



Analyzing Temporal Dynamics in Twitter Profiles for Personalized Recommendations on the Social Web

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The Social Web

Who is this? What are his *personal demands*? How can we make him happy?

Help me to tackle the *information overload*!

Recommend me *news* articles that *now* interest me!

Help me to find interesting *(social) media*!

**Personalize
my Web
experience!**

What we do: Science and Engineering for the Personal Web

domains: **news** **social media** **cultural heritage** **public data** **e-learning**

Personalized Recommendations

Personalized Search

Adaptive Systems

Analysis and User Modeling

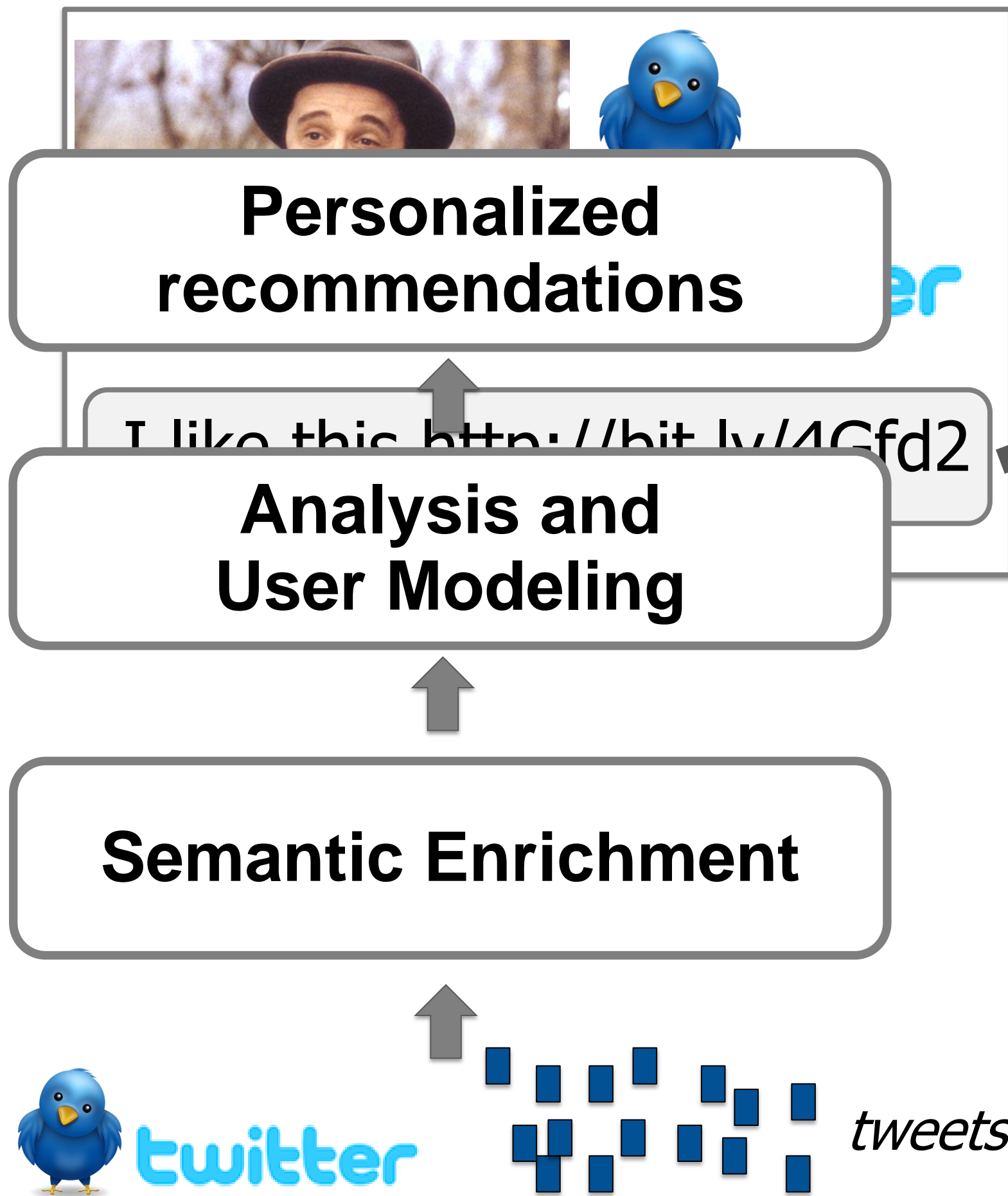
Semantic Enrichment

user/usage data

Social Web

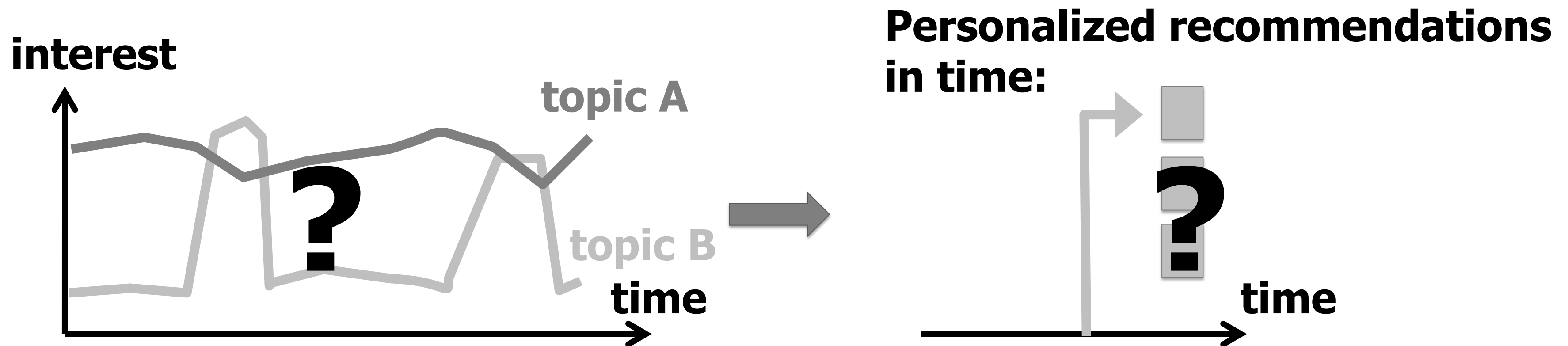


What we do in this paper



Research Questions

1. How do topics evolve over time?
2. How do Twitter-based user profiles evolve over time?
3. Can we exploit Twitter-based profiles for personalizing users' Social Web experience?



Dataset

more than:

20,000

Twitter users

4

months

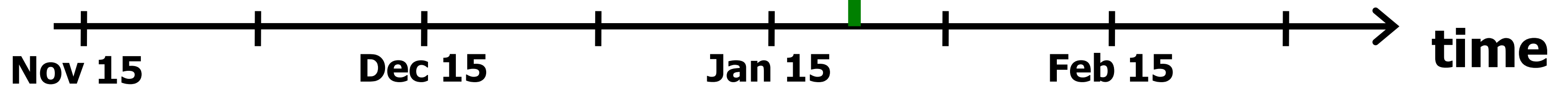
30,000,000

tweets

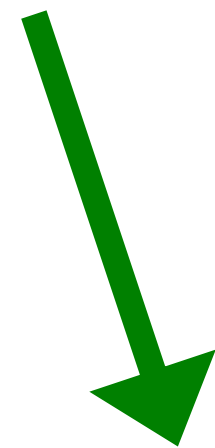


Egyptian revolution

Jan 25



What are topics? How can we represent a topic?

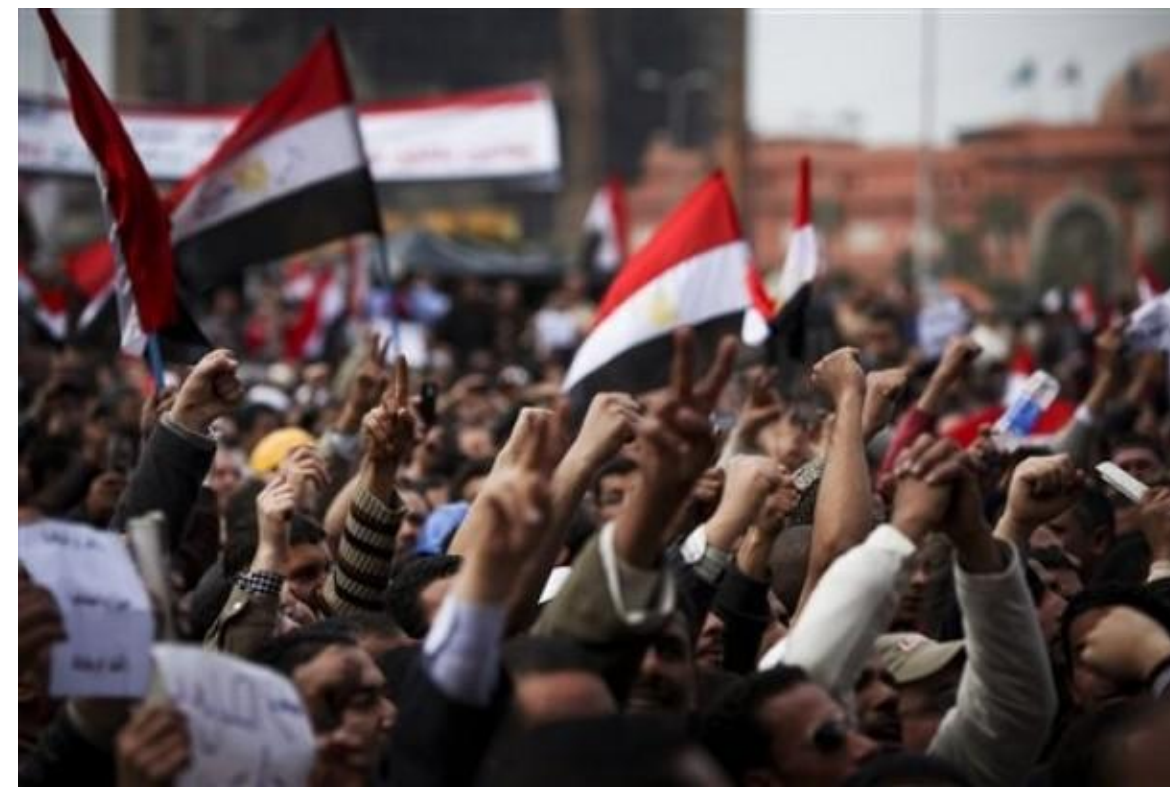


1. How do topics evolve over time?

Representing a topic: via entities (and hashtags)



