




# What is Twitter, a Social Network or a News Media?

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# Twitter, a microblog service



twitter


Home Profile Find People Settings Help Sign out


What's happening? 140


|


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Home

 **red\_nude** 지금 봤어요. 작은 경당이네요. 그 자체로 기도인듯..RT @EGGPUDING: #holybread #photokr <http://twitpic.com/1gssrb>  
less than 5 seconds ago via twtkr

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1 minute ago via web

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2 minutes ago via Osfoora

 **haewoon**  
1,656 tweets

278 following 329 followers 33 listed

**one·forty**  
n. a place to find Twitter apps.

Home

@haewoon

Direct Messages 30

Favorites

Retweets

Search  Q

Saved Searches ▲

kaist

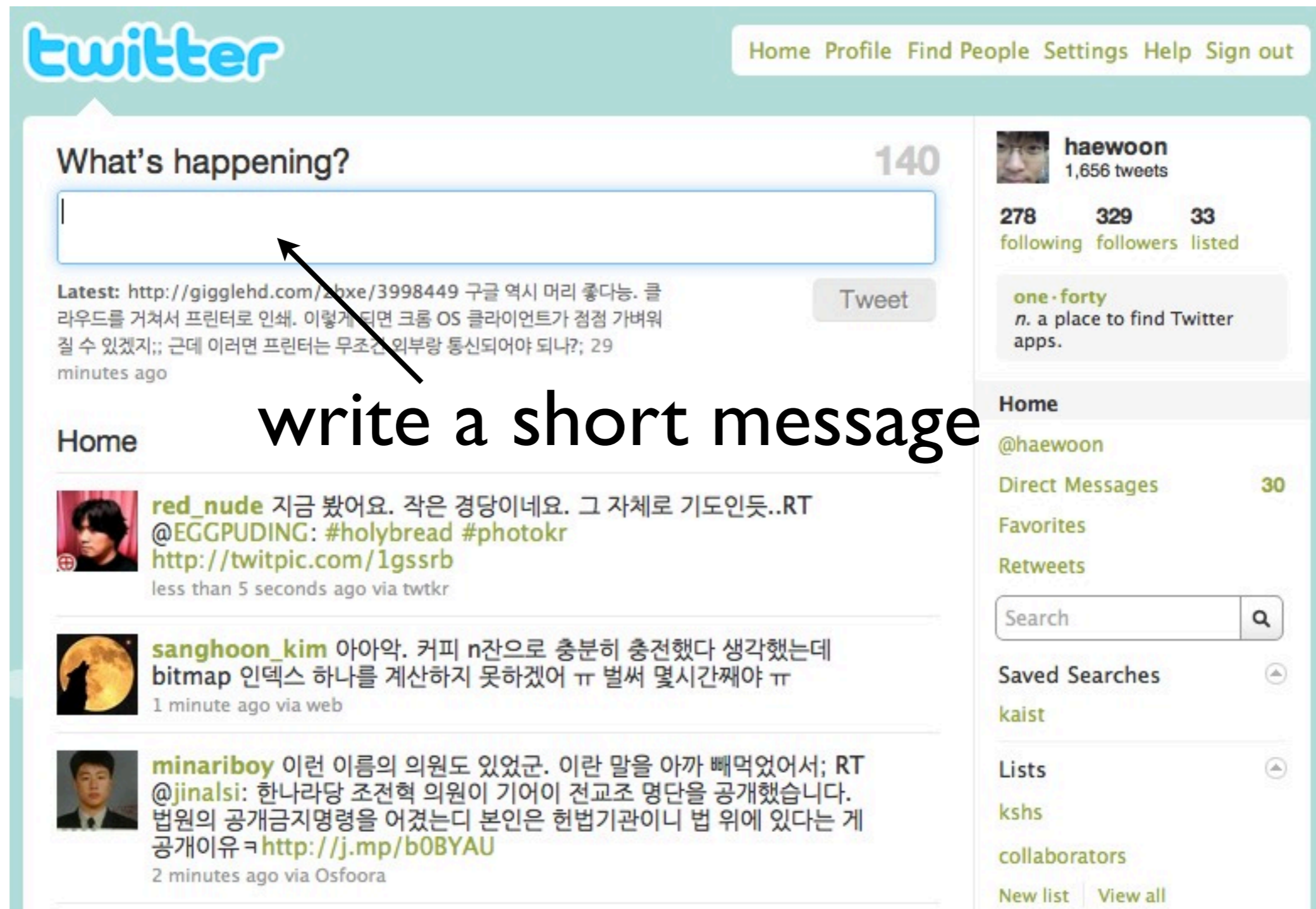
Lists ▲

kshs

collaborators

New list | View all

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**write a short message**

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New list View all

read neighbors' tweets



# In most OSN



“We are friends.”



# In Twitter



“I follow you.”

# Following on Twitter

“Unlike most social networks, following on Twitter is **not mutual**. Someone who thinks you're interesting can follow you, and you don't have to approve, or follow back.”

<http://help.twitter.com/entries/14019-what-is-following>

# Following = subscribing tweets

The image shows a screenshot of a Twitter profile page for user 'haewoon' (1,656 tweets). The page layout includes a navigation bar at the top with links for Home, Profile, Find People, Settings, Help, and Sign out. Below the navigation bar is a 'What's happening?' section with a text input field and a 'Tweet' button. The main content area displays a list of tweets from users followed by 'haewoon'. Three tweets are visible, each with a profile picture and text. Arrows from the text 'recent tweets of followings' point to the first three tweets in the list. The right sidebar shows the user's profile information, including the number of following (278), followers (329), and listed (33). Below this, there are links for 'one · forty' (a place to find Twitter apps), 'Home', '@haewoon', 'Direct Messages' (30), 'Favorites', 'Retweets', 'Saved Searches' (kaist), 'Lists' (kshs, collaborators), and 'New list | View all'.

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recent tweets of followings





**jkrums**

Follow

<http://twitpic.com/135xa> – There's a plane in the Hudson. I'm on the ferry going to pick up the people. Crazy.





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<http://blog.marsdencartoons.com/2009/06/18/cartoon-iranian-election-demonstrations-and-twitter/marsden-iran-twitter72/>

# The goal of this work

We analyze how directed relations of following set Twitter apart from existing OSNs.

Then, we see if Twitter has any characteristics of news media.

# me · di · a [*mee-dee-uh*]



1. a pl. of medium



2. the means of communication, as radio and television, newspapers, and magazines, that reach or influence people widely

# The goal of this work

We analyze how directed relations of following set Twitter apart from existing OSNs.

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# Summary of our findings

- 
- 
1. Following is mostly not reciprocated (not so “social”)
  2. Users talk about timely topics
  3. A few users reach large audience directly
  4. Most users can reach large audience by WOM\* quickly

\*WOM: word-of-mouth

# Data collection (09/6/1~9/24)

- 41.7M user profiles (near-complete at that time)
- 1.47B following relations \*publicly available
- 4262 trending topics
- 106M tweets mentioning trending topics
  - ▶ Spam tweets removed by CleanTweets

# How we crawled

- Twitter's well-defined 3rd party API
- With 20+ 'whitelisted' IPs
  - ▶ Send 20,000 requests per IP / hour





# Recent studies

- Ranking methodologies [WSDM'10]
- Predicting movie profits [HYPERTEXT'10]
- Recommending users [CHI'10 microblogging]
- Detecting real time events [WWW'10]
- The 'entire' Twittersphere unexplored

# Part I.

1. Following is mostly not reciprocated (not so “social”)
2. Users talk about timely topics
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# Why do people follow others?

- Reflection of offline social relationships

otherwise,

- Subscription to others' messages

# Sociologists' answer

- “Reciprocal interactions pervade every relation of primitive life and in all social systems”



# Is following reciprocal?

- Only **22.1%** of user pairs follow each other
- Much lower than
  - ▶ 68% on Flickr
  - ▶ 84% on Yahoo! 360
  - ▶ 77% on Cyworld guestbook messages

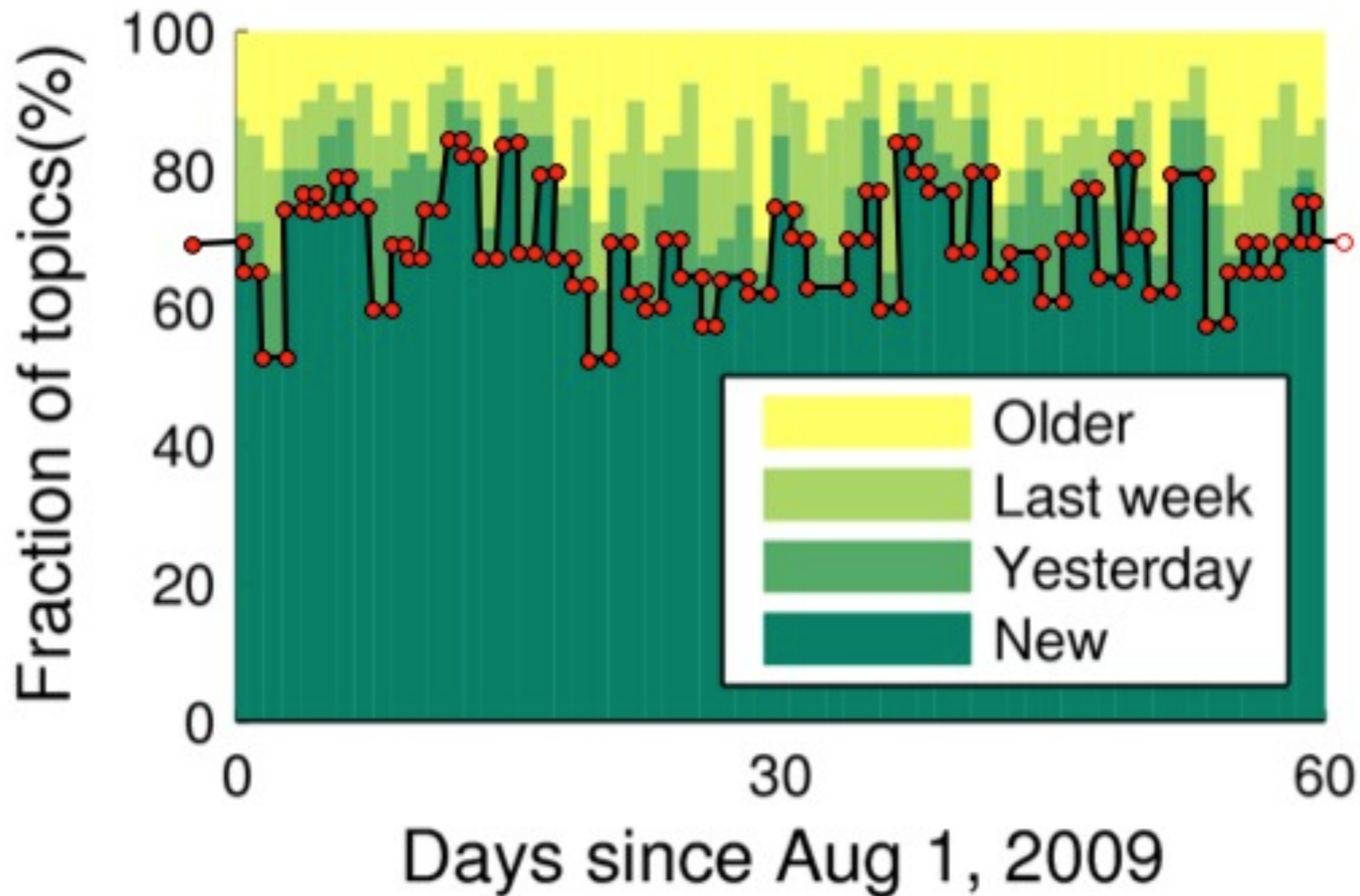
# Low reciprocity of following

- Following is not similarly used as friend in OSNs
  - ▶ Not reflection of offline social relationships
- Active subscription of tweets!

