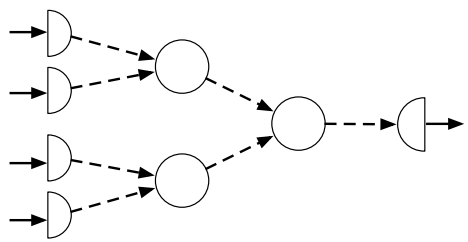
Raphtory: A new tool for large temporal networks applied to the far right social network Gab



Presenter: Imane Hafnaoui,
Project team (alphabetical order):
Naomi Arnold, Richard G. Clegg, Félix Cuadrado, Raul Mondragon, Hugo Parada, Ben Steer

Aims of this talk (unordered list)

Aim A: Give insight into data

What drives the evolution of the alt-right social network gab?

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Aim 1: Show a technique

Temporal analysis and in particular "windowing" is an invaluable tool for social network analysis.

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Aim 1: Show a technique

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Aim α: Sell you a tool

Raphtory is an open-source, big-data platform developed at QMUL. It is unique in its ability to perform flexible temporal analysis on batch or streamed graph data.

The gab platform (and why we care)

- 95GB raw data (19 million posts) from gab platform (medium data).
  - Data is user, posts (threaded), timestamps and other metadata.
  - NB our research on structure not content.
- First eighteen months of data available.
  - September 2016 – May 2018.
- Largely complete data from this period.
  - "free speech" focus means "everything" is public.
- Alt-right focus:
  - Racism, fake news, hate speech, radicalisation.

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We can form a graph from a social network by creating an edge between two users if they have a relationship, interact, etc.

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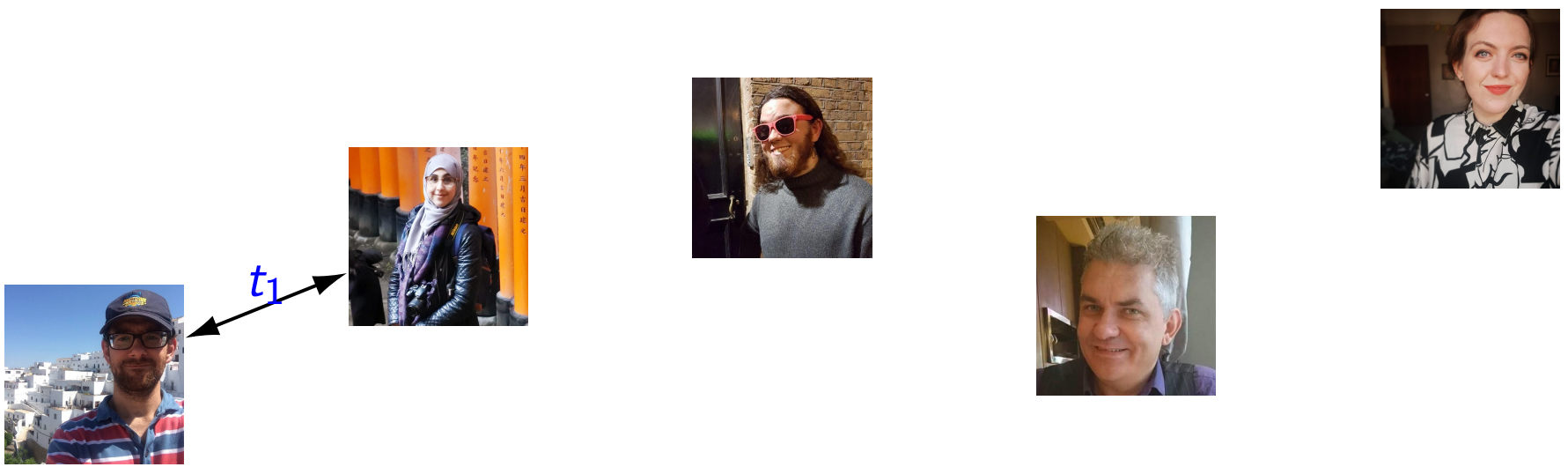

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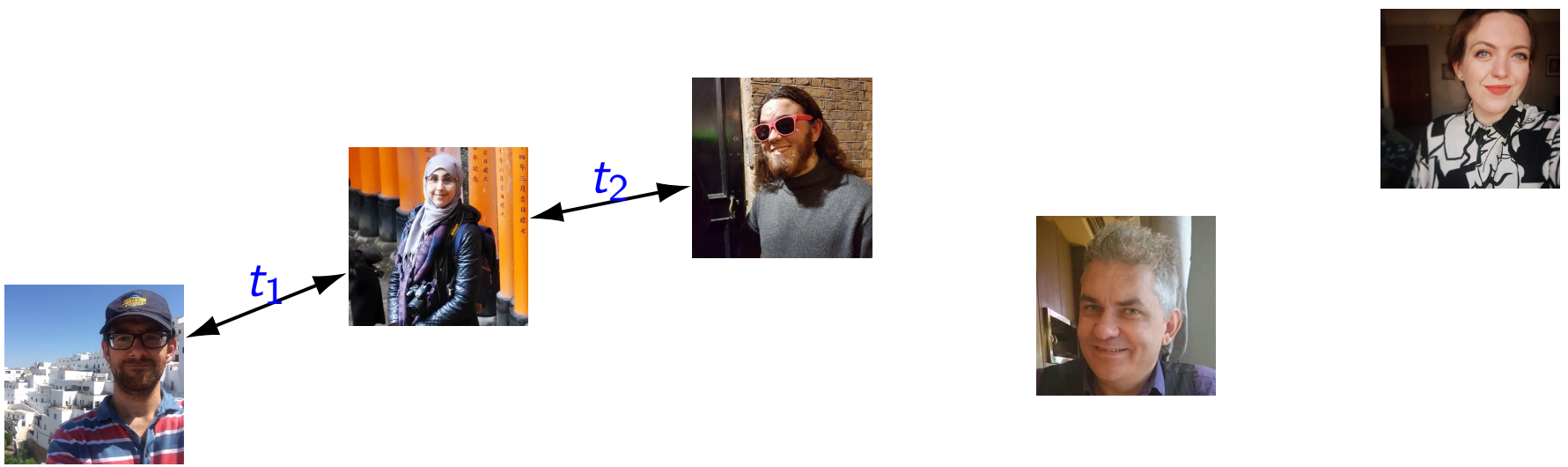

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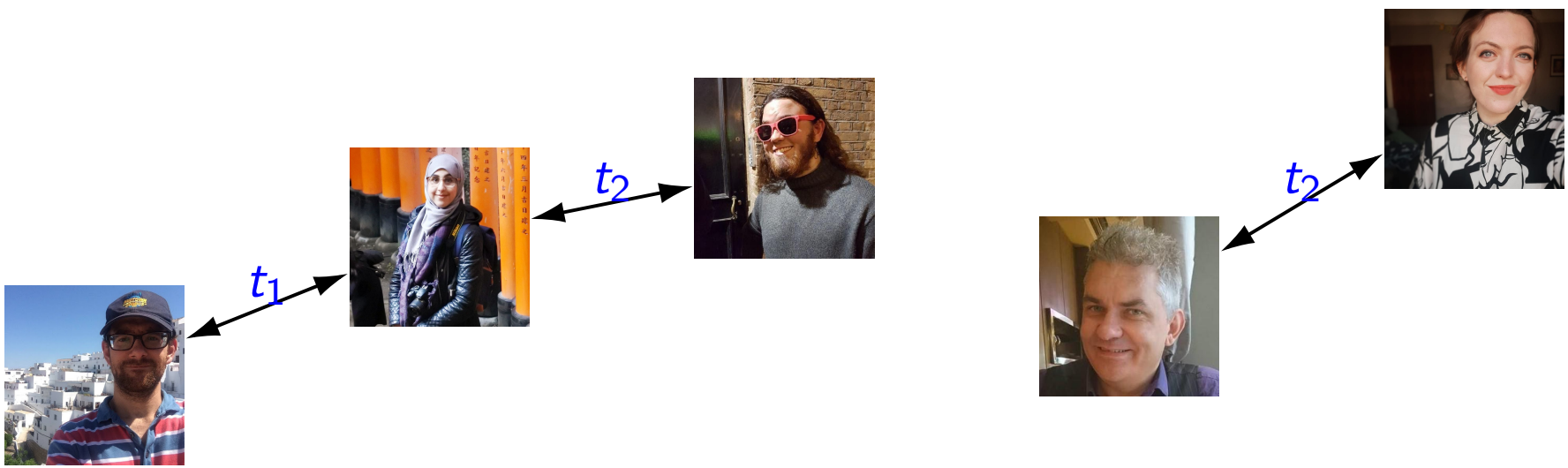

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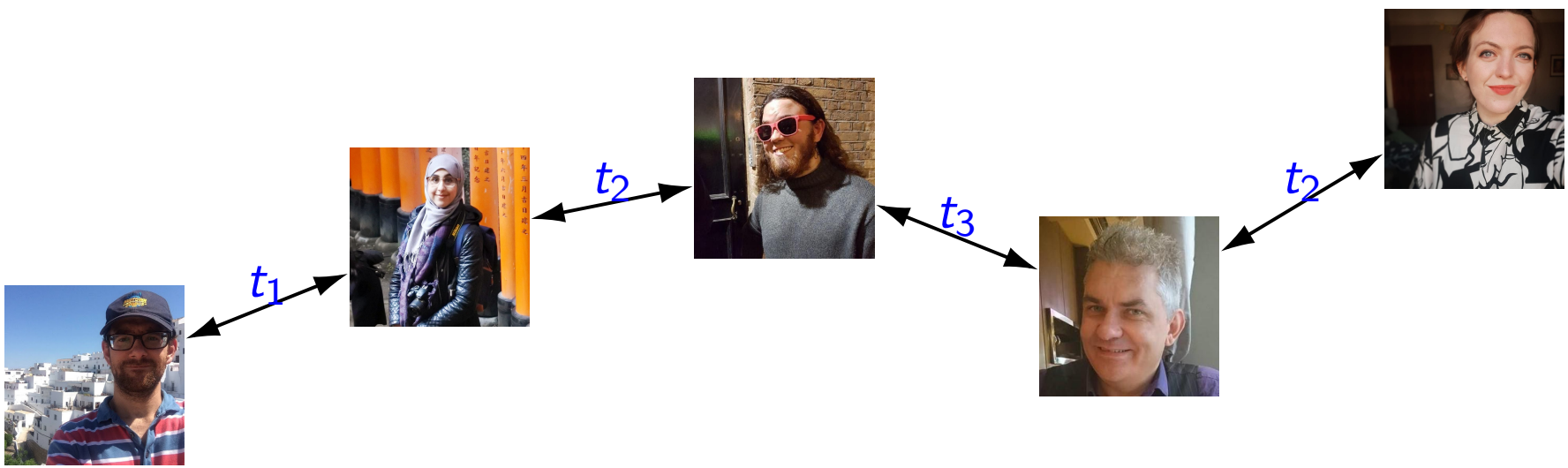

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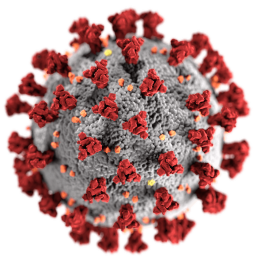


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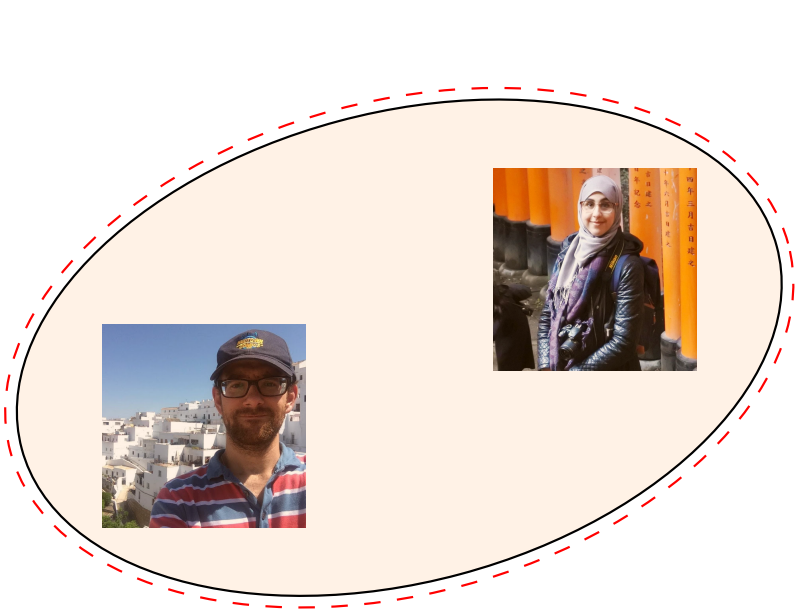
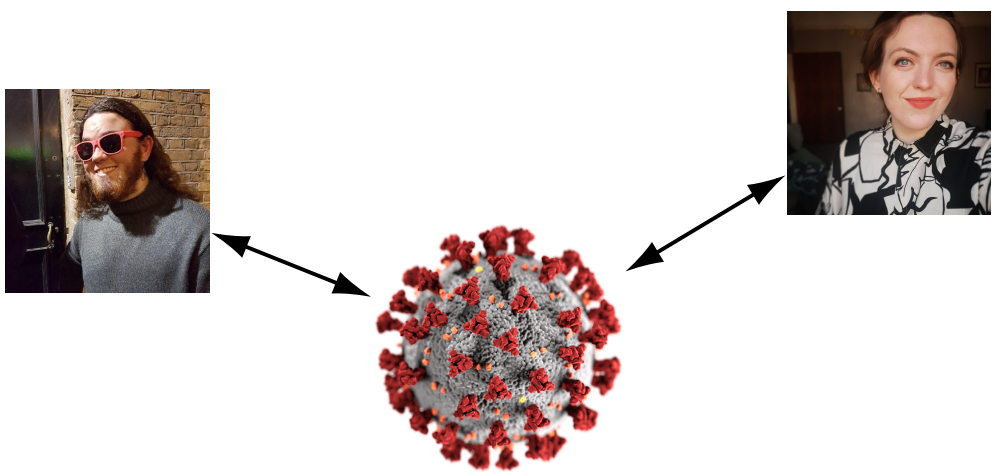
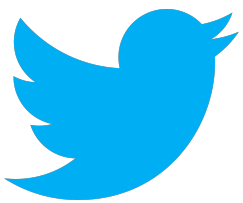
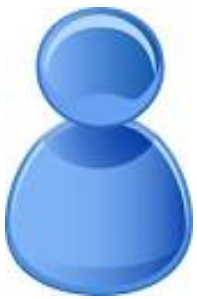