Egypt



Topic = Egyptian revolution

#jan25

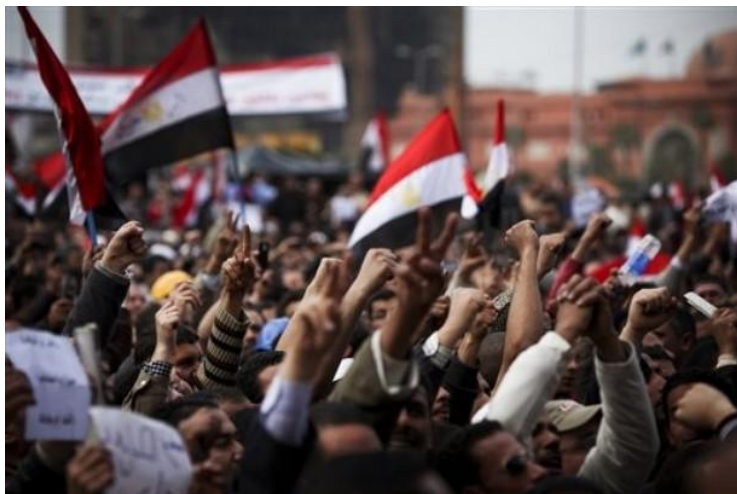
#tahrir



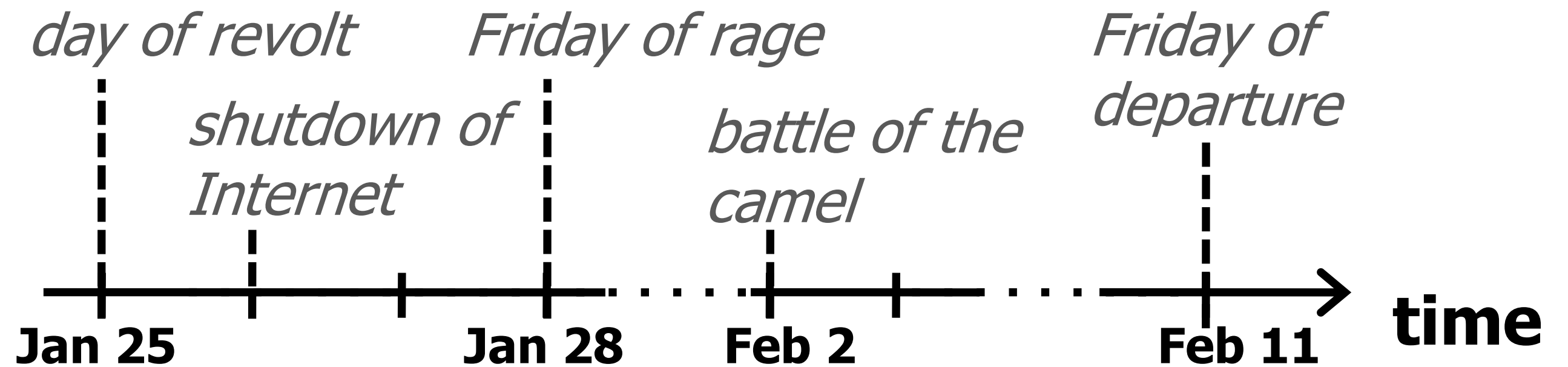
Mubarak



Cairo

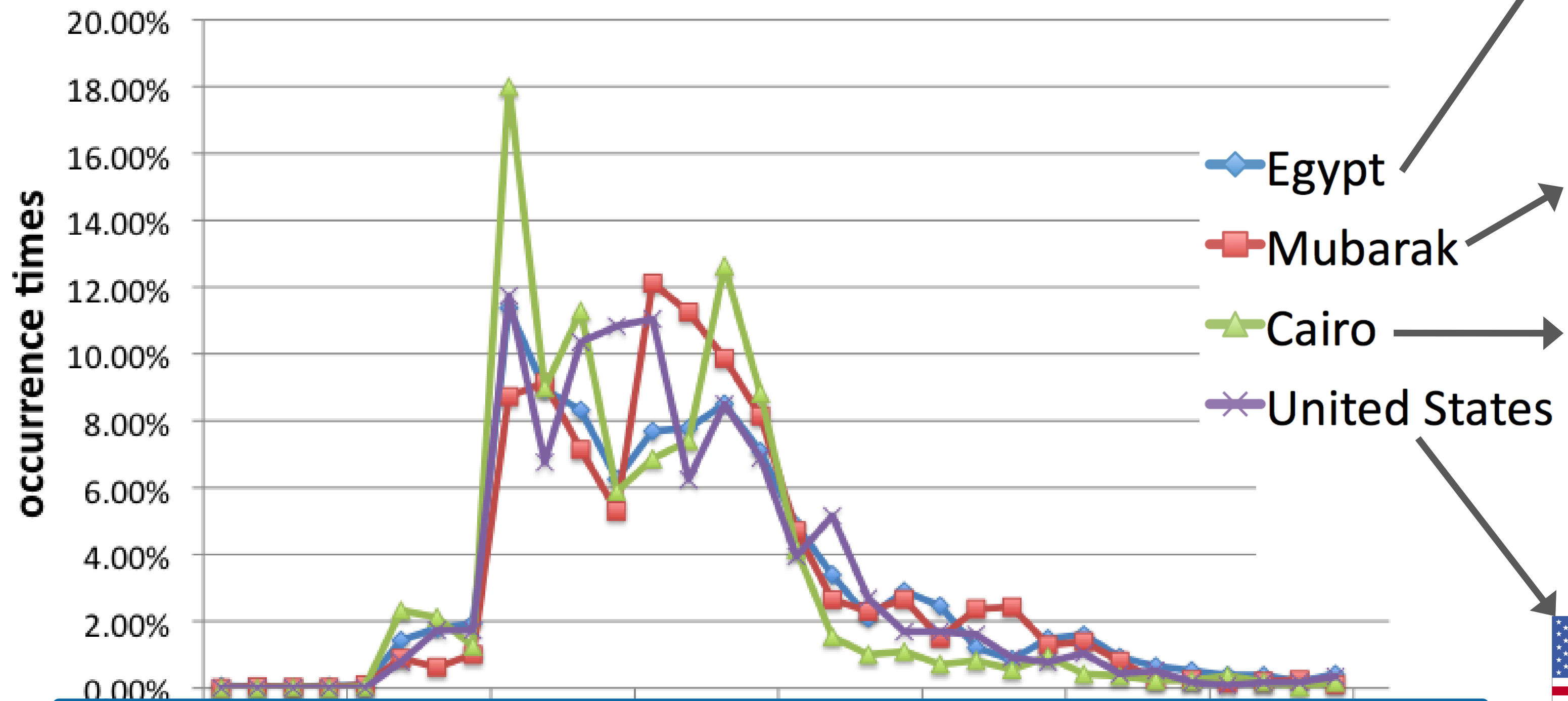


Egyptian revolution



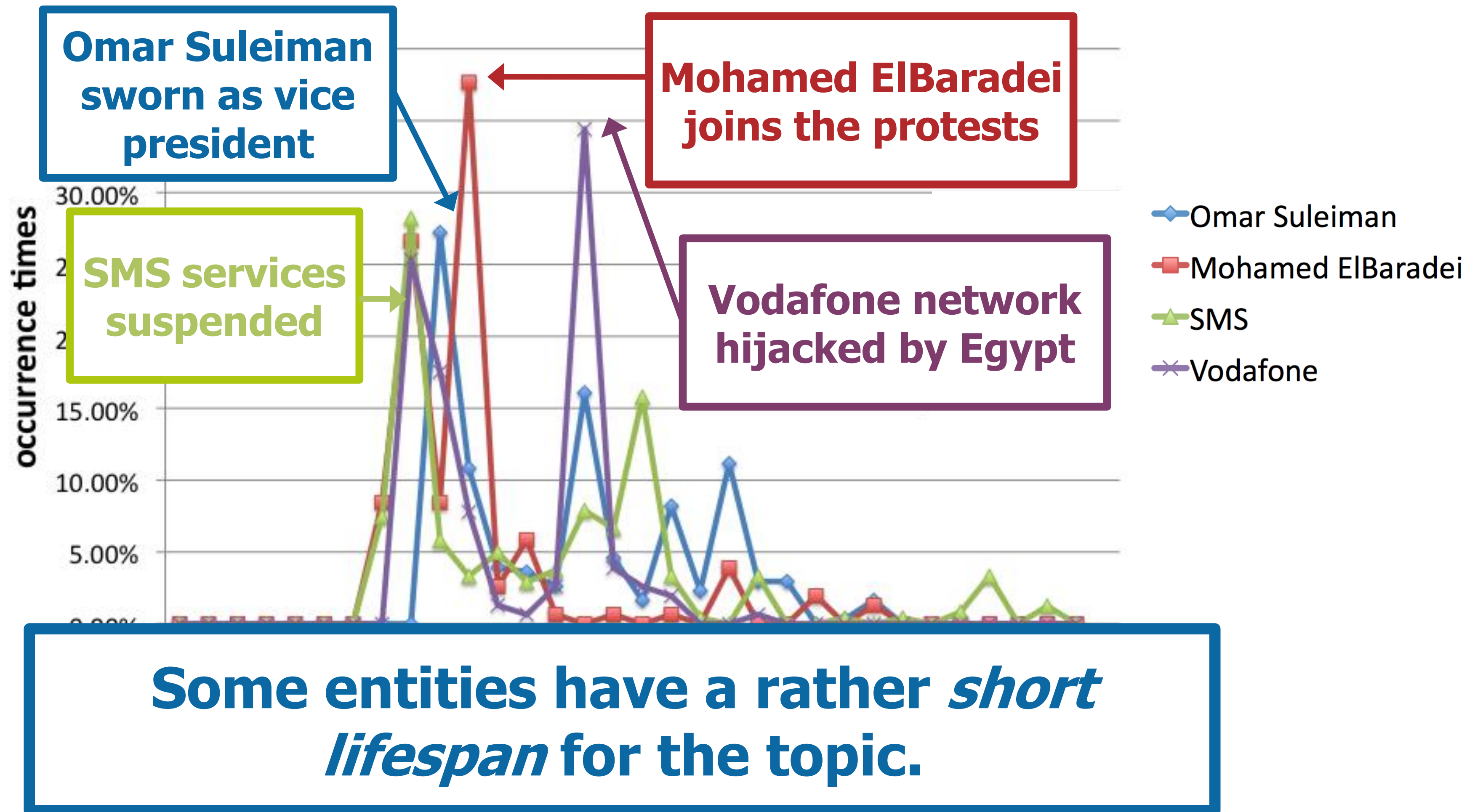
1. How do topics evolve over time?

