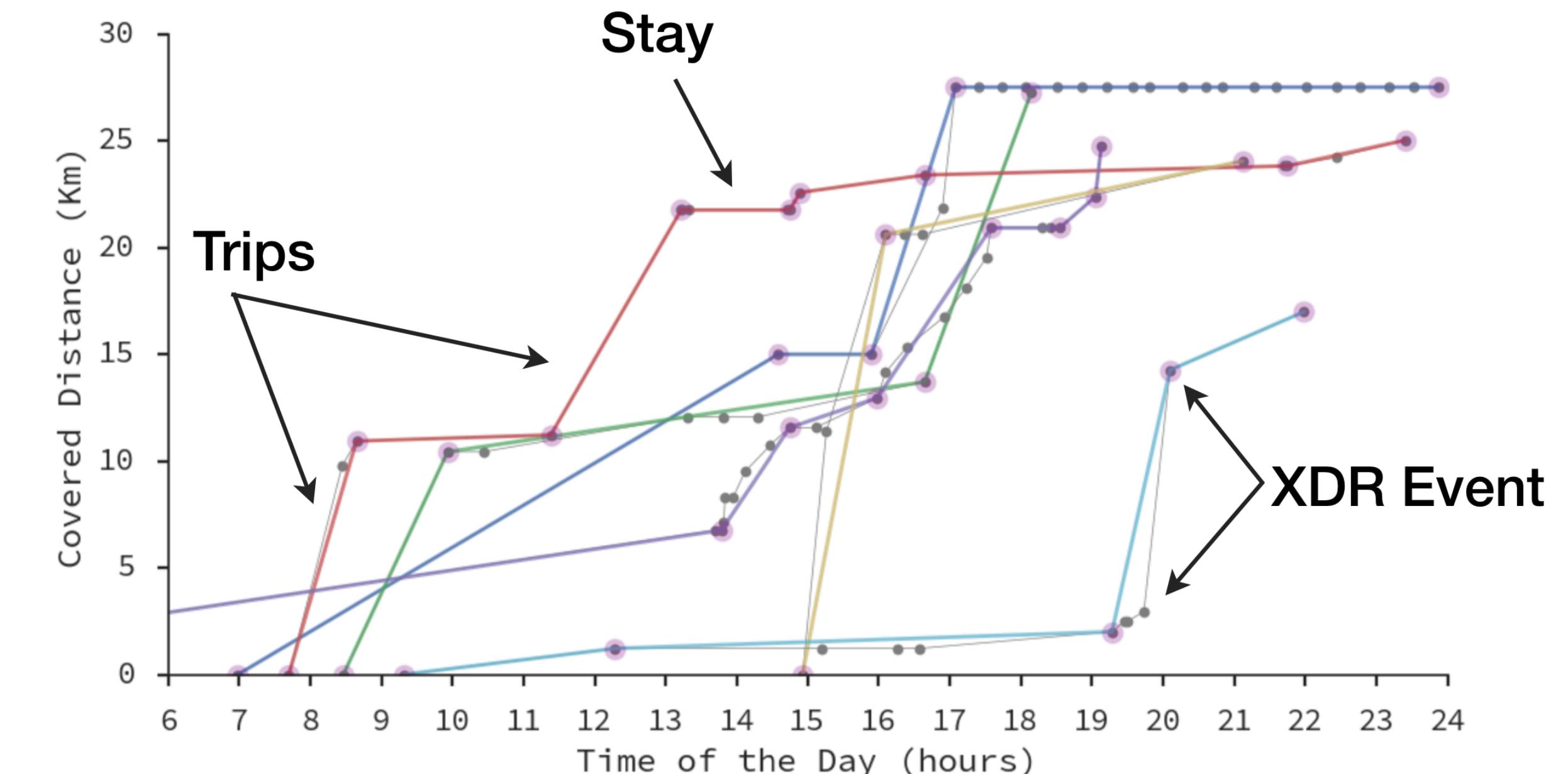


Fondecyt de Iniciación

Billing Records (Data Download)