# Part II.

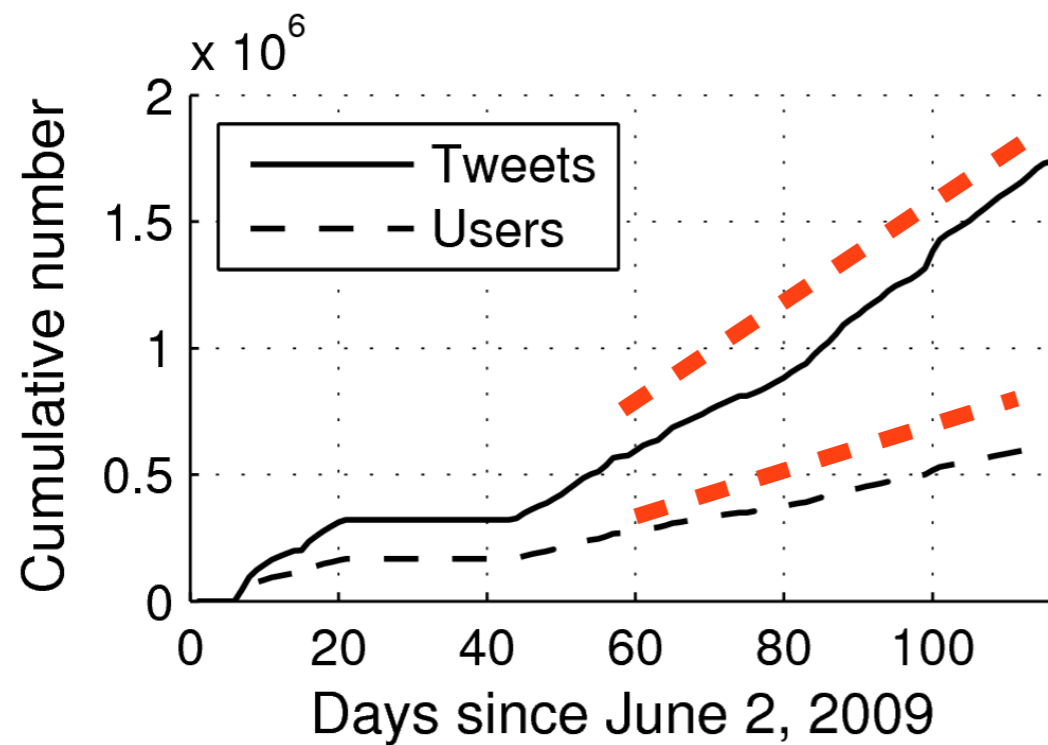
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# Dynamically changing trends

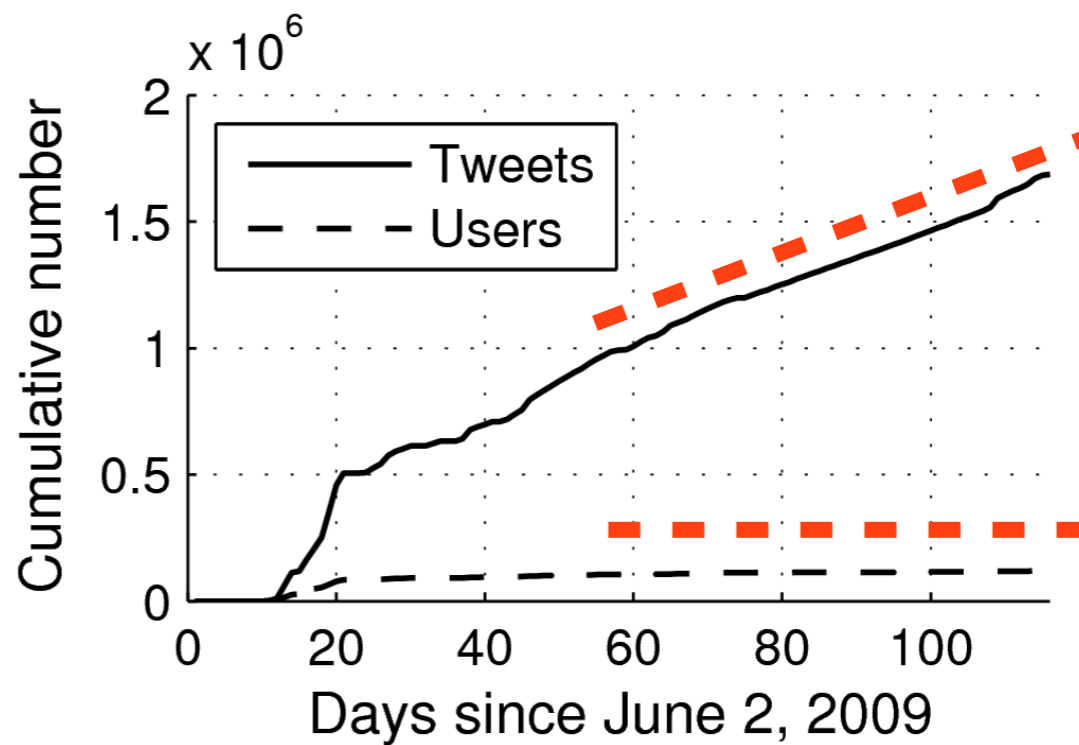




# User participation pattern can be a signature of a topic



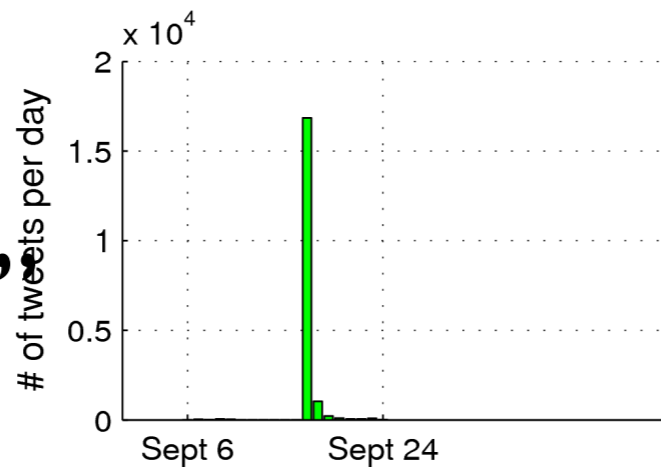
(a) Topic 'apple'



(b) Topic '#iranelection'

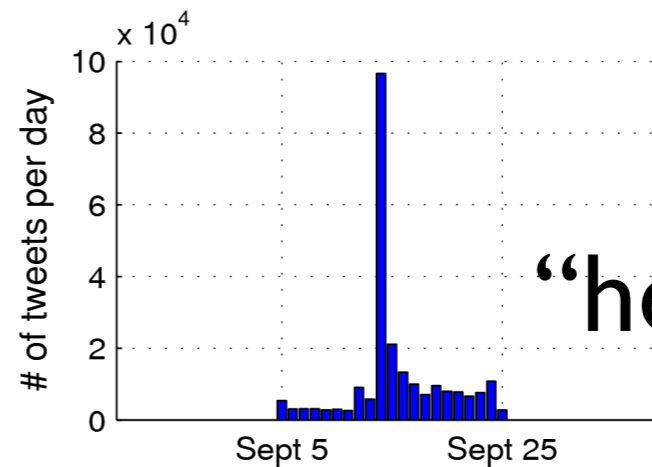
# Majority of topics are headline

31.5%  
“ephemeral”



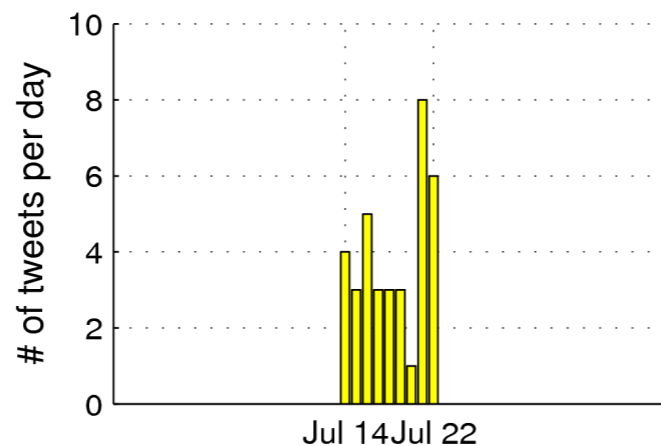
(a) Exogenous subcritical  
(topic ‘#backintheday’)

54.3%  
“headline news”



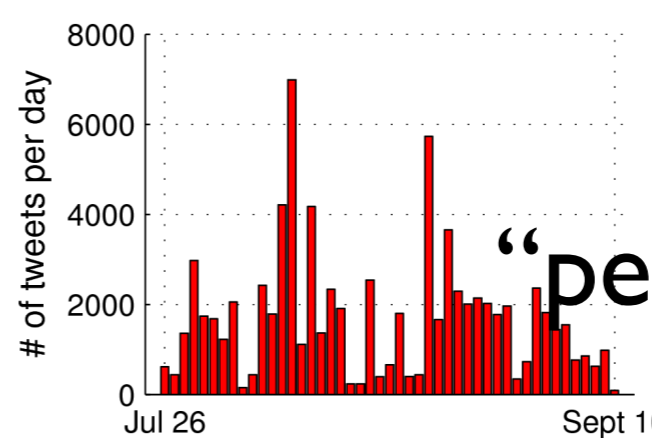
(b) Exogenous critical  
(topic ‘beyonce’)

6.9%



(c) Endogenous subcritical  
(topic ‘lynn harris’)

7.3%  
“persistent news”



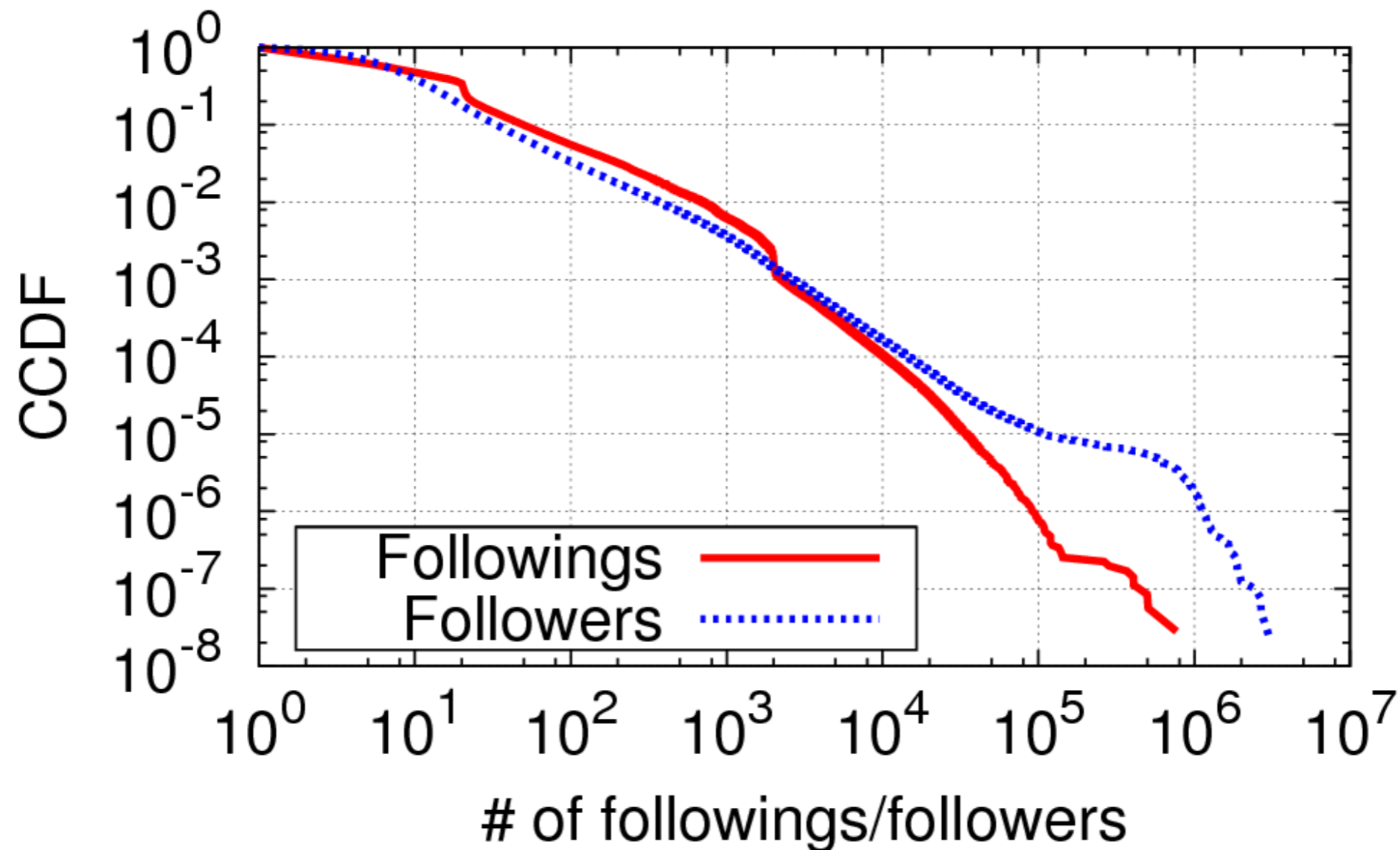
(d) Endogenous critical  
(topic ‘#redsox’)