Popularity of related entities over time



Some entities are continuously relevant for a topic (*long lifespan* for the topic).

Popularity of related entities over time (cont.)



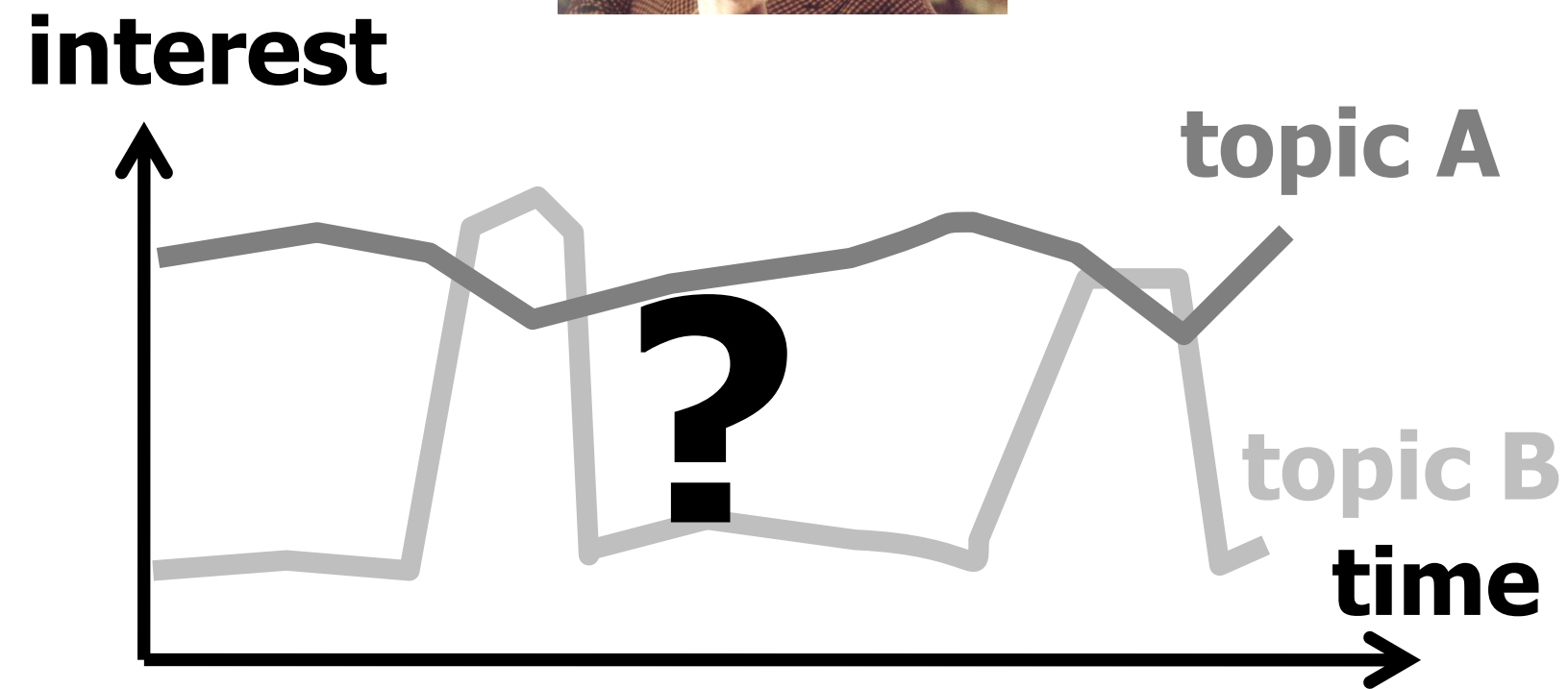
1. How do topics evolve over time?

→ *Observations*

Importance of entities that represent a topic varies over time
(*long-term vs. short-term lifespan of entities*)

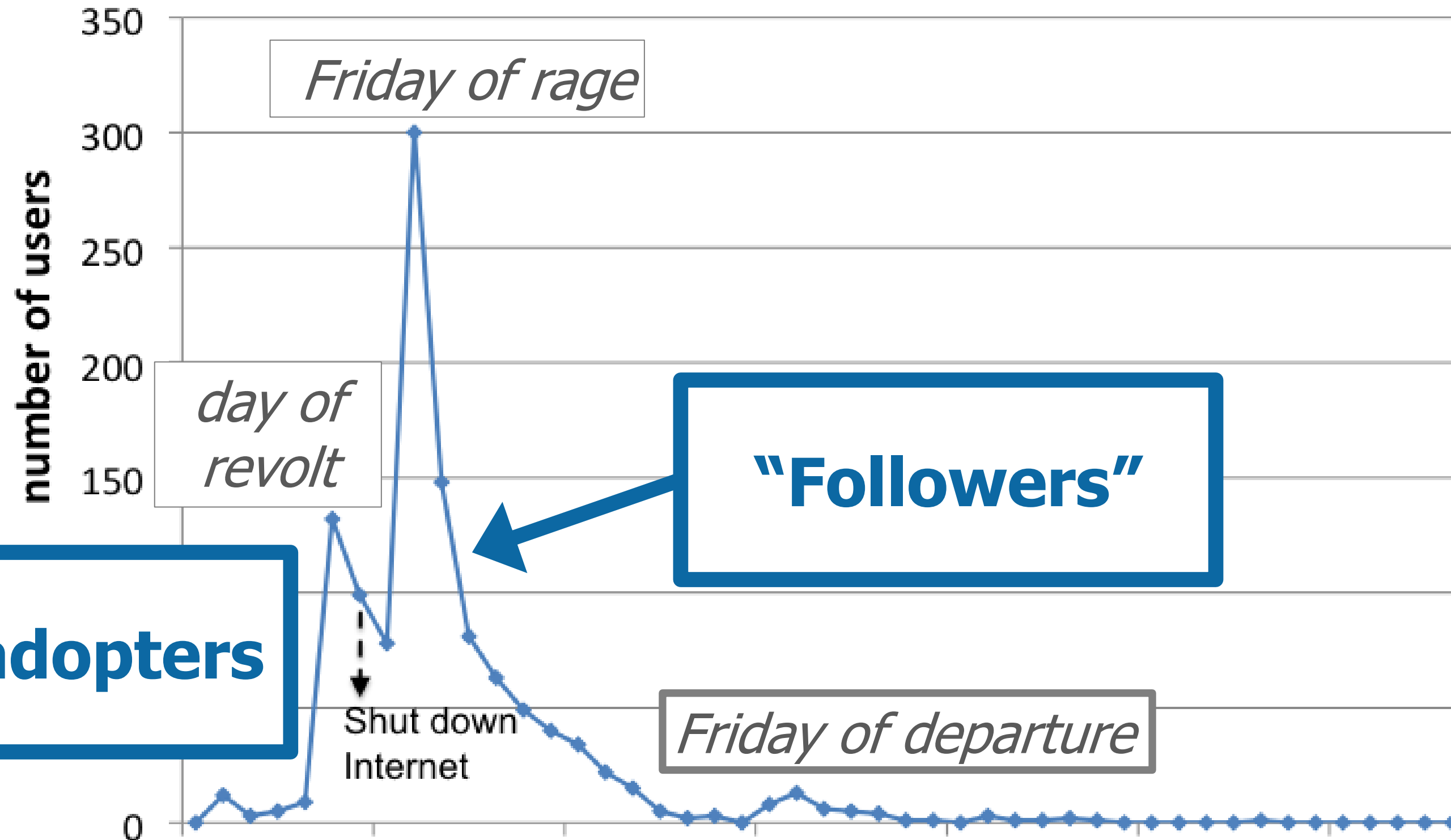
→ **Representation of a topic (topic profile) depends on the time when it is requested**

(When) is Bob interested into the topic?