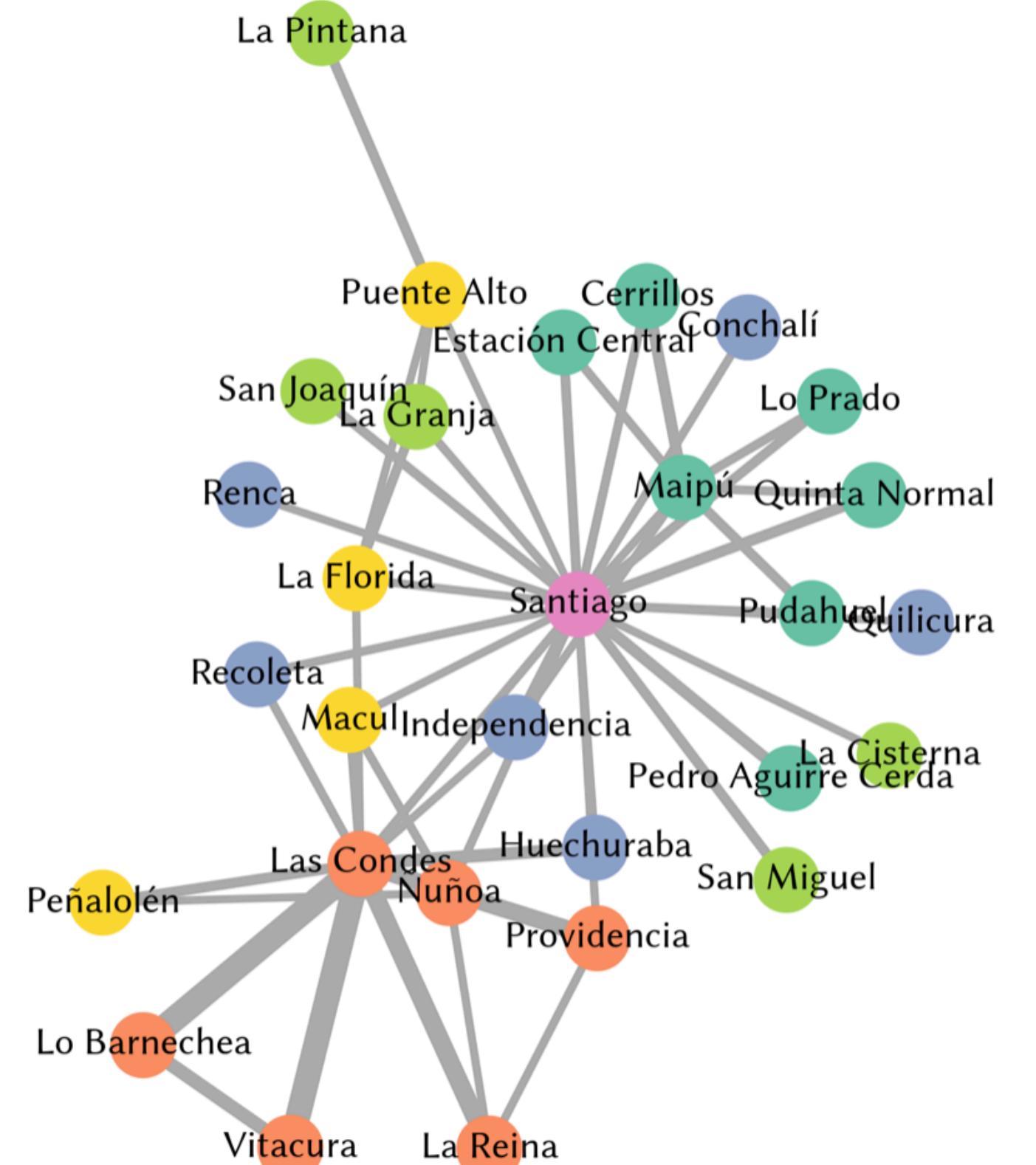
Trip Detection



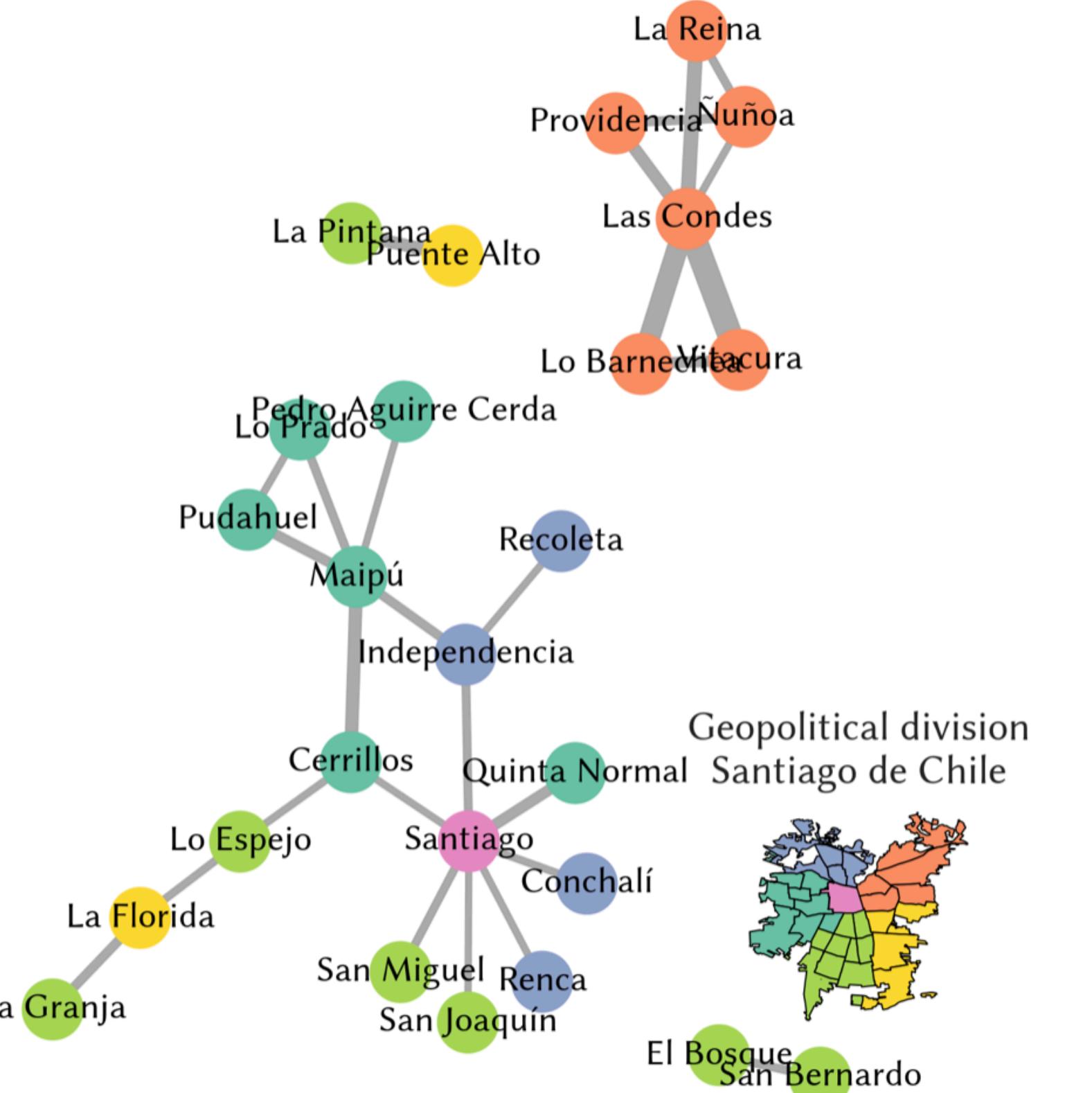
* De Montjoye, Y. A., Hidalgo, C. A., Verleysen, M., & Blondel, V. D. (2013). Unique in the crowd: The privacy bounds of human mobility. *Scientific reports*, 3, 1376.

* Graells-Garrido, E., & Saez-Trumper, D. (2016, May). A day of your days: estimating individual daily journeys using mobile data to understand urban flow. In Proc. of the 2nd Int. Conf. on IoT in Urban Space (pp. 1-7). ACM.