# Part III.

1. Following is mostly not reciprocated (not so “social”)
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- 3. A few users reach large audience directly**
4. Most users can reach large audience by WOM\* quickly

# How many followers a user has?

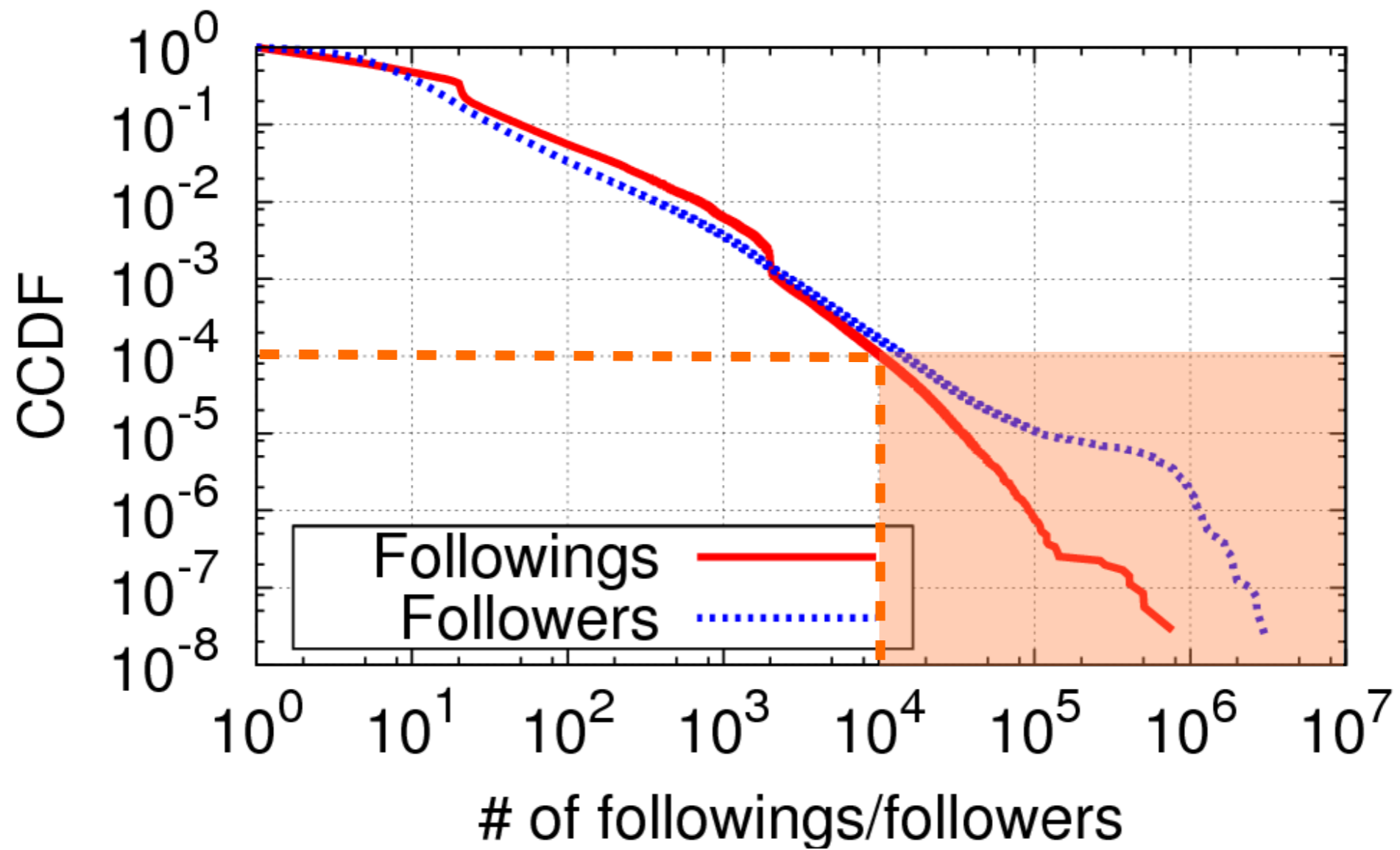




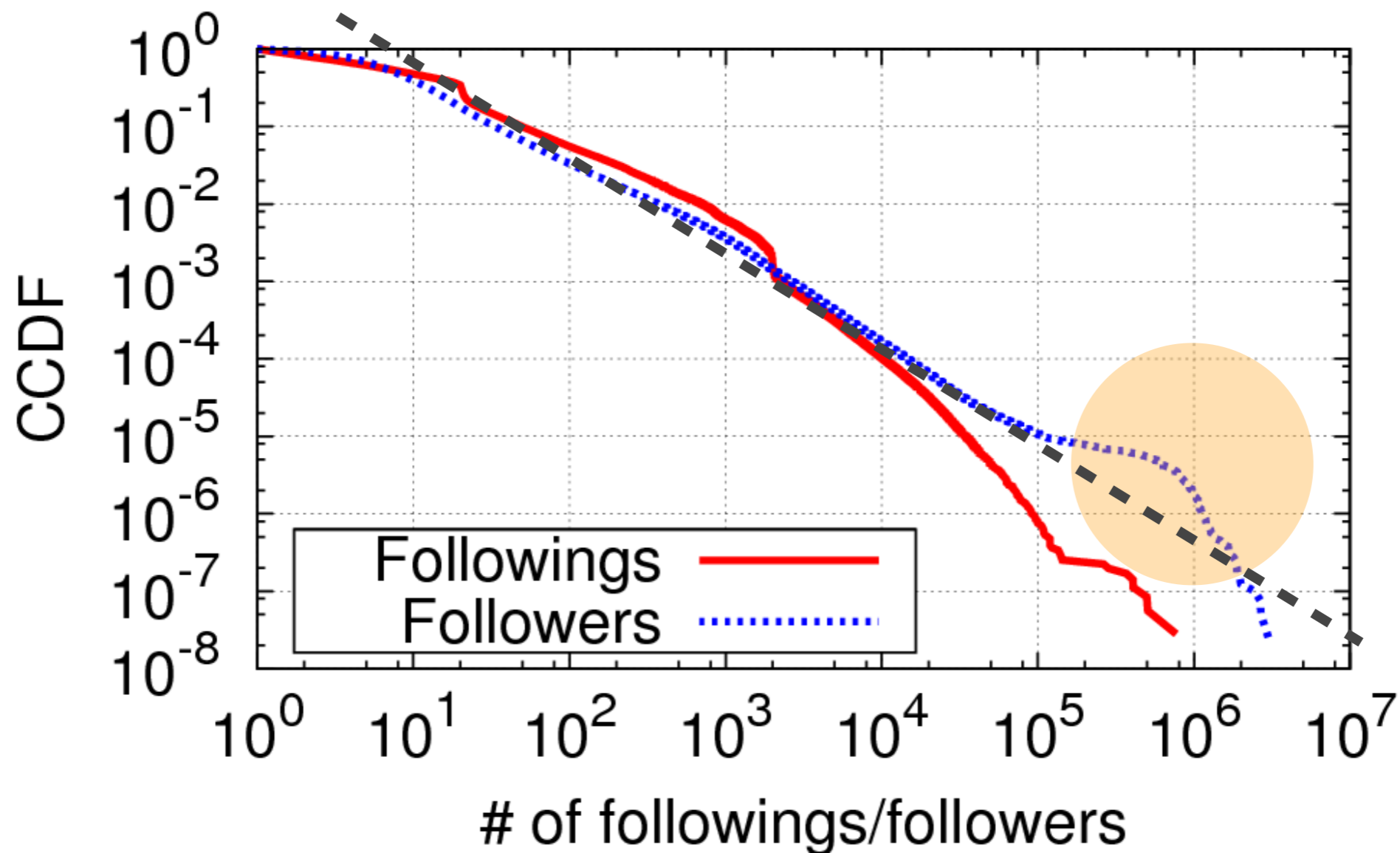
# CCDF

- Complementary Cumulative Density Function
- $CCDF(x=k) = \int_k^{\infty} P(x) dx$

# Reading the graph



# Plenty of super-hubs

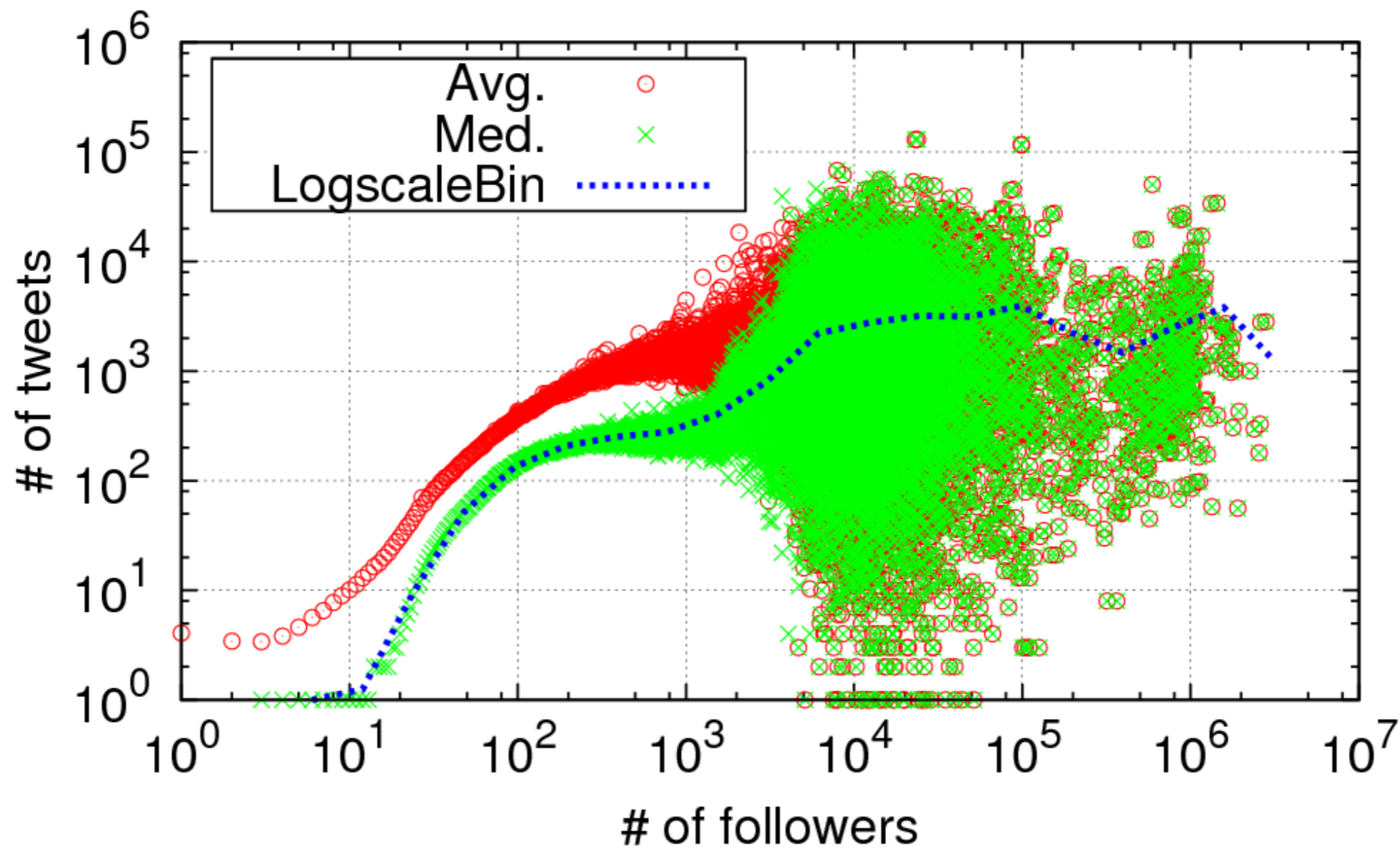


# More super-hubs than projected by power-law

- Where do they get all the followers? Possibly from...
  - ▶ Search by 'name'
  - ▶ Recommendation by Twitter
- They reach millions in one hop