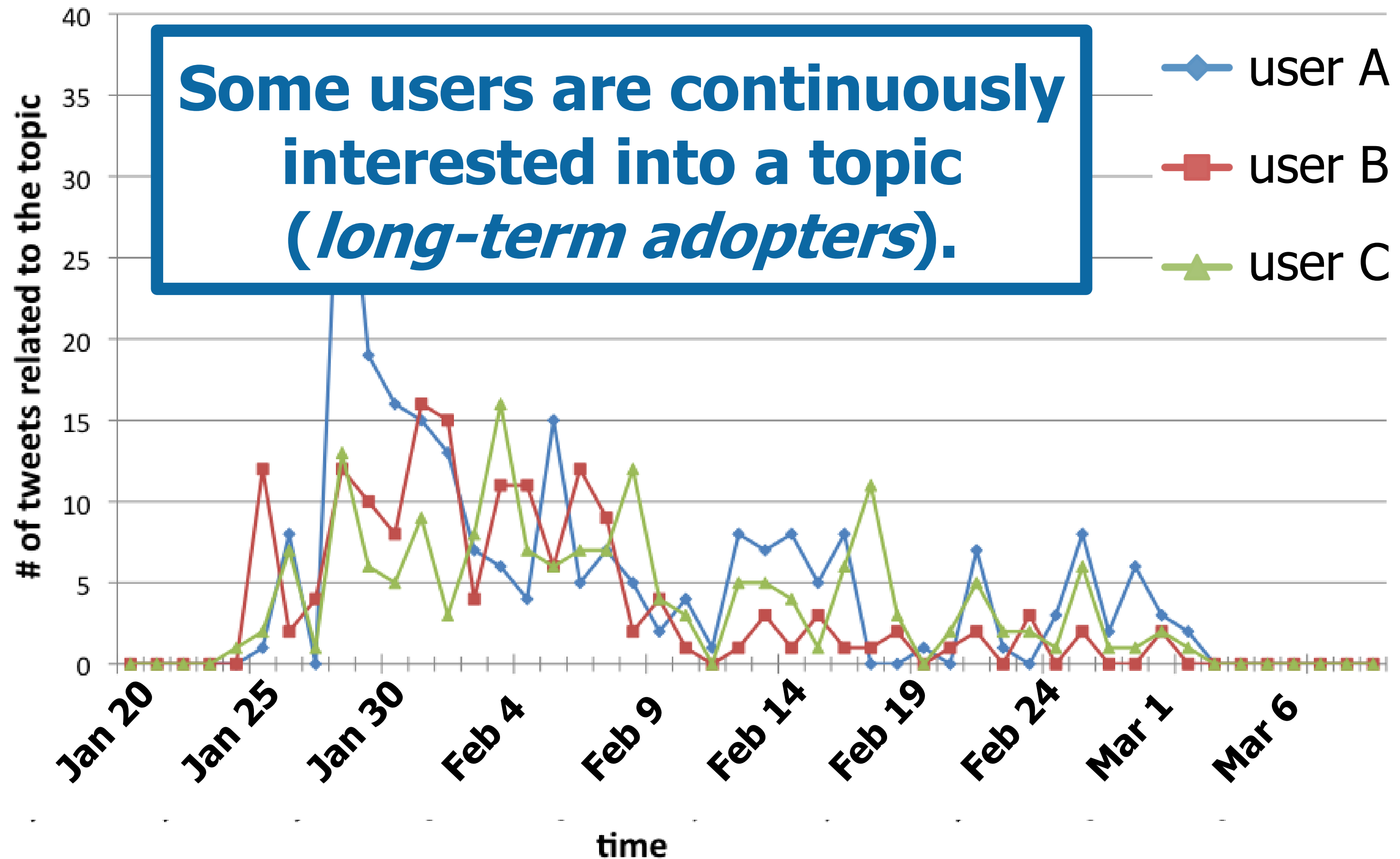
2. How do the interests of individual users into a topic change over time?

When do users become interested?

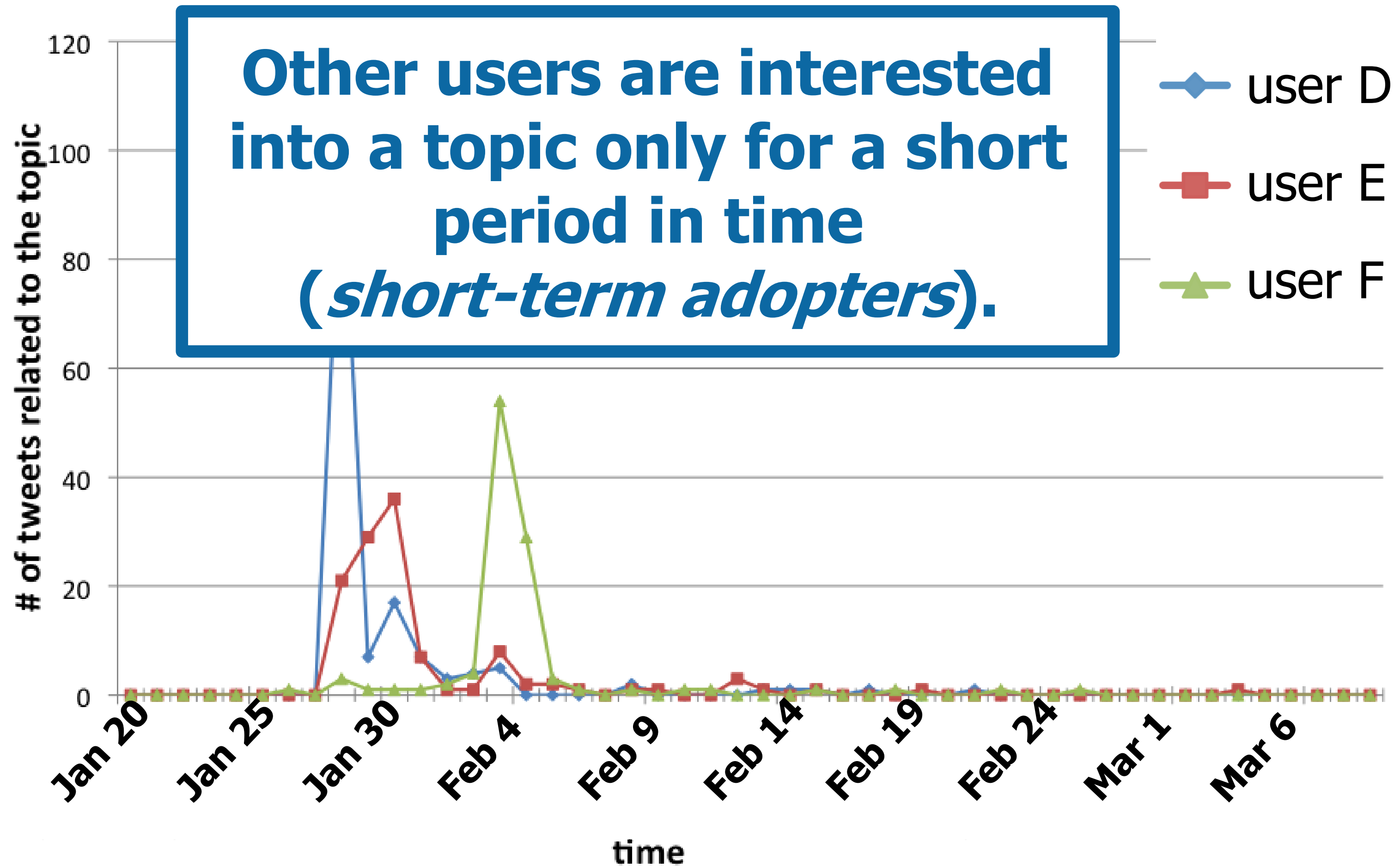


If a user becomes interested into the topic then she become interested within a few days