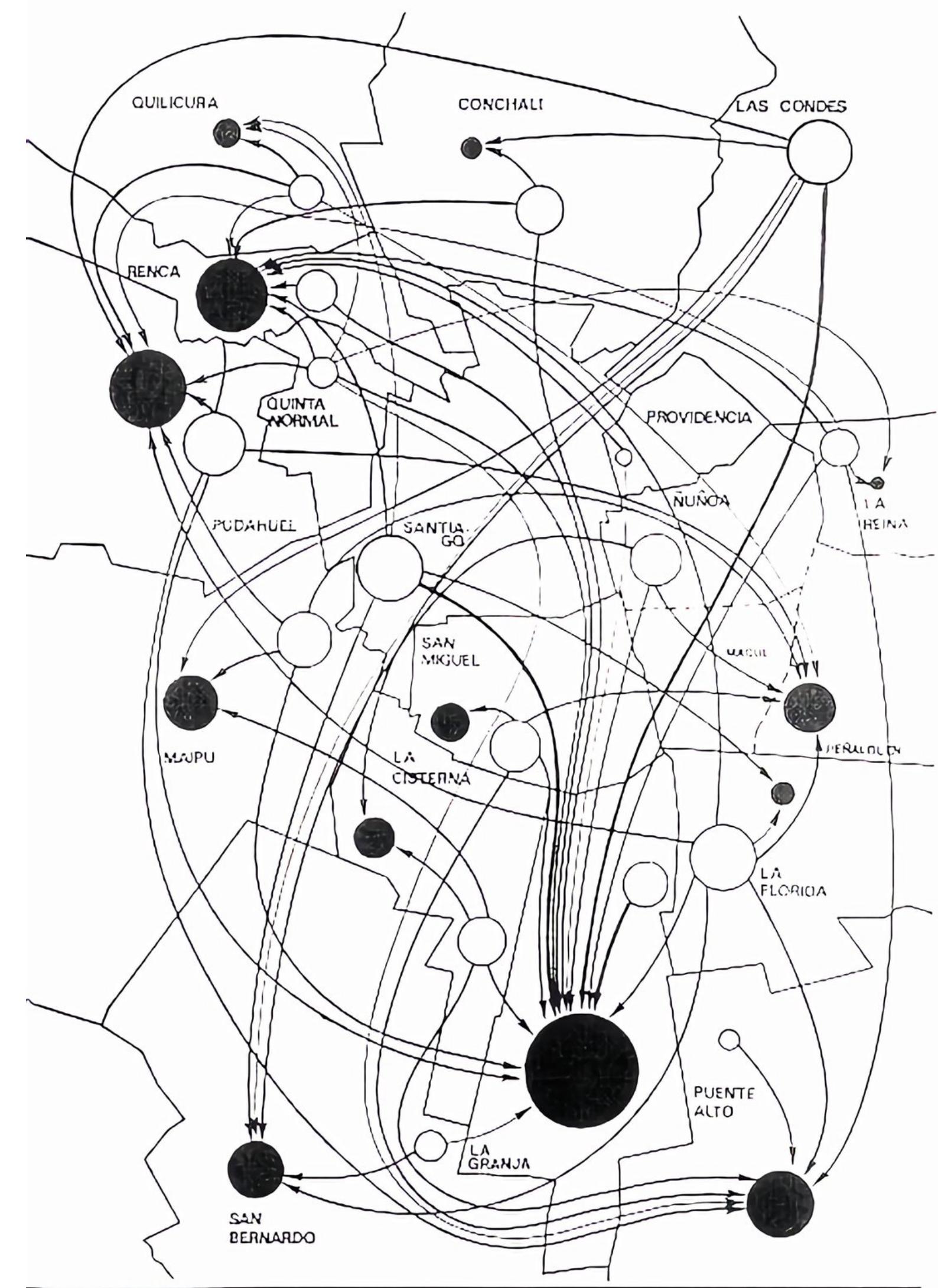
Comm. Network between Municipalities



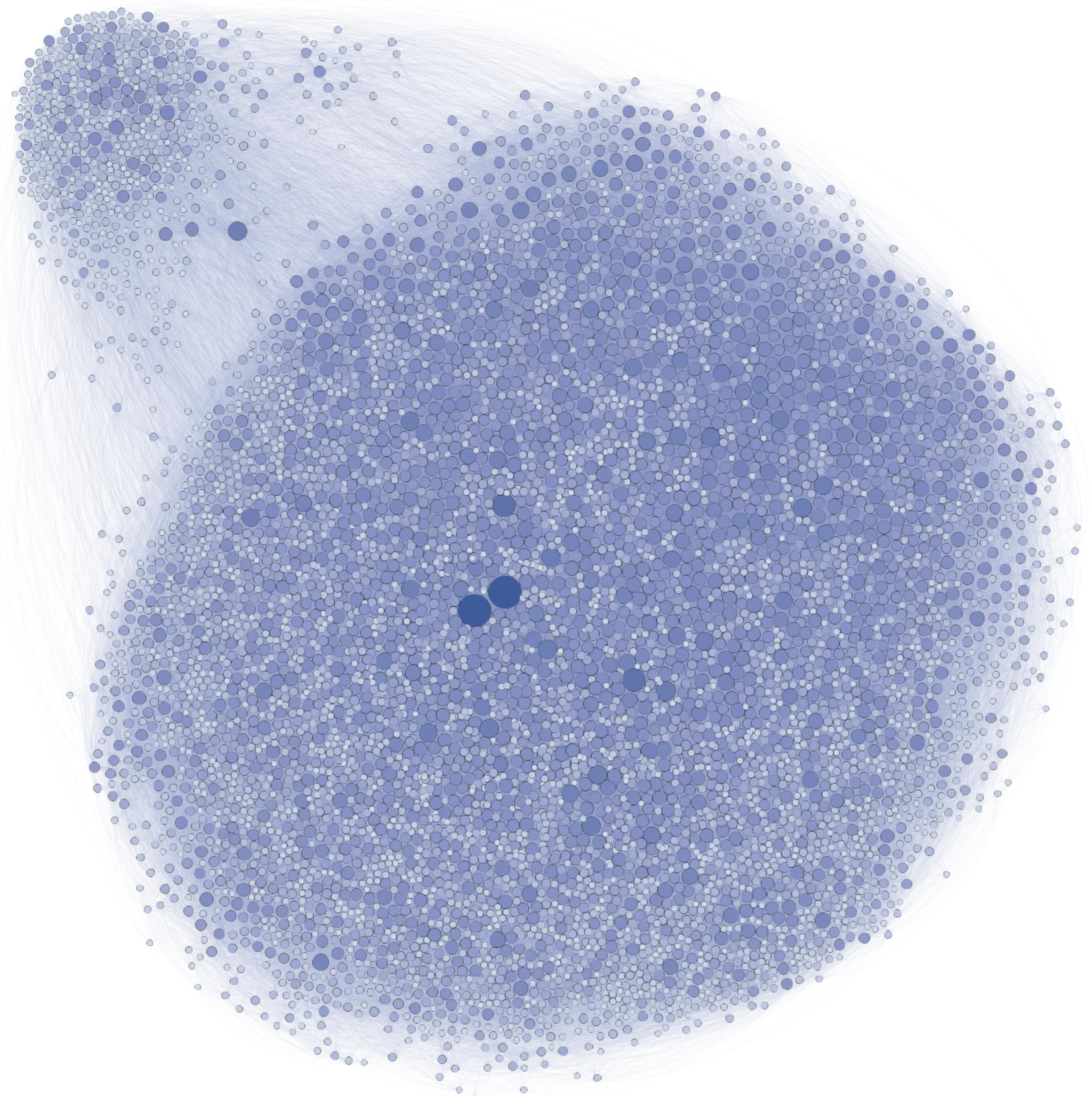
Business days



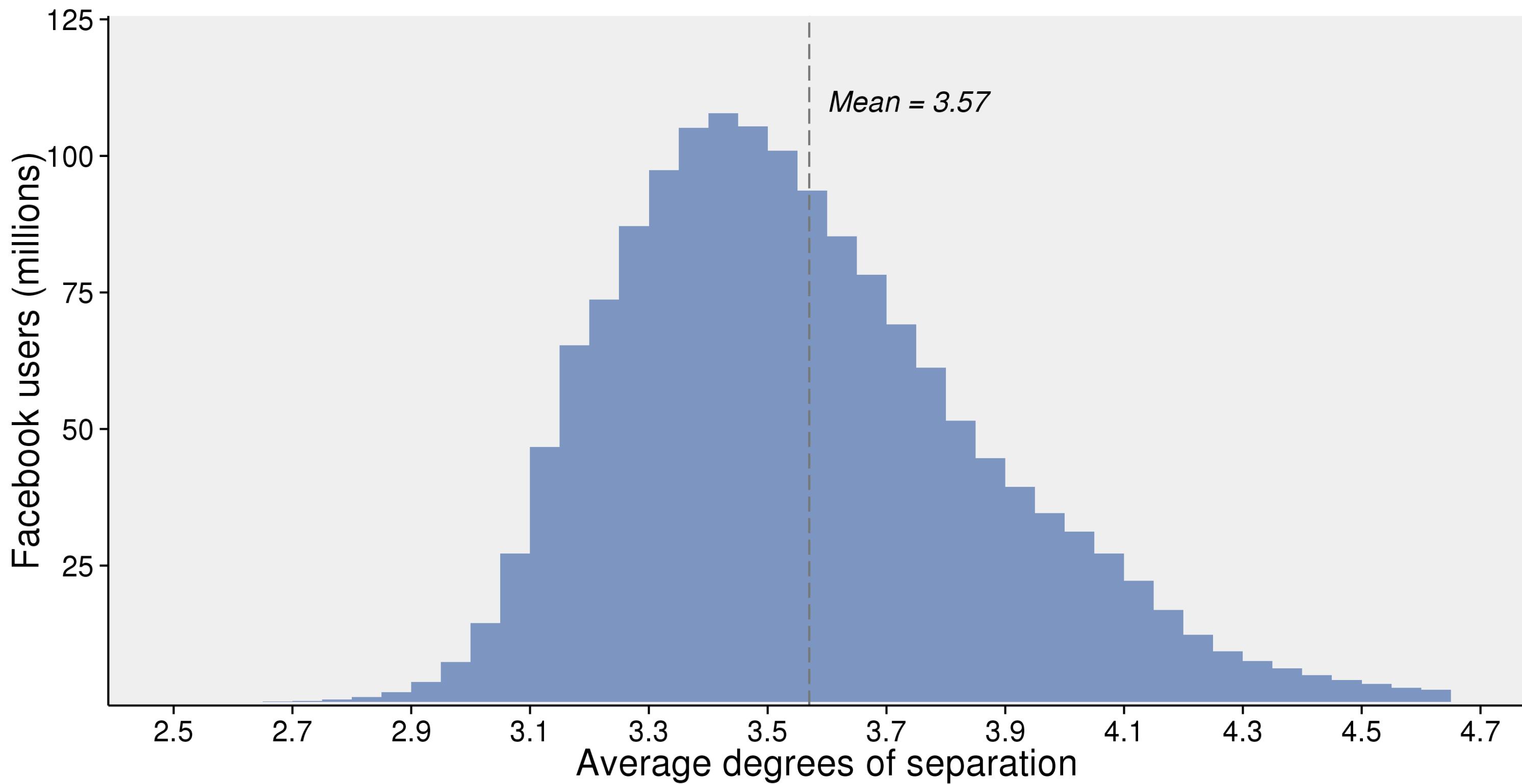
Weekends



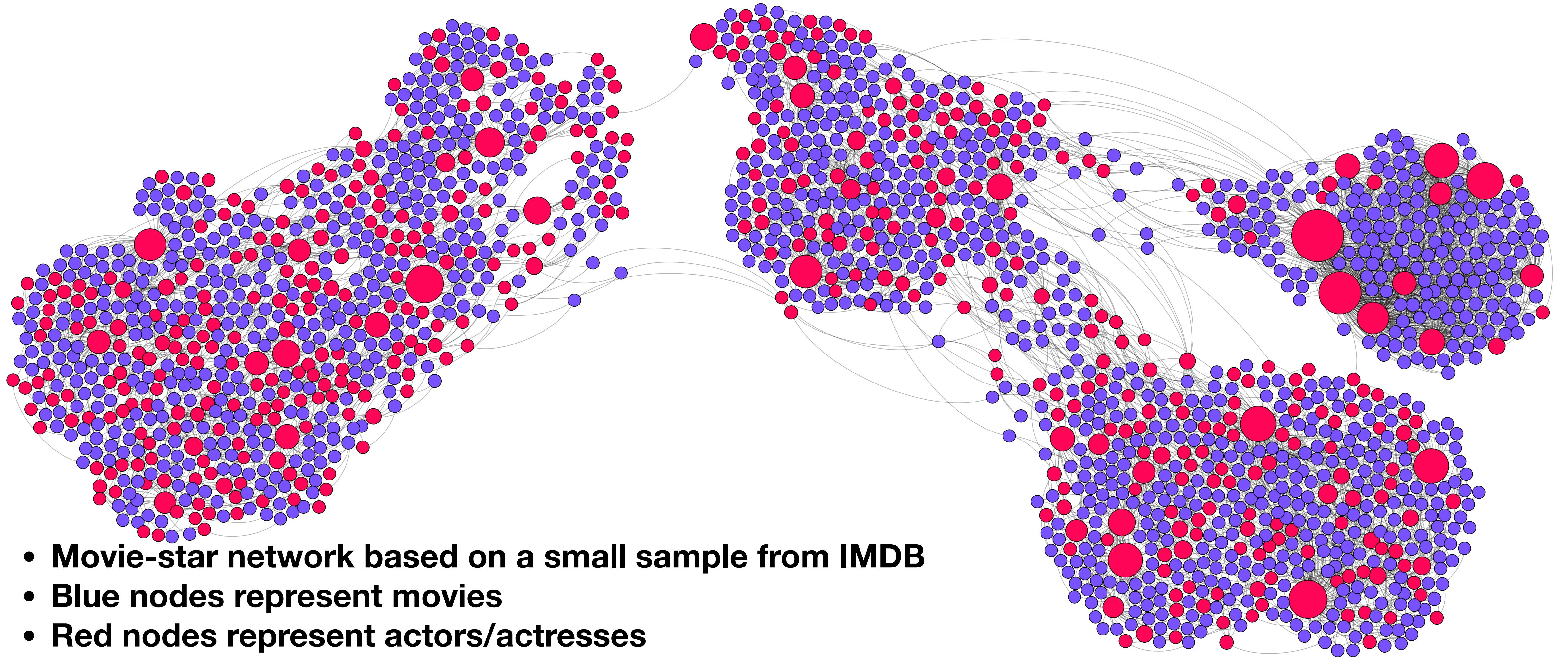
- Facebook users at Northwestern University
- What do nodes represent?
- What do links represent?
- Do links have direction?
- Do links have weights?
- Larger, darker nodes have more connections; what does that represent?
- What do the two clusters tell us?



