

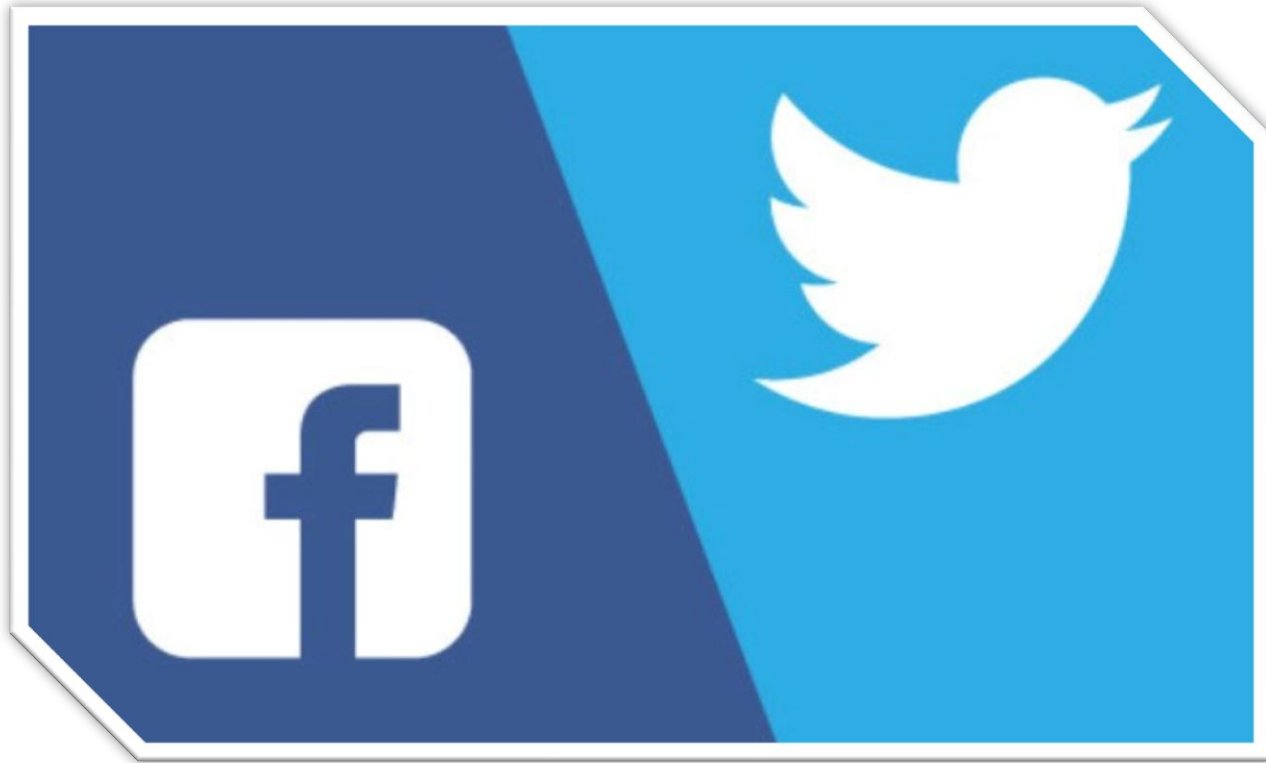
IMPACT OF MESSAGE SORTING ON ACCESS TO NOVEL INFORMATION IN NETWORKS

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ASONAM 2016

Feed based networks can cause information overload



- Information can be...
 - Irrelevant
 - overly duplicated
 - too much

ALGORITHMIC INFORMATION SORTING IN NETWORKS

- Algorithms change what users see
 - In overload, important information may never be seen
- We will concentrate on message sorting

PROBLEM:
**ARE INDIVIDUALS IN THE NETWORK MORE
INFORMED UNDER DIFFERENT MESSAGE
SORTING SCHEMES?**

- How can algorithms help the network receive
 - more diverse information
 - in a timely manner

RELATED WORK

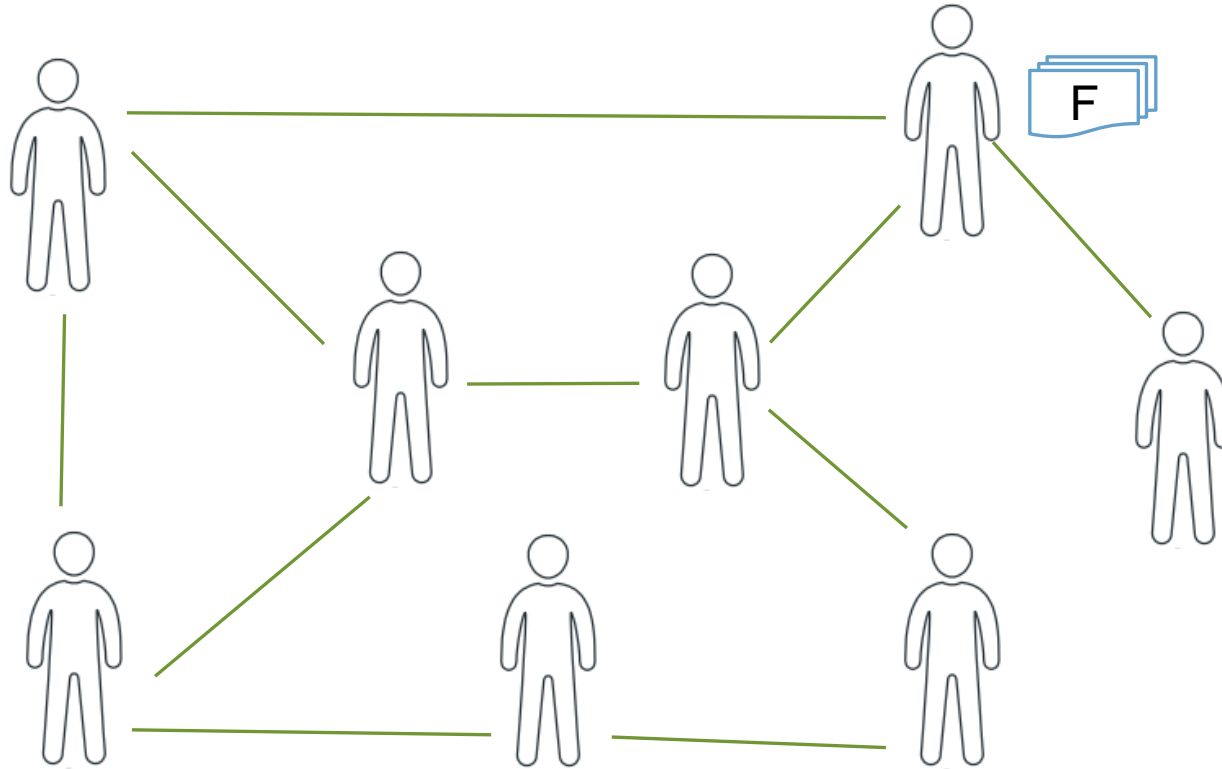
- Growing concern in access to information in social networks
 - Homophily limits access to different points of view
 - Predictive algorithms tend to amplify homophily^{1,2,3}
- The impact of the basic sorting is not yet studied

¹ E. Bakshy, S. Messing, and L. Adamic, “Exposure to ideologically diverse news and opinion on facebook,” *Science*, 2015.

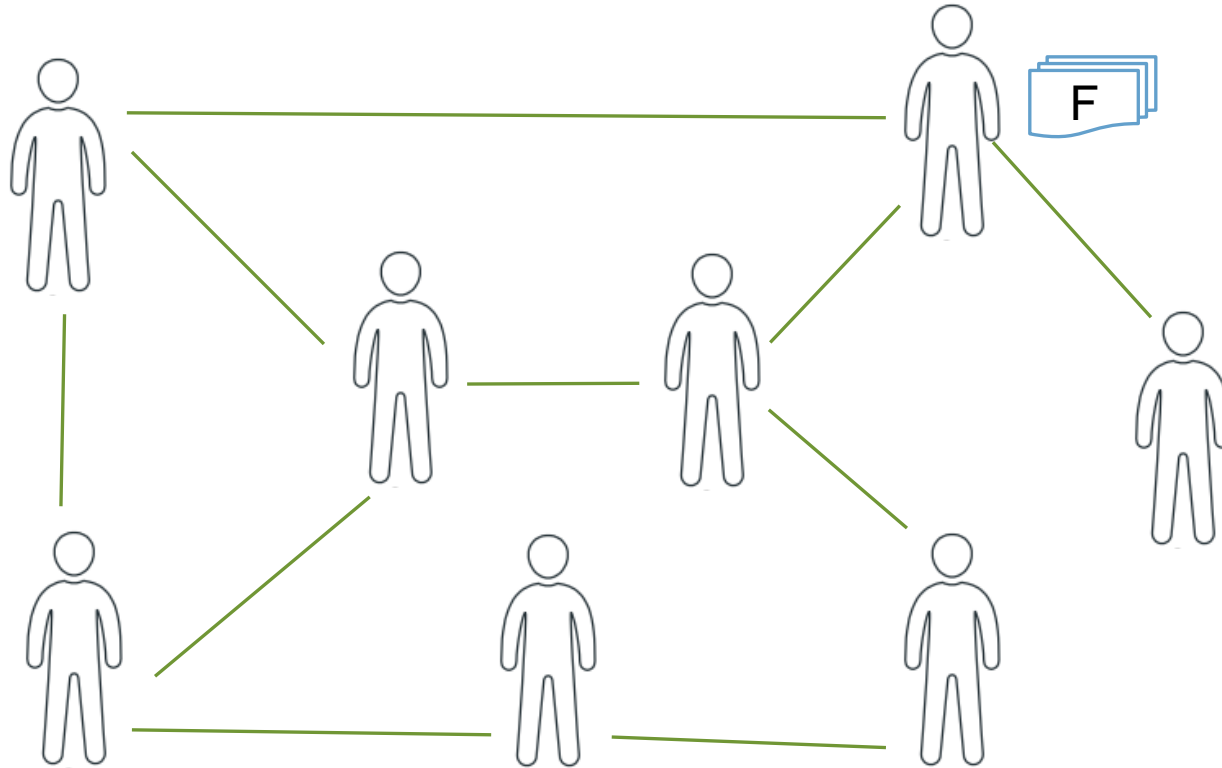
² Z. Tufekci, “Algorithms in our midst: Information, power and choice when software is everywhere,” in *CSCW*, 2015.

³ M. Eslami, A. Aleyasen, K. Karahalios, K. Hamilton, and C. Sandvig, “Feedvis: A path for exploring news feed curation algorithms,” in *CSCW*. 2015

SIMULATE AGENTS IN NETWORK



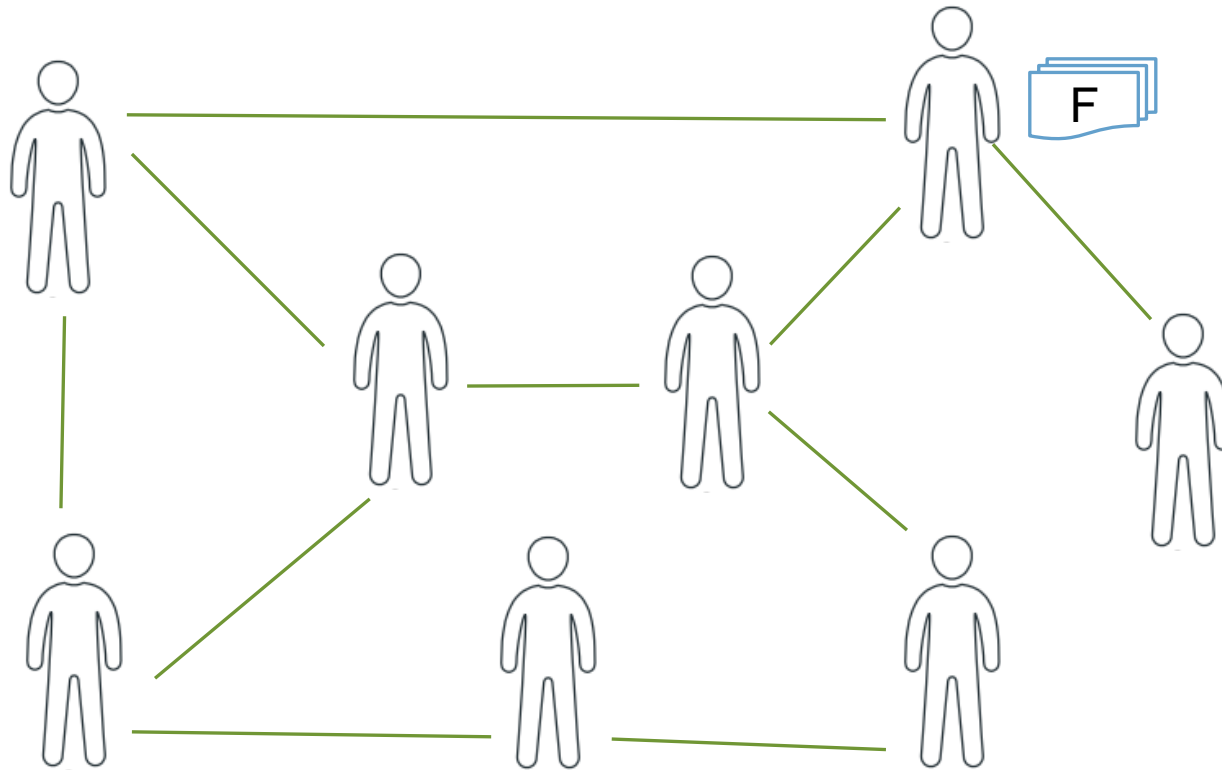
SIMULATE AGENTS IN NETWORK



Inbox Sortings:

1. Last in-First out (LIFO)

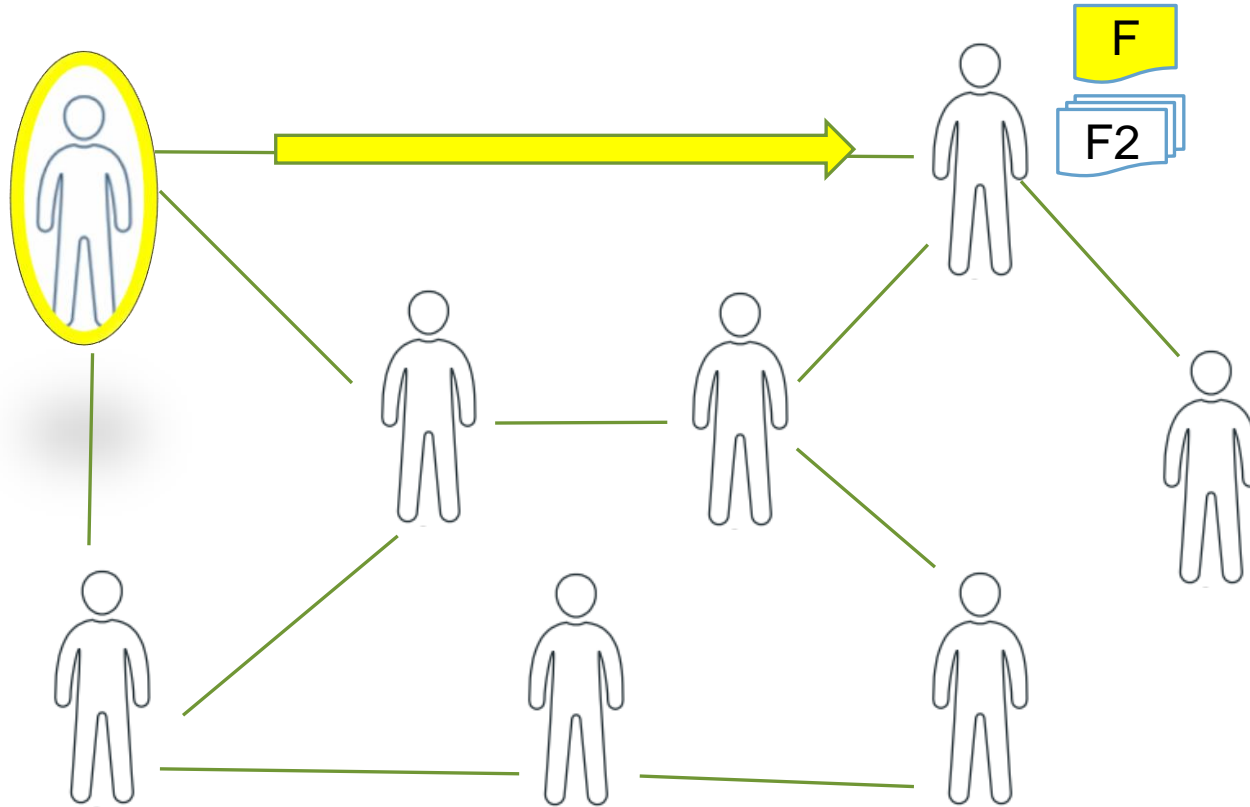
SIMULATE AGENTS IN NETWORK



Inbox Sortings:

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2. First in-First out (FIFO)