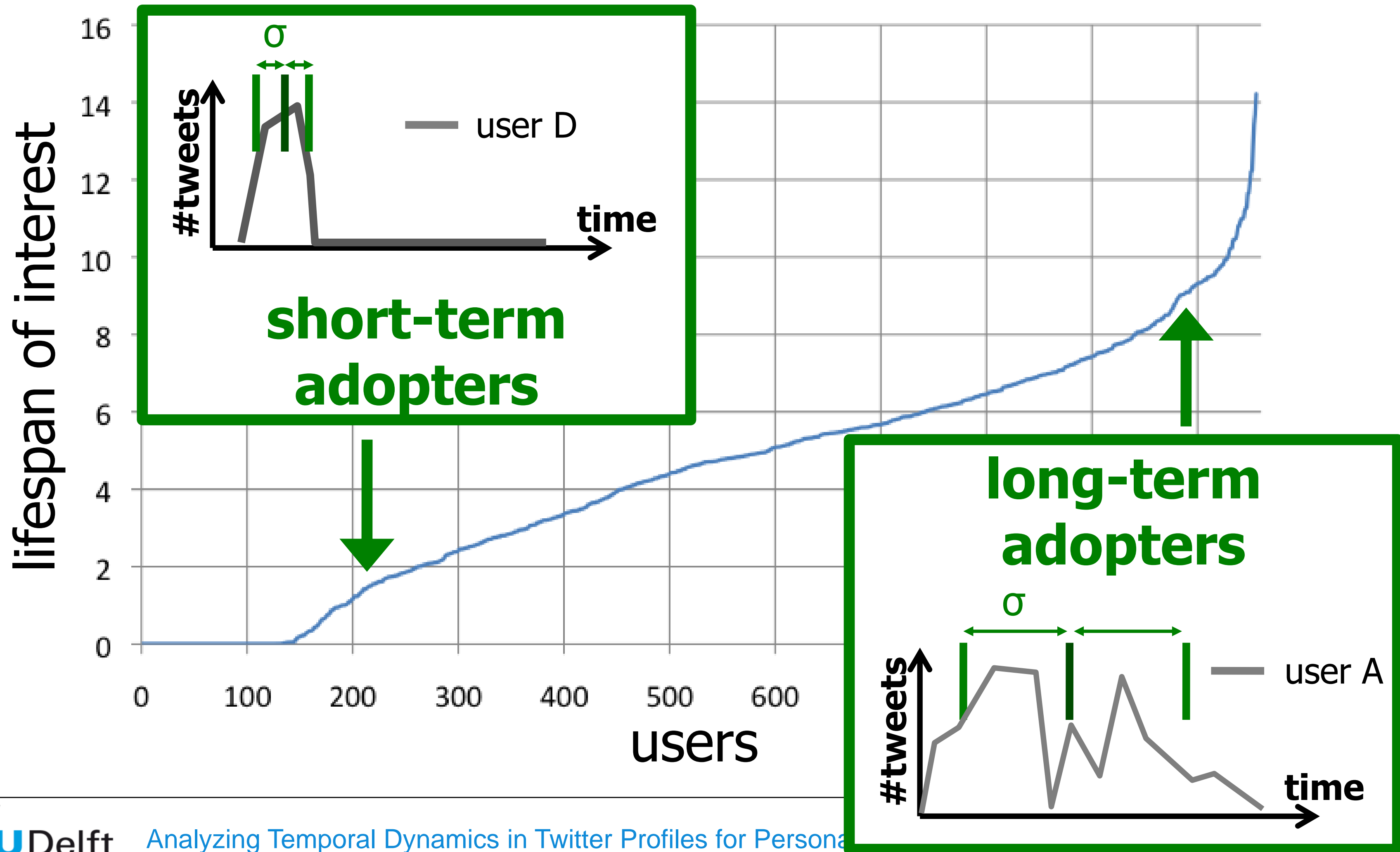
Users' interests over time



Users' interests over time (cont.)



Users' interests over time (cont.)

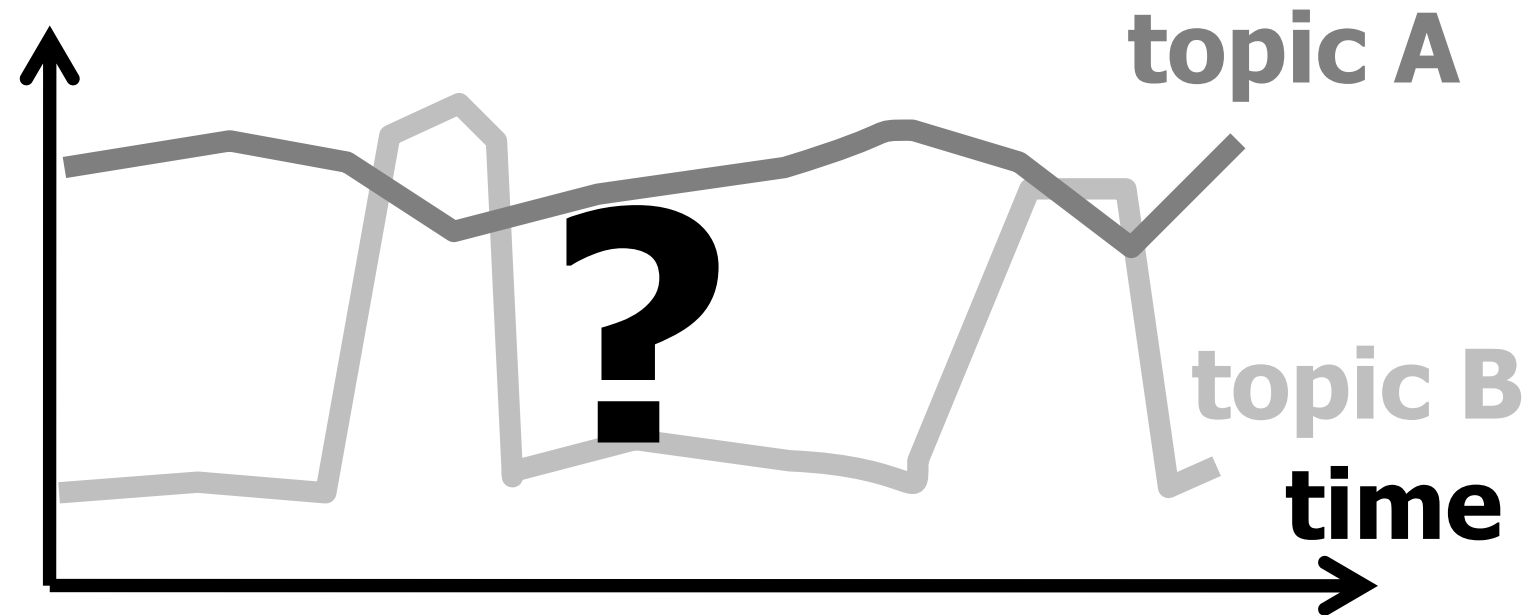


2. How do the interests of individual users into a topic change over time?

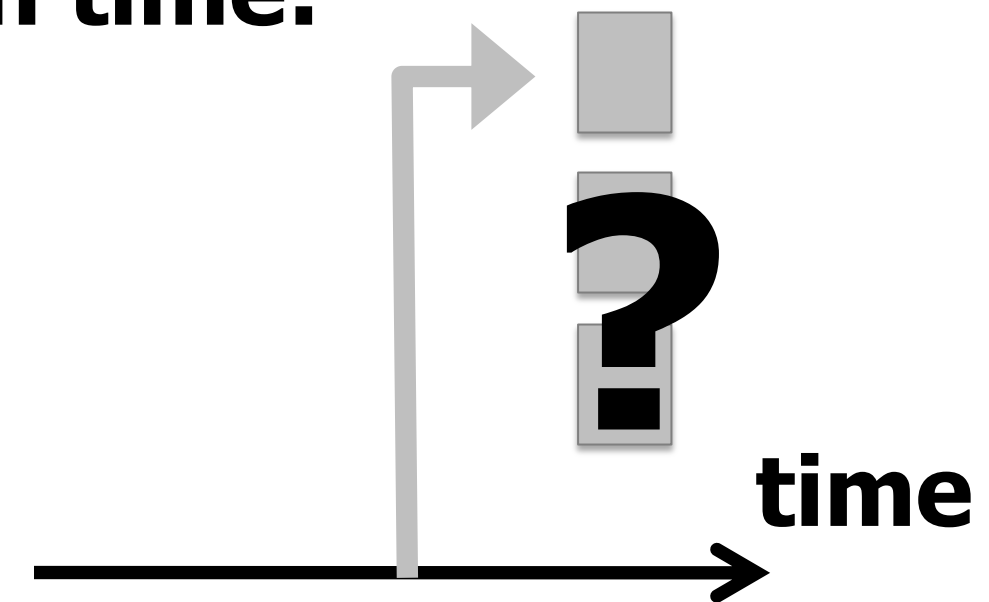
→ *Observations*

- Most users, who are interested into the topic, become interested within a few days
- Lifespan of users' interest:
 - *Long-term adopters*
 - *Short-term adopters*
- High overlap between early adopters and long-term adopters

interest



Personalized recommendations
in time:



3. Can we exploit Twitter-based profiles for personalizing users' Social Web experience?

Twitter-based user profiles

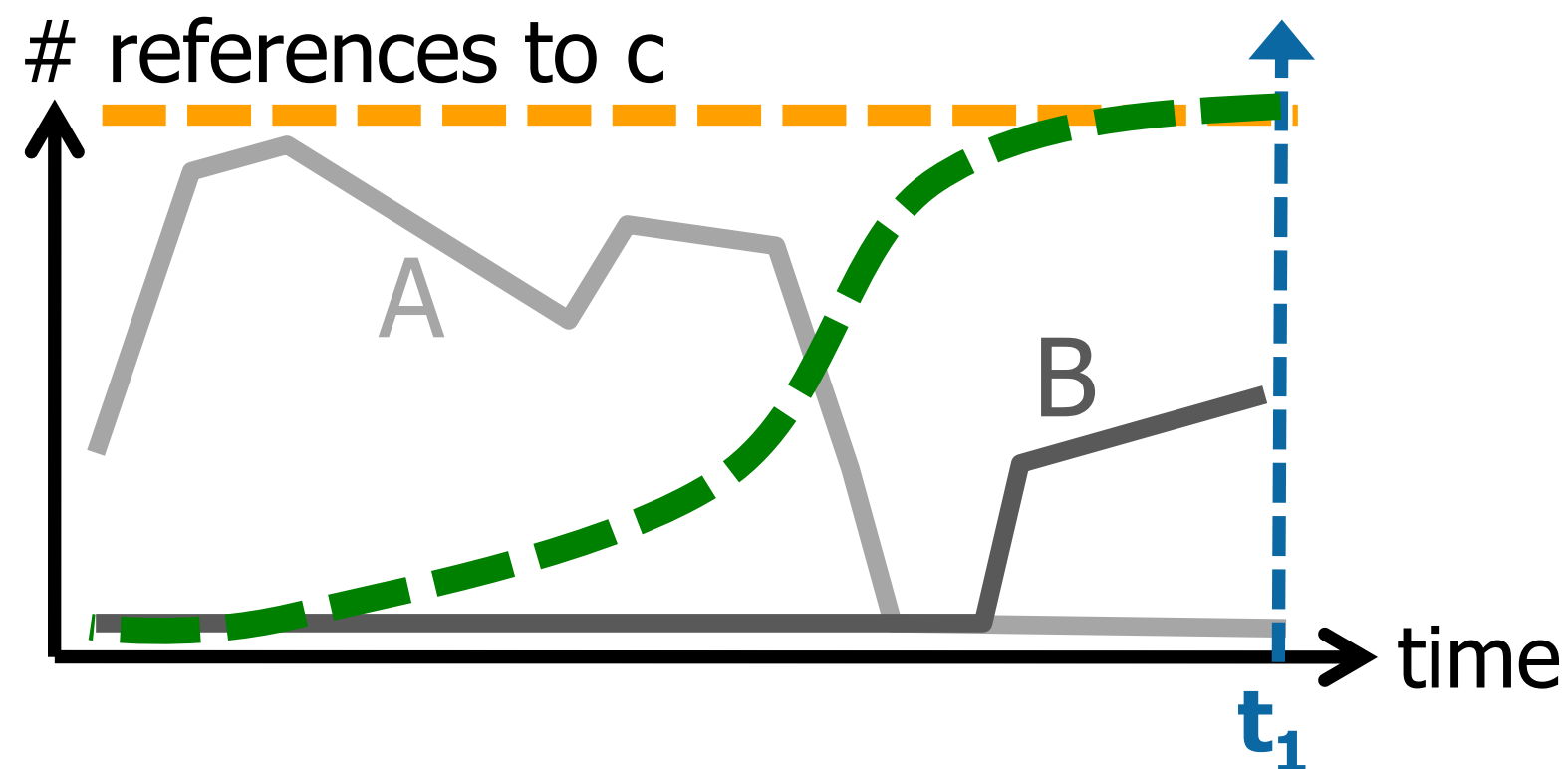
User Profile:

$$P(u, time) = \{(c, weight(c, time, T_u)) \mid c \in C_H \cup C_E\}$$

Profile type:

i) Hashtag-based vs. ii) Entity-based

References of user u to concepts A and B:

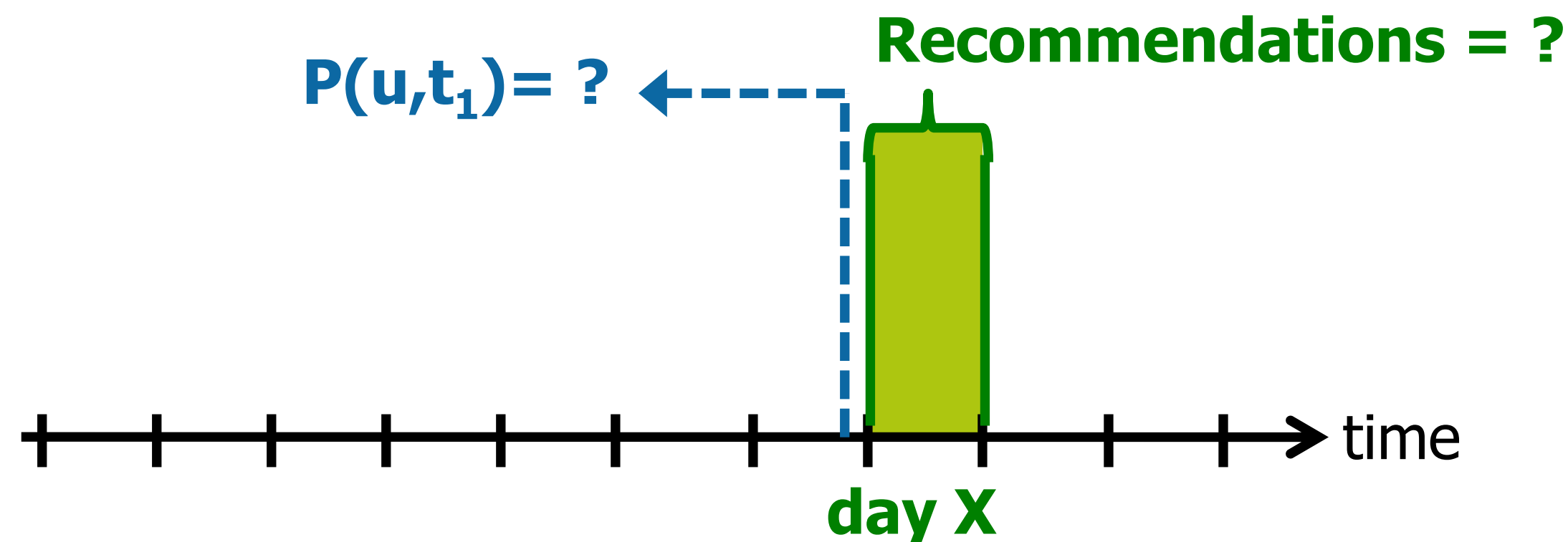


Weighting schemes:

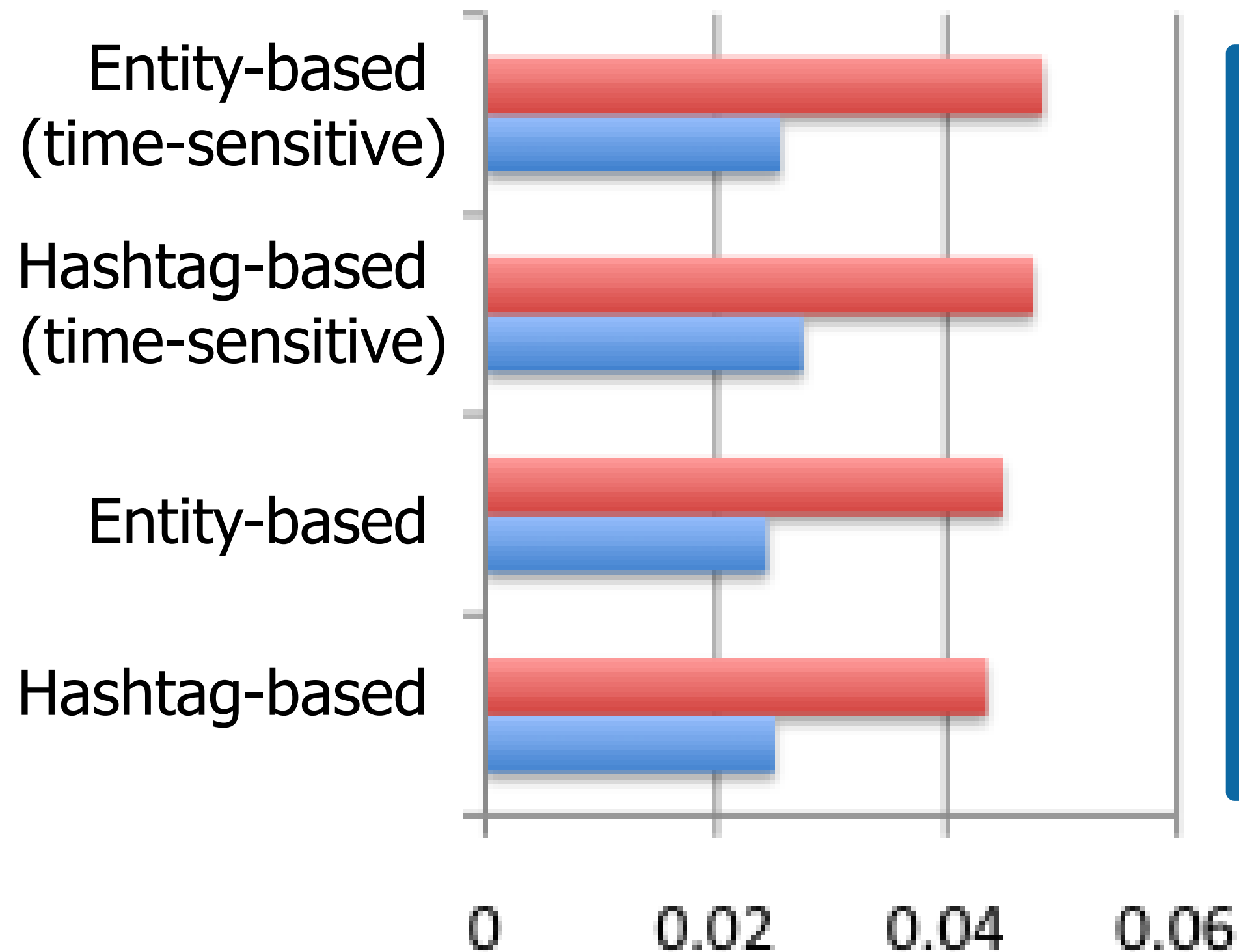
- i) **"term frequency"**: use entire user history)
- ii) **time-sensitive**: weigh concepts a user is "currently" interested in stronger than others

Twitter-based Profiles for Personalization

- **Task:** Recommending Web sites (= tweets with URLs)
- **Recommender algorithm:** cosine similarity between profile and tweets
- **Ground truth:** re-tweets of users
- **Candidate items:** URLs posted on **day X**
- **Evaluation period:** 12 days (Jan 20th – Jan 30th 2011)