- Stanley Milgram diseñó un experimento para calcular el grado de separación entre dos personas desconocidas.
- Facebook año 2016: promedio es 3.57

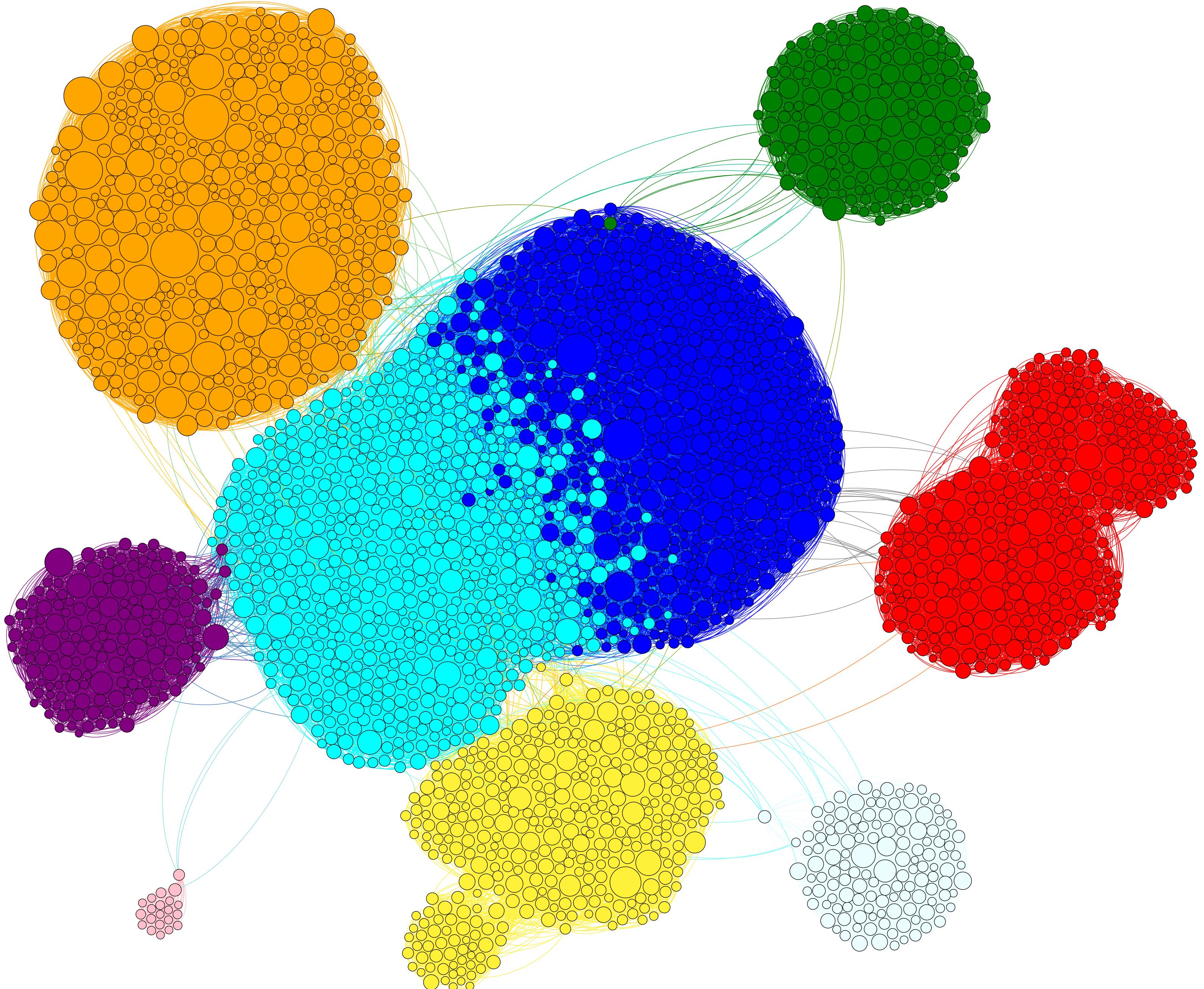


- Travers, Jeffrey, and Stanley Milgram. "An Experimental Study of the Small World Problem." *Sociometry*, vol. 32, no. 4, 1969, pp. 425–443. JSTOR, JSTOR, www.jstor.org/stable/2786545
- <https://research.fb.com/three-and-a-half-degrees-of-separation/>