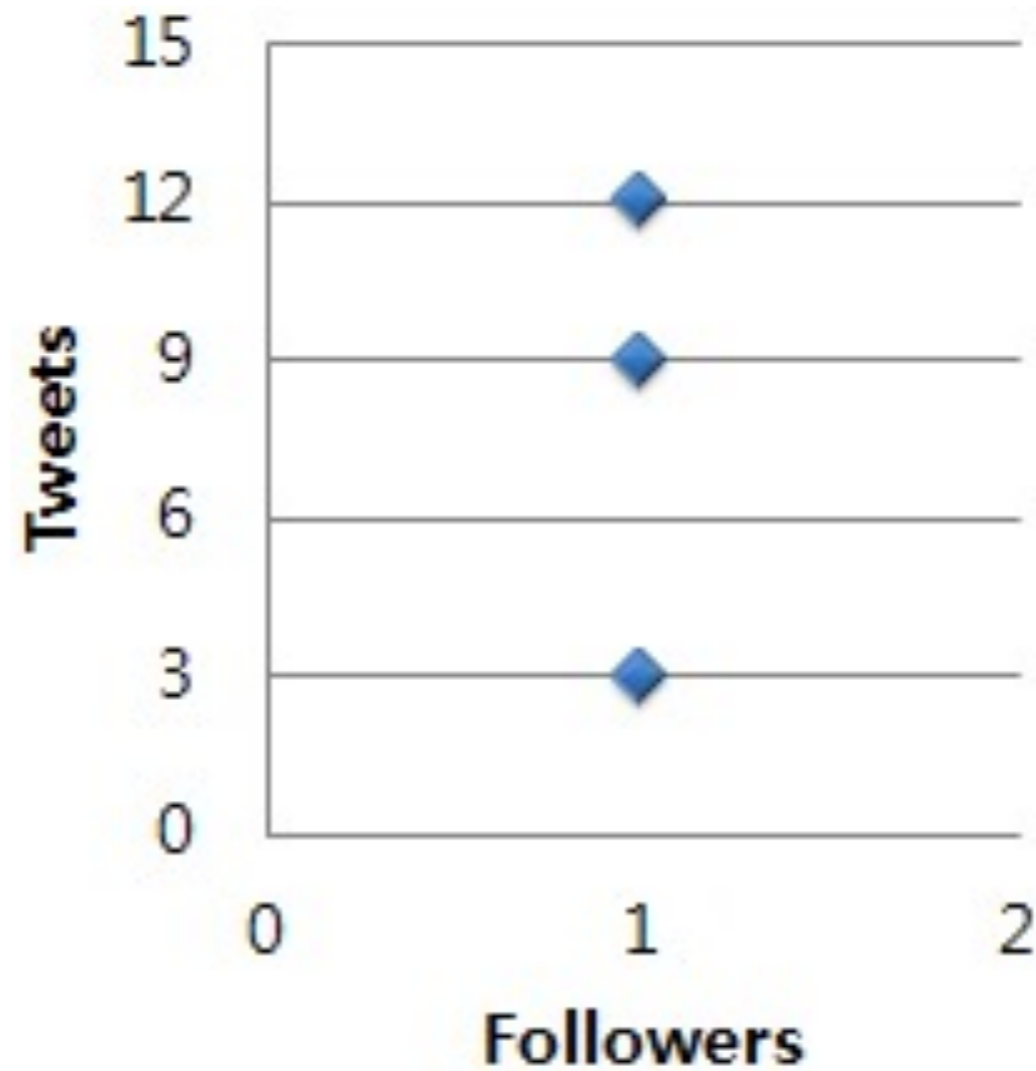


# Are those who have many followers active?



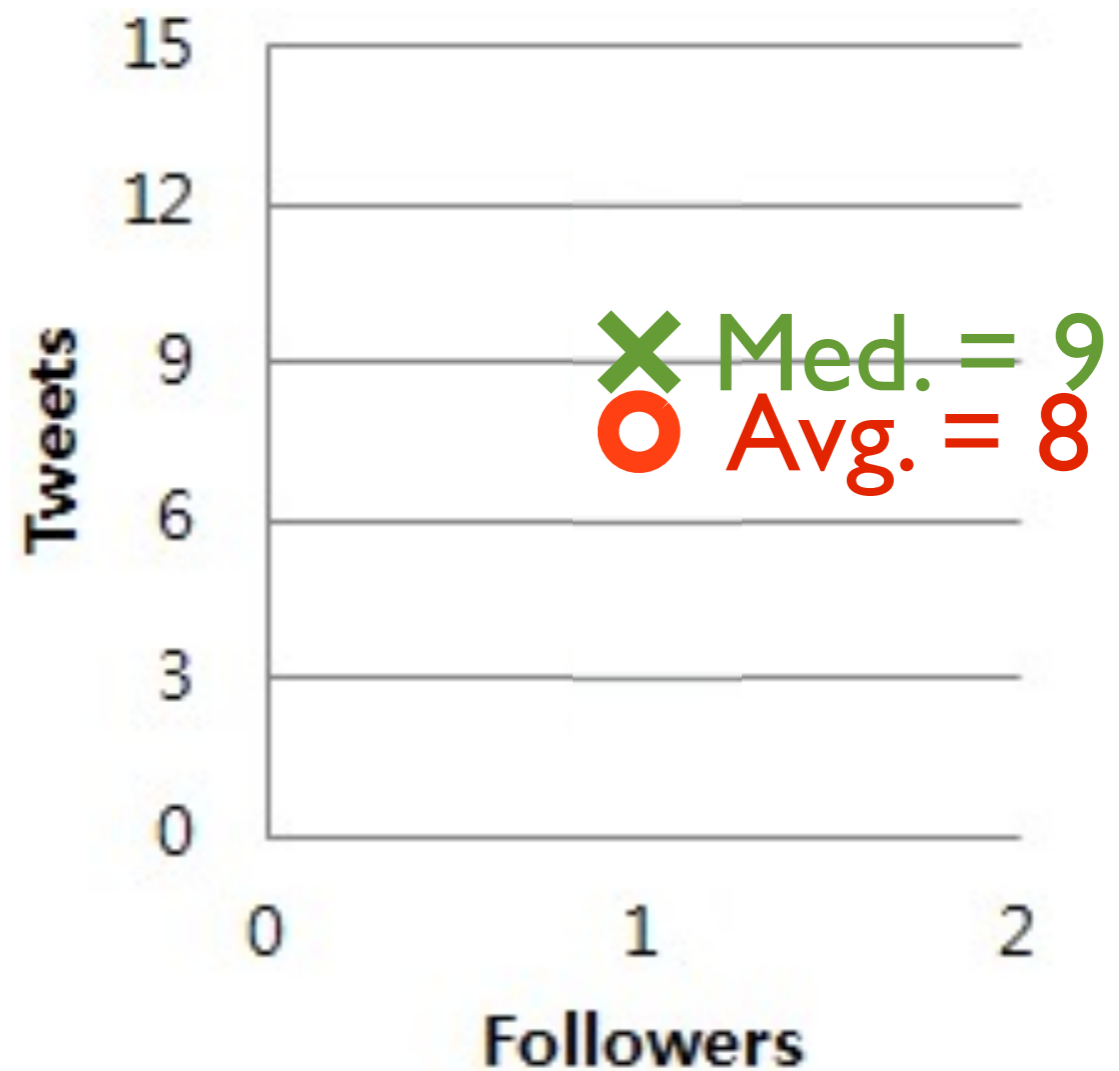
# How we plotted

followers	tweets
1	3
1	9
1	12

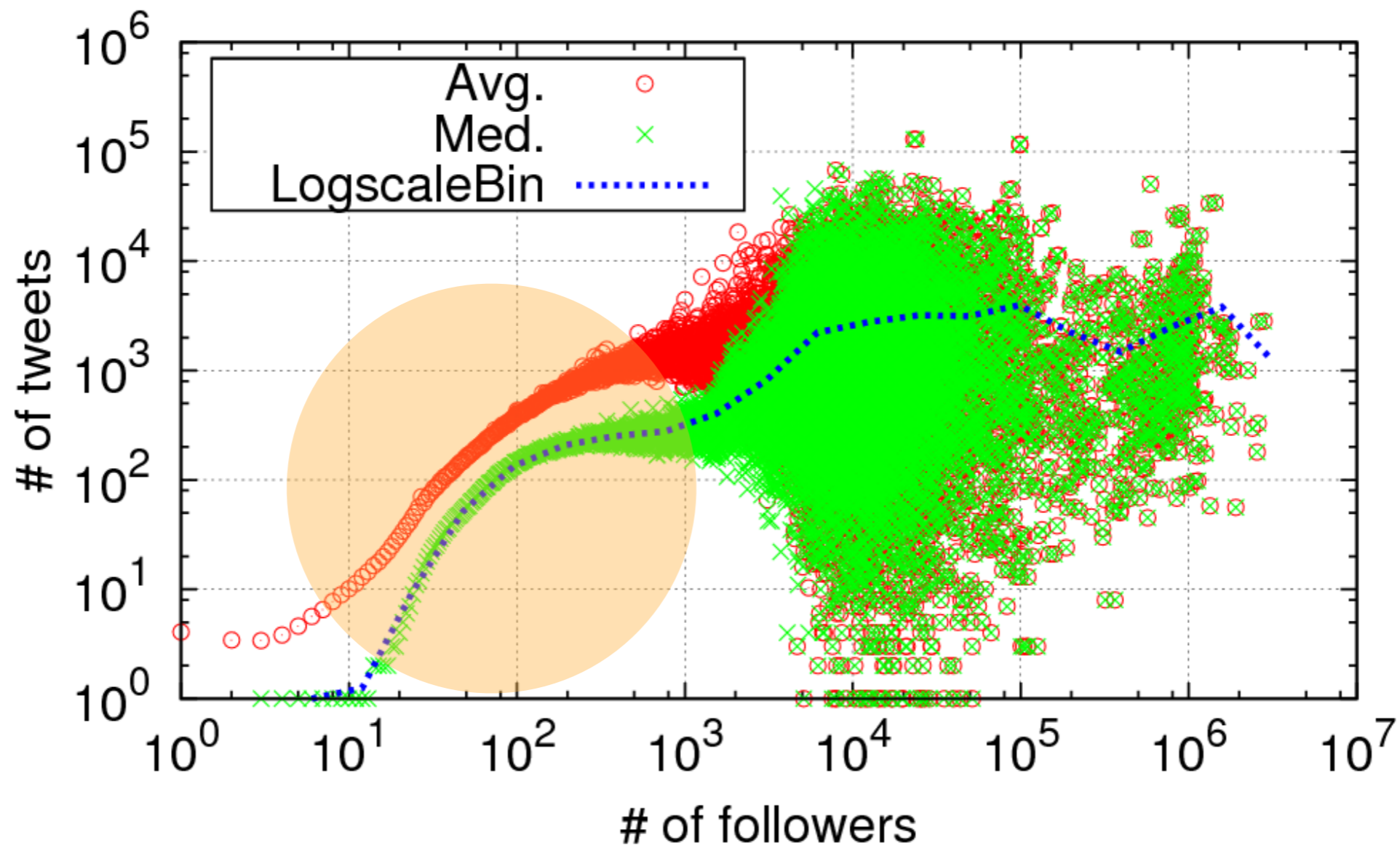


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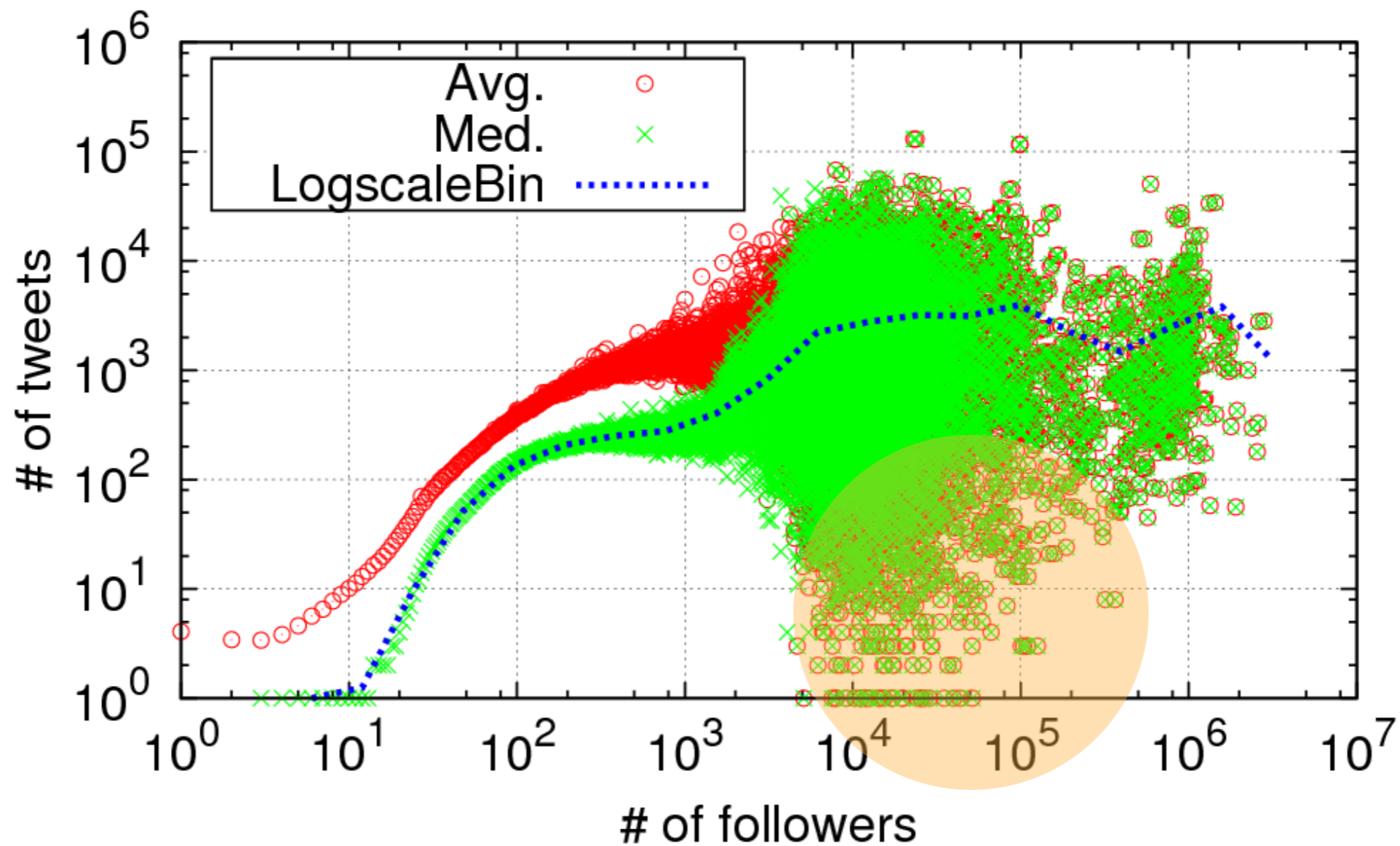
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# More followers, more tweets



# Many followers without activity



# Twitter user rankings by Followers, PageRank and RT

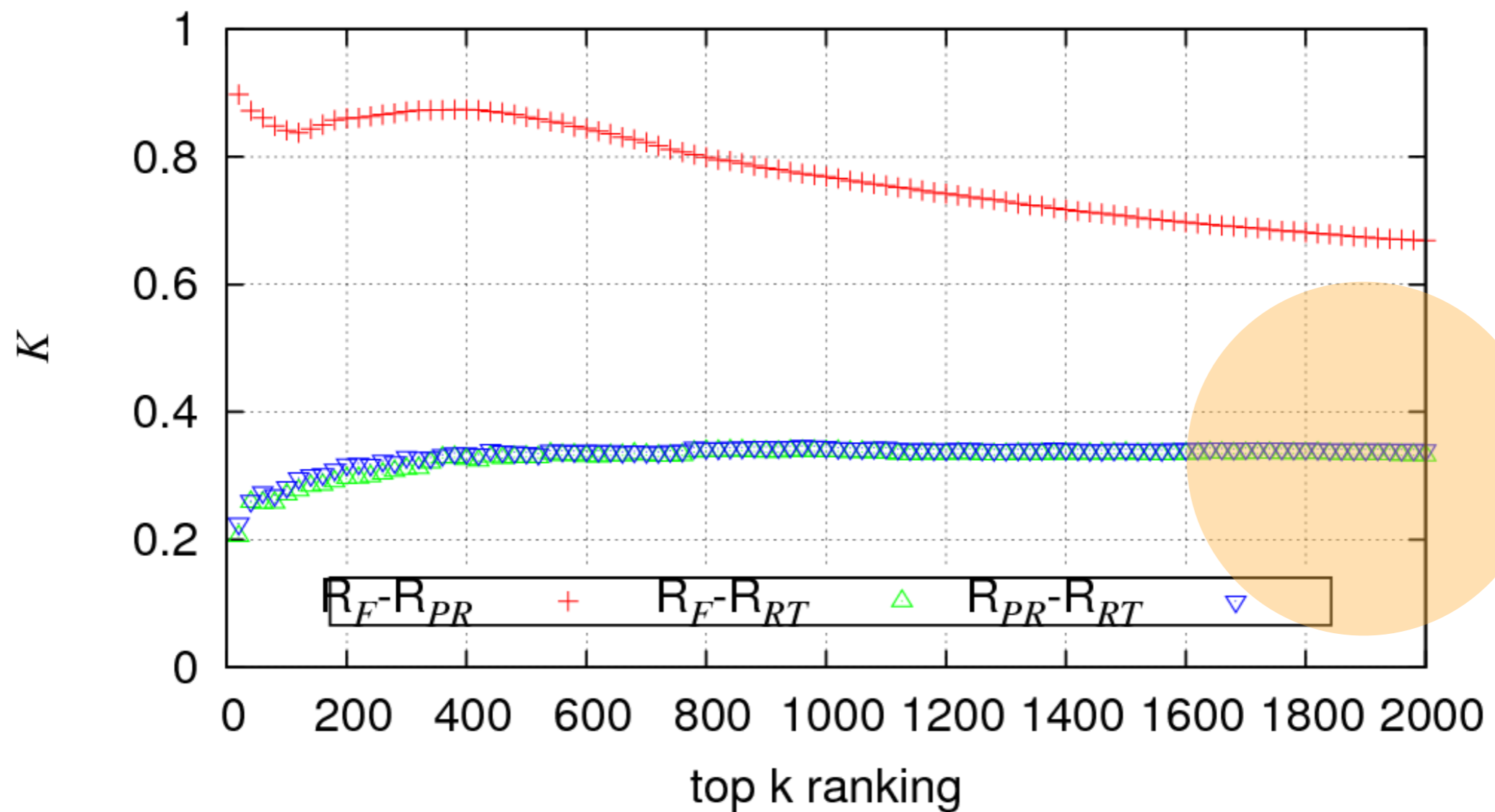


Rank	Followers	PageRank	RT
1	actor	actor	news