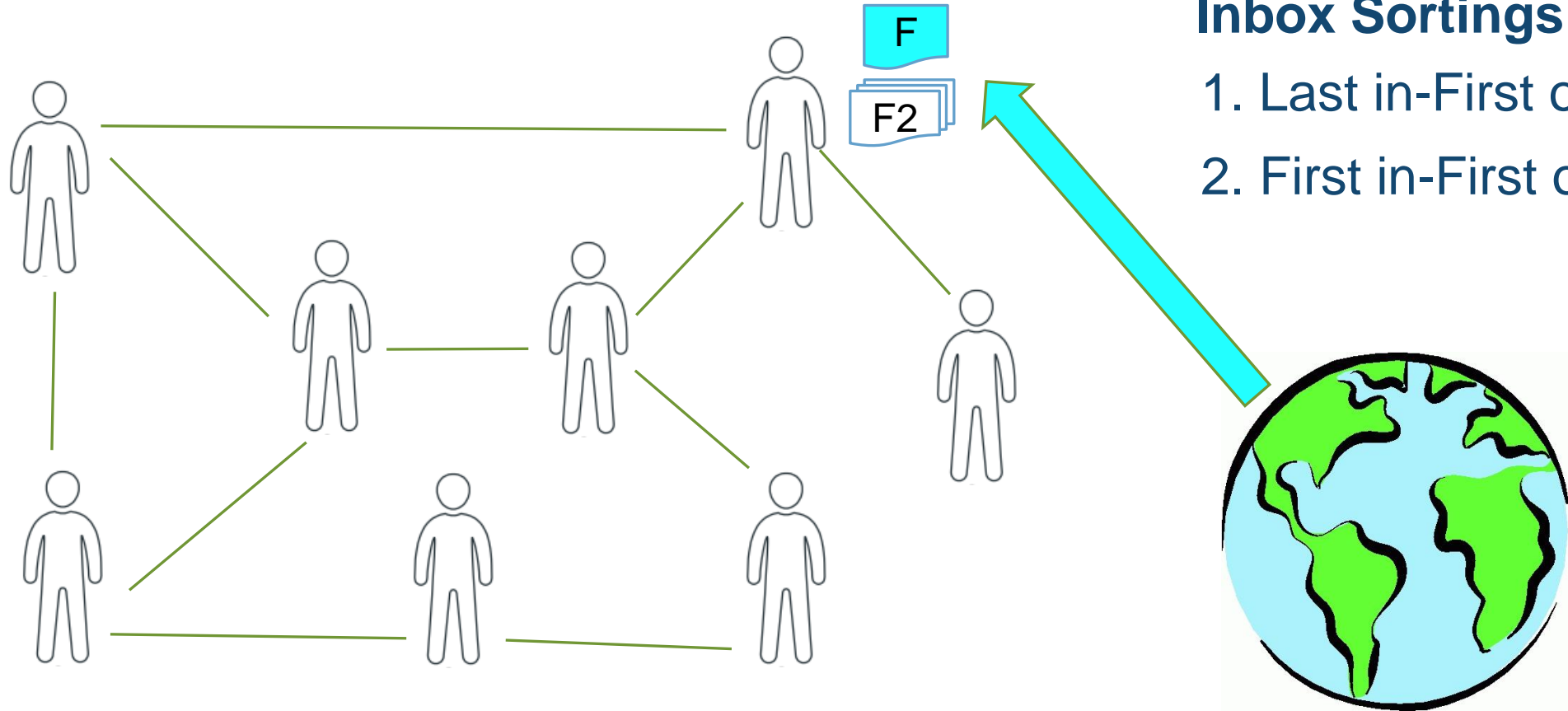
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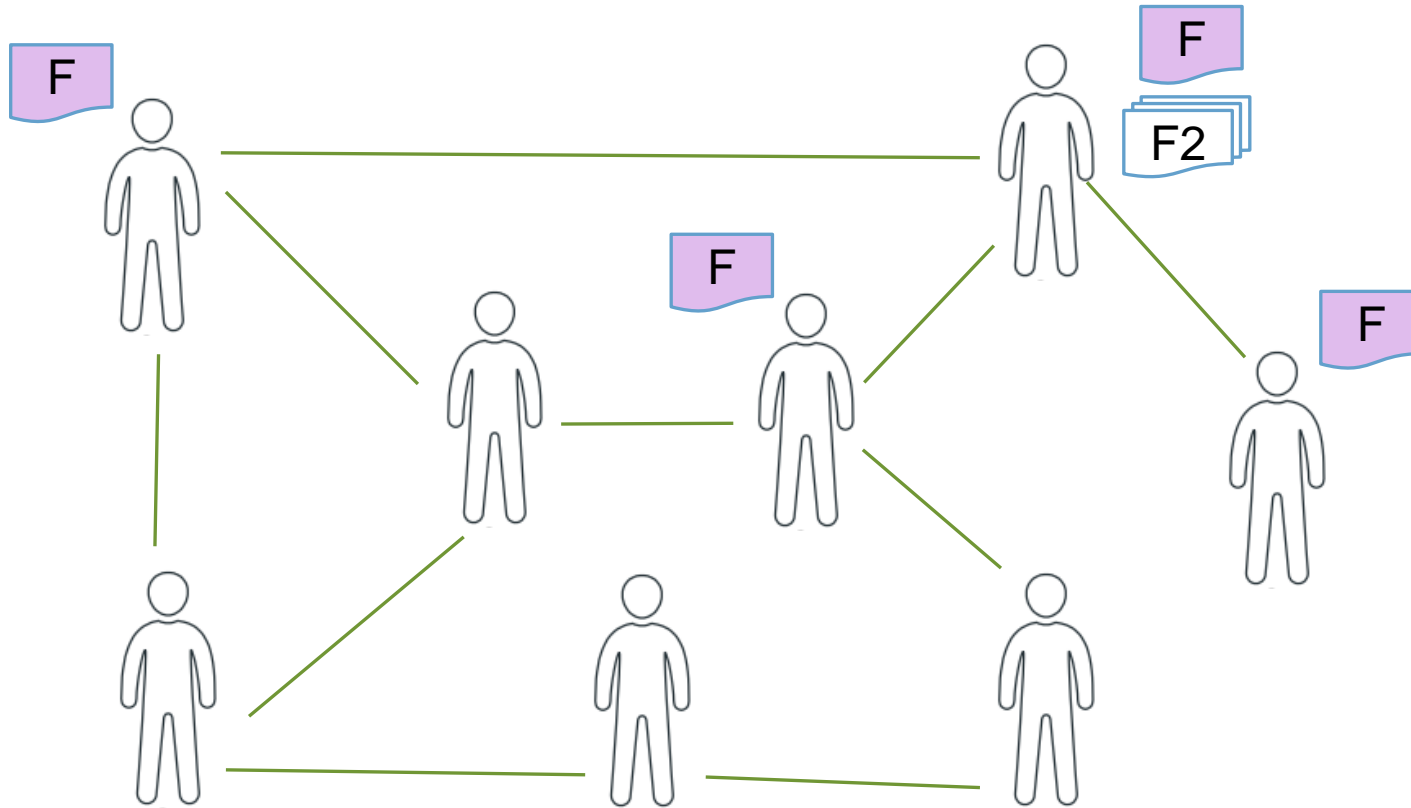
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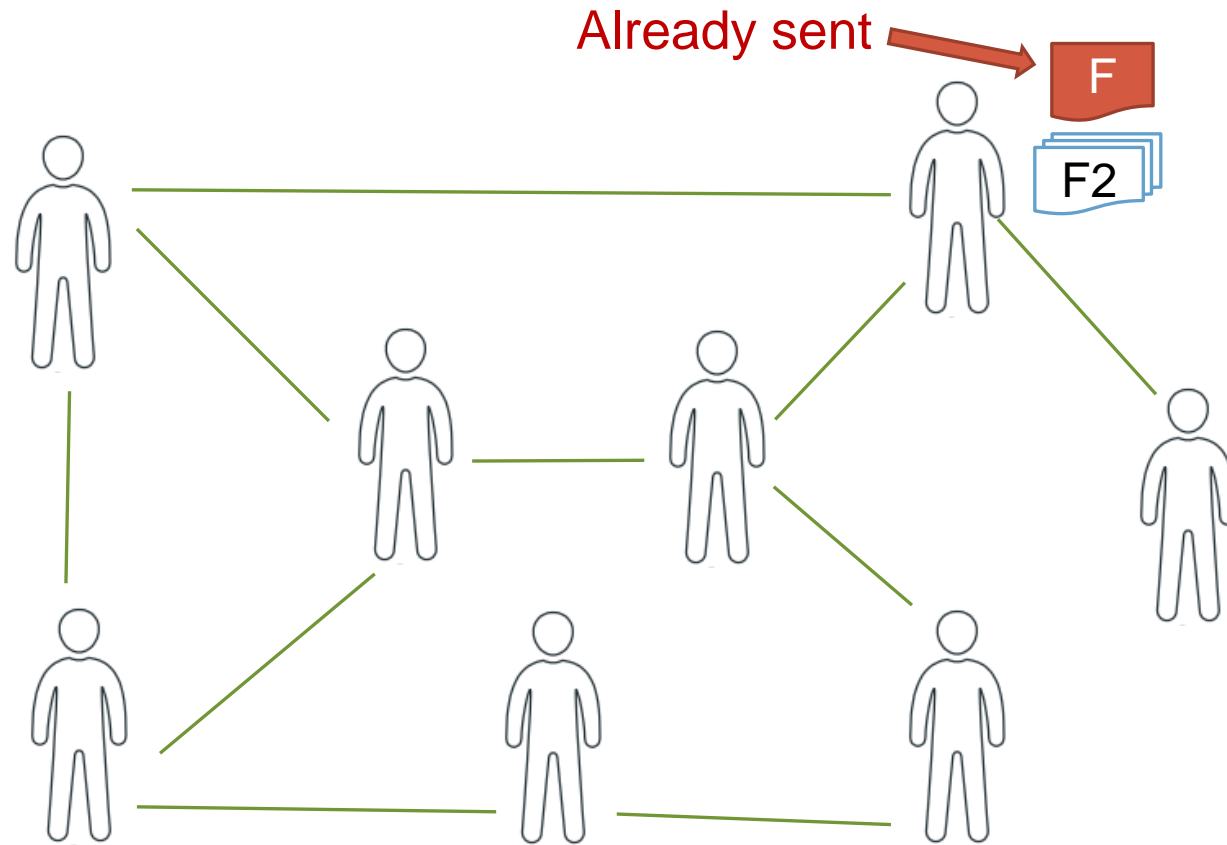
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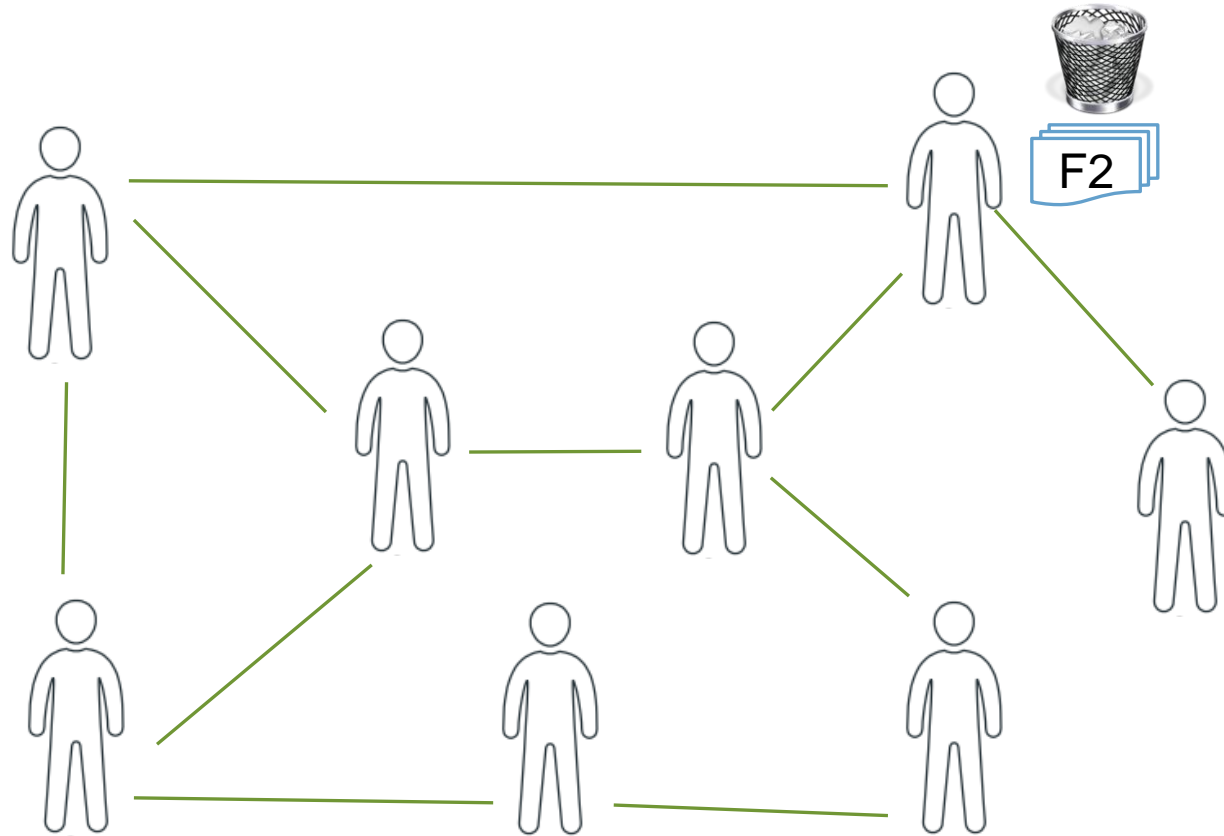
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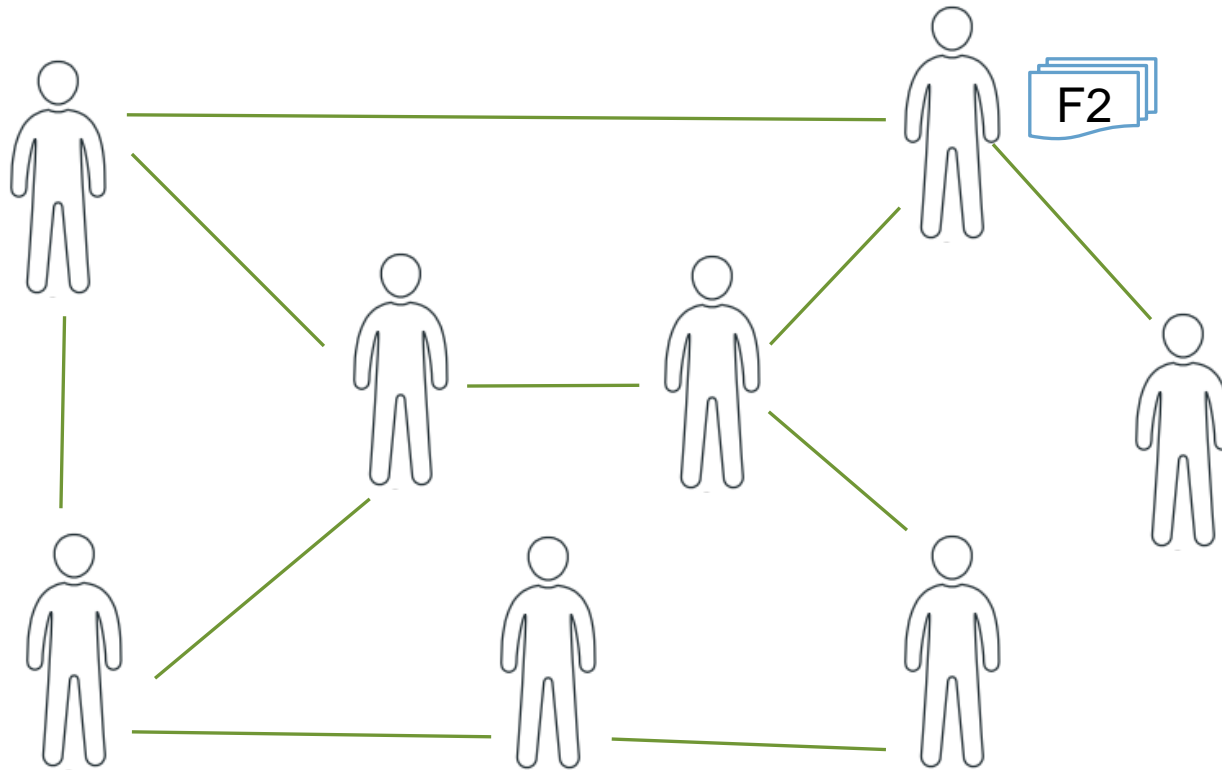
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SIMULATE AGENTS IN NETWORK



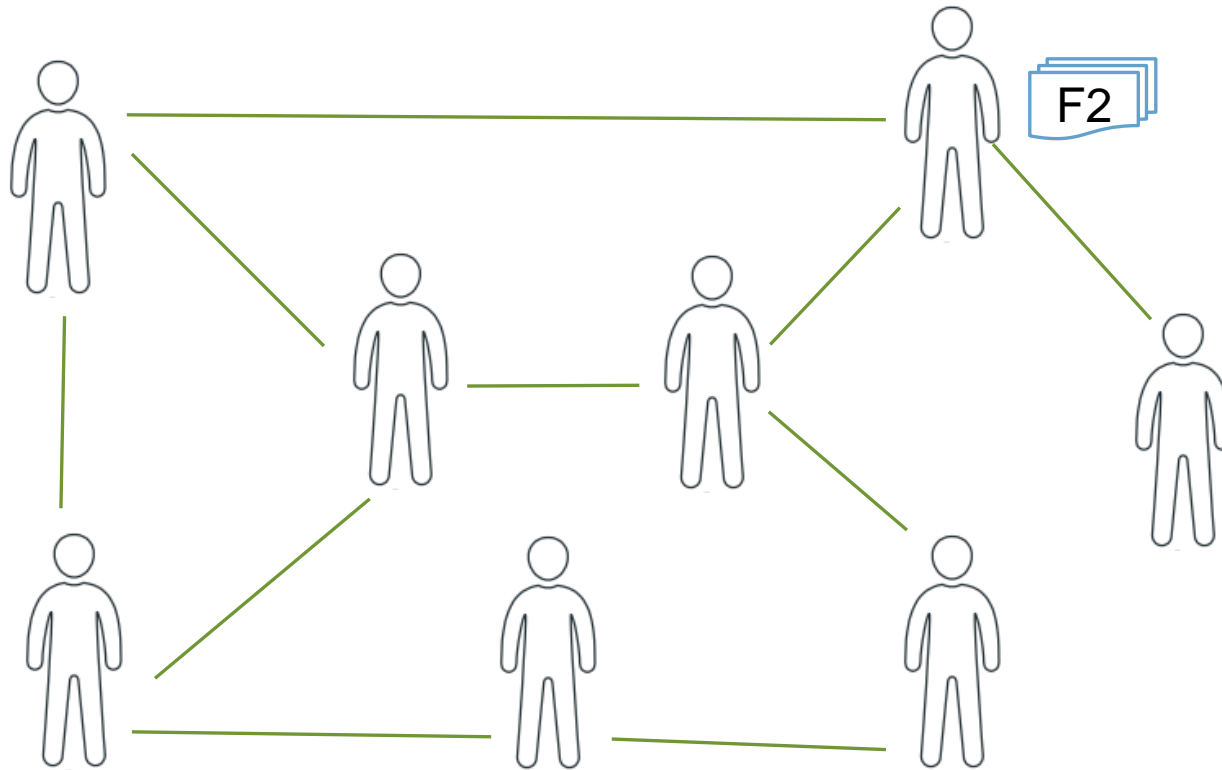
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Agent Attributes:

1. Capacity

SIMULATE AGENTS IN NETWORK



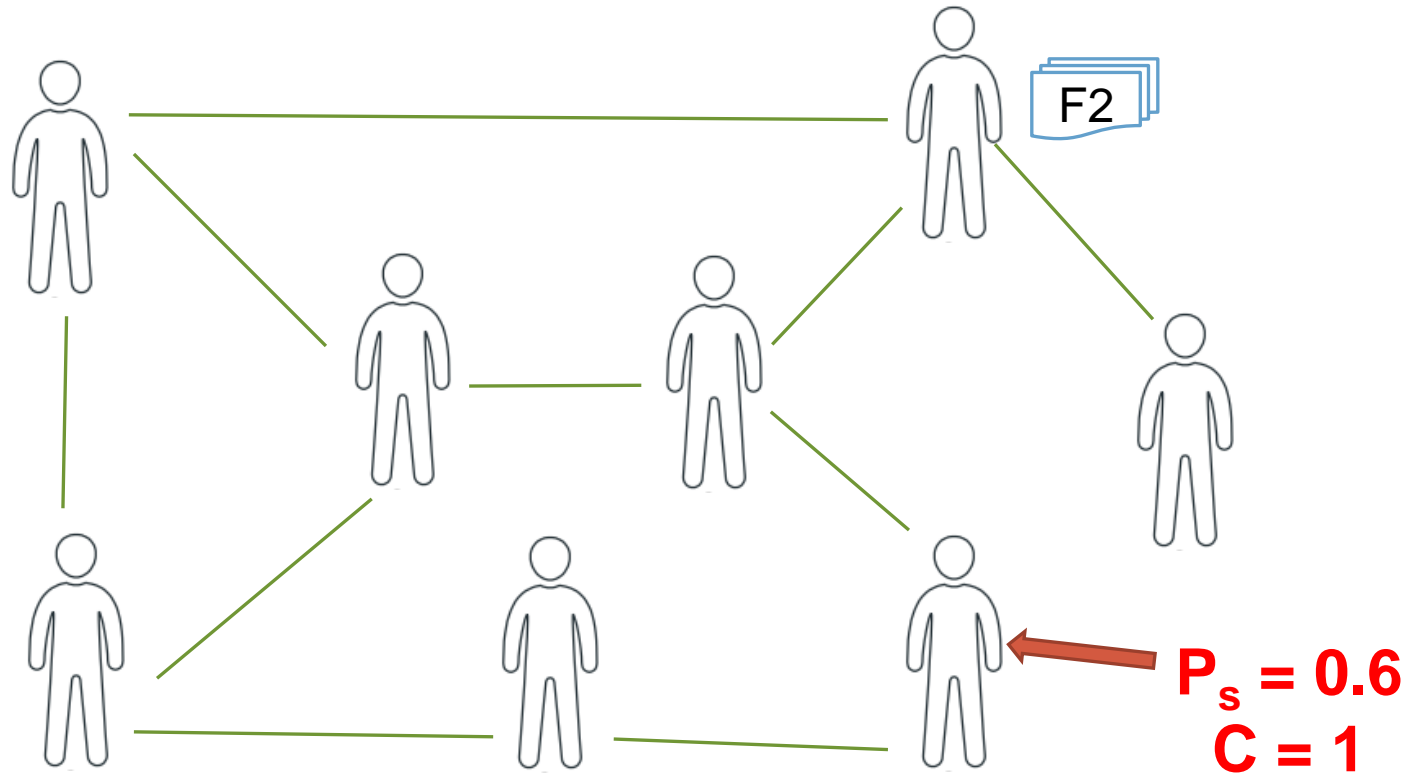
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Agent Attributes:

1. Capacity
2. Propensity to send

SIMULATE AGENTS IN NETWORK



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Agent Attributes:

1. Capacity
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INFORMATION TRAFFIC PATTERNS

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High Traffic Burst

INFORMATION TRAFFIC PATTERNS



High Traffic Burst



Streaming Traffic

HOW WE UNDERSTAND PERFORMANCE

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1. Average number of unique facts known per agent

-The more unique facts an agent knows the better!

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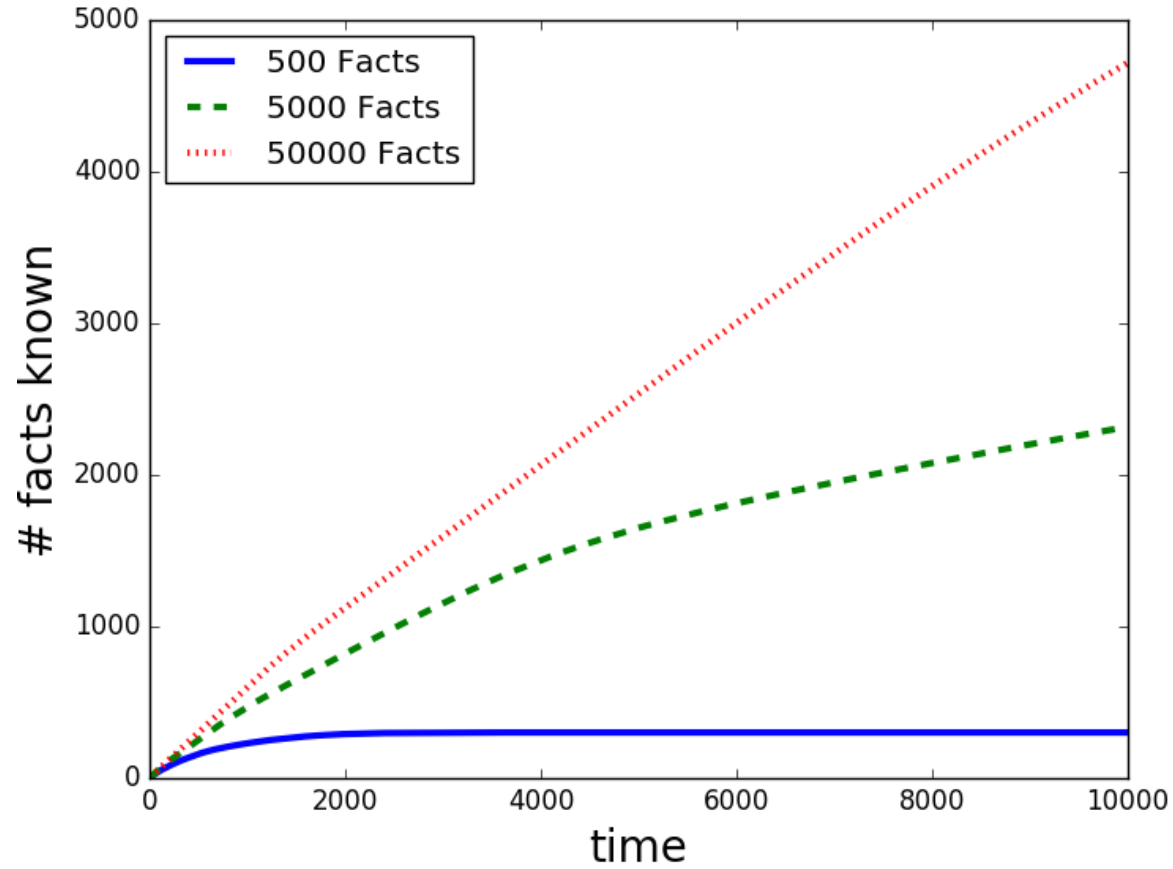
3. Number of copies made for each facts (branching factor)

SIMULATIONS RAN 50 TIMES & AVERAGED

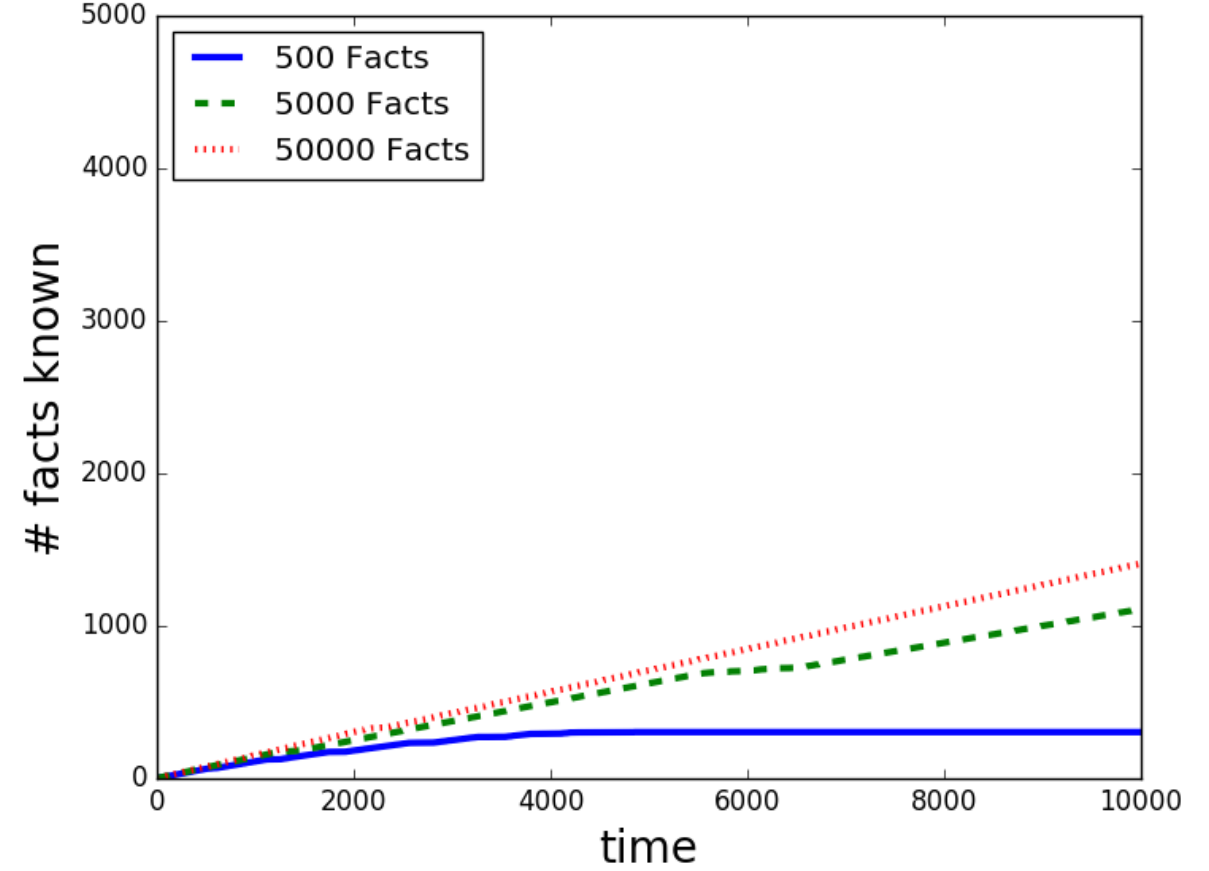
- Small World graphs
- 256 nodes
- 50% Rewire probability
- Similar densities