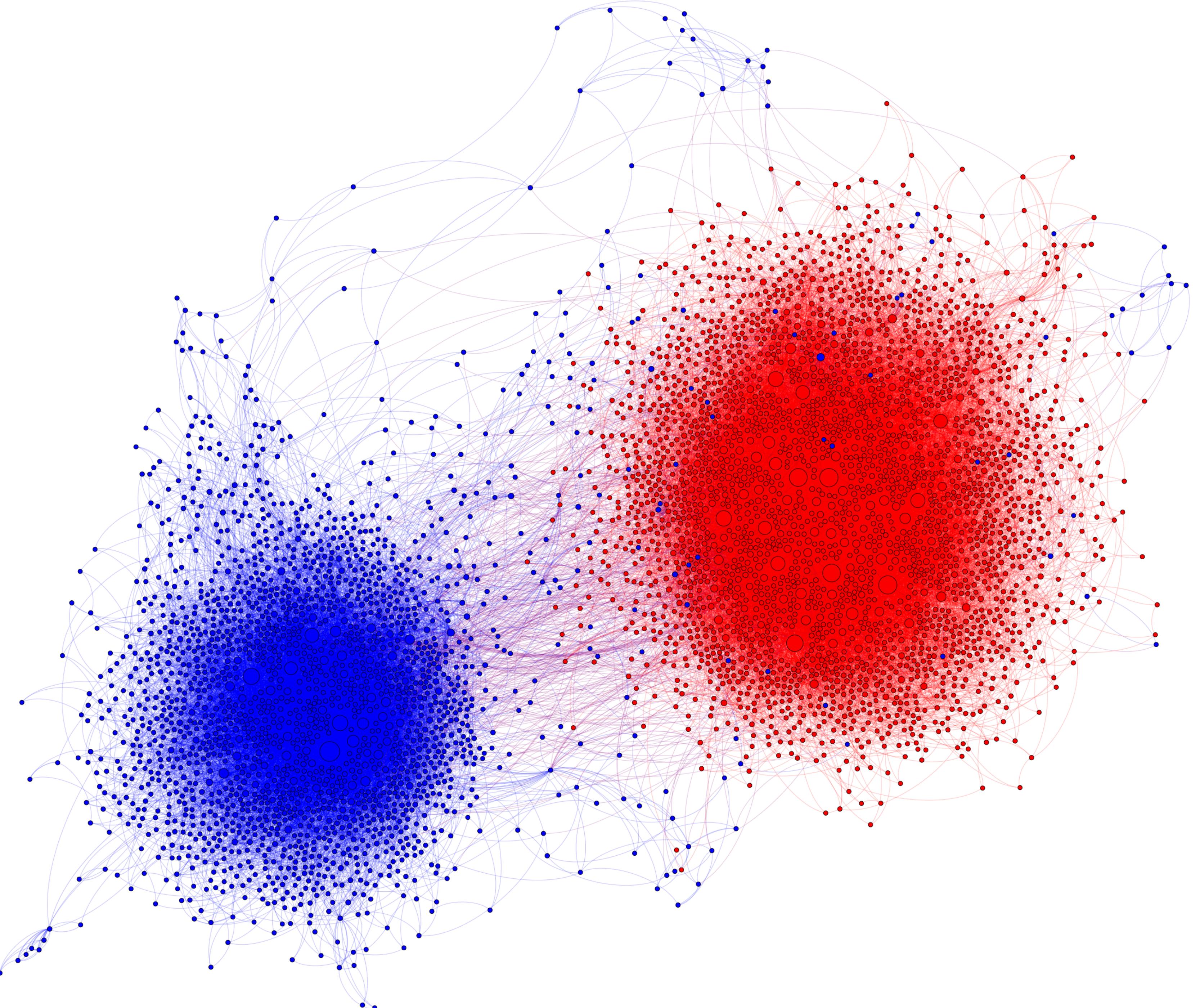


- Movie-star network based on a small sample from IMDB
- Blue nodes represent movies
- Red nodes represent actors/actresses
- What do links represent?
- Do links have direction?
- Do links have weights?
- Larger nodes have more connections; what does that mean?
- What do the clusters represent?

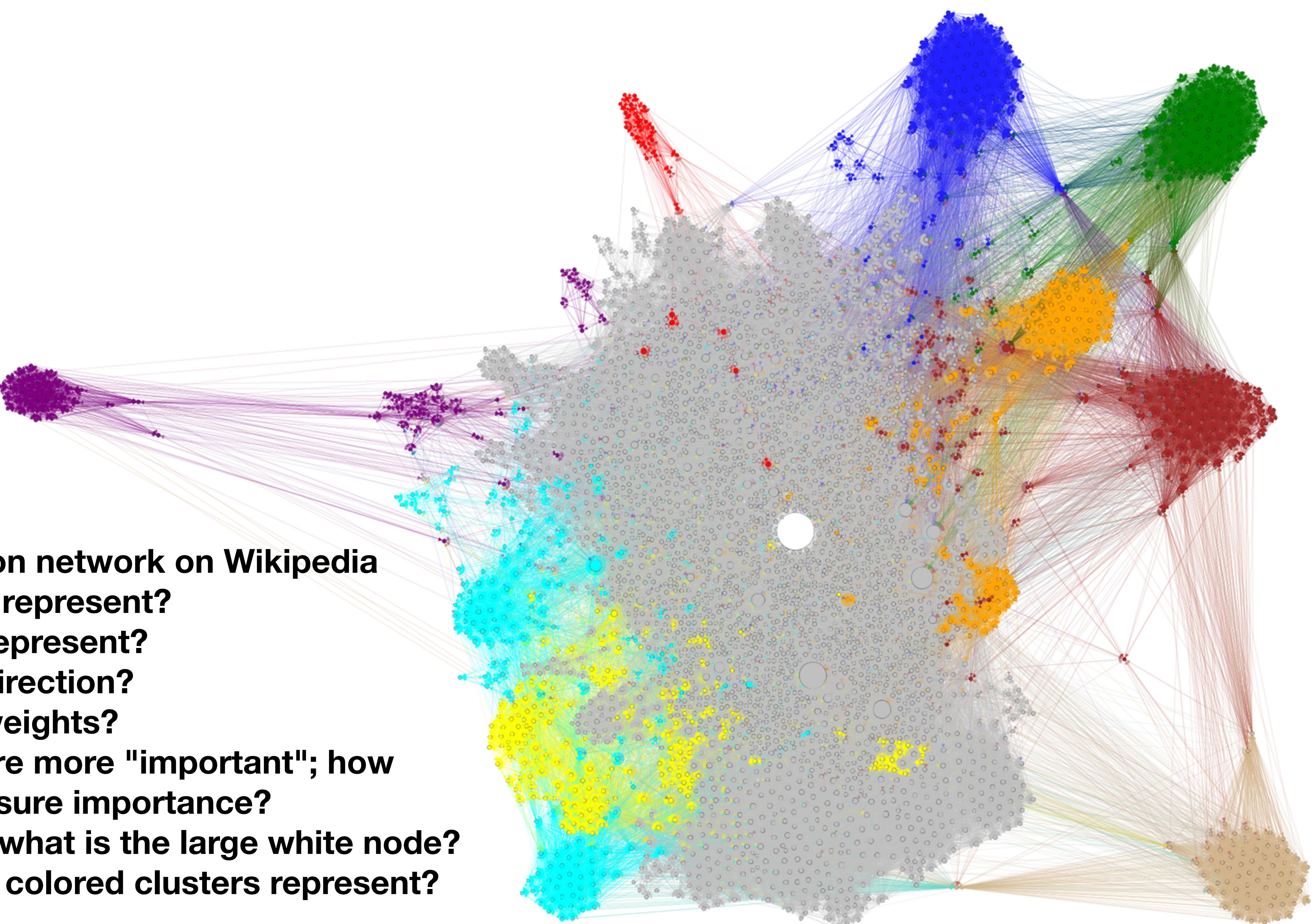
- Movie co-star network based on a small sample from IMDB
- What do nodes represent?
- What do links represent?
- Do links have direction?
- Do links have weights?
- Larger nodes have more connections; what does that mean?
- What do the clusters represent?