The Raphtory tool



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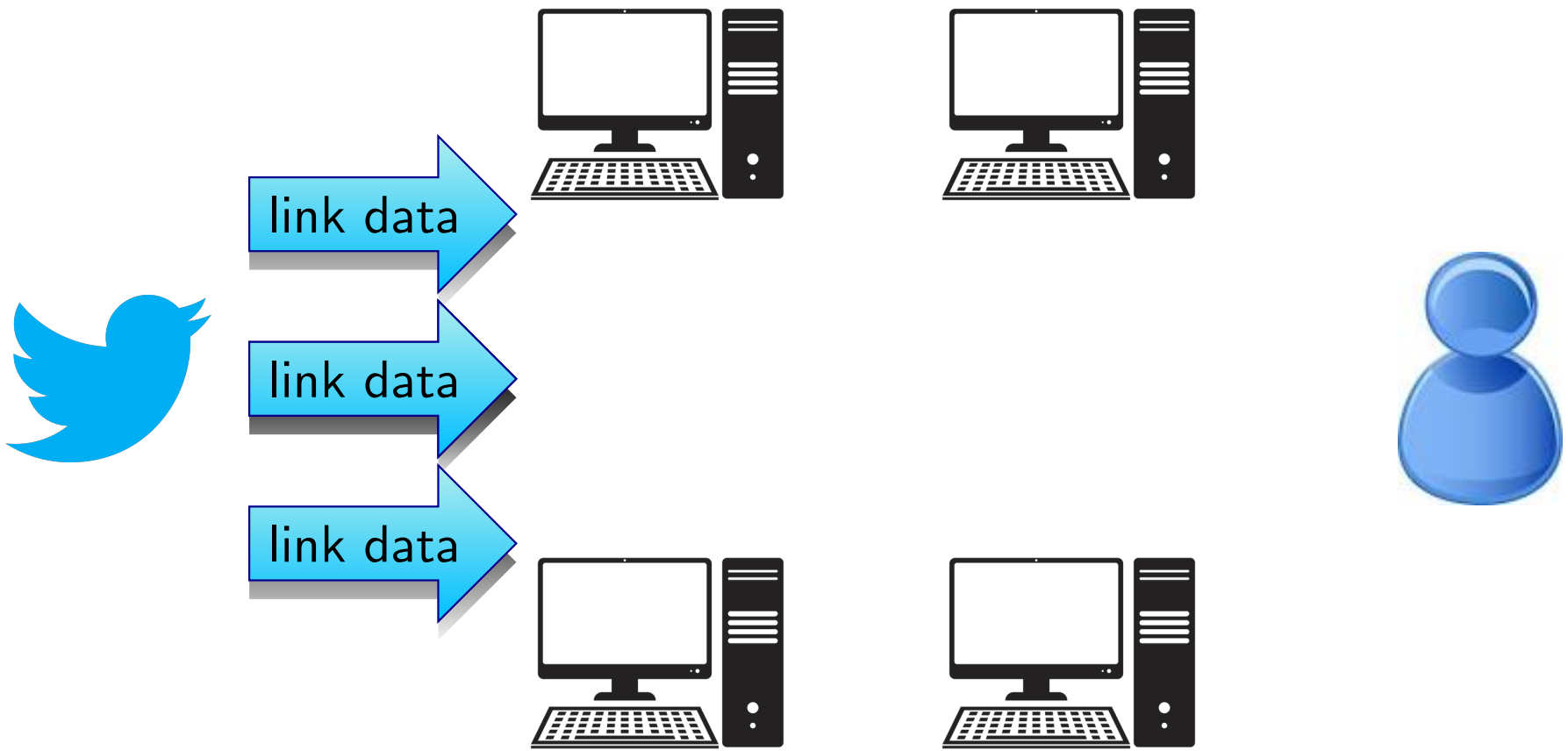

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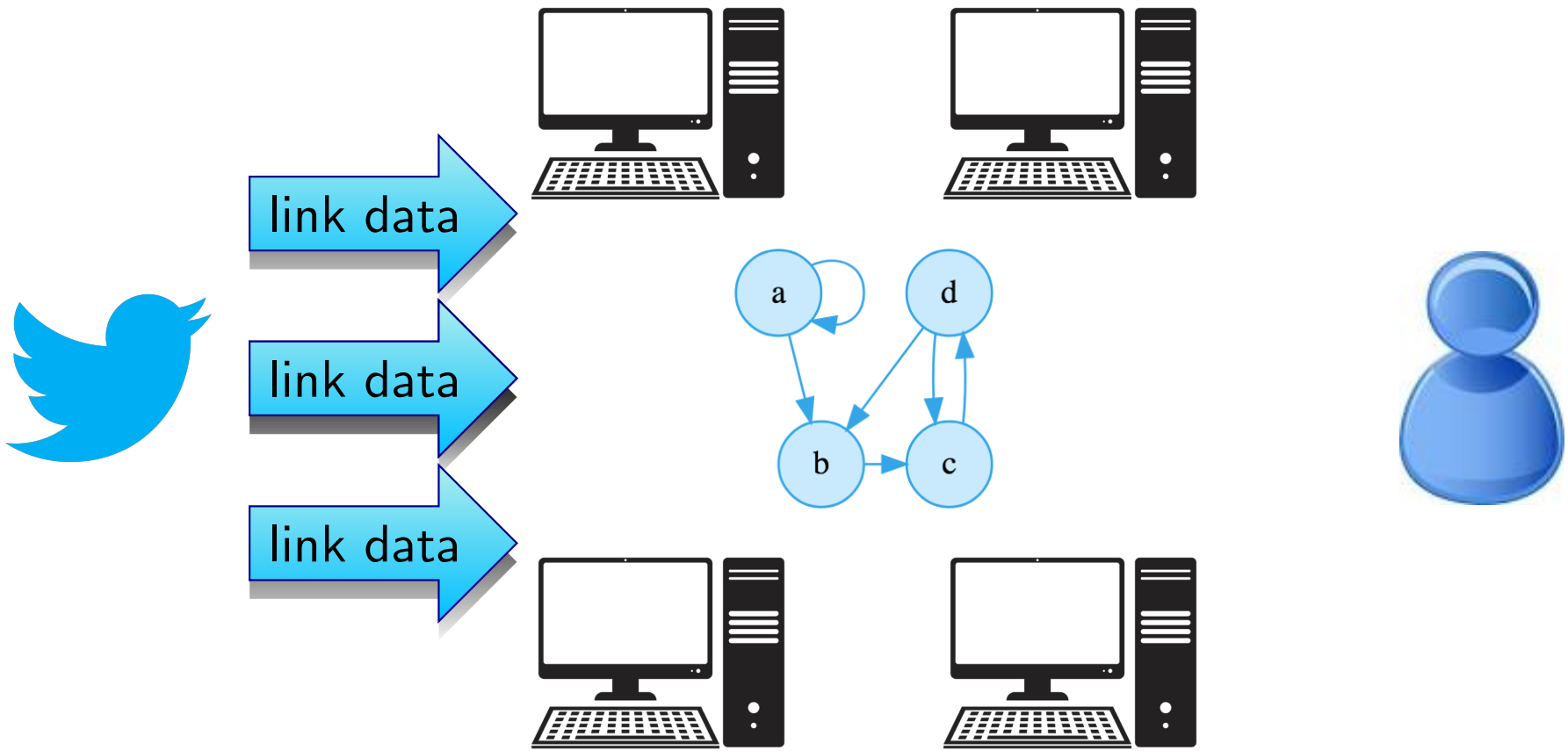

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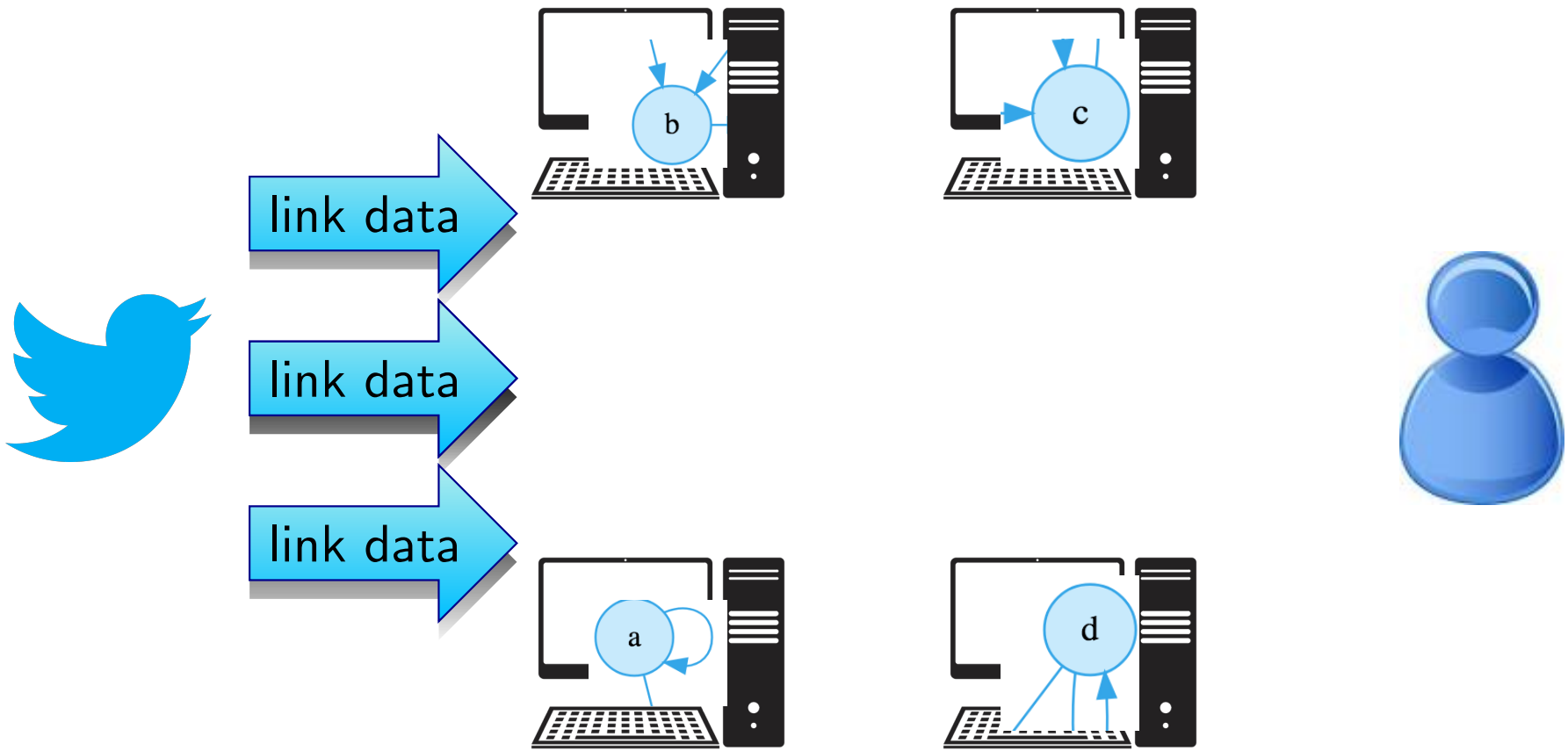

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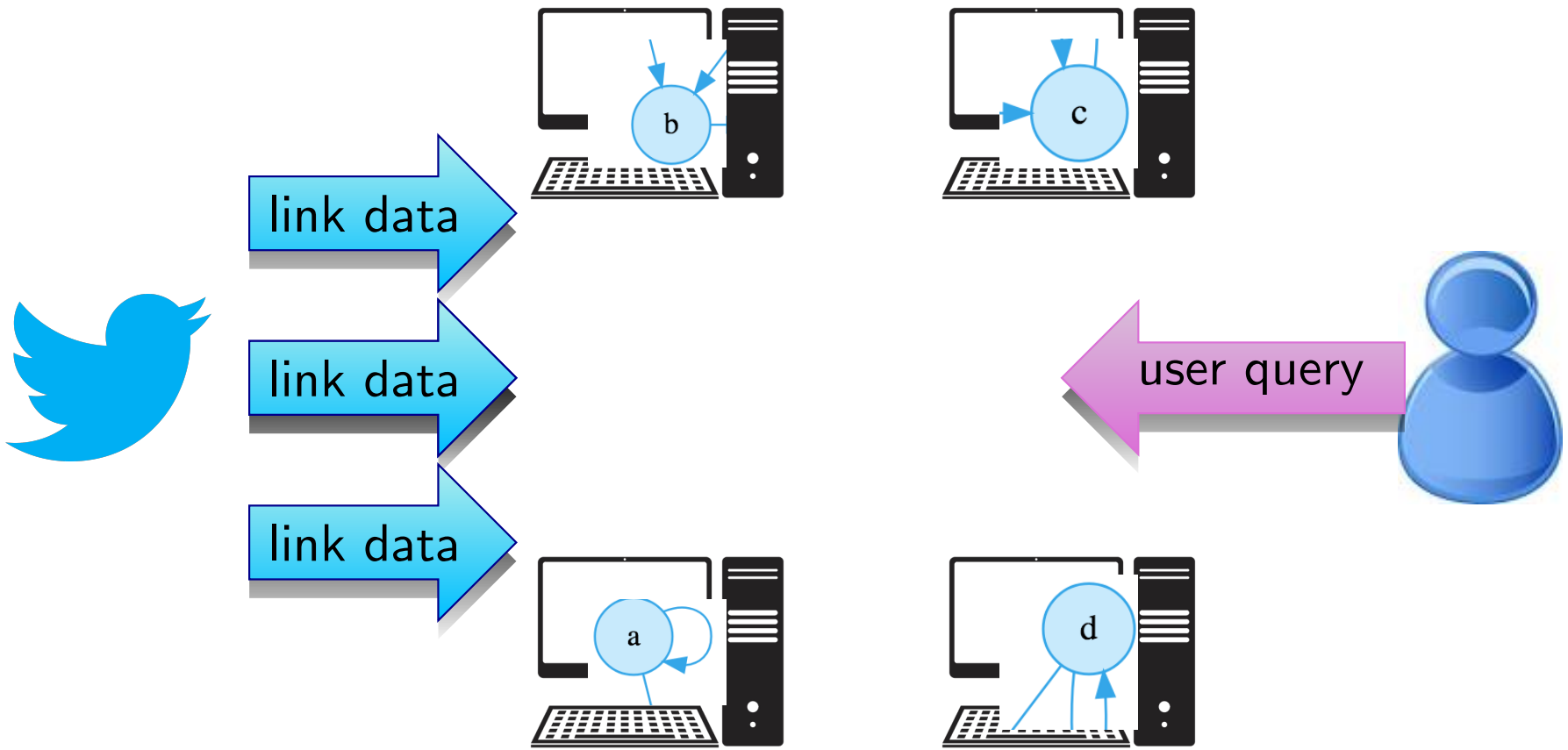