FIFO out performs LIFO in High Traffic

FIFO

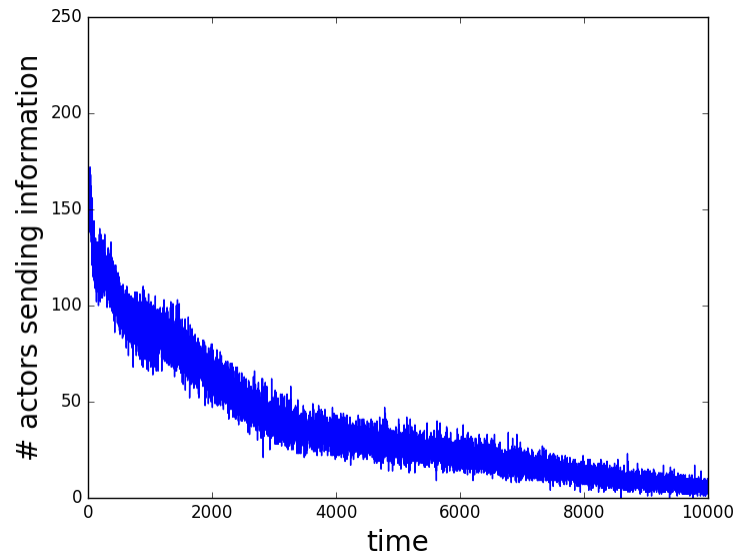
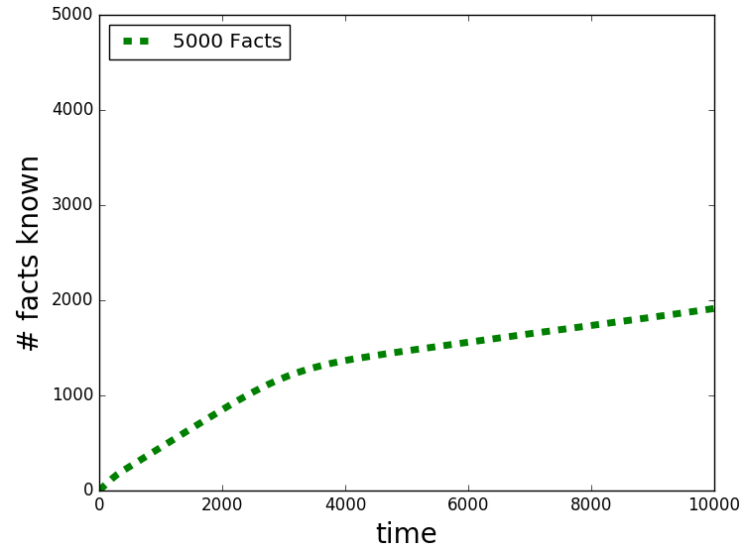


LIFO

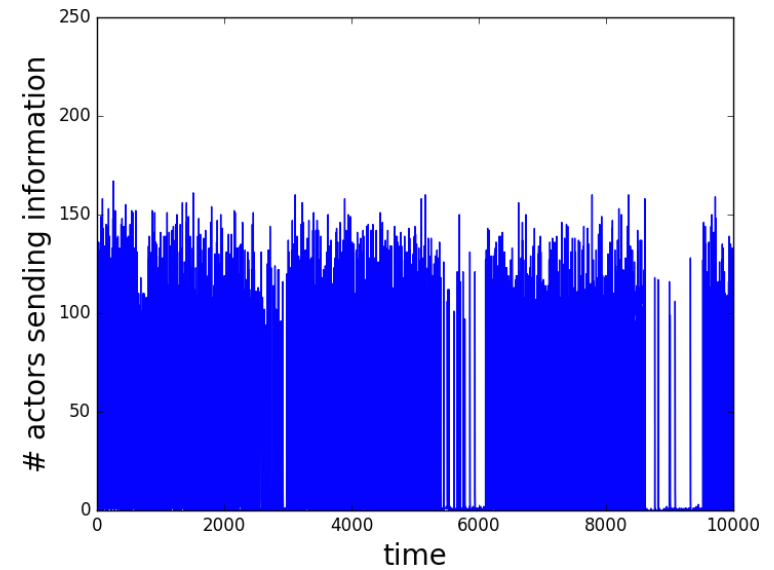
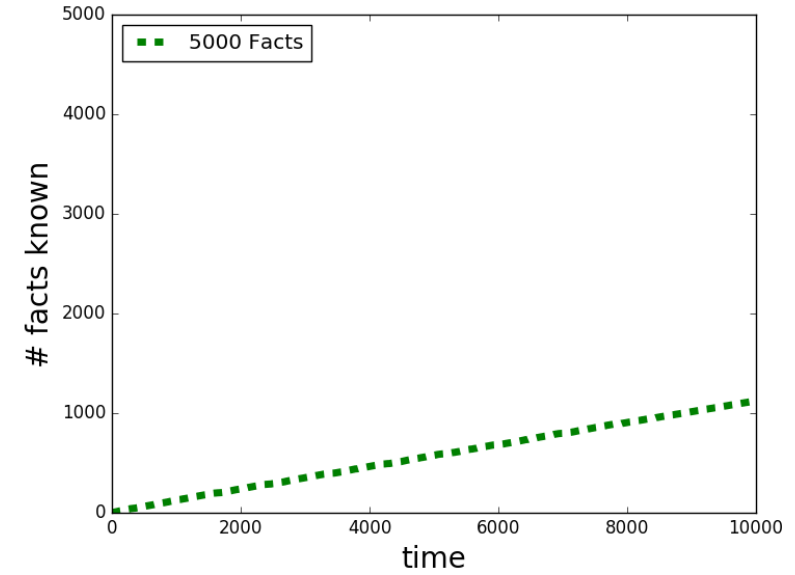


LIFO suffers from synchronization on duplicate facts

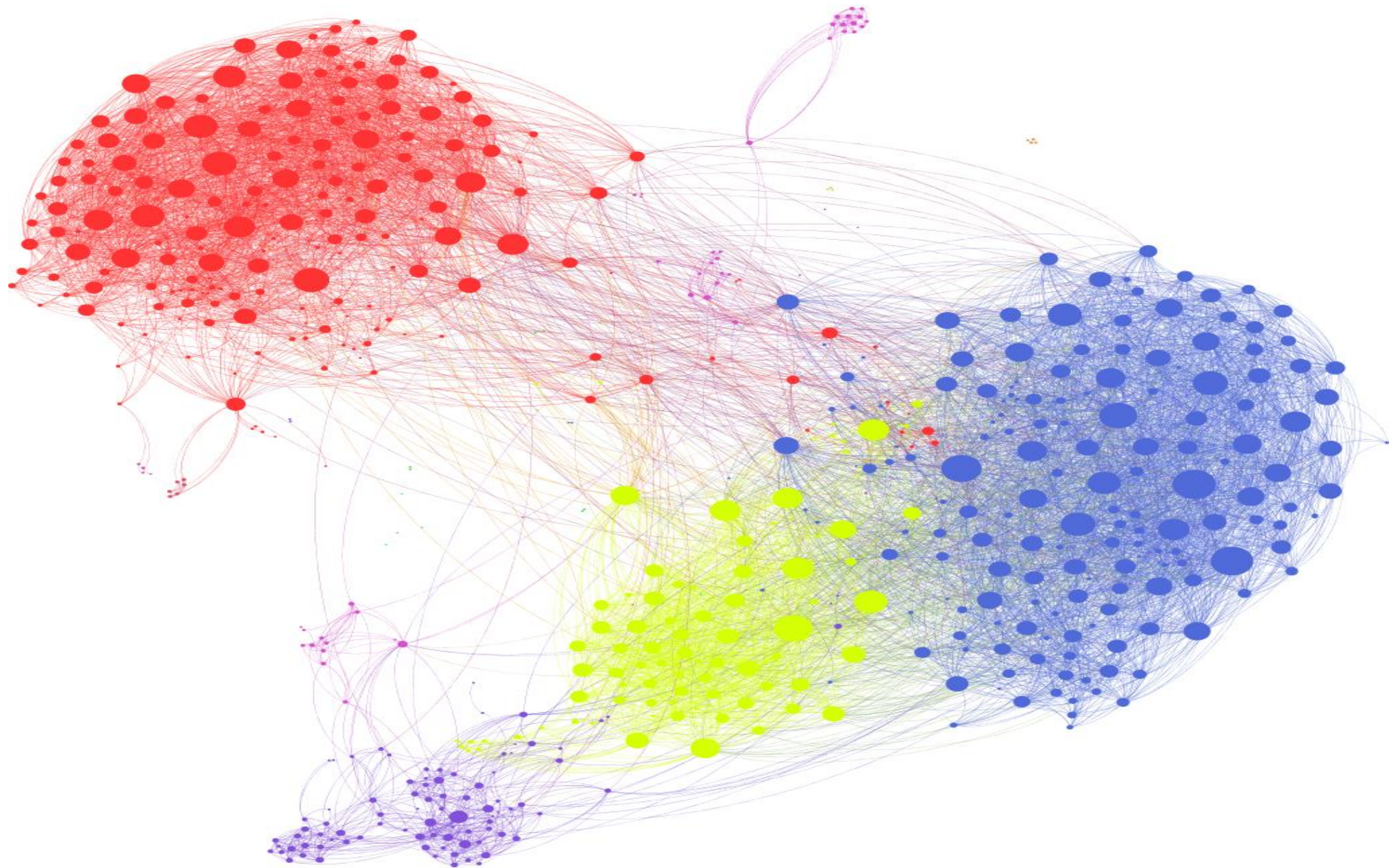
FIFO

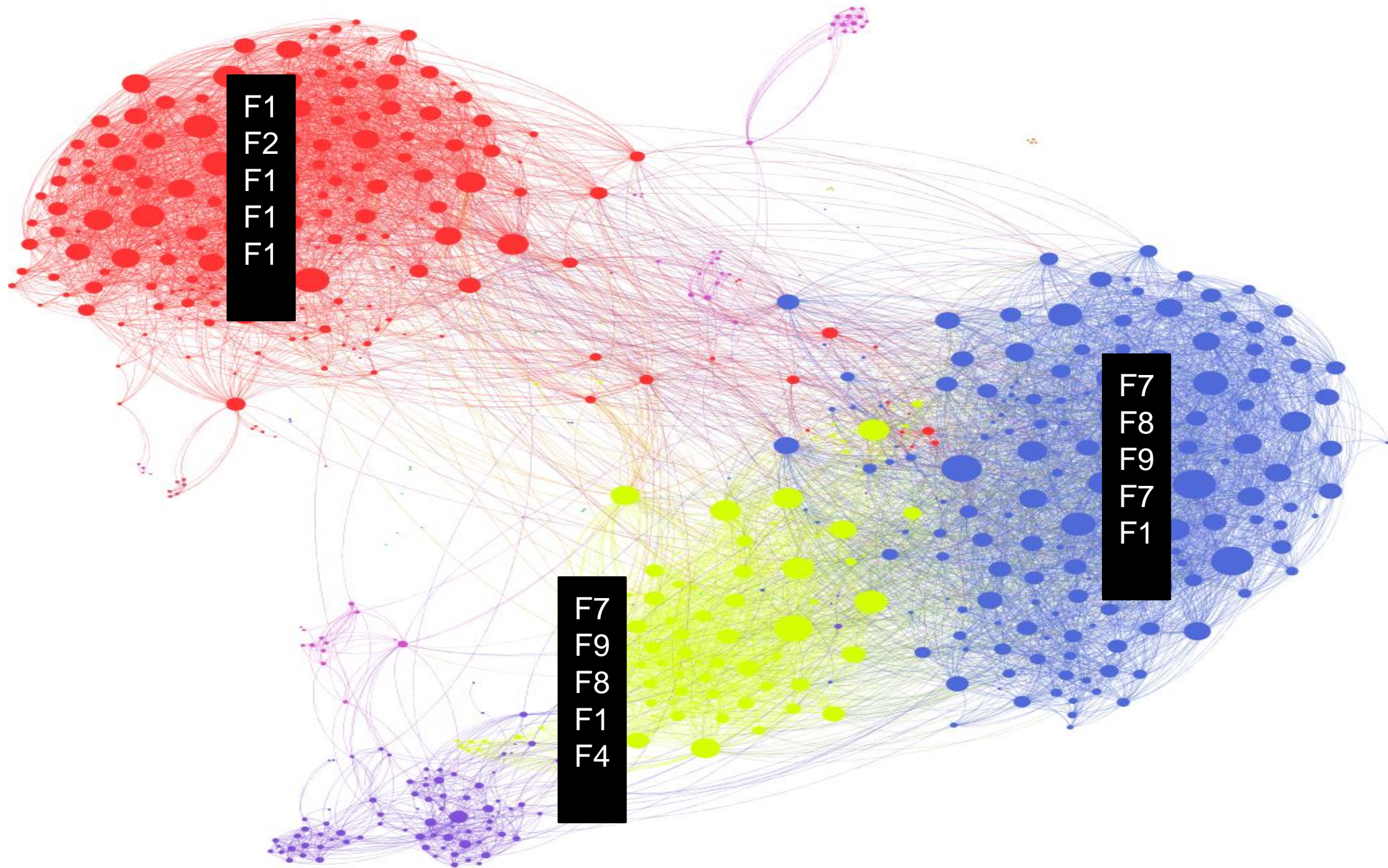


LIFO



**SYNCHRONIZATION IS WHEN EACH
AGENT IN THE NETWORK HAS THE
SAME STACK OF ALREADY SENT
FACTS**





RELATED WORK

- Epidemic Networks
 - Flare-up synchronization^{1,2}
- Synchronization in literature is different from the synchronization found in this work
 - Single states vs Queuing of states