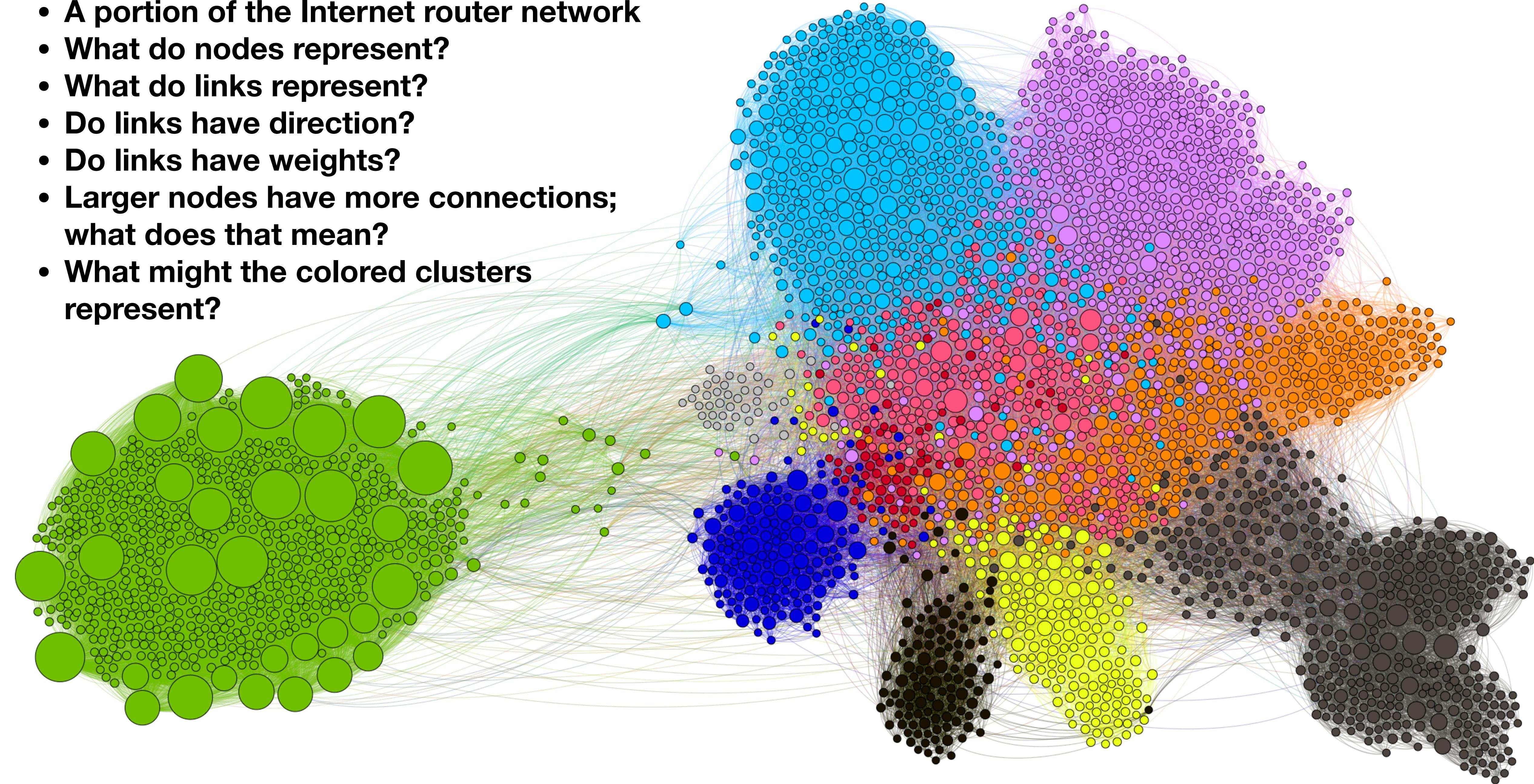
- Retweet network on Twitter, based on political posts during 2010 US election
- What do nodes represent?
- What do links represent?
- Do links have direction?
- Do links have weights?
- Larger nodes have more connections; what does that mean?
- What do the clusters and colors represent?



- Math information network on Wikipedia
- What do nodes represent?
- What do links represent?
- Do links have direction?
- Do links have weights?
- Larger nodes are more "important"; how would you measure importance?
- Can you guess what is the large white node?
- What might the colored clusters represent?

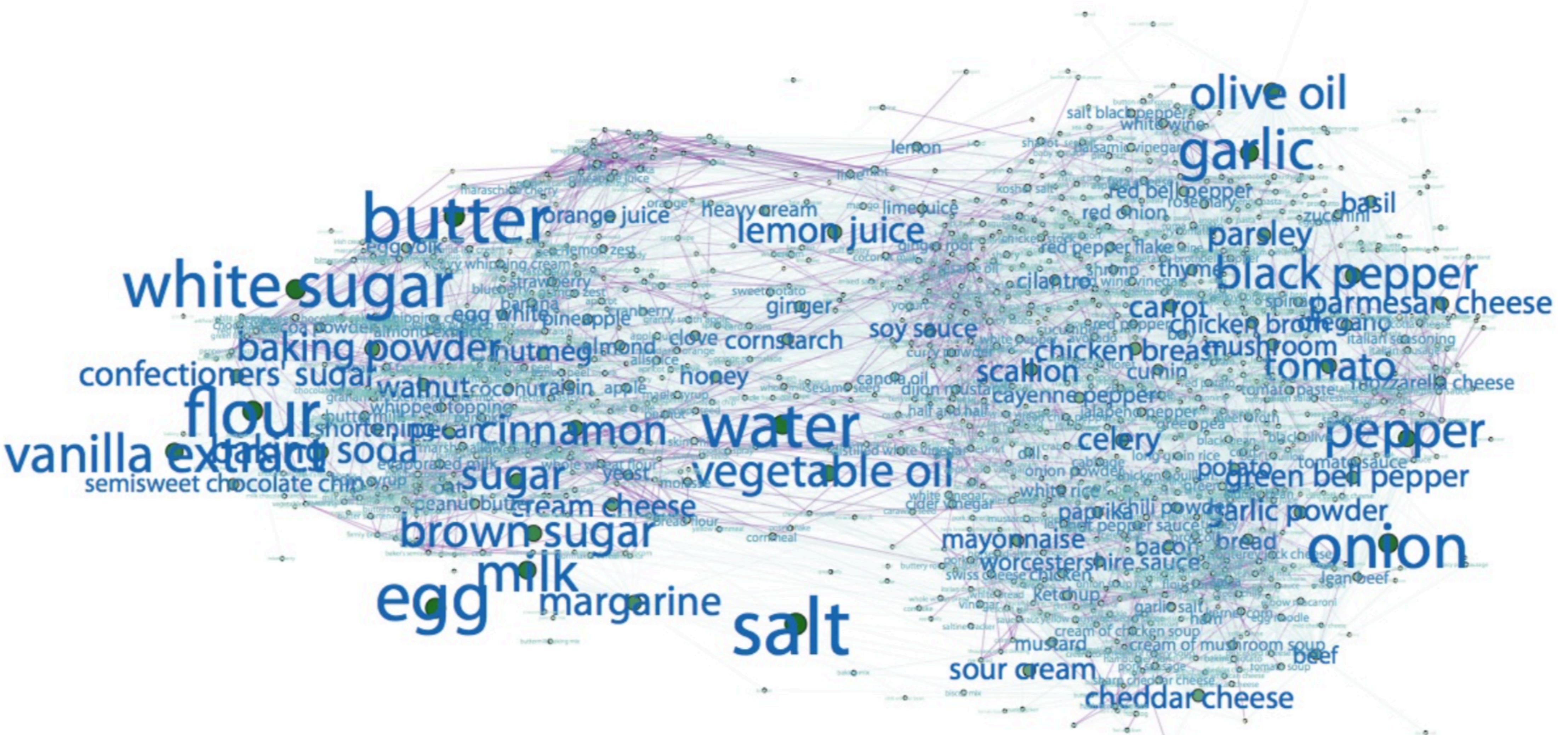


- A portion of the Internet router network
- What do nodes represent?
- What do links represent?
- Do links have direction?
- Do links have weights?
- Larger nodes have more connections; what does that mean?
- What might the colored clusters represent?