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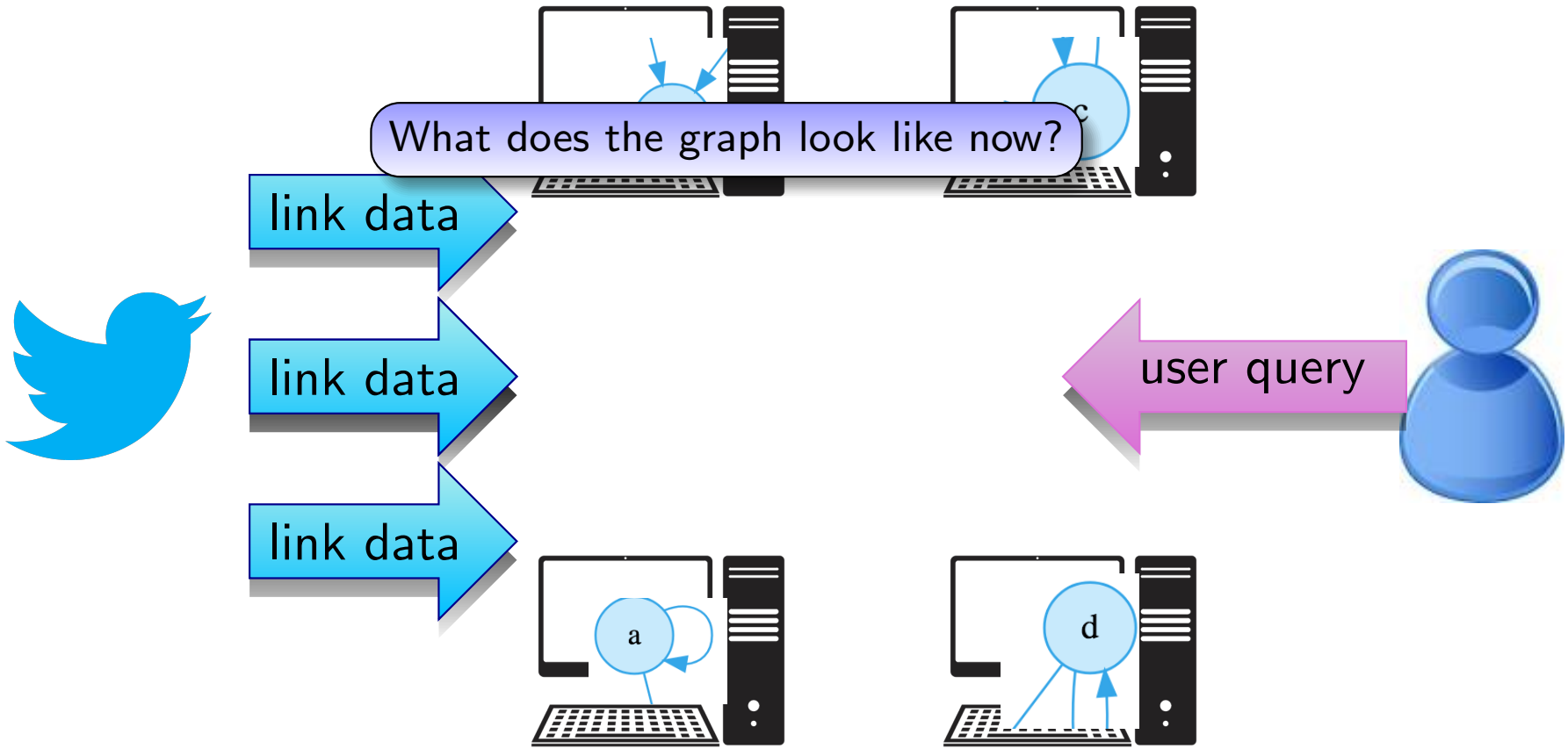

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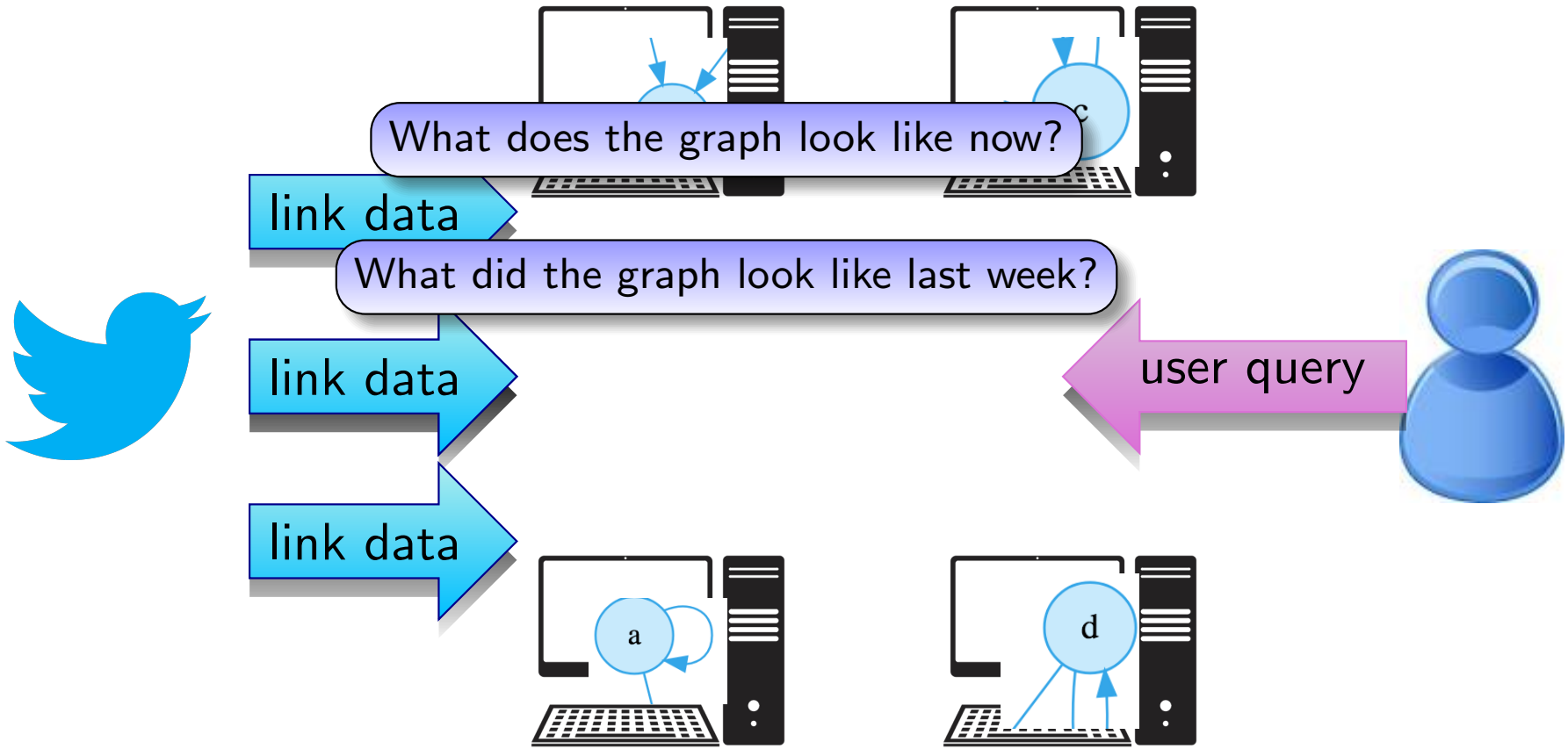

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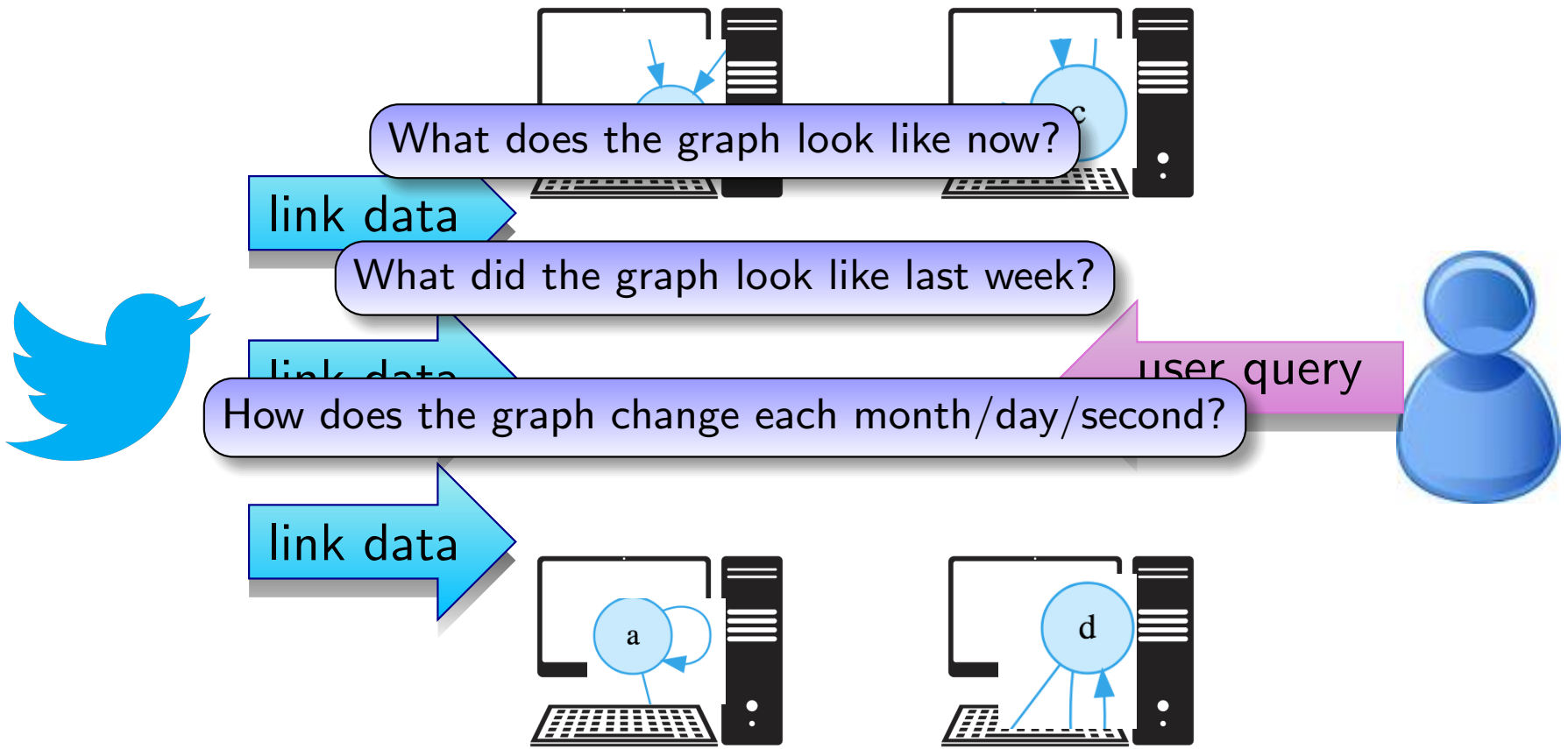

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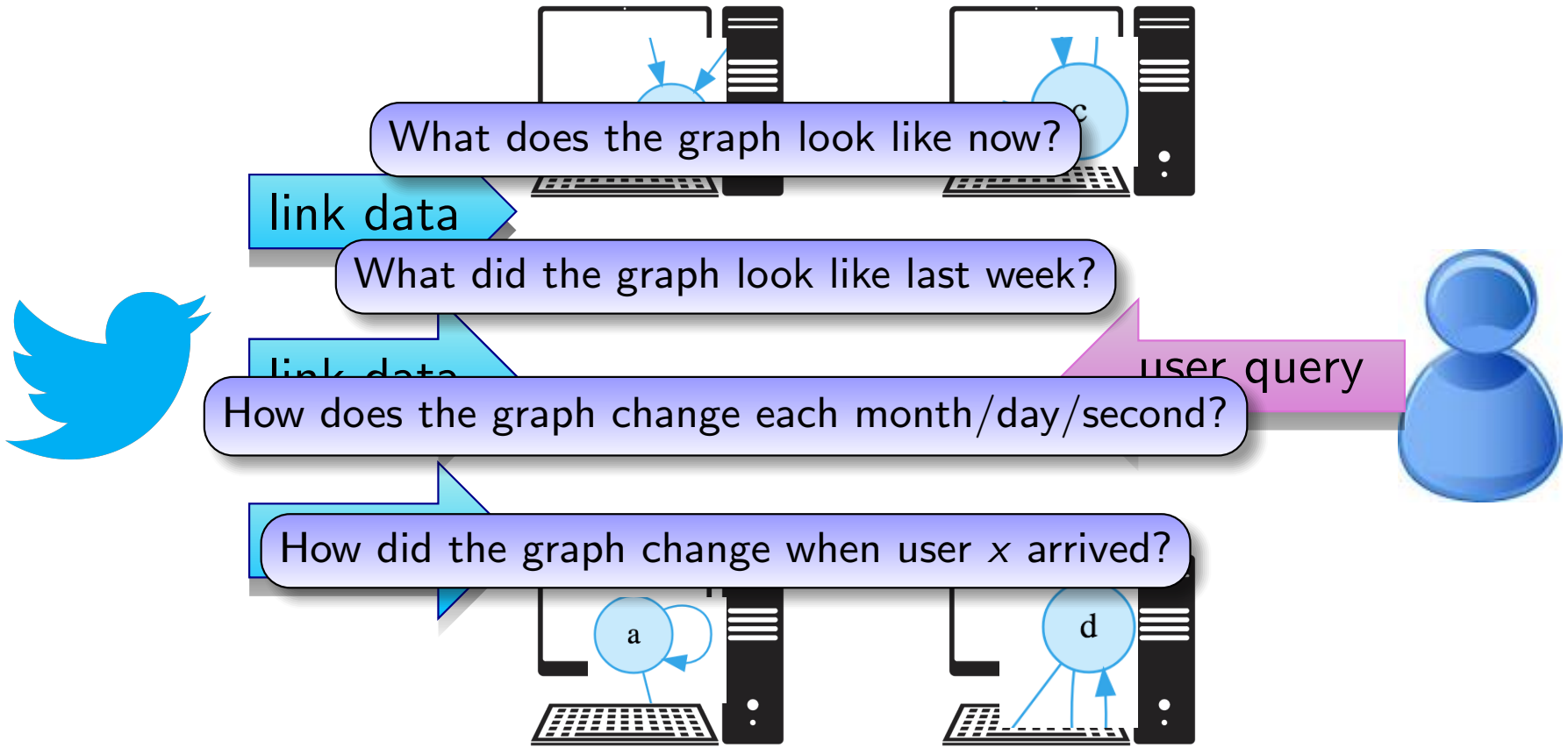