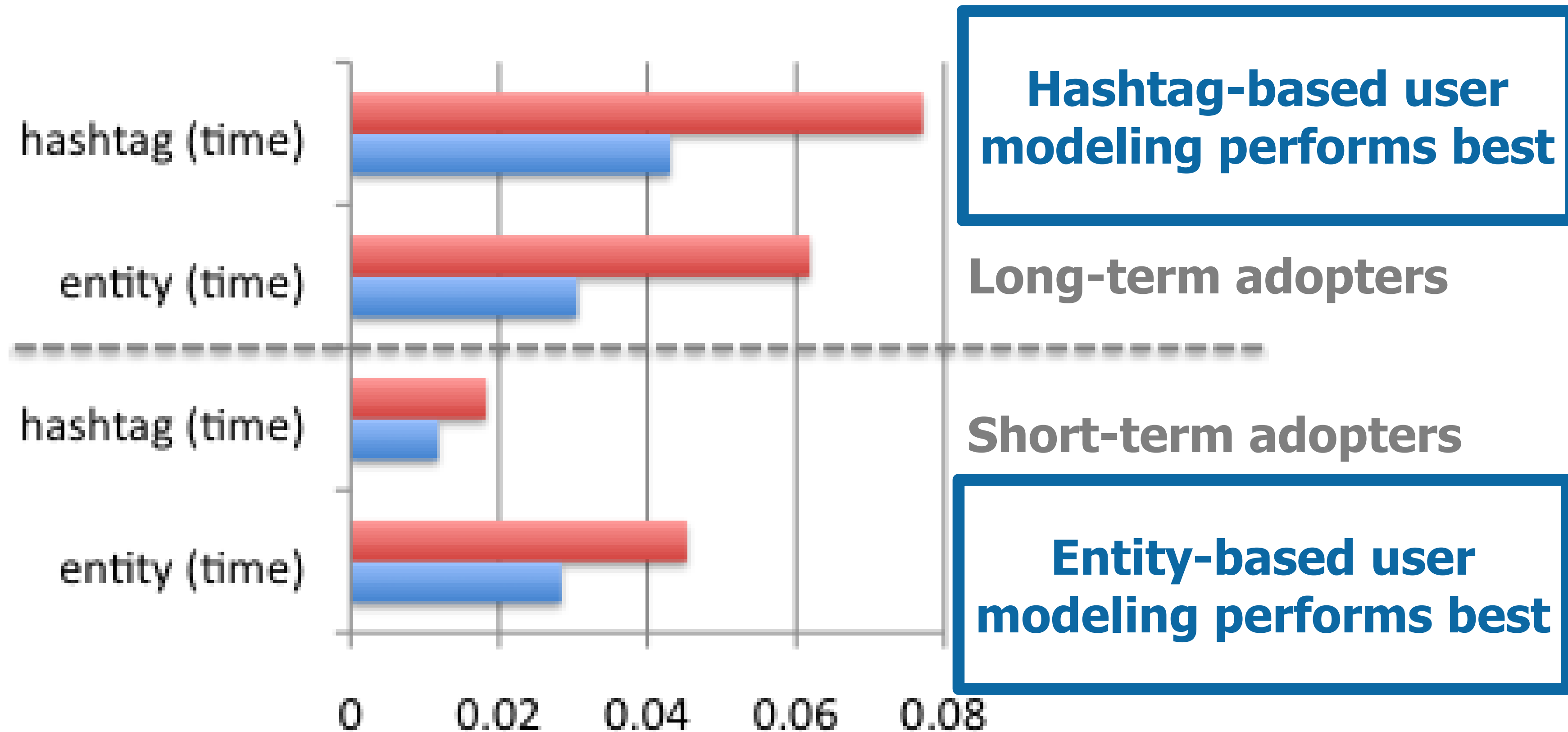


Which user modeling strategy is best for computing personalized recommendations?

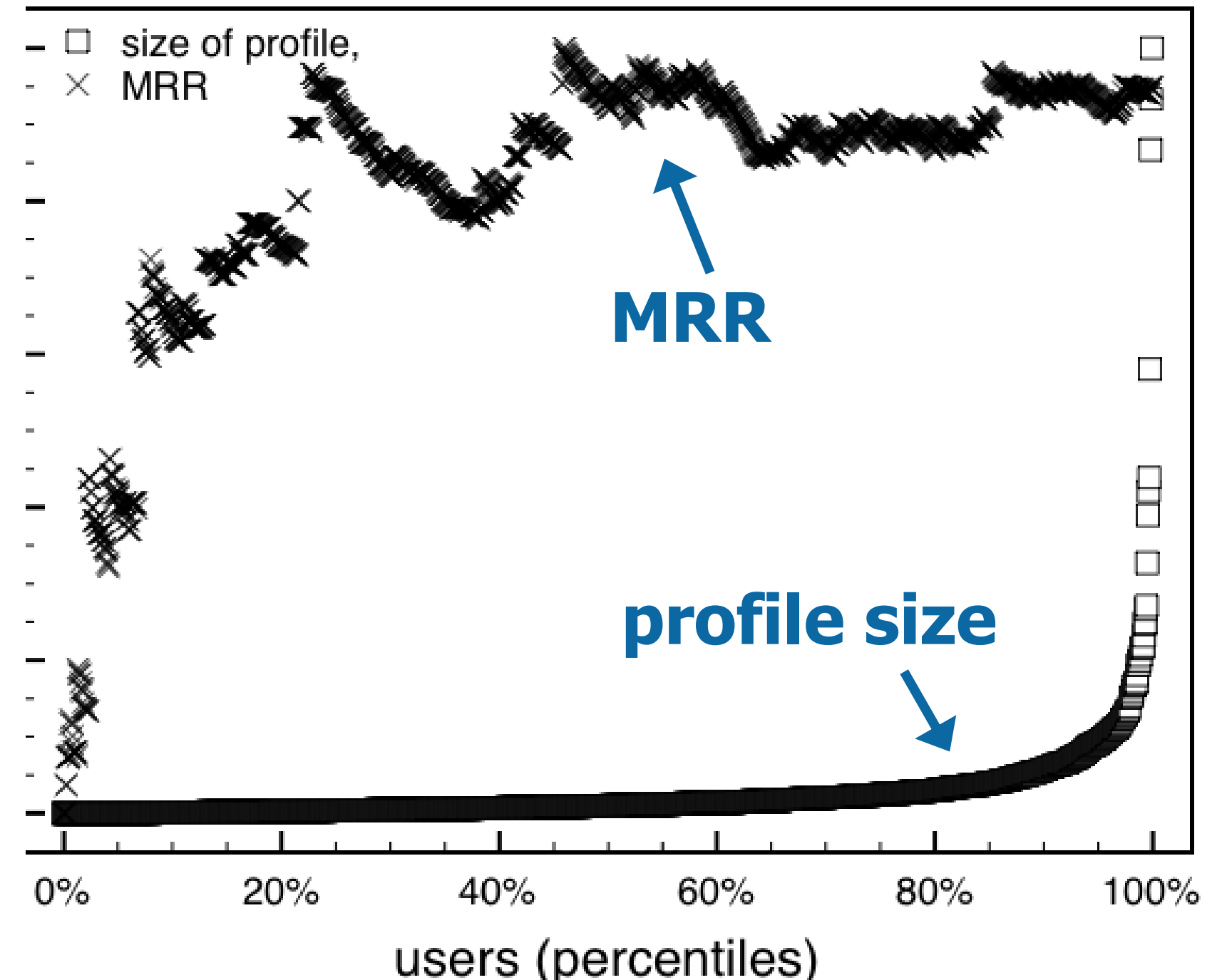
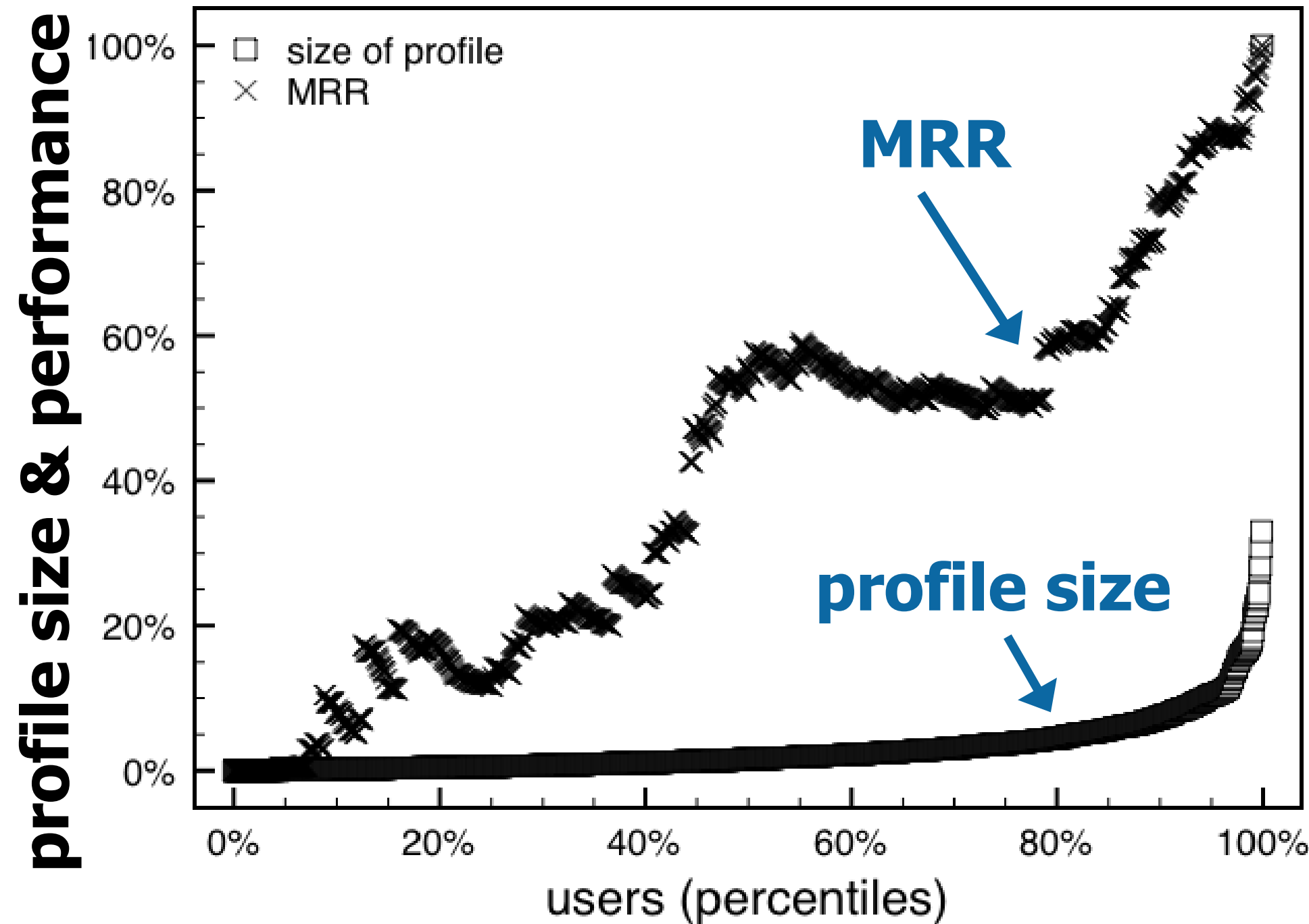


Time-sensitive profiles improve recommendation quality

“Best” user modeling strategy varies for different types of users



Impact of profile size on recommendation quality



Hashtag-based profiles:

The bigger the profile the higher the recommendation quality (MRR).