2	musician	president	news
3	show host	news	news
4	news	show host	journalist
5	show host	musician	news
6	twitter	show host	news
7	president	sports star	musician
8	show host	musician	news
9	sports star	twitter	comedian
10	model	show host	about iran

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# Great discrepancy among rankings



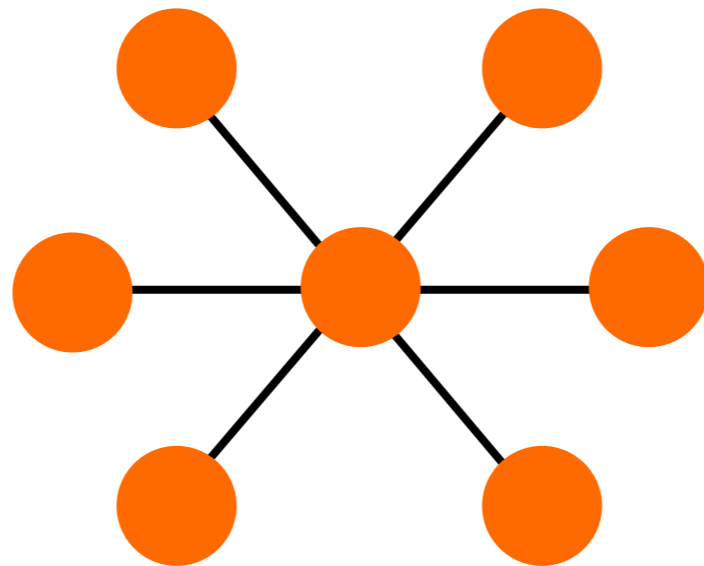
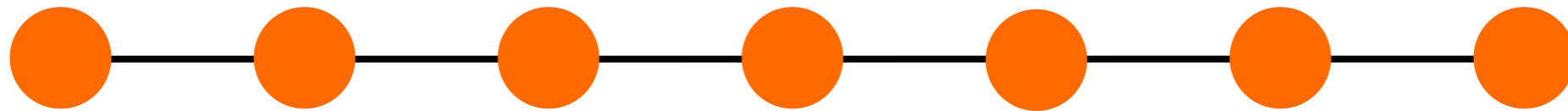


# Part IV.

1. Following is mostly not reciprocated (not so “social”)
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\*WOM: word-of-mouth