Temporal graphs – interaction graphs

Interaction graph for time t and a window length τ

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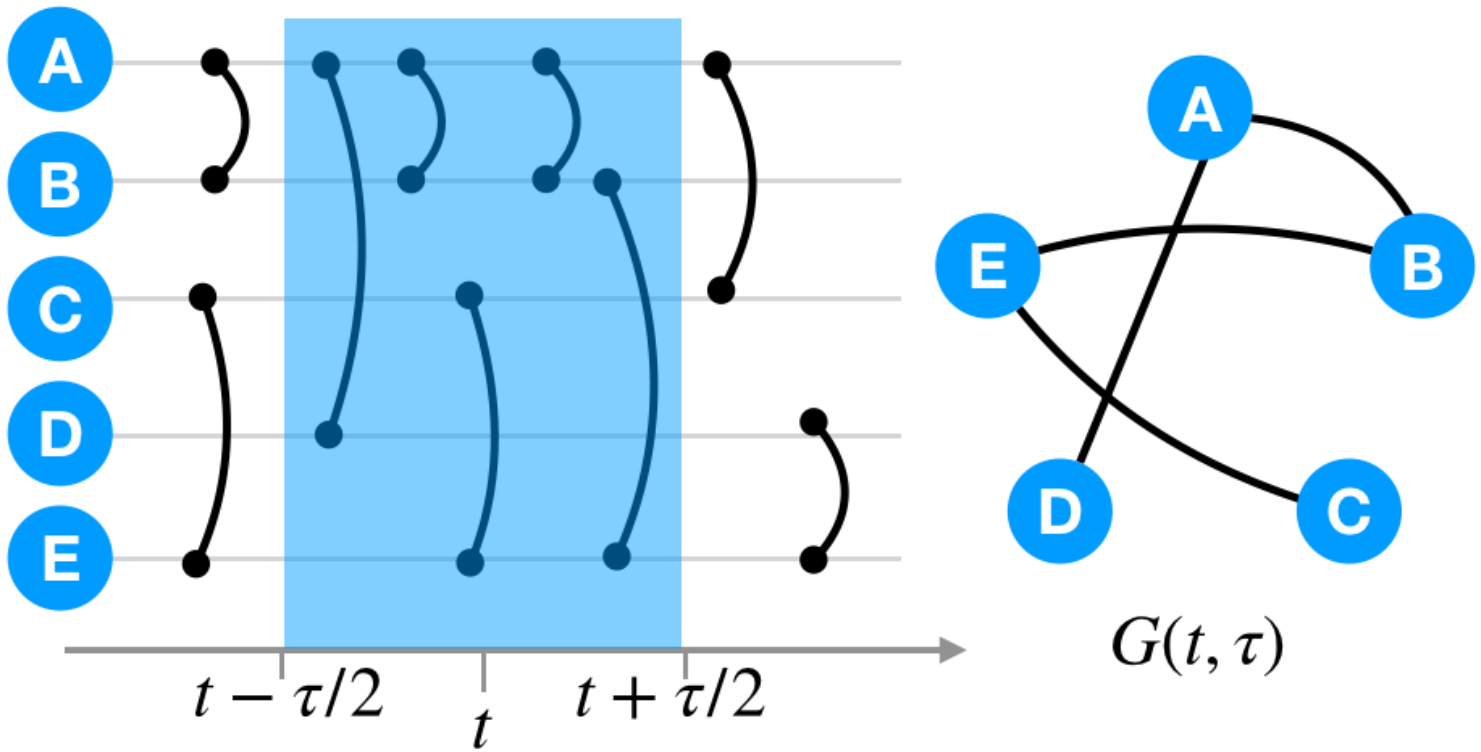

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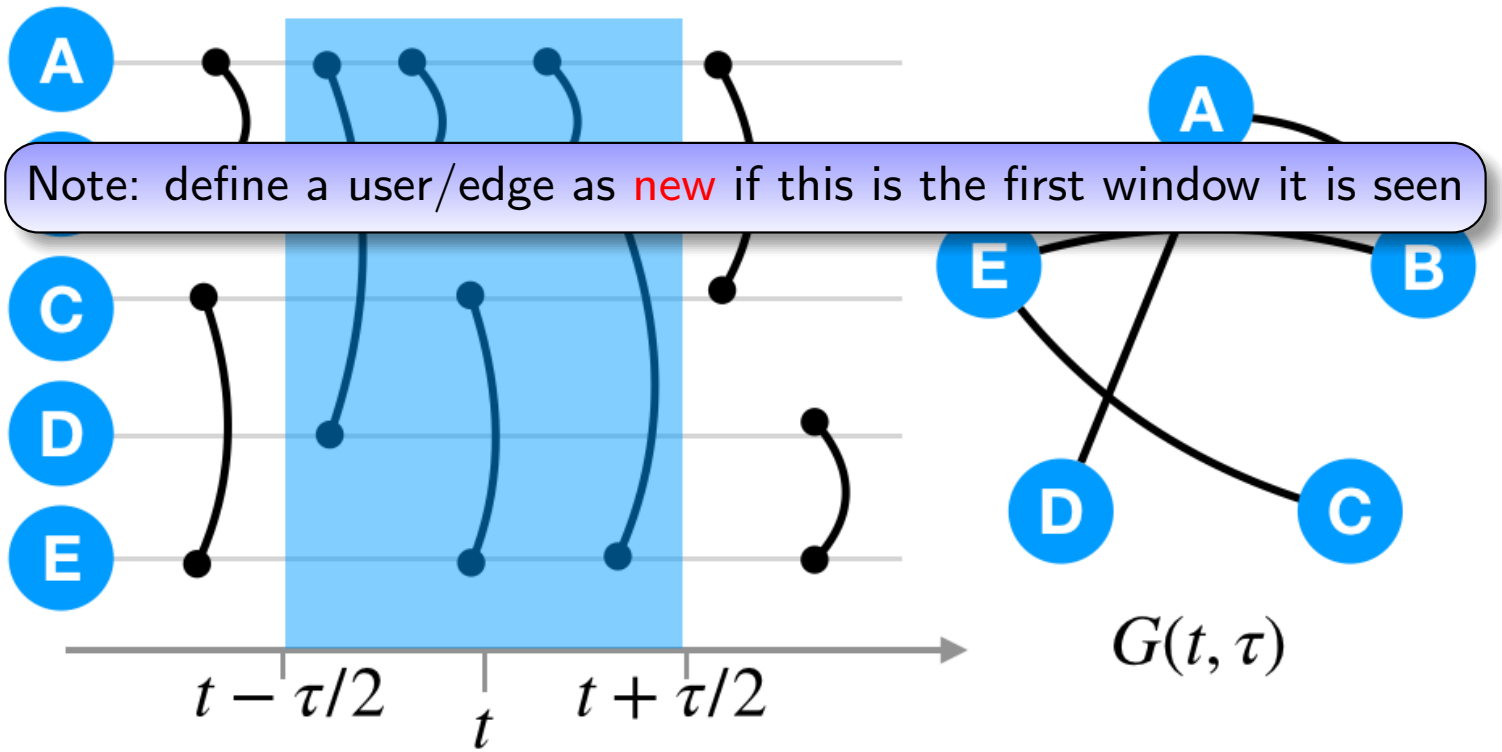

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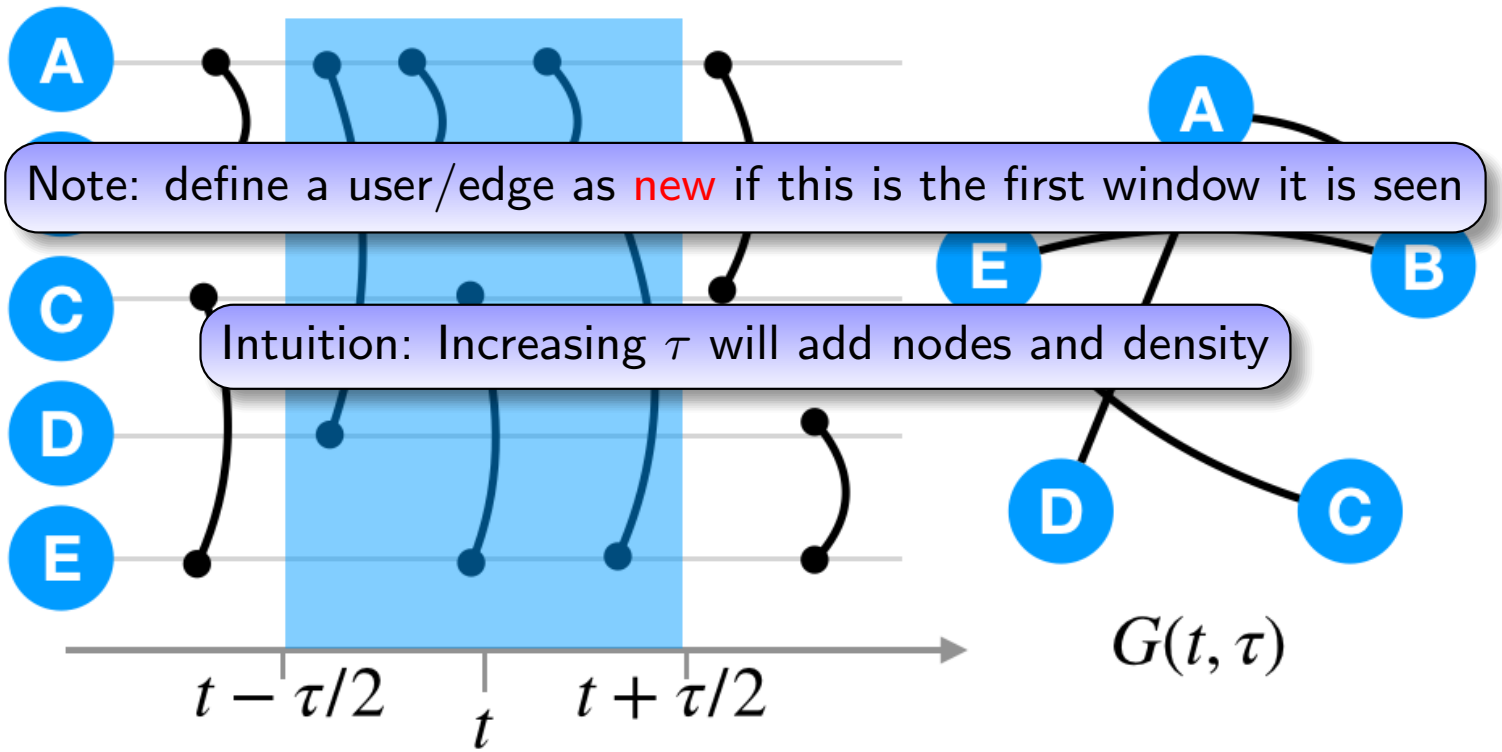
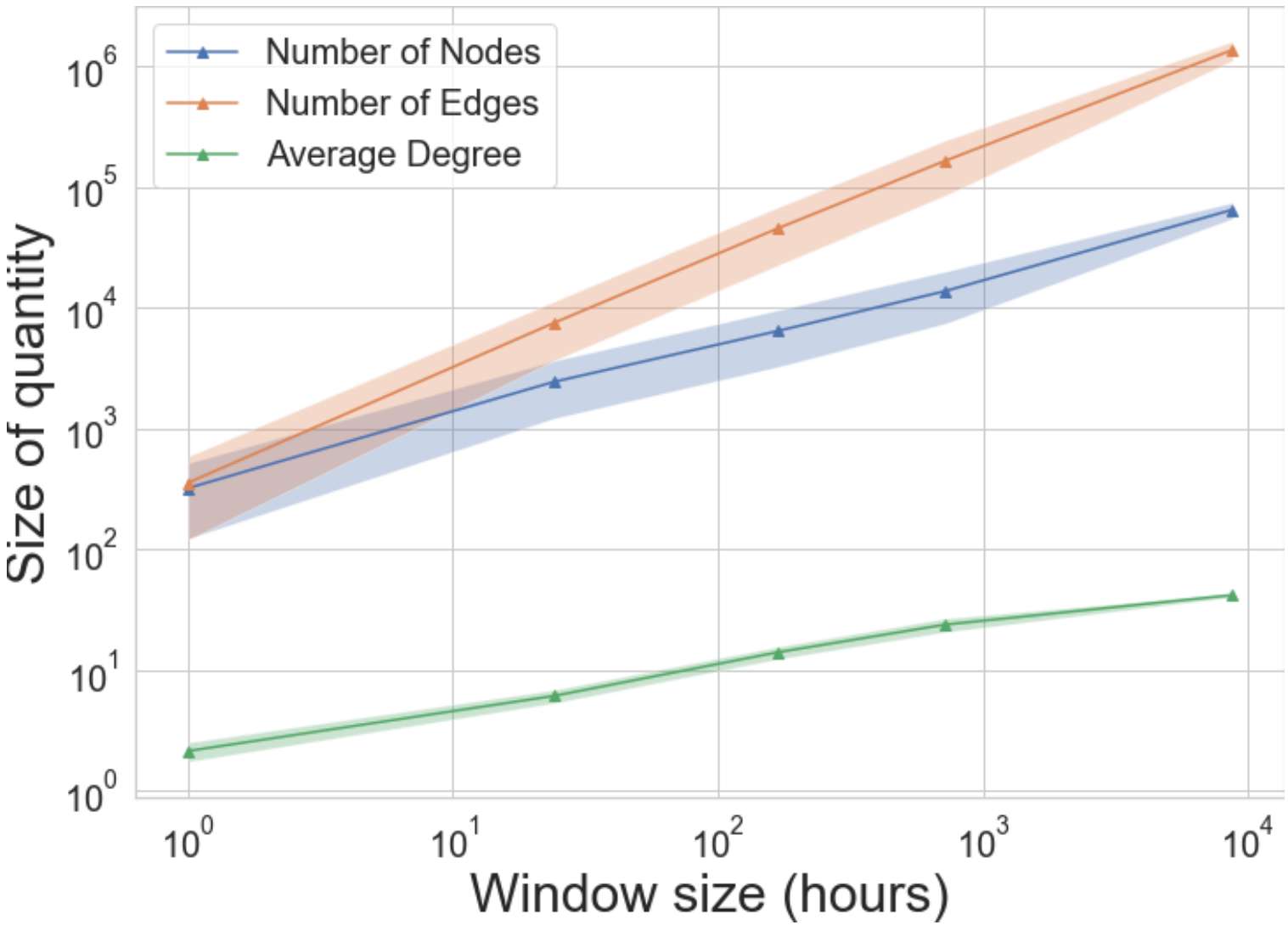


Checking our intuition



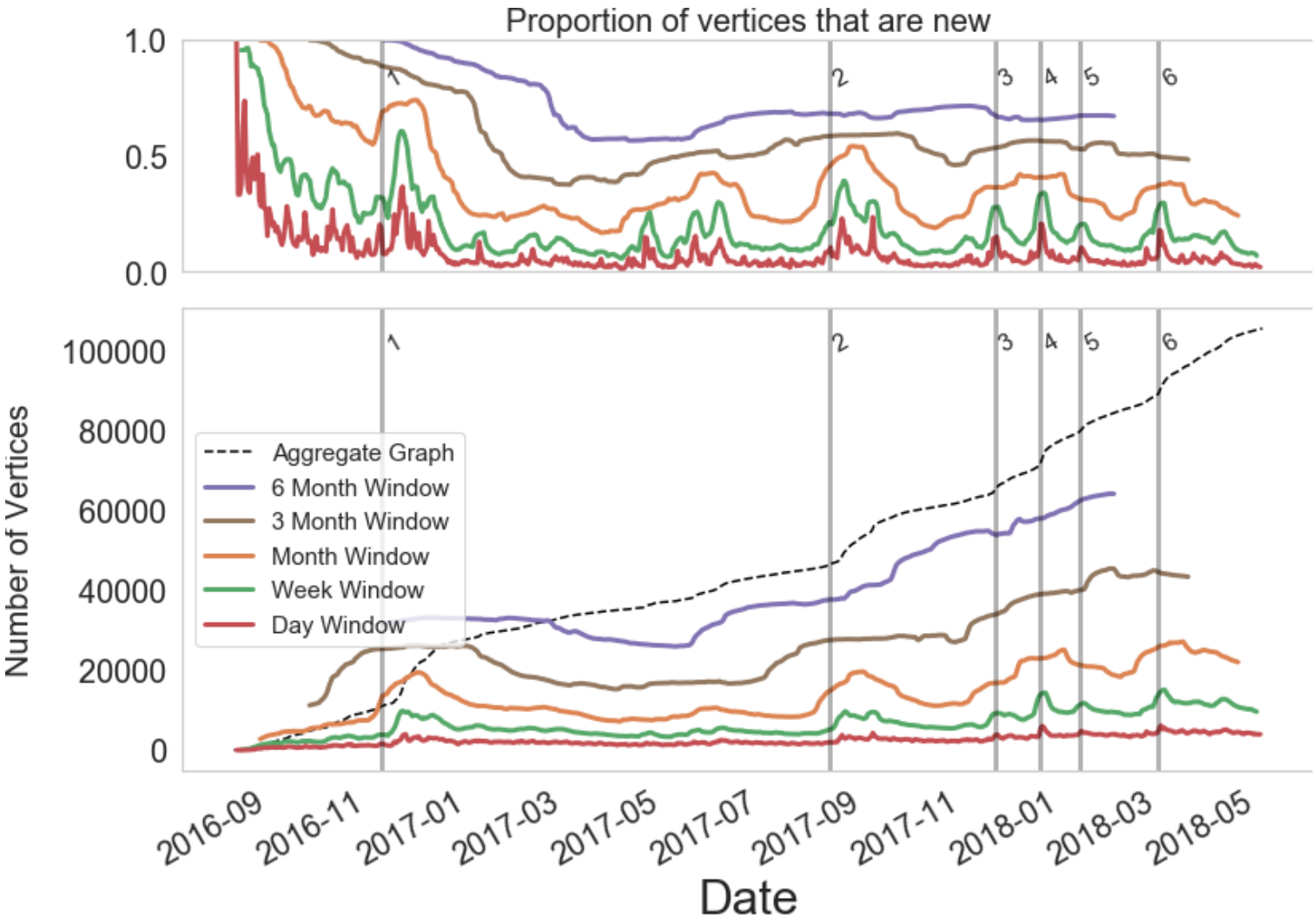
Some research questions for gab data

What simple questions can we ask of the data

Remember our focus is structure not content. We are not (we cheat a little here at one point) digging into the content of messages.