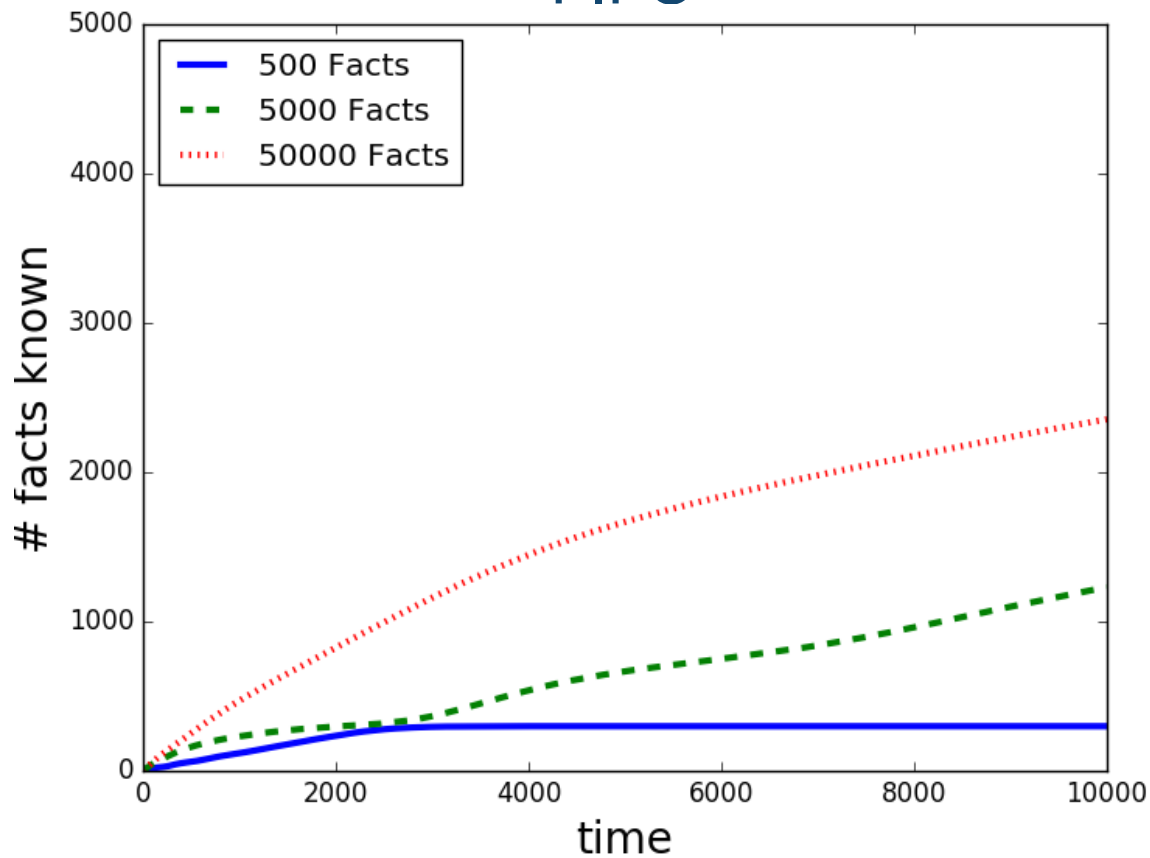
1 L. F. Lago-Fernandez, R. Huerta, F. Corbacho, and J. A. Siguena, "Fast response and temporal coherent oscillations in small-world networks," Physical Review Letters, vol. 84, no. 12, p. 2758, 2000.

2 C. Moore and M.E. Newman, "Epidemics and percolation in small-world networks," Physical Review E, vol. 61, no. 5, p. 5678, 2000.

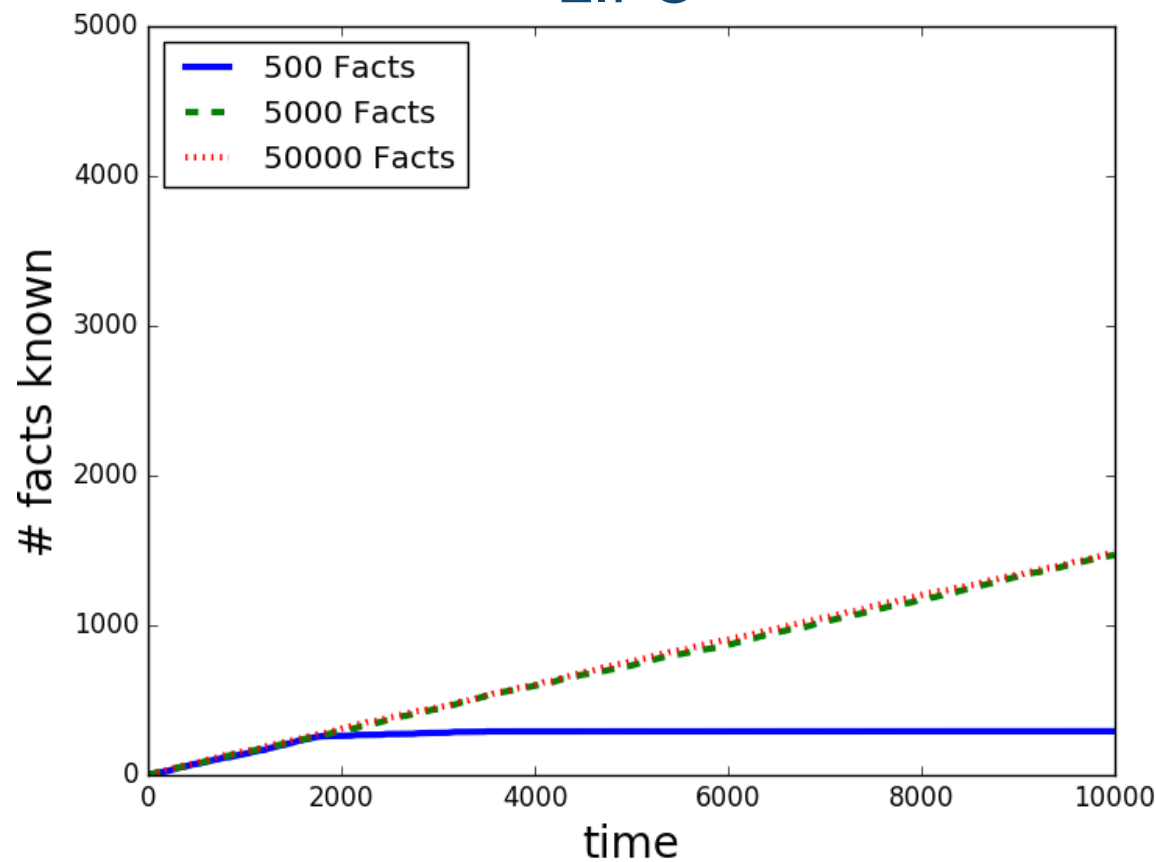
**LIFO IS IMPACTED BY
SYNCHRONIZATION; FIFO IS NOT**

LIFO can out perform FIFO in Streaming Traffic

FIFO

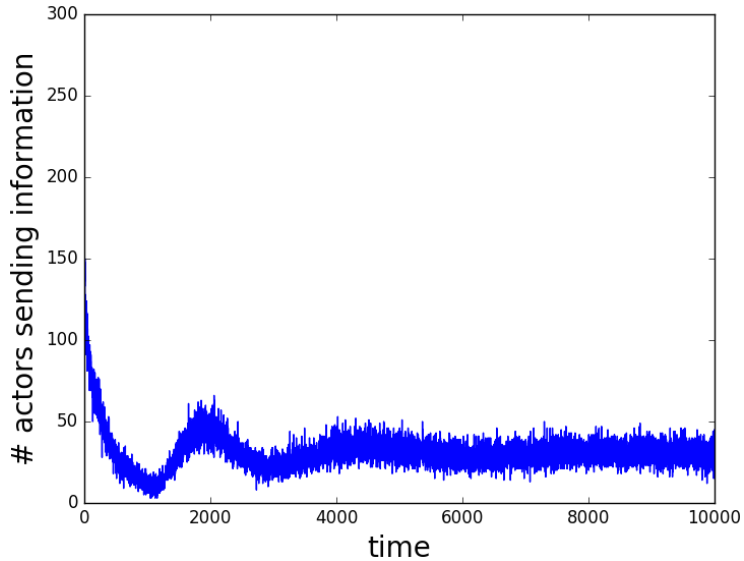
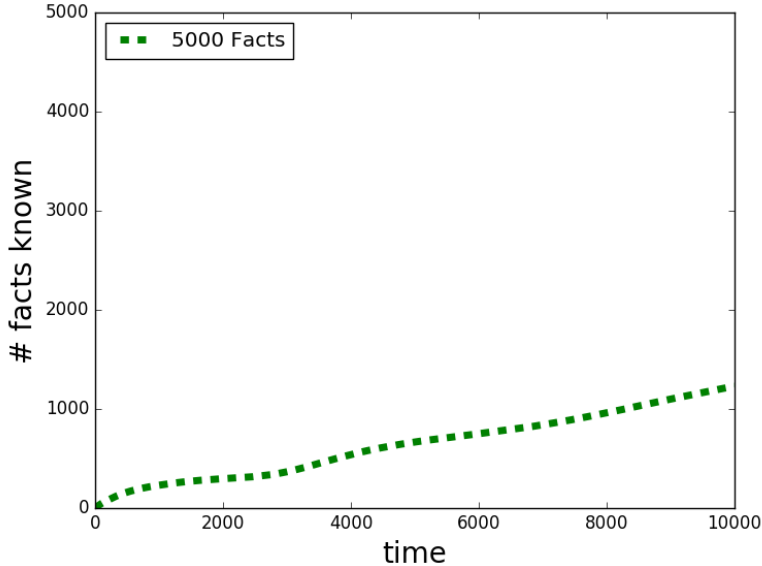


LIFO

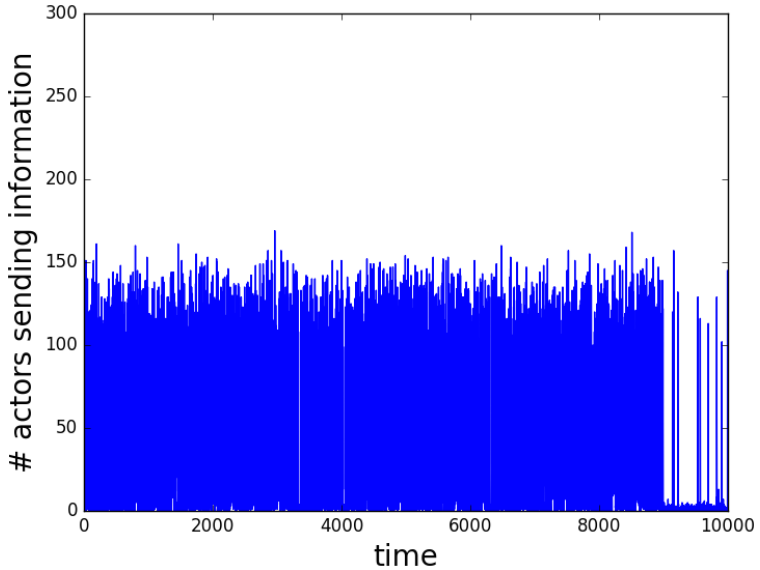
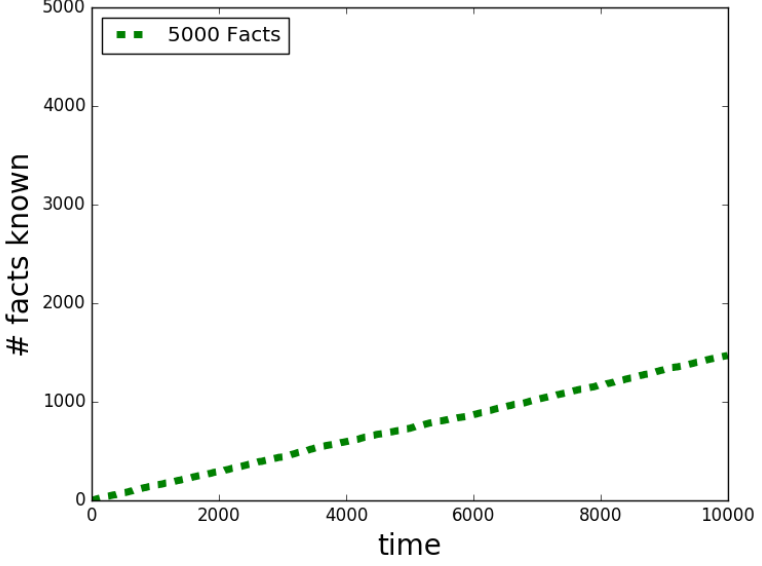