# Which is more efficient for WOM?

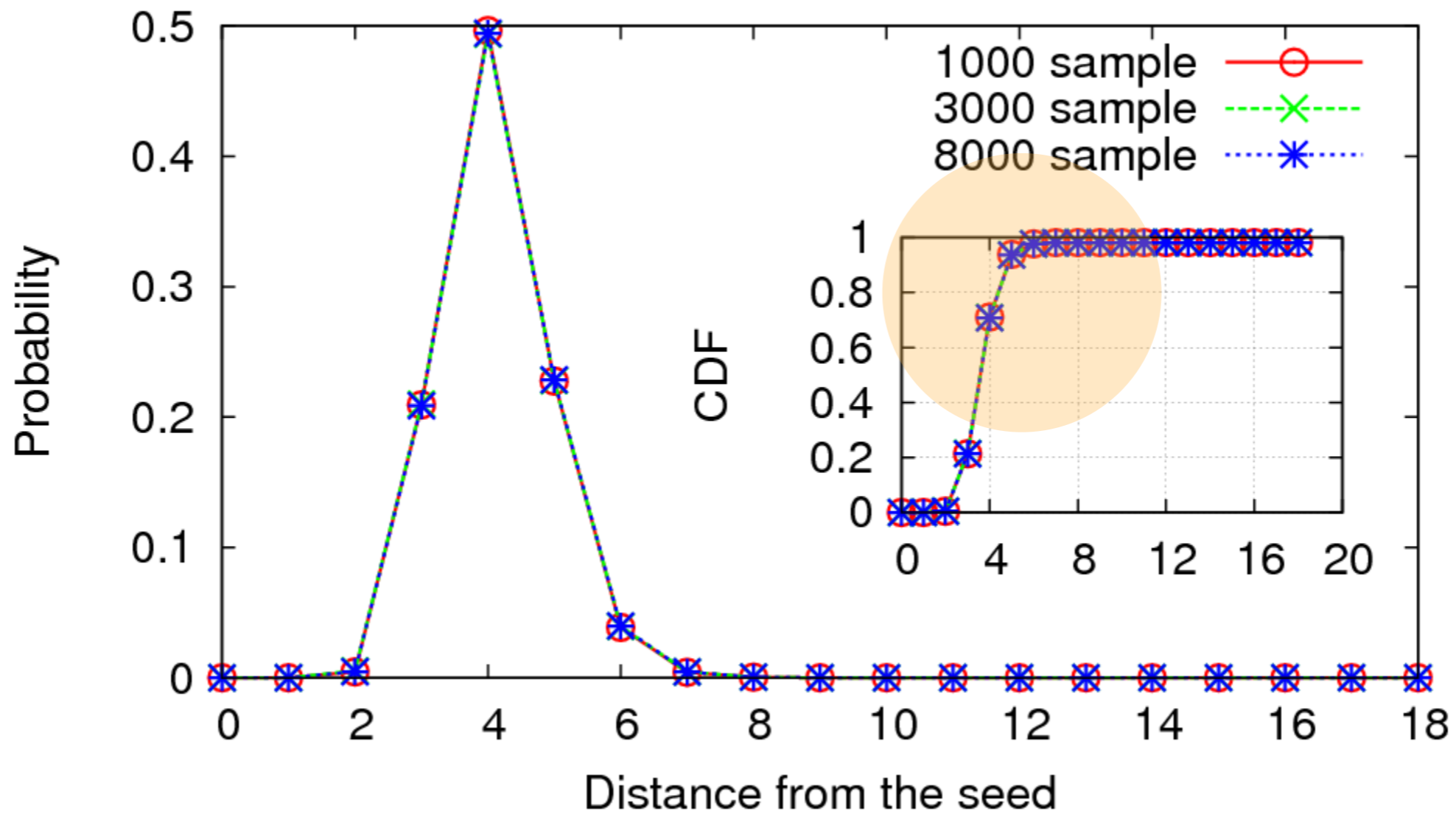




# In Twitter

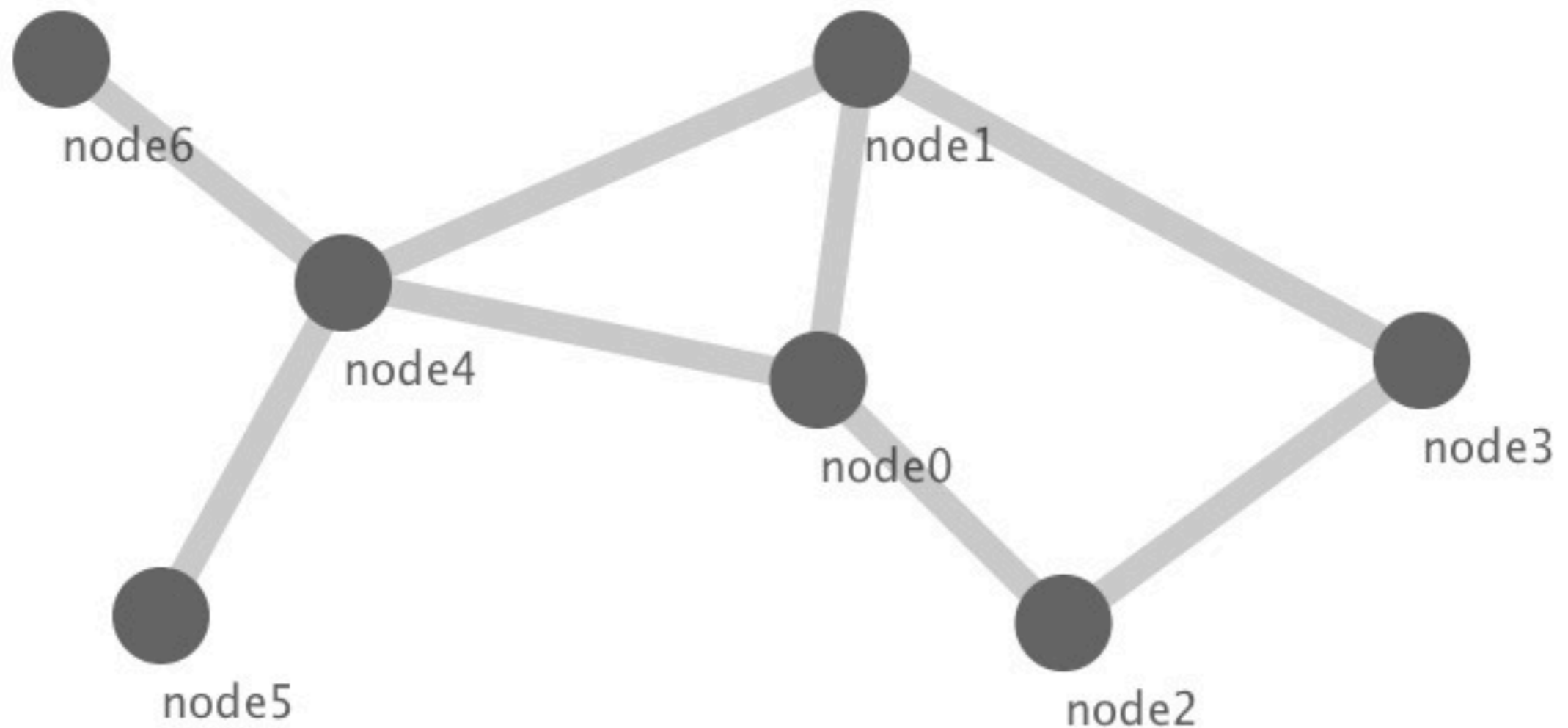


# Average path length: 4.1



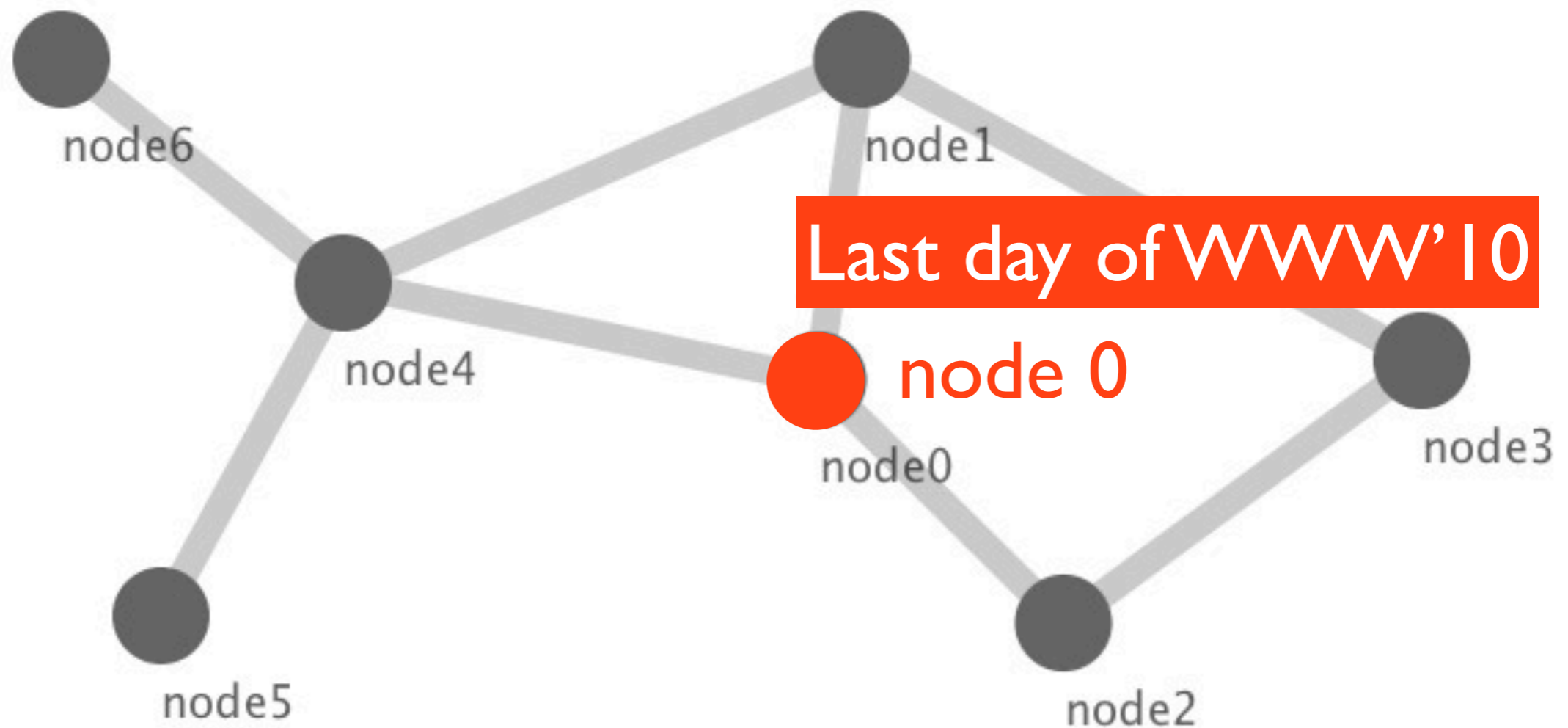
# Retweet (RT)