- Is gab growing, what drives the growth?
- Is gab a "social" network (friends interacting)?
- Is gab a "community" (in a loose sense)?
- Is gab controlled by an "elite"?

What drives growth on gab?



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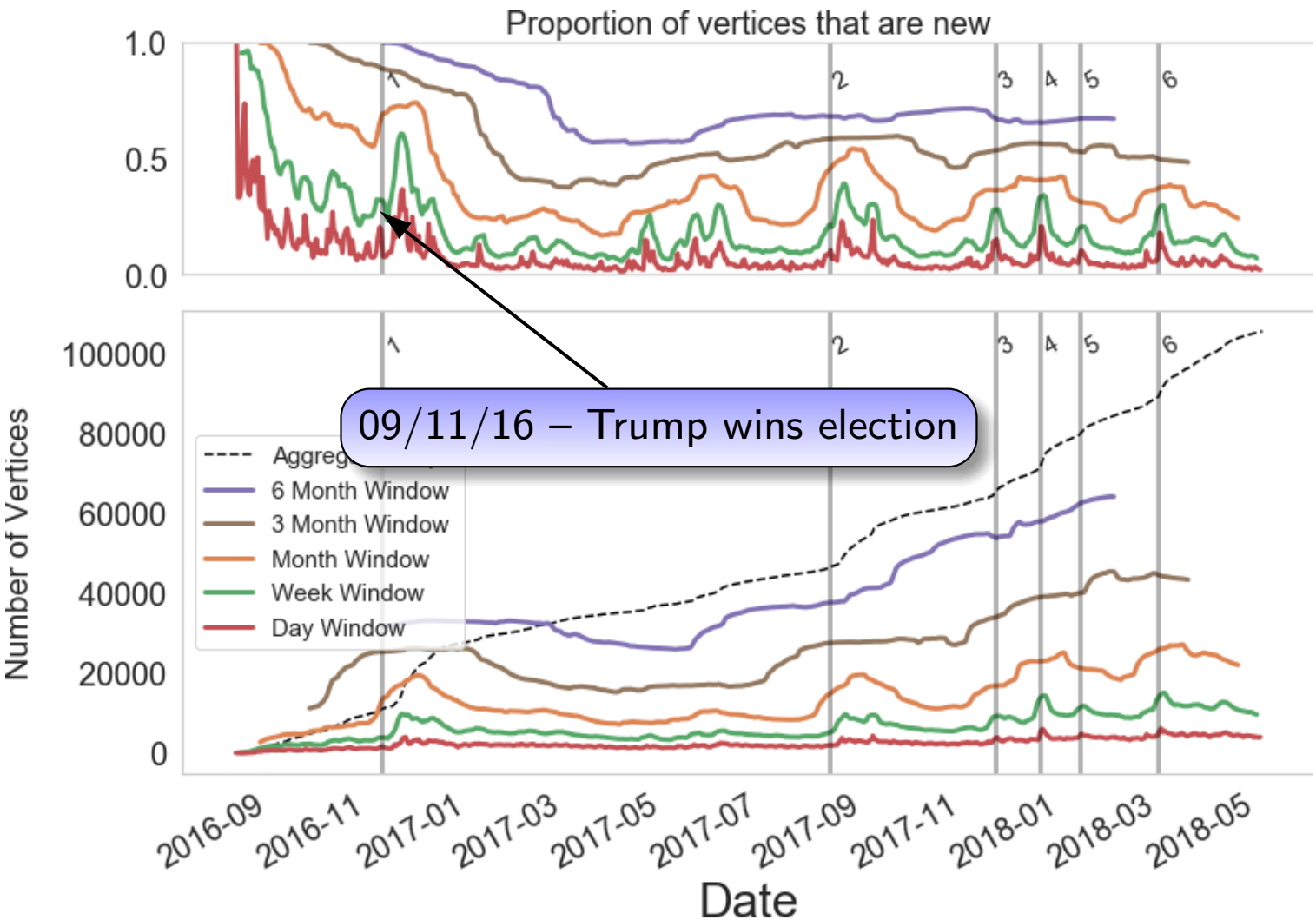

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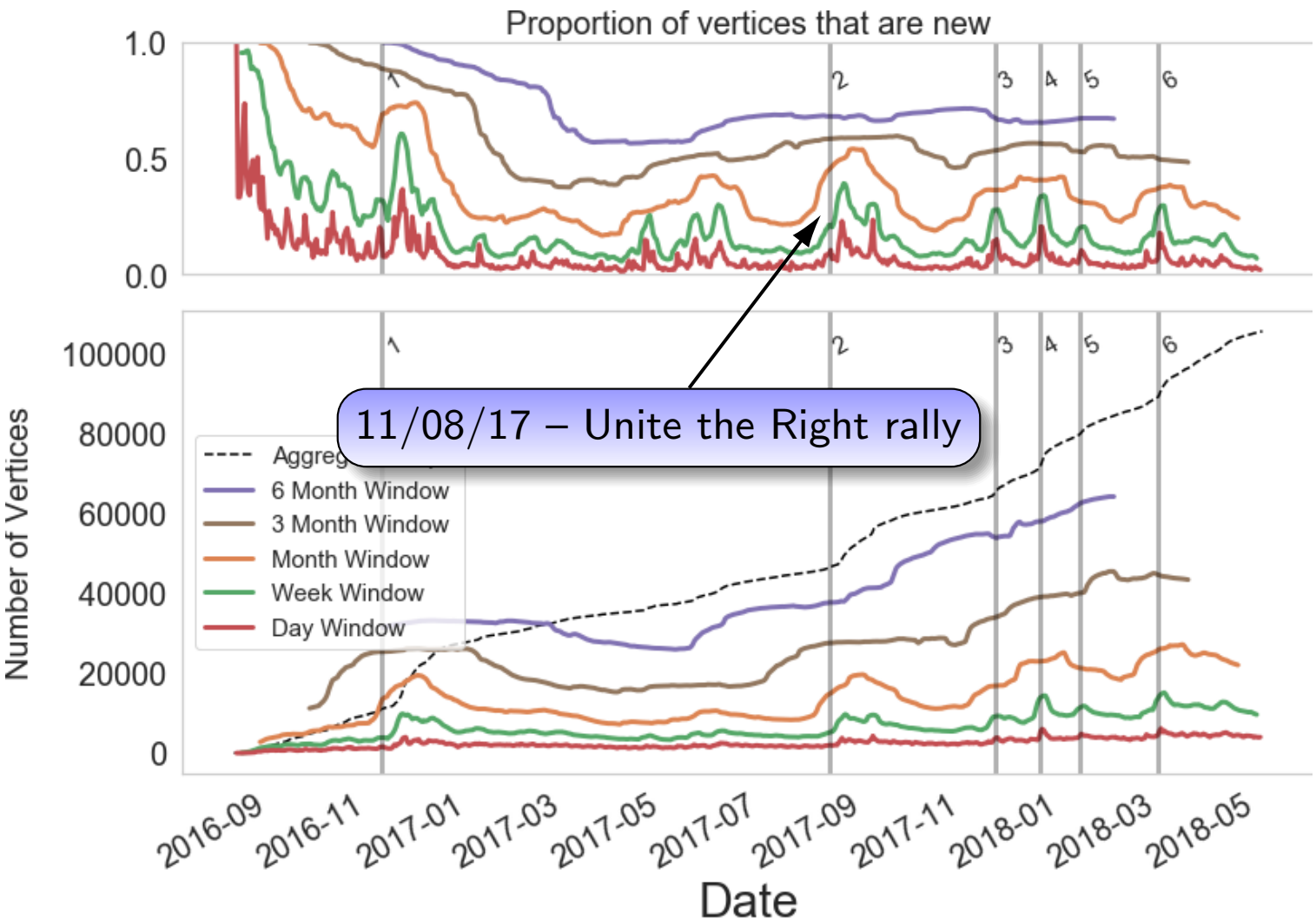

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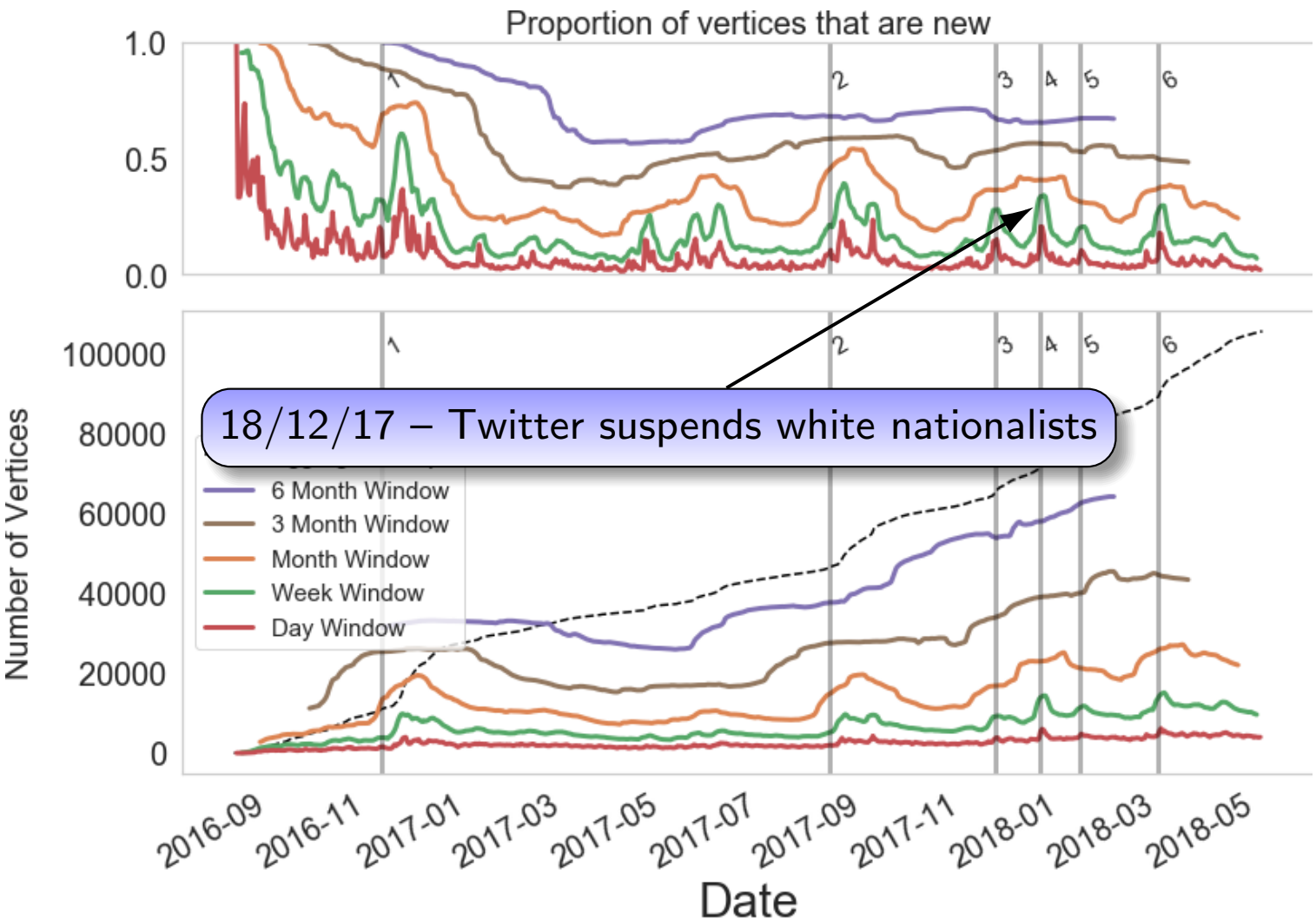