Entity-based profiles:

More robust against "sparse" profiles.

Conclusions and Future Work

1. Topics on Twitter:
 - Importance of entities for a topic varies over time (long-term vs. short-term entities)
2. User interests over time:
 - Majority of users becomes quickly (few days) interested in a topic
 - Long-term adopters vs. Short-term adopters
3. Twitter-based profiles for personalization:
 - Time-sensitive user modeling improves recommendation quality
 - Selection of user modeling strategy should take the type of user into account:
 - Long-term adopters: hashtag-based
 - Short-term adopters: entity-based

Future work: for what type of personalization tasks can we exploit what type of Twitter profiles? <http://wis.ewi.tudelft.nl/tweetum/>

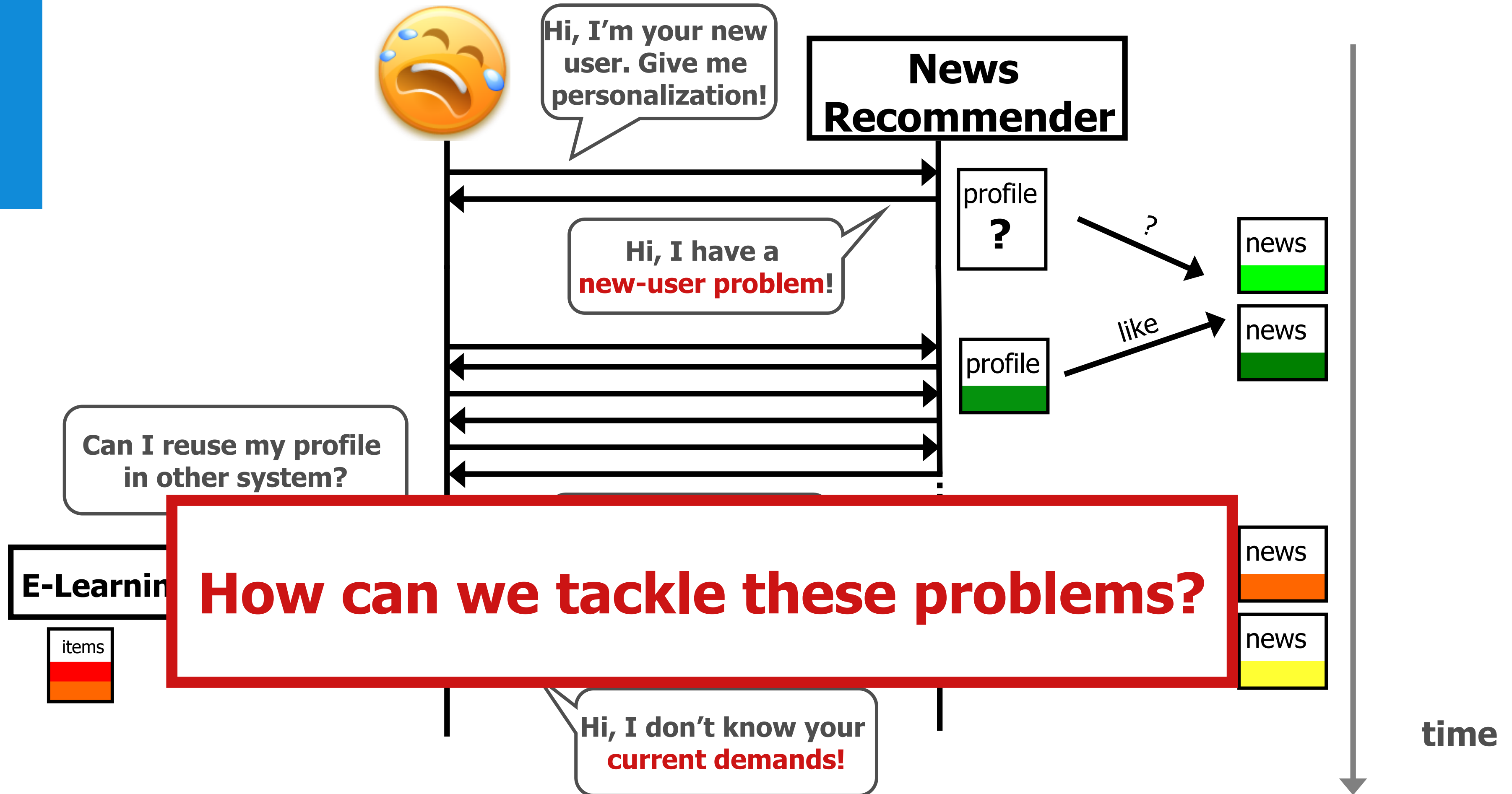
Thank you!

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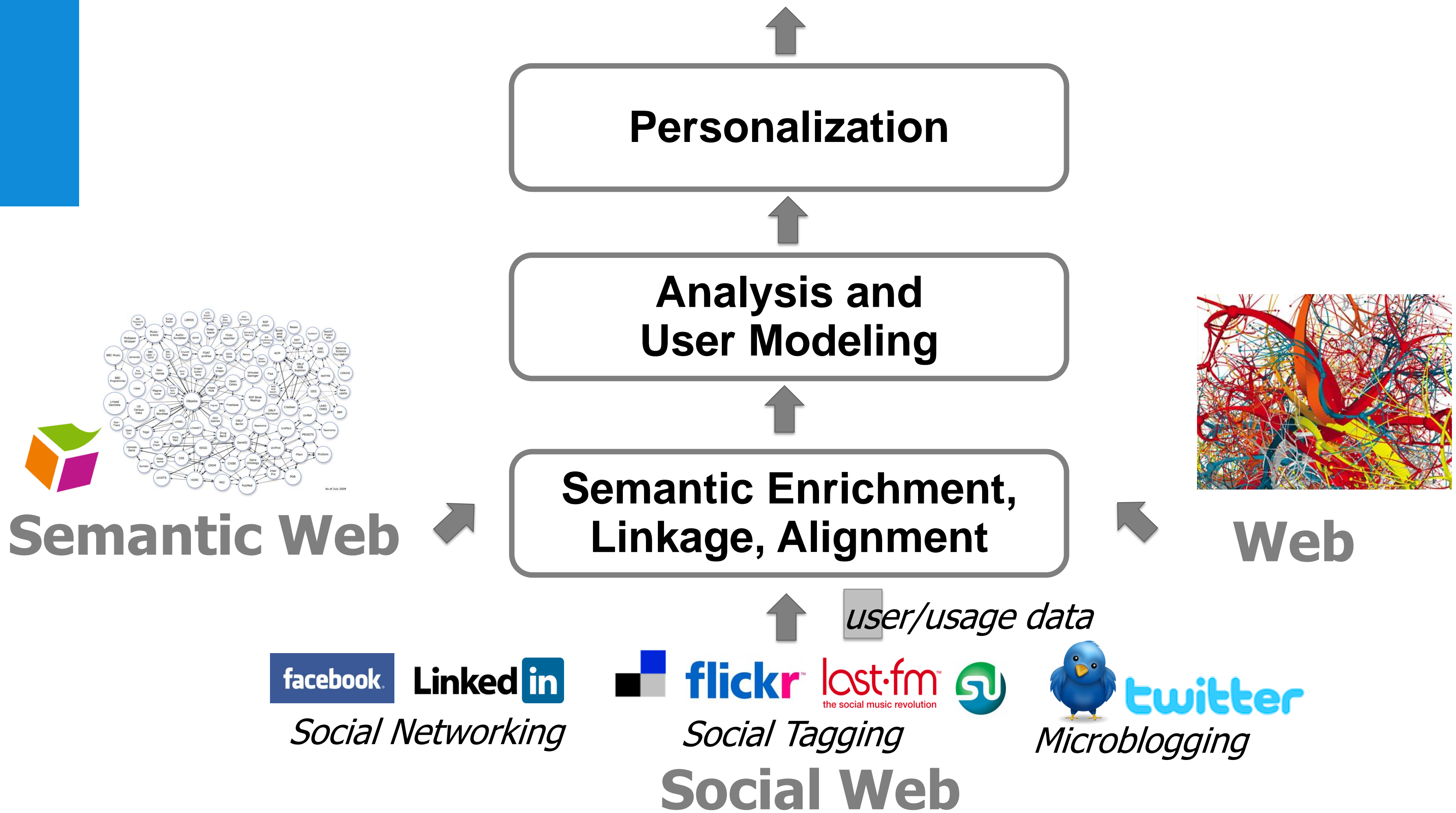


Twitter: @persweb
<http://wis.ewi.tudelft.nl/tweetum/>

Problems of today's Web Systems



What we do: Personal Web



Twitter



200,000,000

Twitter users

60,000,000

tweets per day

85%

of the tweets related to "news"

2

questions...