- Relay tweets from a following to followers



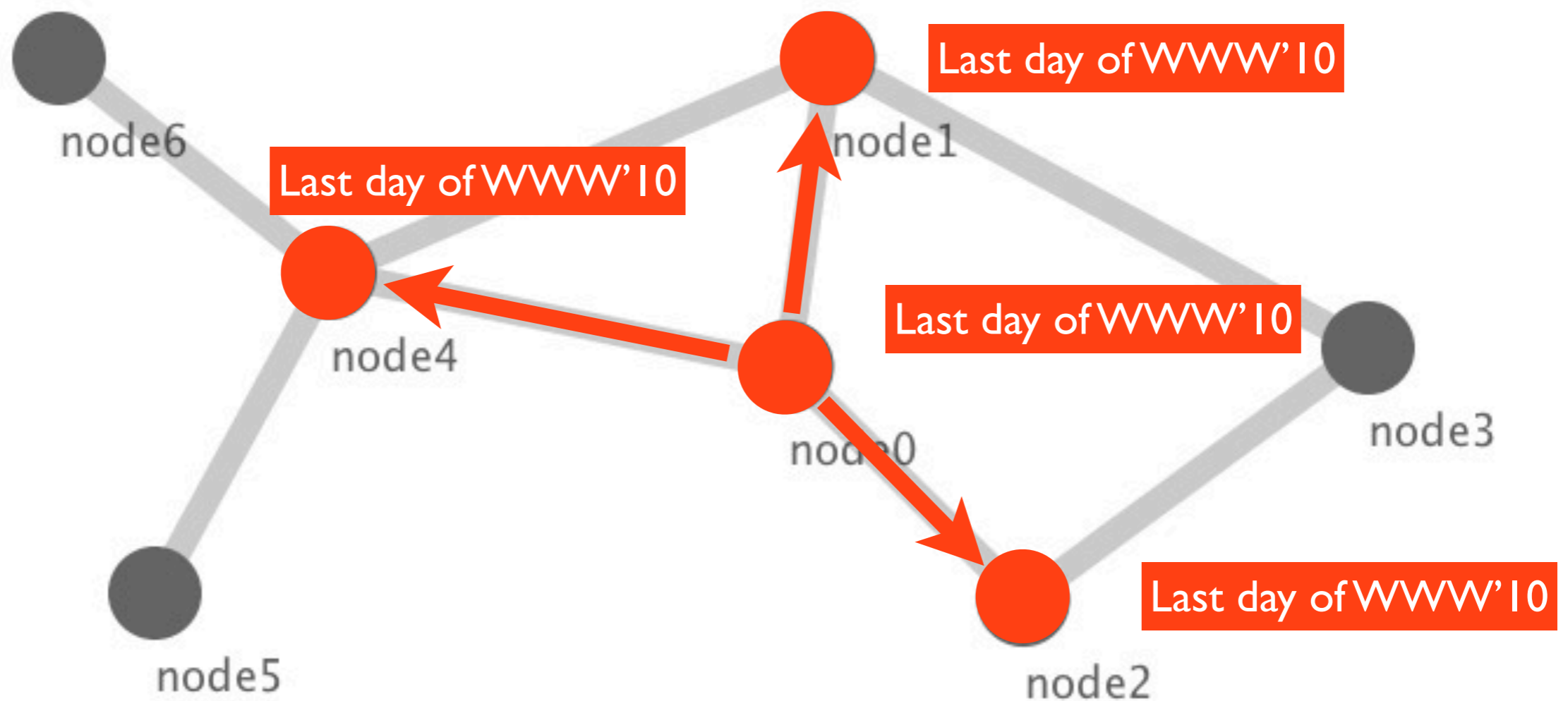
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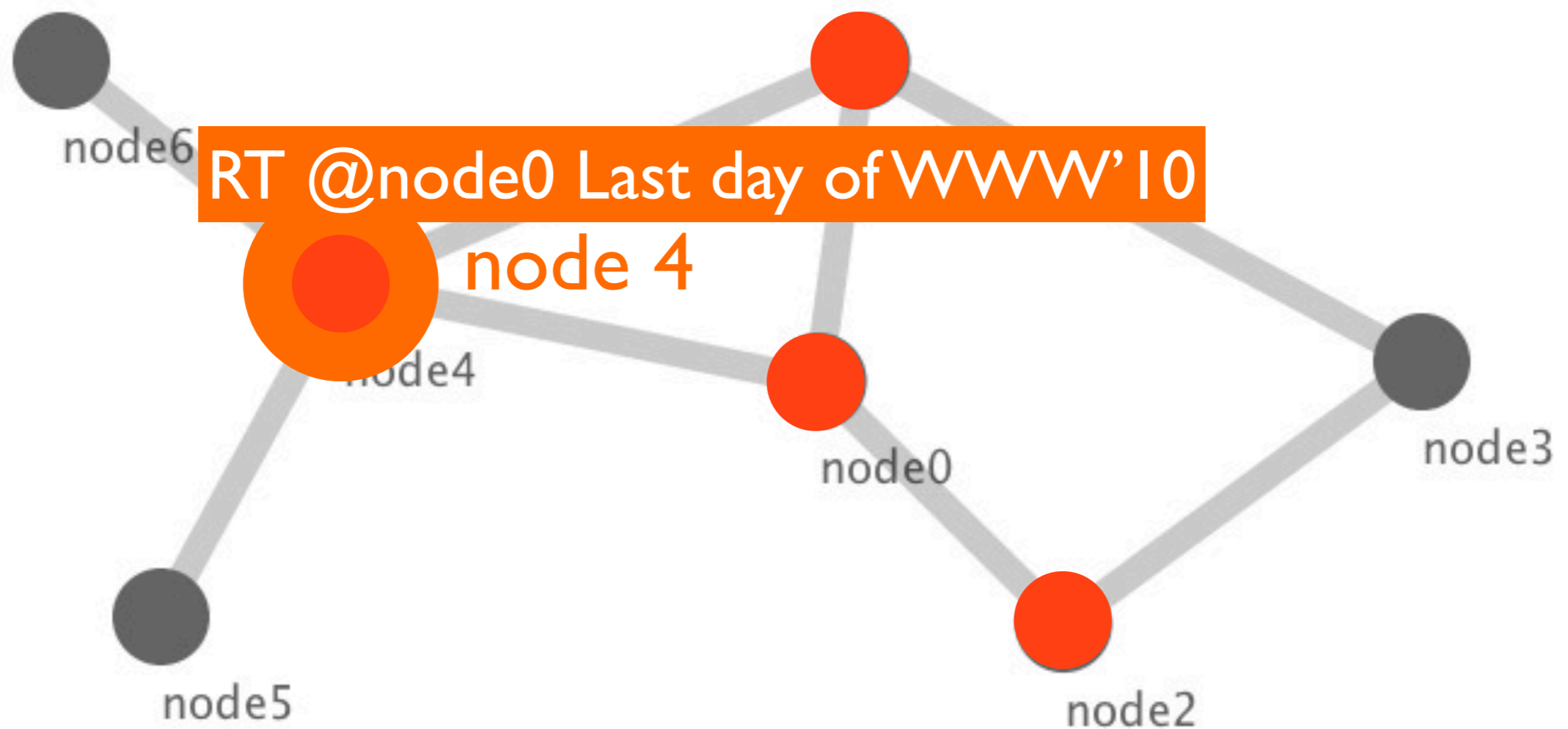
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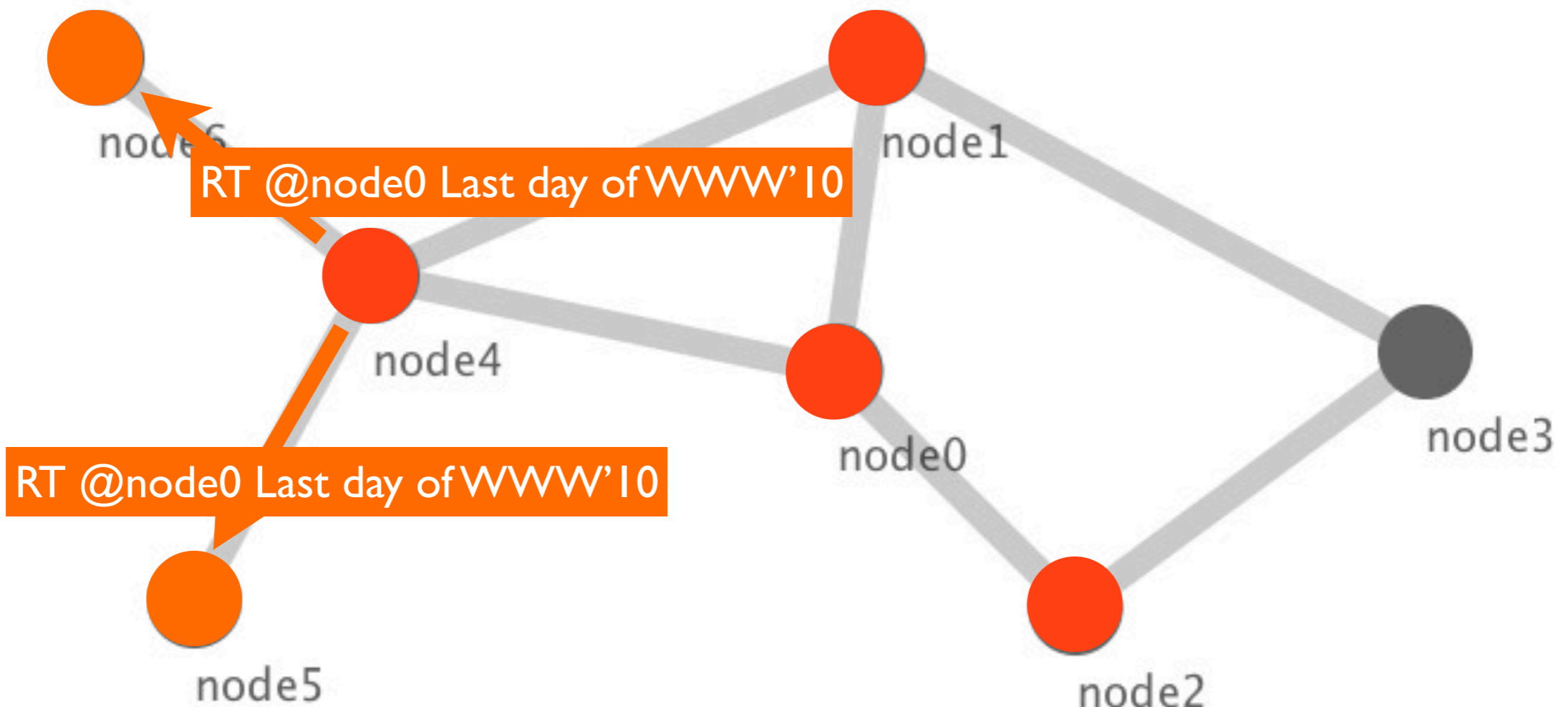




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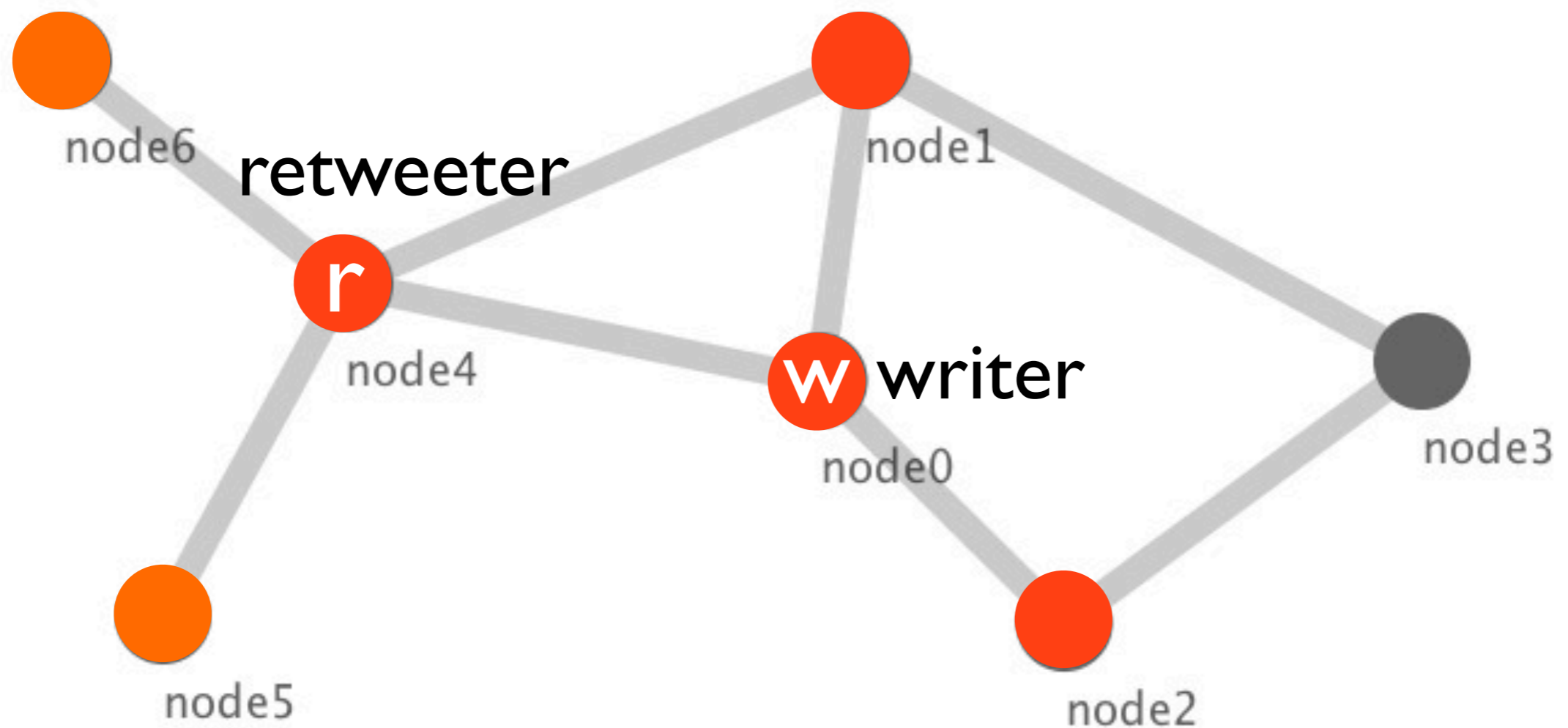
- Relay tweets from a following to followers