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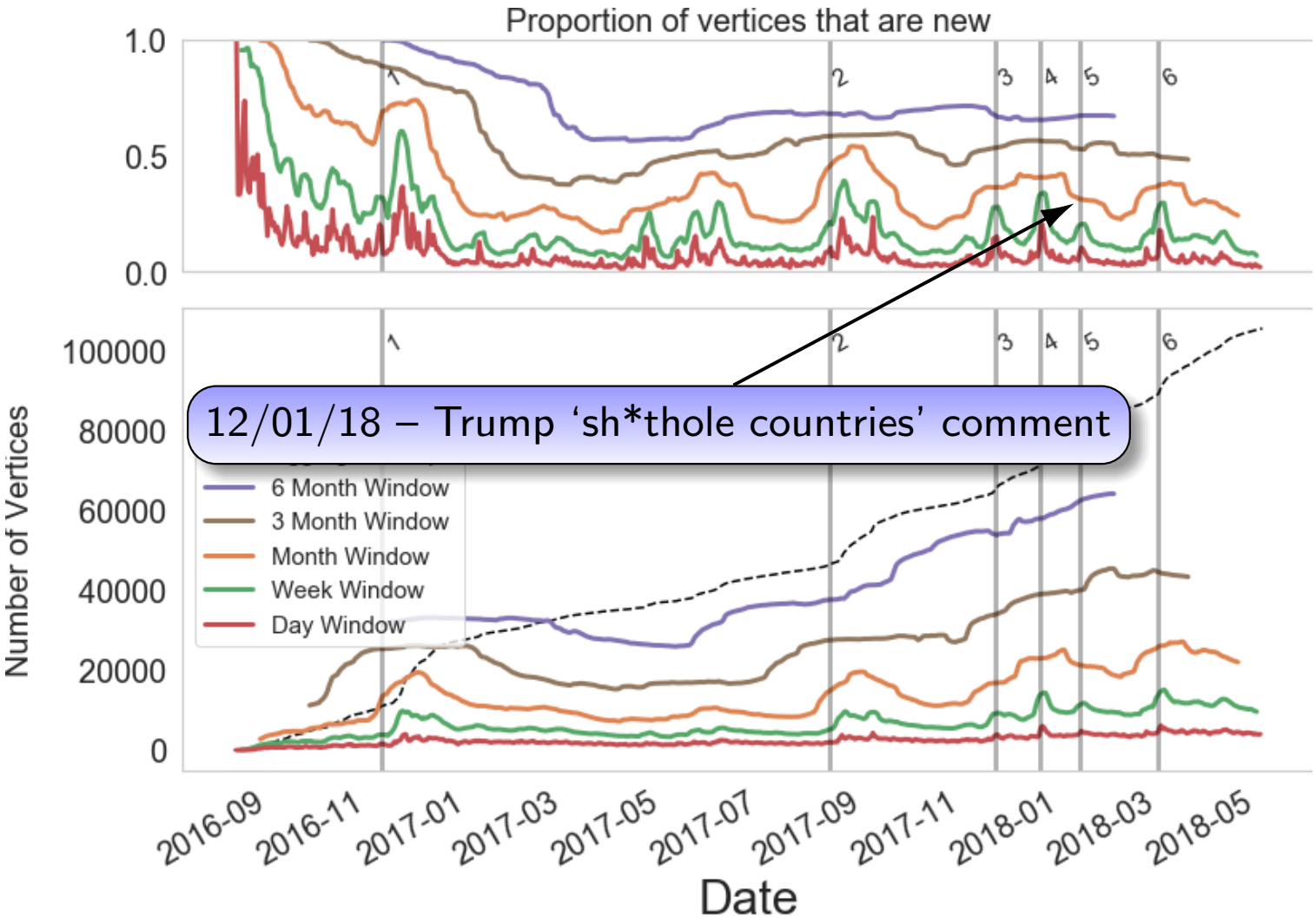

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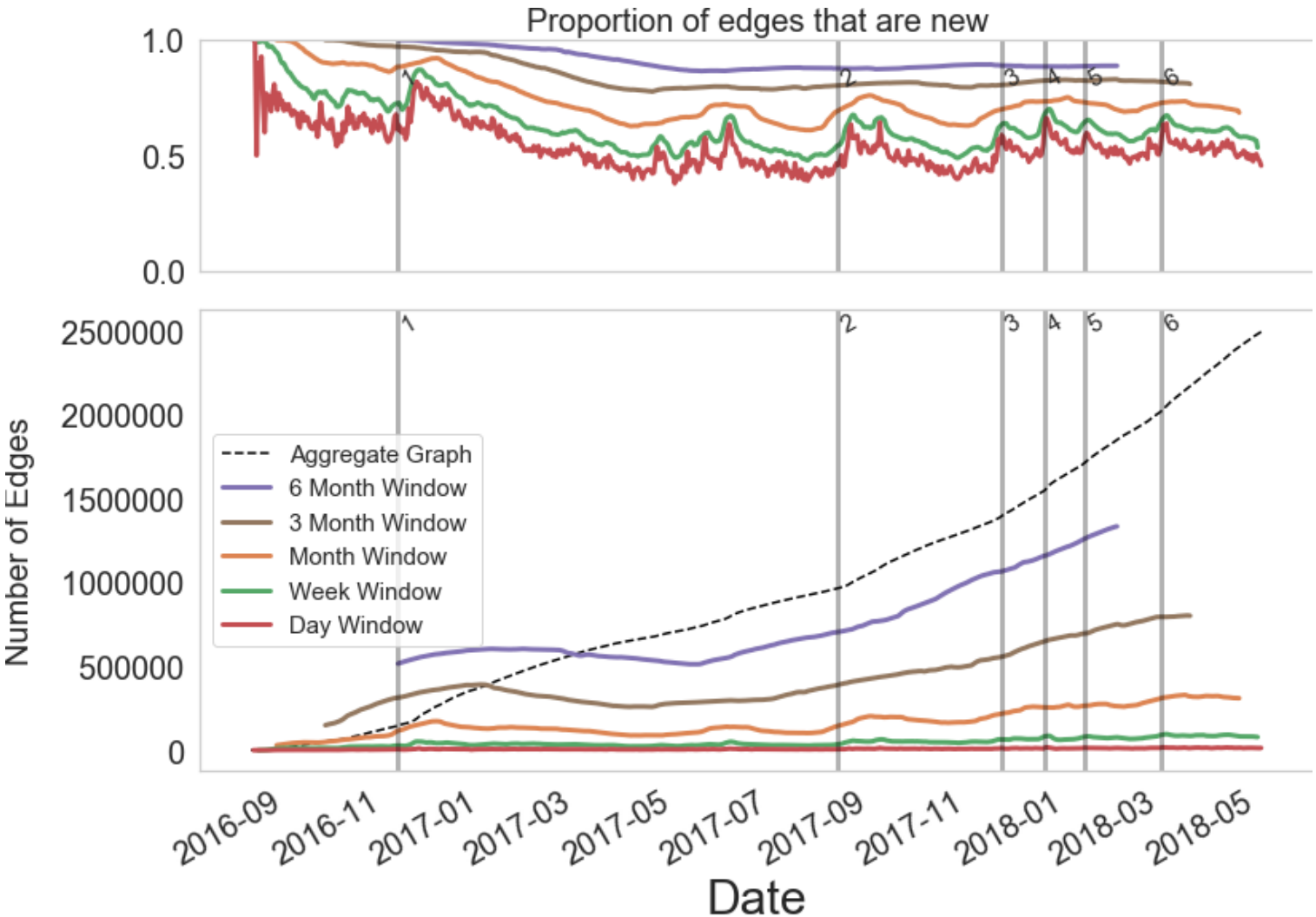

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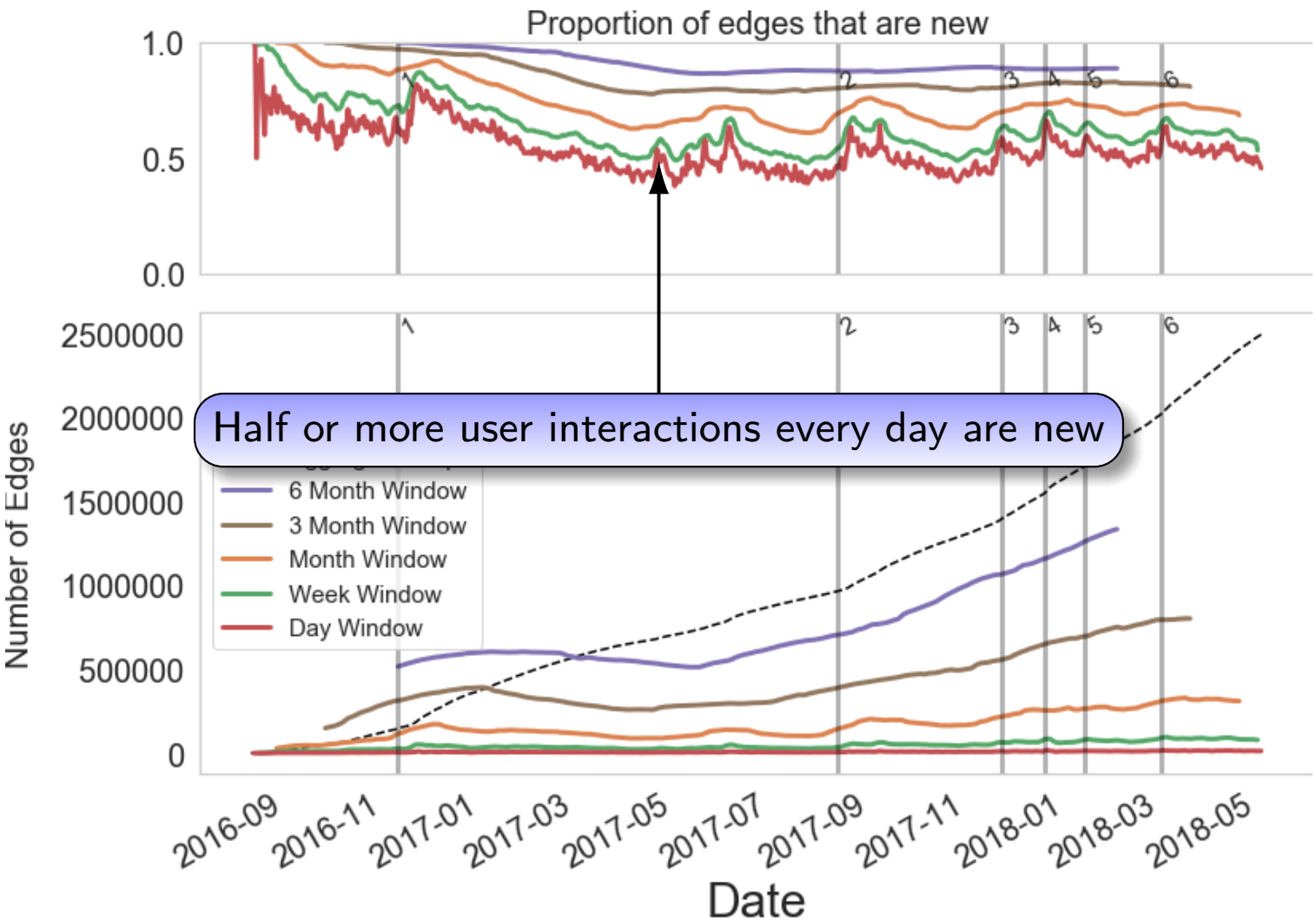

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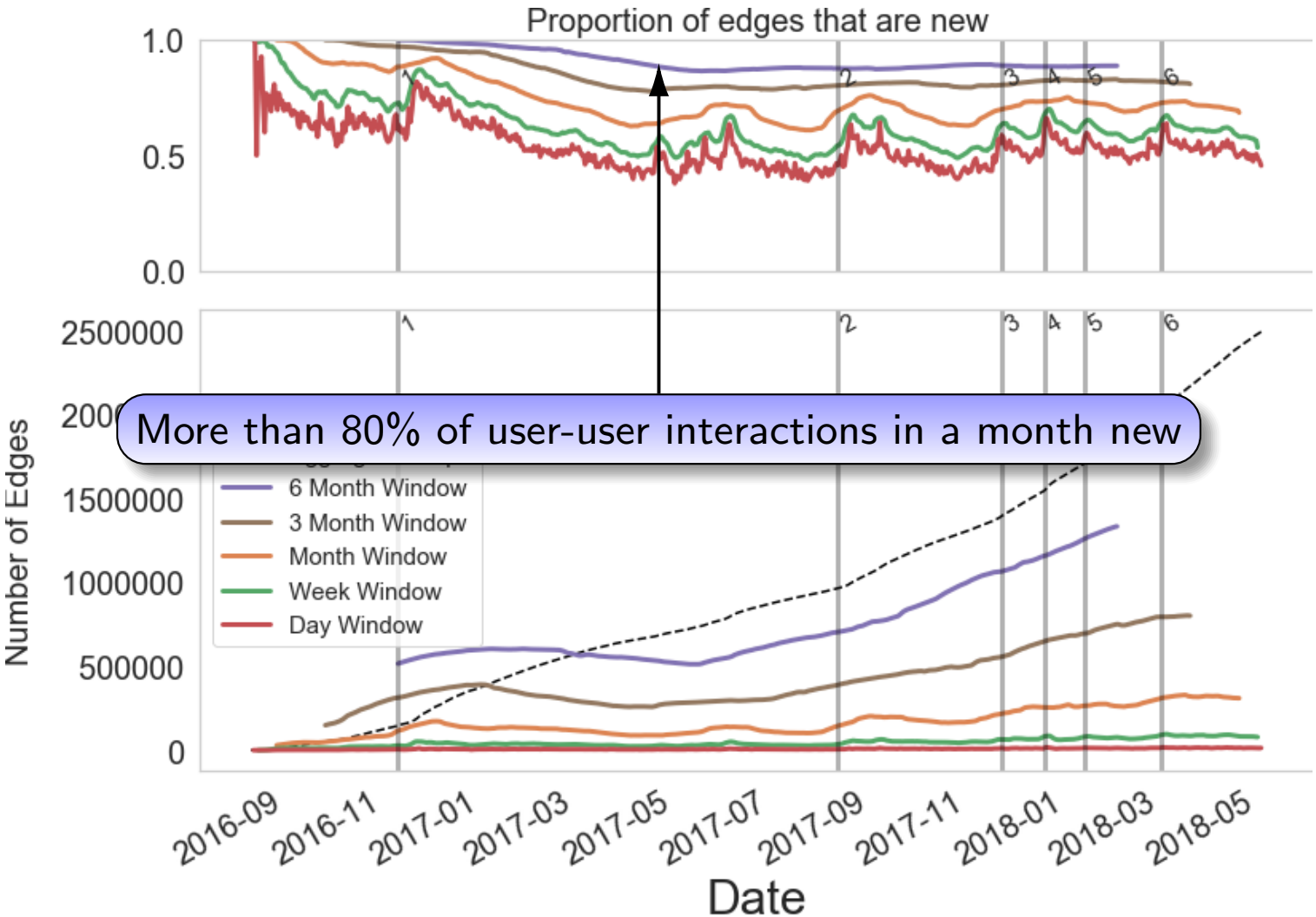

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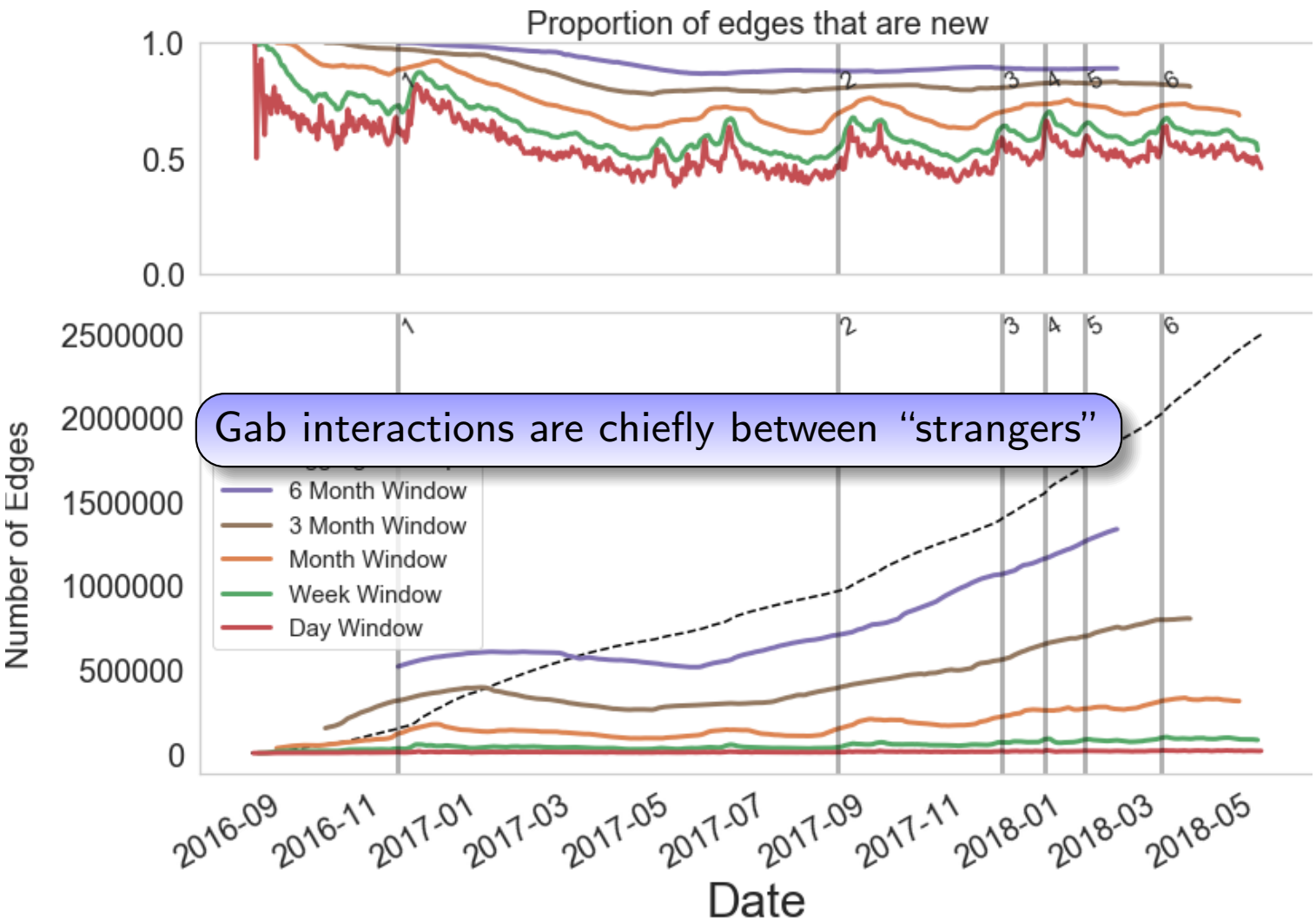

Is gab a community? Largest Connected Component

Definition:Connected component

A connected component is a sub graph of a graph within which all nodes can trace a path to each other. The largest connected component (LCC) is the one with the most nodes.