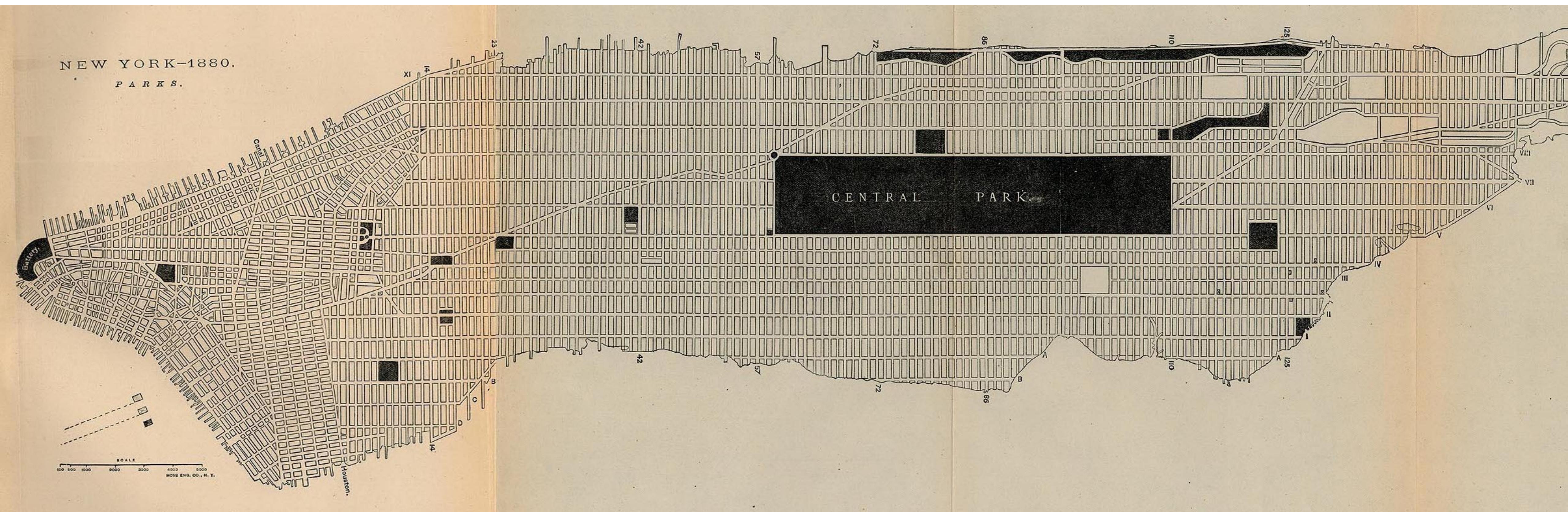
- Protein interaction network of yeast
- What do nodes represent?
- What do links represent?
- Do links have direction?
- Do links have weights?
- Larger nodes have more connections; what does that mean?
- What do the clusters represent?



* Chun-Yuen Teng, Yu-Ru Lin, and Lada A. Adamic. 2012. Recipe recommendation using ingredient networks. In Proceedings of the 4th Annual ACM Web Science Conference (WebSci '12). ACM, New York, NY, USA, 298-307. DOI=<http://dx.doi.org/10.1145/2380718.2380757>

* Extraído desde slides curso Social Network Analysis de la Dra. Lada Adamic. <http://www.ladamic.com>

What are the nodes and links of the network represented in this street map?



Map of New York in 1880. From Report on the Social Statistics of Cities, Compiled by George E. Waring, Jr., United States Census Office, 1886. Image courtesy of University of Texas Libraries

Objetivos del curso

- Aprender conceptos básicos de la literatura en el área de Ciencia de Redes.
- Analizar y describir los componentes estructurales y las propiedades de una red.
- Analizar una red social y caracterizar sus propiedades de mundo pequeño.
- Medir varias métricas de centralidad y sus distribuciones, y aplicarlas para detectar vértices importantes de una red y sus roles en la red.
- Cuantificar la homofilia y clustering, y explicar cómo aparecen en diferentes sistemas.
- Describir procesos dinámicos en redes, como el contagio de enfermedades y la difusión de rumores.
- Apreciar la amplia relevancia de la Ciencia de Redes en varias áreas del conocimiento y sus aplicaciones, incluyendo biología, negocios, inteligencia artificial, recomendación y medios sociales.

Evaluación

- Laboratorio: 40%
 - Trabajo en equipo con una entrega preliminar y entrega final. Incluye presentación oral. Presentaciones semanales de avance.
- Cátedra: 60%
 - Cuatros tareas en duplas.
 - Lectura y presentación de artículo científico (personal).

Software

- Usaremos Python con Jupyter Notebooks <https://jupyter.org/>
- Y los siguientes módulos para trabajar con las redes (cada uno tiene su propia ventaja/desventaja)
 - NetworkX (principal) <https://networkx.org/>
 - Graph-Tool <https://graph-tool.skewed.de/>
 - iGraph <https://igraph.org/python/>
- Recomendaciones:
 - Instalar Mini-Conda en tu computador, y crear un ambiente dedicado para el curso <https://docs.conda.io/en/latest/miniconda.html>
 - Configurar Mini-Conda para que utilice los paquetes de conda-forge <https://conda-forge.org/>

[https://github.com/diegocaro/
networkscience](https://github.com/diegocaro/networkscience)

¿Cómo atraemos más estudiantes?

Bibliografía

- Barabasi + Menczer
- Notebooks libro [https://github.com/CambridgeUniversityPress/
FirstCourseNetworkScience/tree/master/tutorials](https://github.com/CambridgeUniversityPress/FirstCourseNetworkScience/tree/master/tutorials)

Acknowledgement

- Presentación basada en las slides del libro “A first course in network science” de Menzcer, Fortunato y Davis.