Streaming traffic helps mitigate the synchronization in LIFO

FIFO

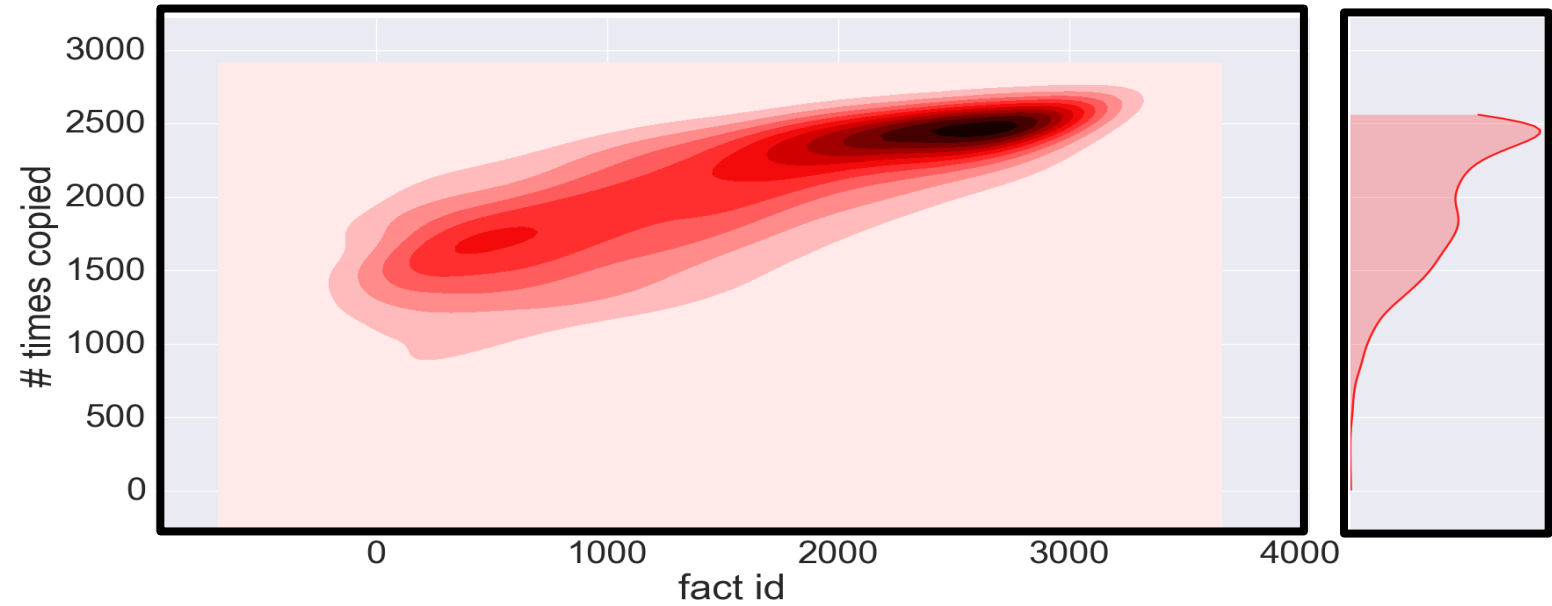


LIFO

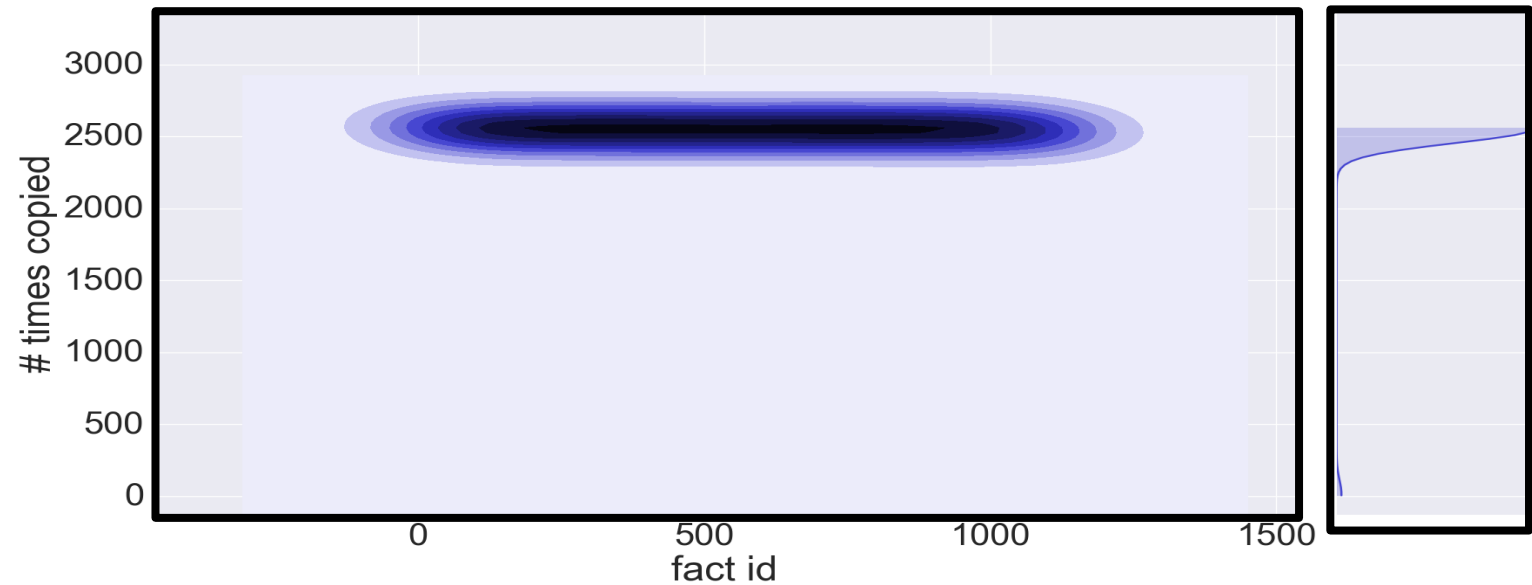


In LIFO facts that are sent go viral, In FIFO more facts are sent

FIFO

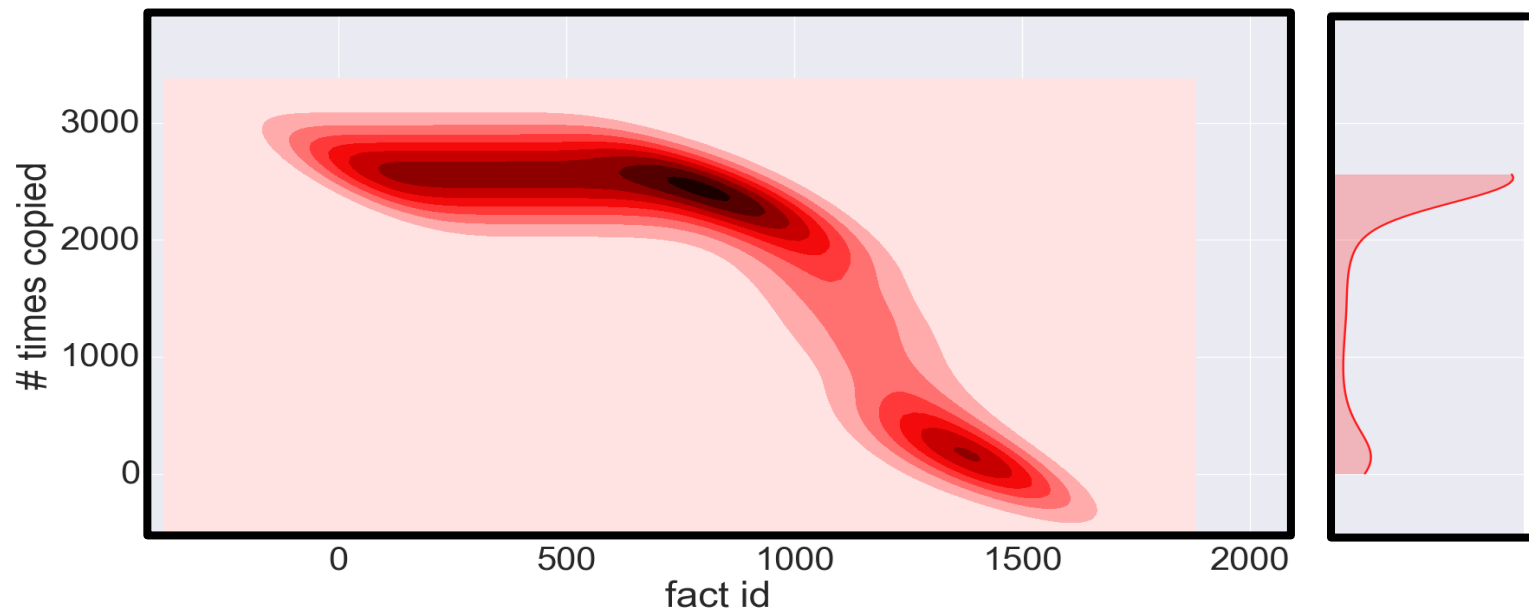


LIFO

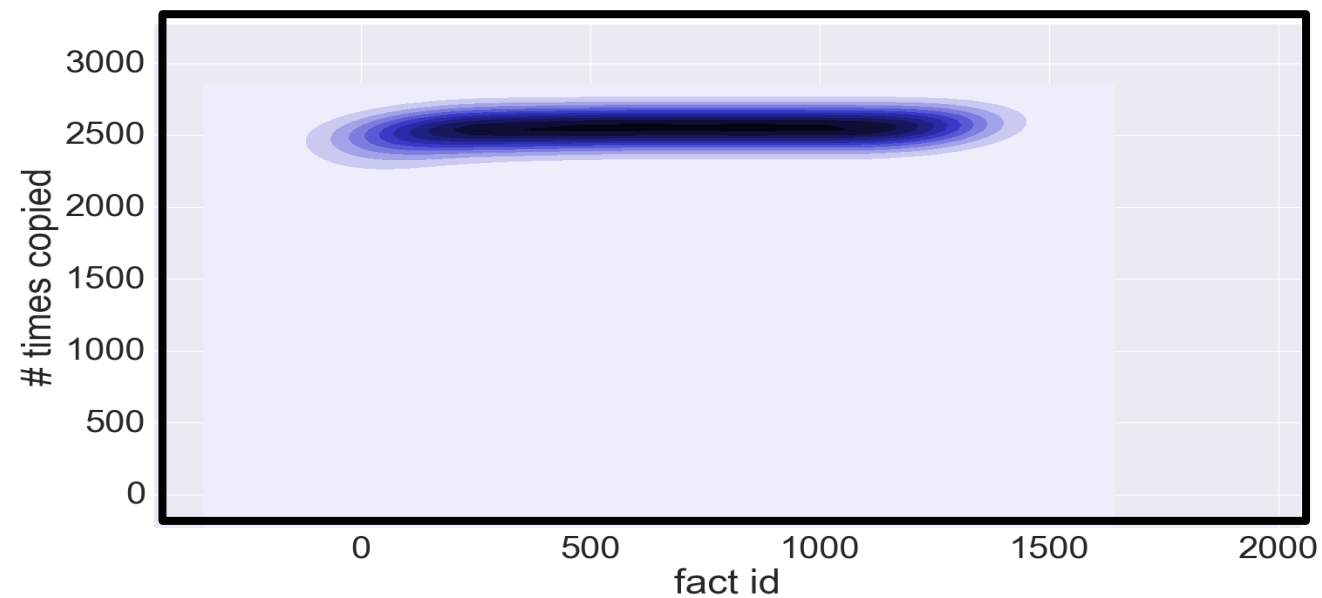


Streaming traffic has an effect on FIFO branching distribution

FIFO



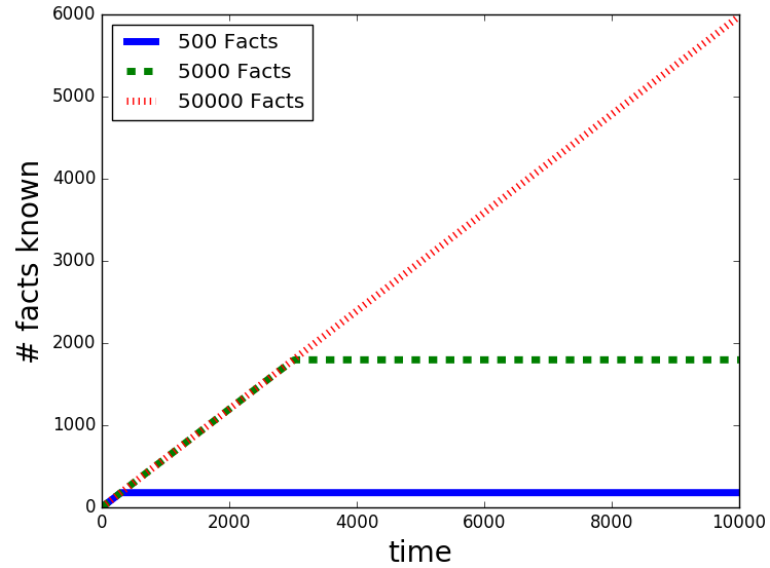
LIFO



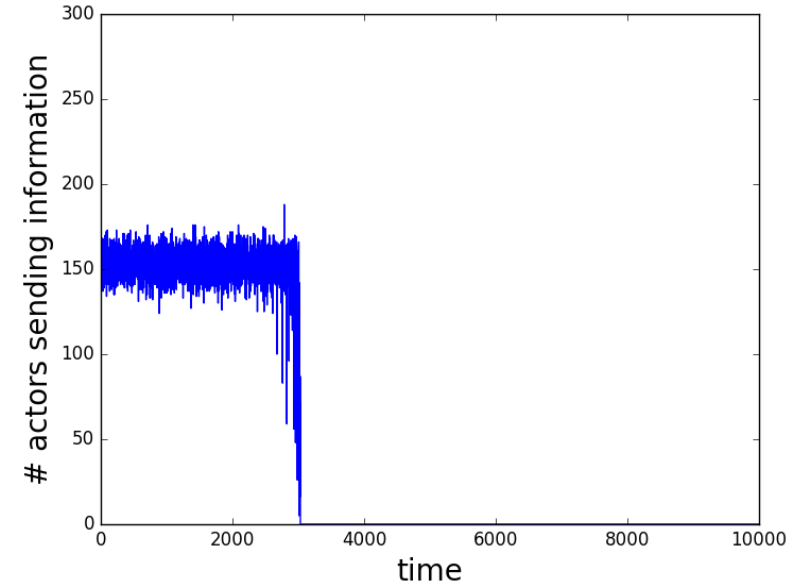
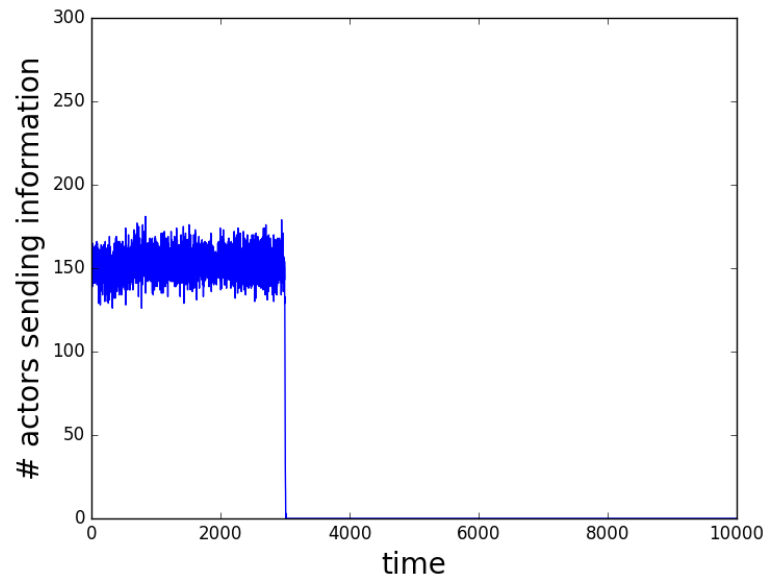
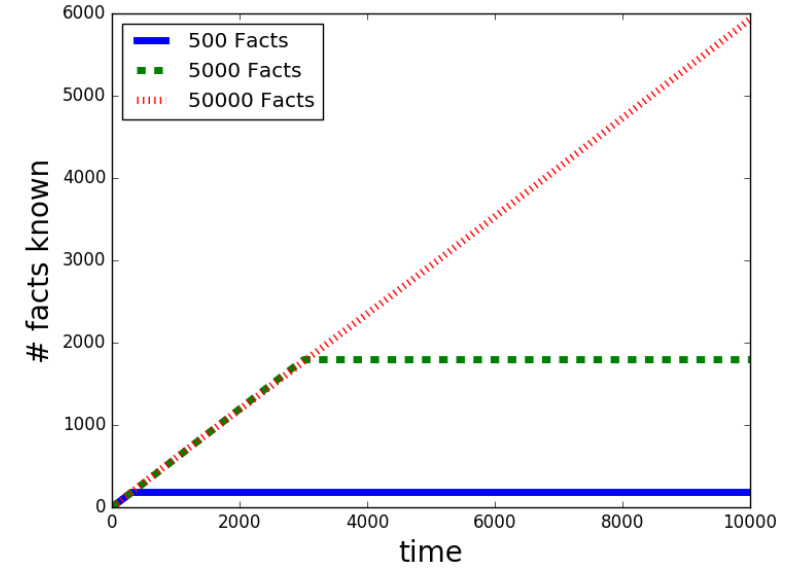
**DUPLICATION IS THE KEY
DIFFERENCE**

When duplicates are removed, LIFO and FIFO converge

FIFO WITH NO DUPLICATES

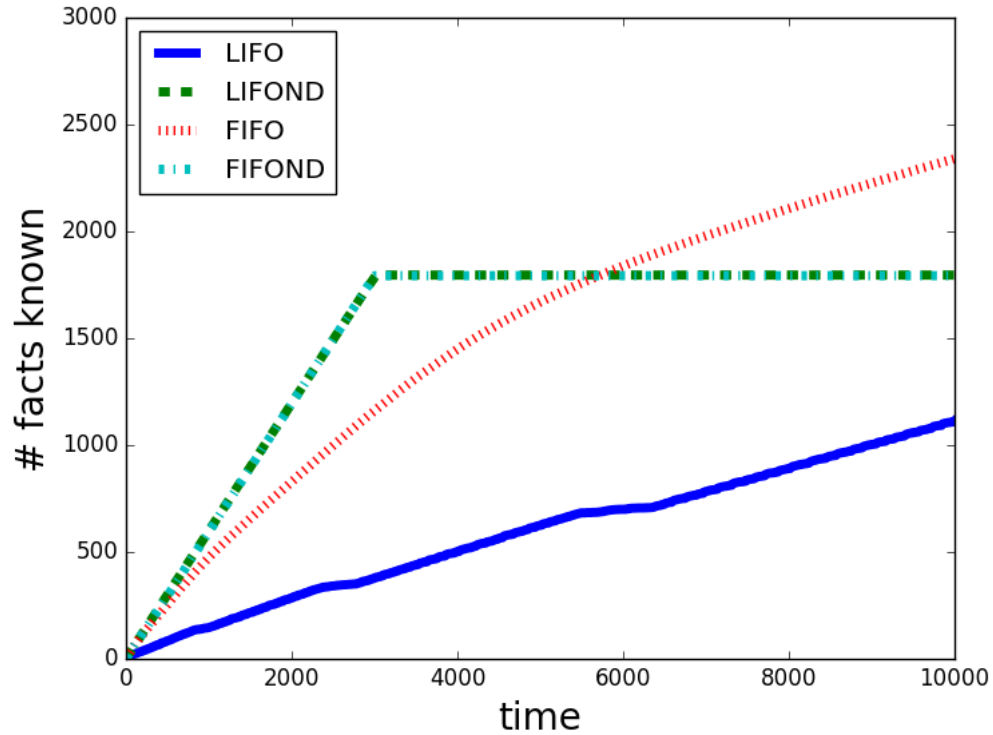


LIFO WITH NO DUPLICATES

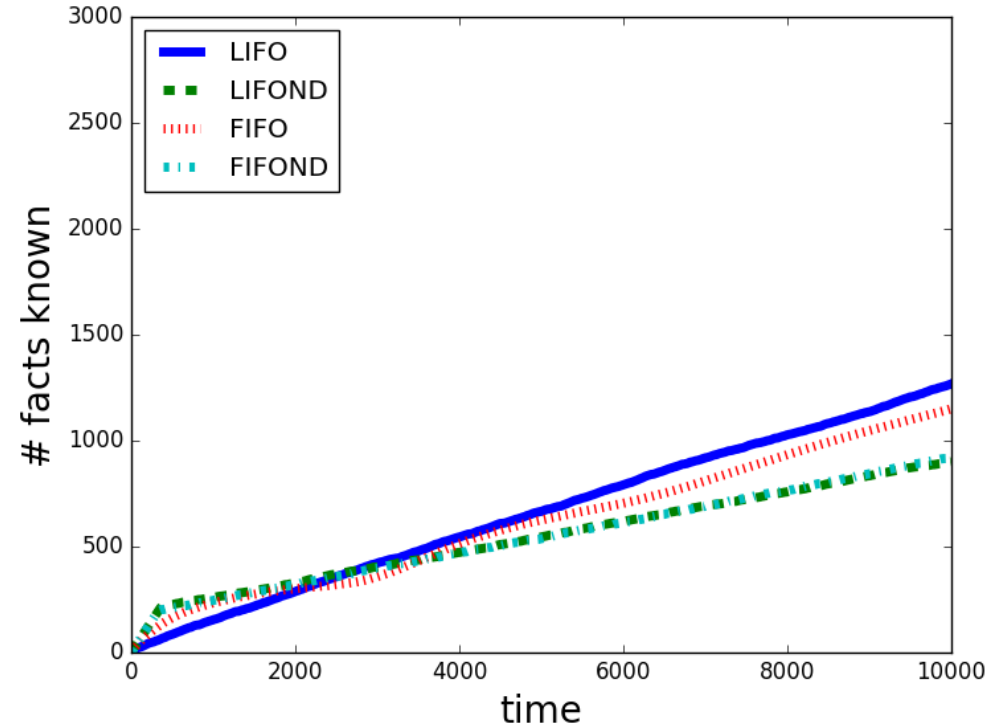


Use FIFO in High Traffic and LIFO in Stream Traffic

HIGH TRAFFIC BURST



STREAMING TRAFFIC



5000 Facts in the system

Feed sorting is a crucial factor in information spread

- **LIFO** - users are prone to becoming synchronized on duplicate or already seen information; problematic for high traffic information arrival patterns
- **FIFO** – users can gain significantly more diverse information out of the box, especially in high traffic information arrival patterns
- Duplication of messages is the key cause in performance difference
- **Future** - explore much more intricate sorting mechanisms, develop analytical frameworks to better these sorting mechanisms in networks

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THANKS TO:
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