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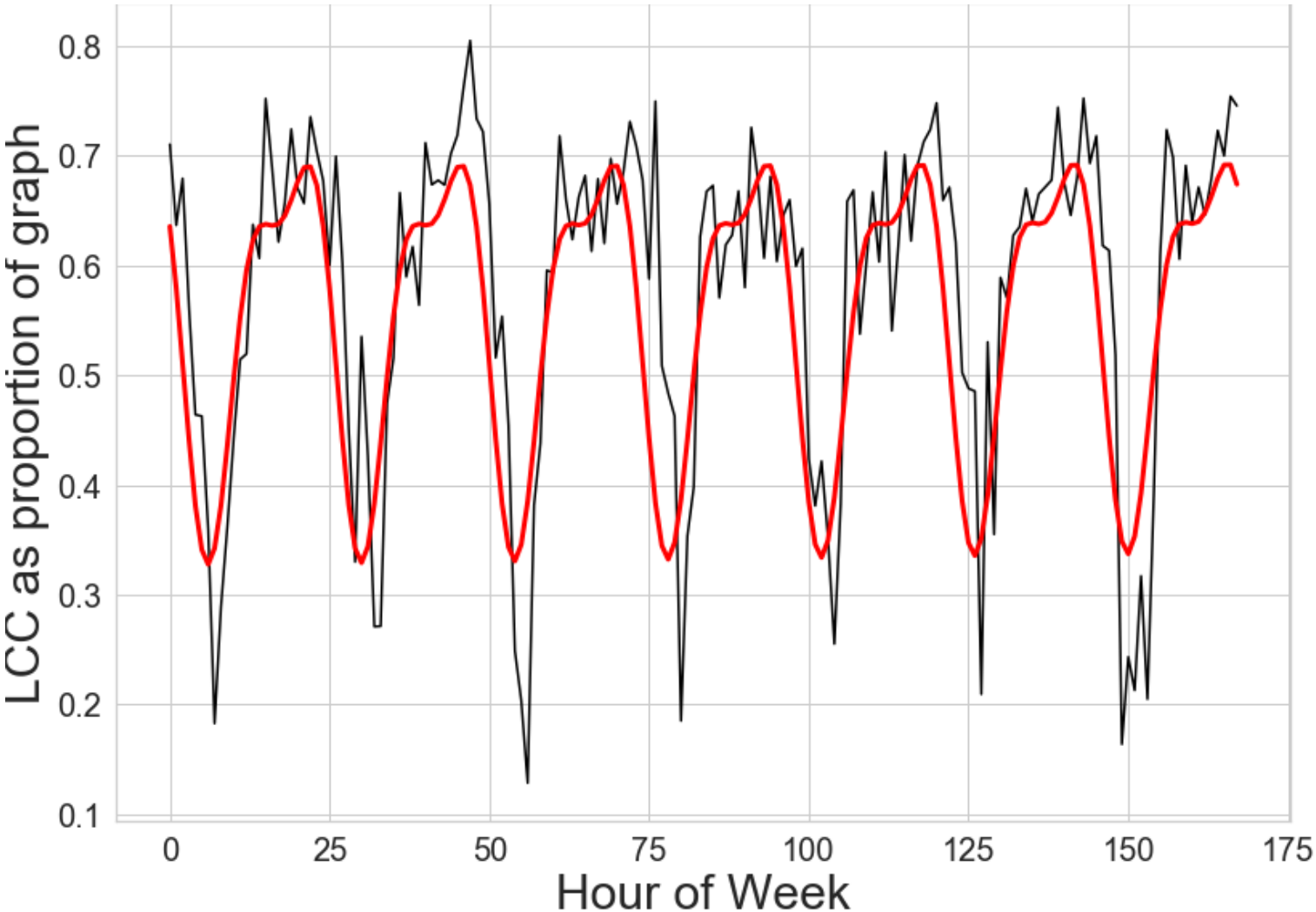
- LCC is size of the largest "community" (in loosest sense).
- Remember: only count people active within the window.
- Expectation: in a "large" window most users within the LCC.
- But what happens as we look at smaller and smaller windows?

Is gab a community? LCC (hour window)



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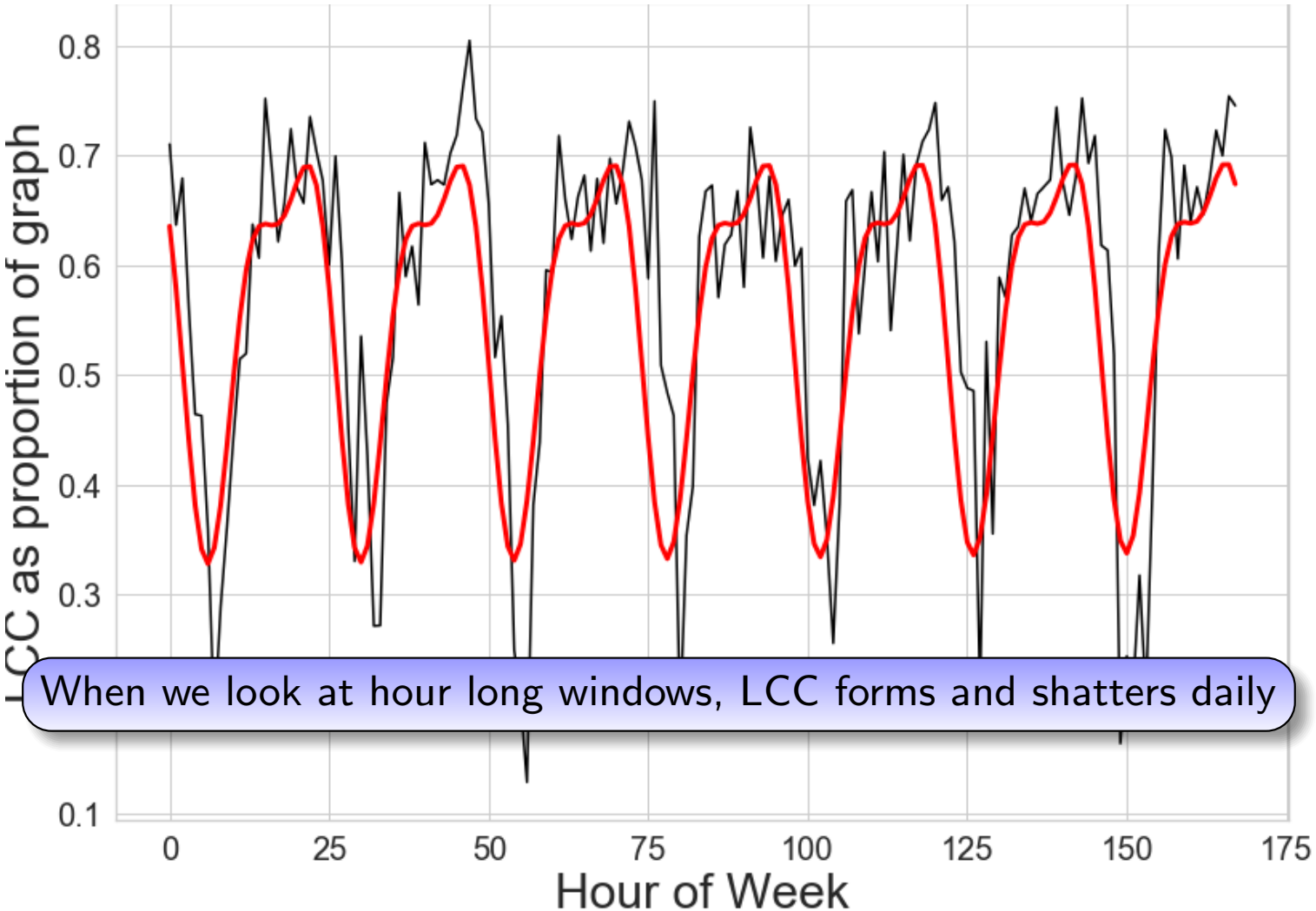

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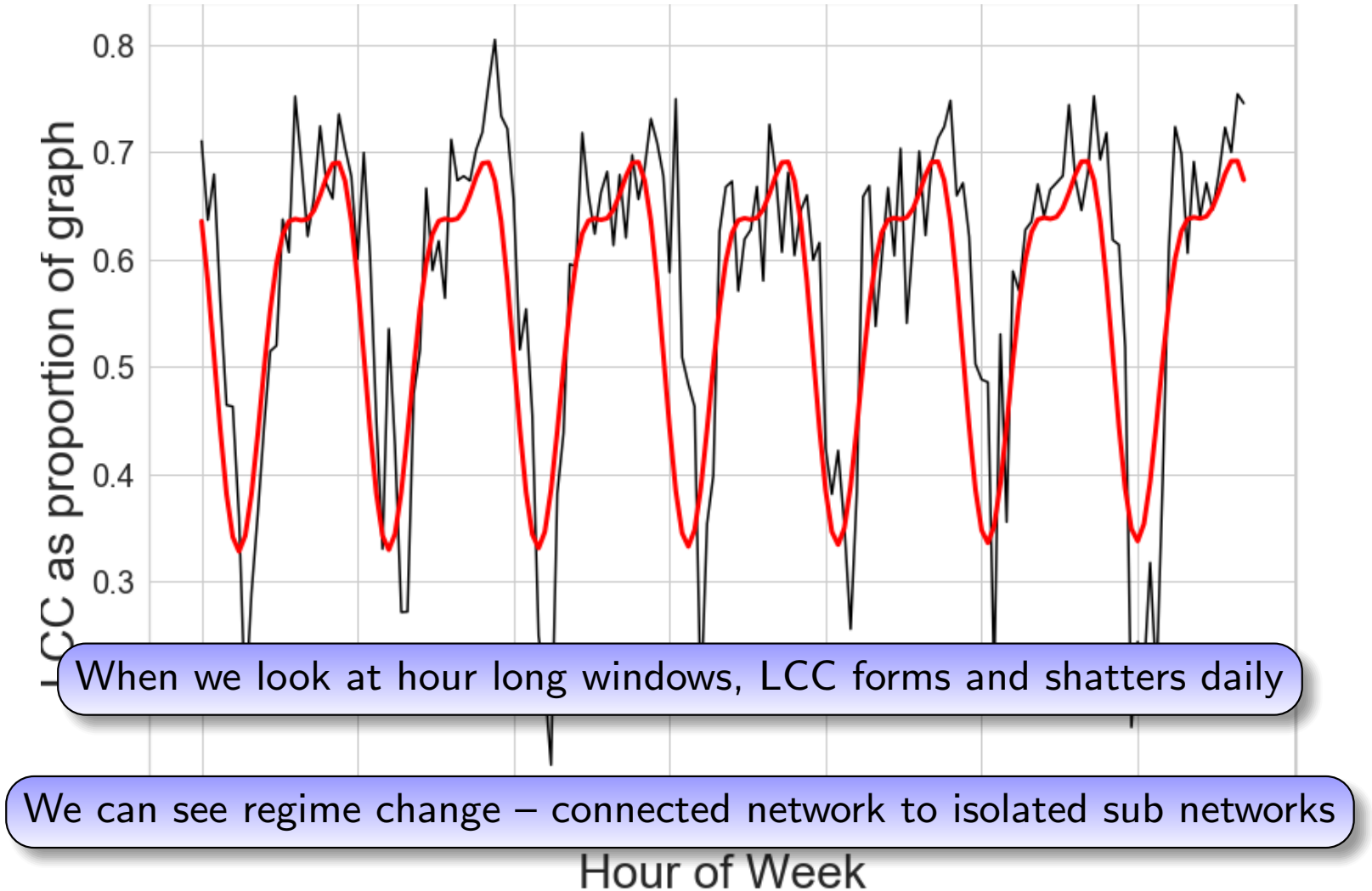

Is gab controlled by an "elite"?

- One measurement: Are the same people always most "talked about"?
- Proxy measurement: Node degree is the number of users who engaged with that user.
- Are highest degree nodes same between windows W_A and W_B?

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Jaccard Similarity (for top N users)

Let A, B be set of top N users in windows W_A, W_B.

$$J(A, B) = \frac{A \cap B}{A \cup B}.$$

Refresh rate top N users, windows W_A, W_B

Refresh rate $R = 1 - J(A, B)$

$0 \rightarrow W_A$ same users as W_B and $1 \rightarrow$ no users the same.

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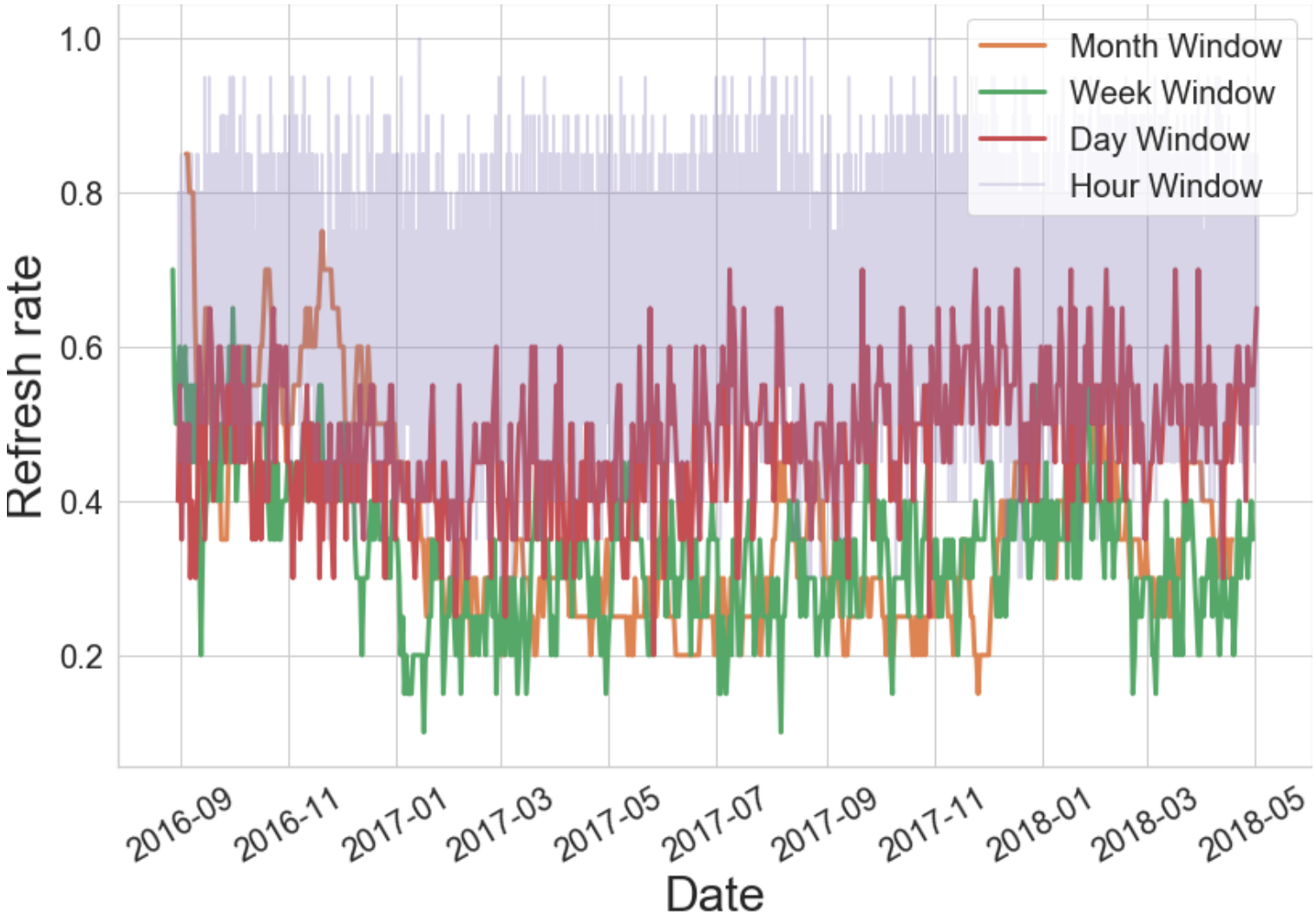

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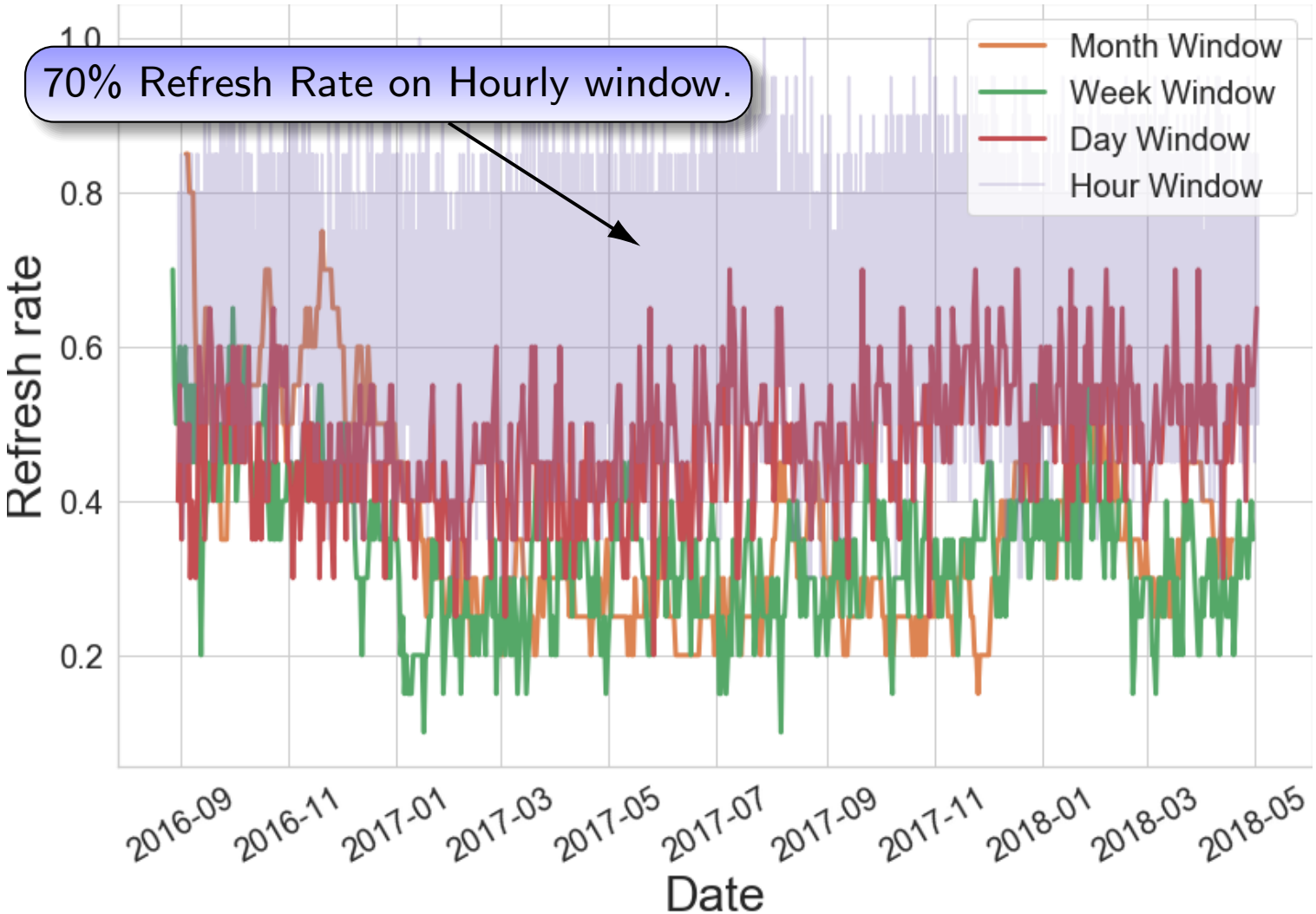

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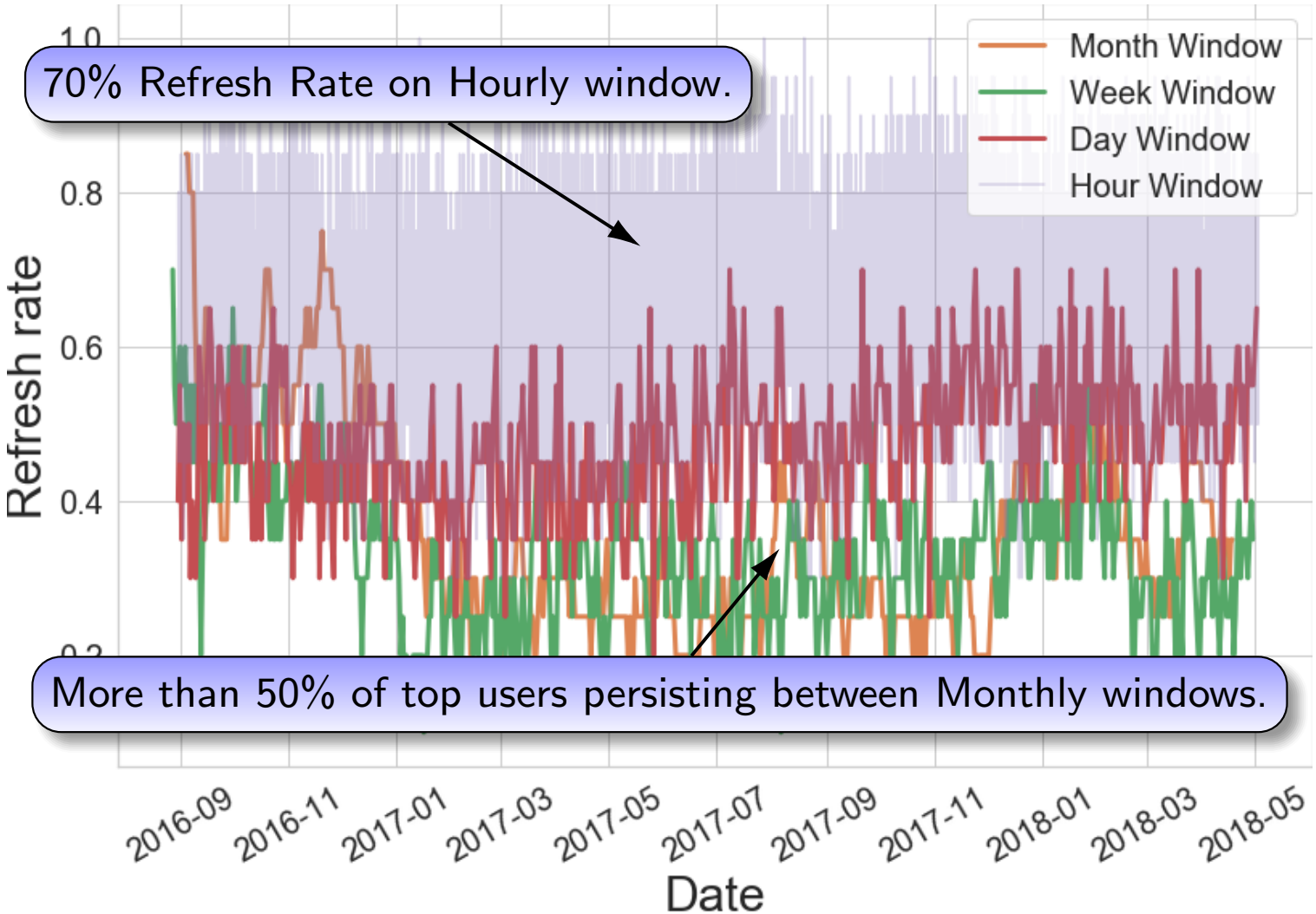

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- Gab is not a "social" network – interactions between "strangers" not friends.
- The interactions within Gab do not always form a "connected" community. We observed a daily shattering of the LCC and diurnal change of regime never observed before.
- Are a cadre of elite users controlling users' attention?
  Not clear: At longer timescales there is a group who receives a lot of attention. At only one timescale you will get a misleading answer.

Conclusions (about Raphtory and temporal networks)

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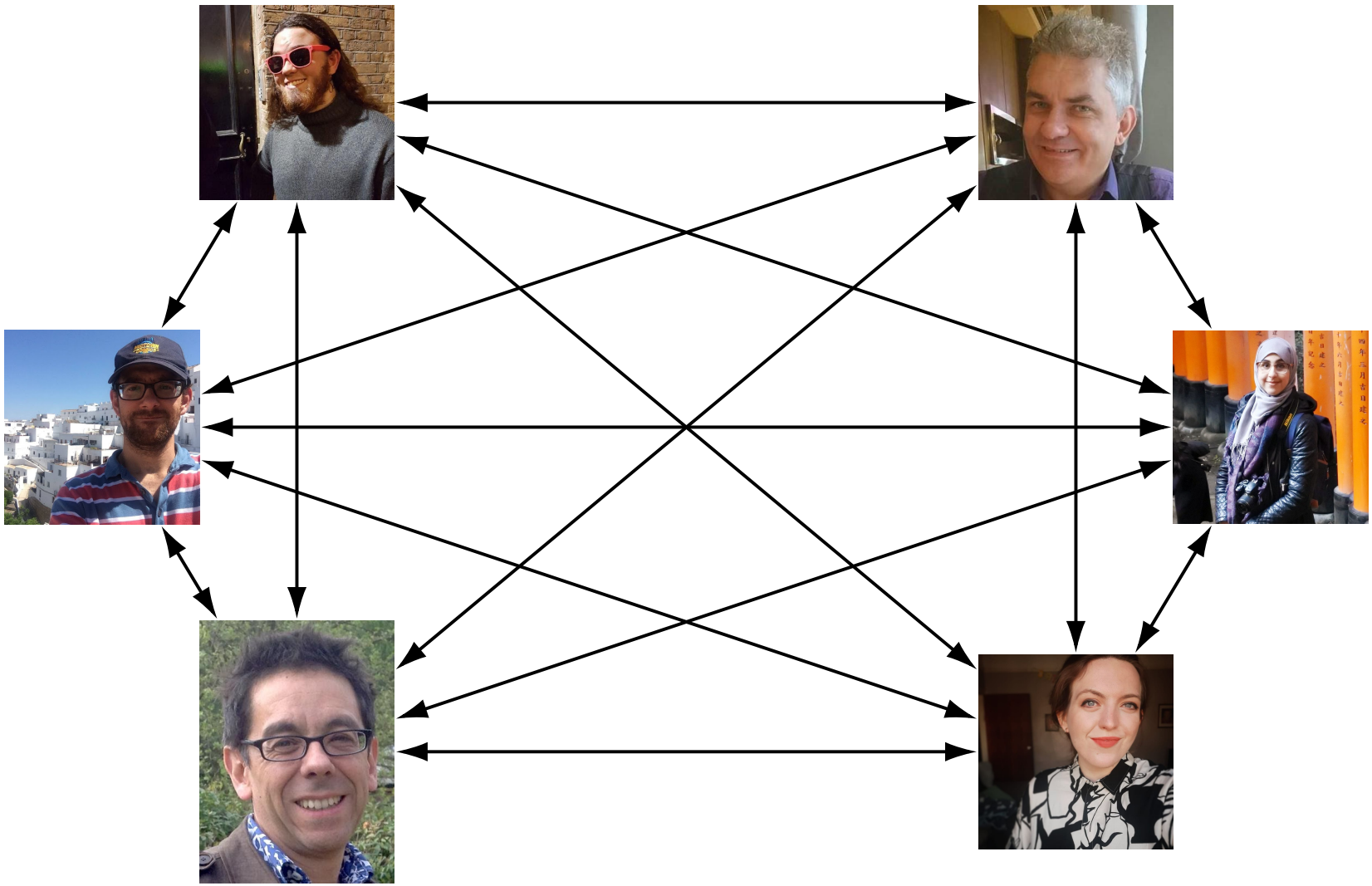
- Temporal networks provide a rich array of techniques that can get more out of your network data.
  - Window based analysis provides many levels of insight.
- The Raphtory tool is a great way to look at temporal graph data.
  - Urban analytics – intervention in social networks.
  - Bitcoin/blockchain – tracking "dark markets".
  - Semantic networks – changing word meanings.
  - Other social networks – compare and learn more.

Our Raphtory social network (a small subgraph)



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