RT @node0 Last day of WWW'10



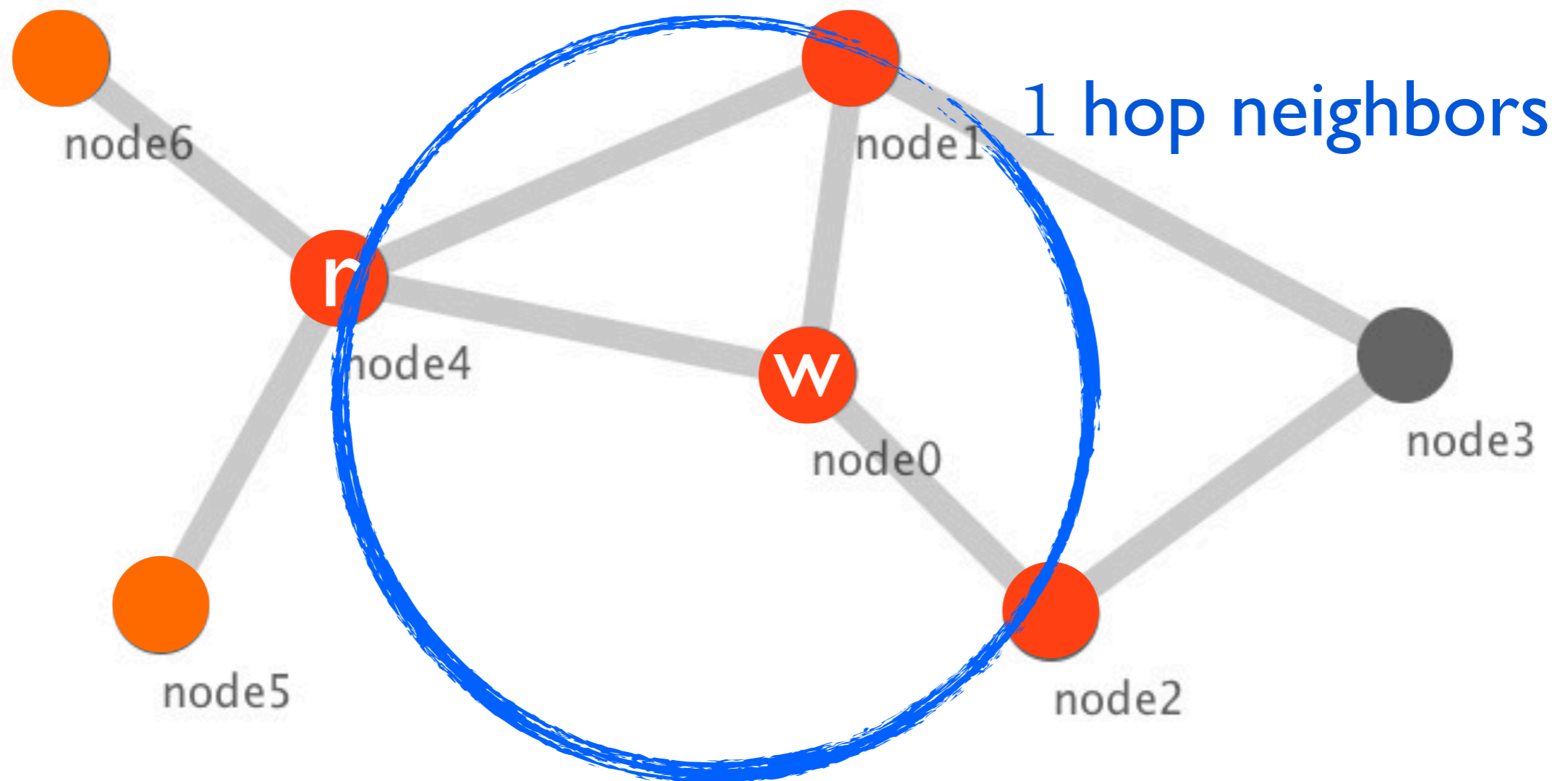
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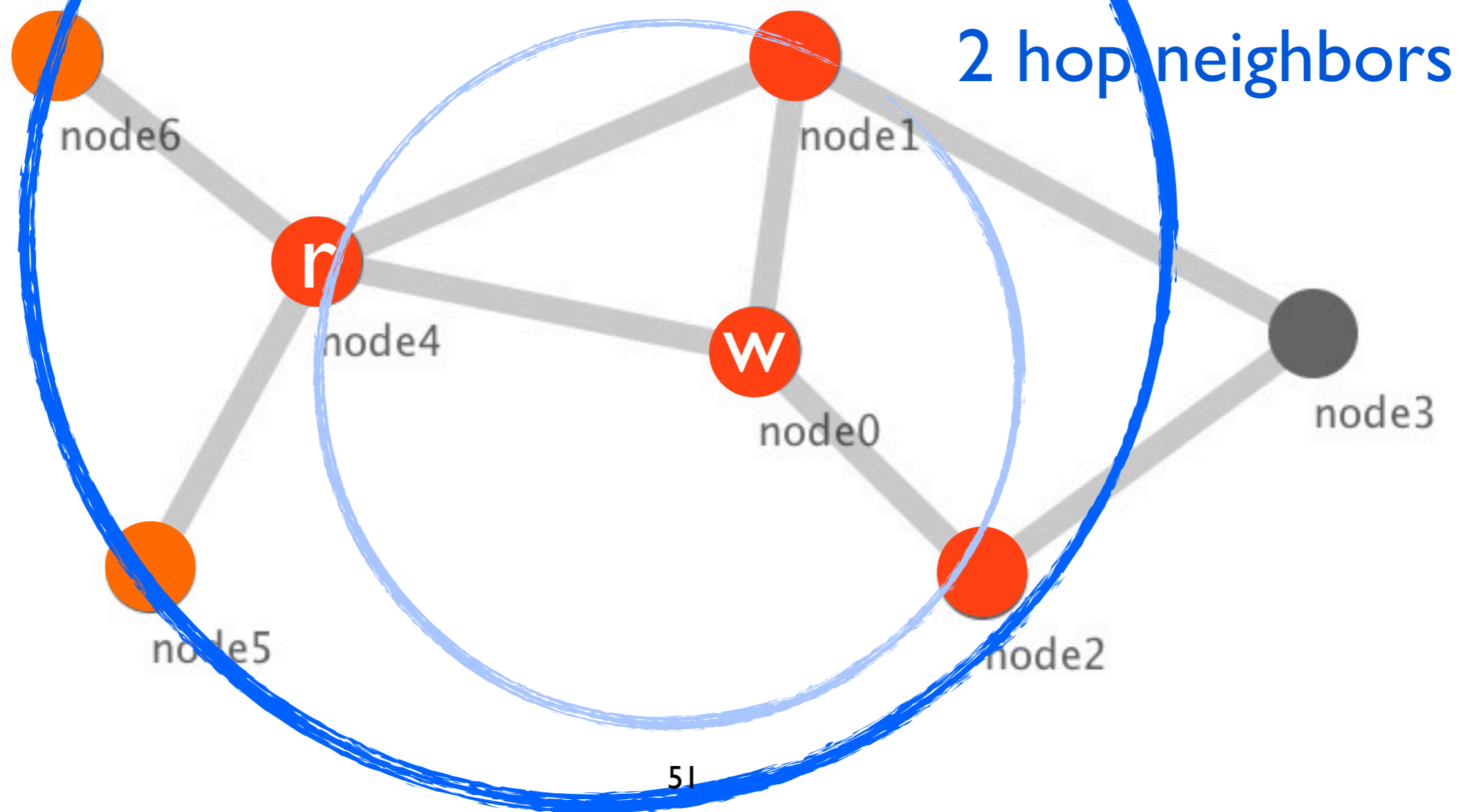
# Retweet (RT)

- Not only 1 hop neighbors



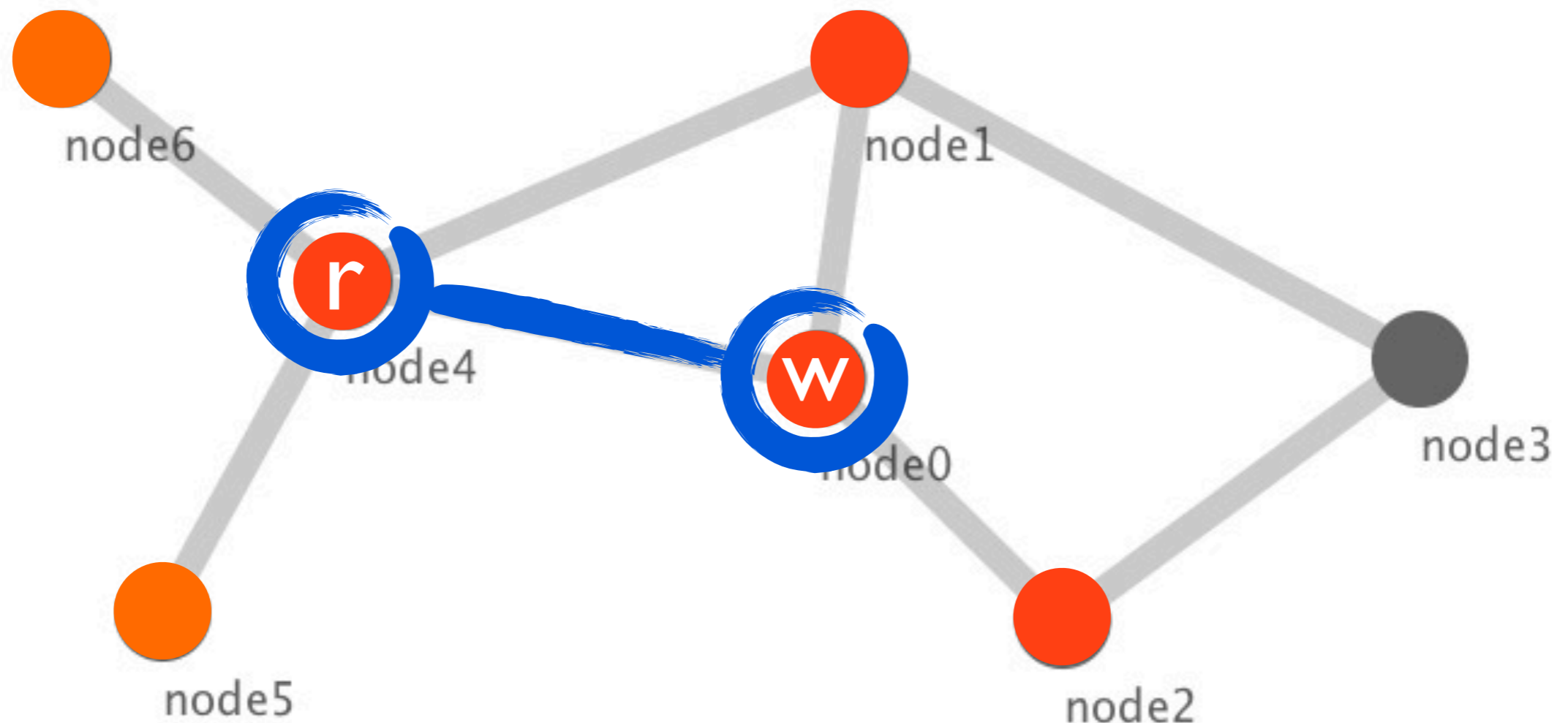
# Retweet (RT)

- More goes further



# We construct RT tree

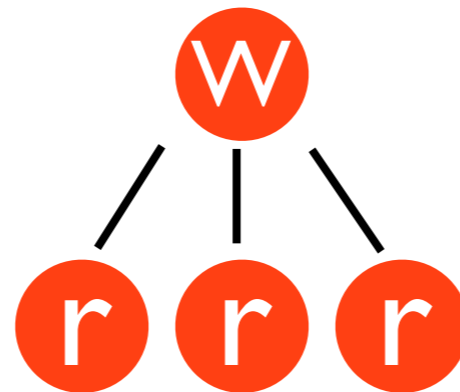
- A tree with writer and retweeter(s)



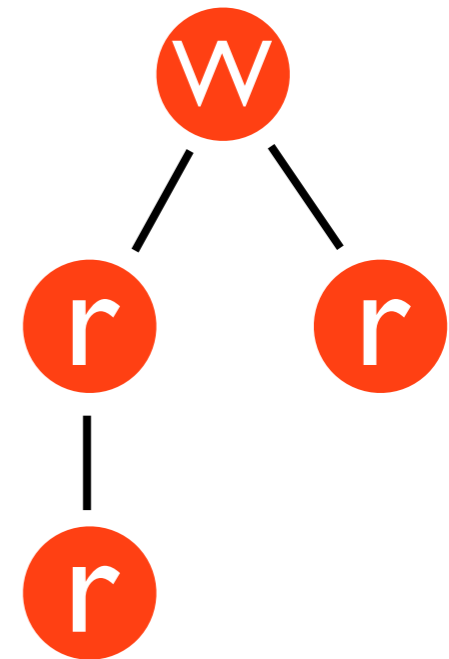
# Height of RT trees



1

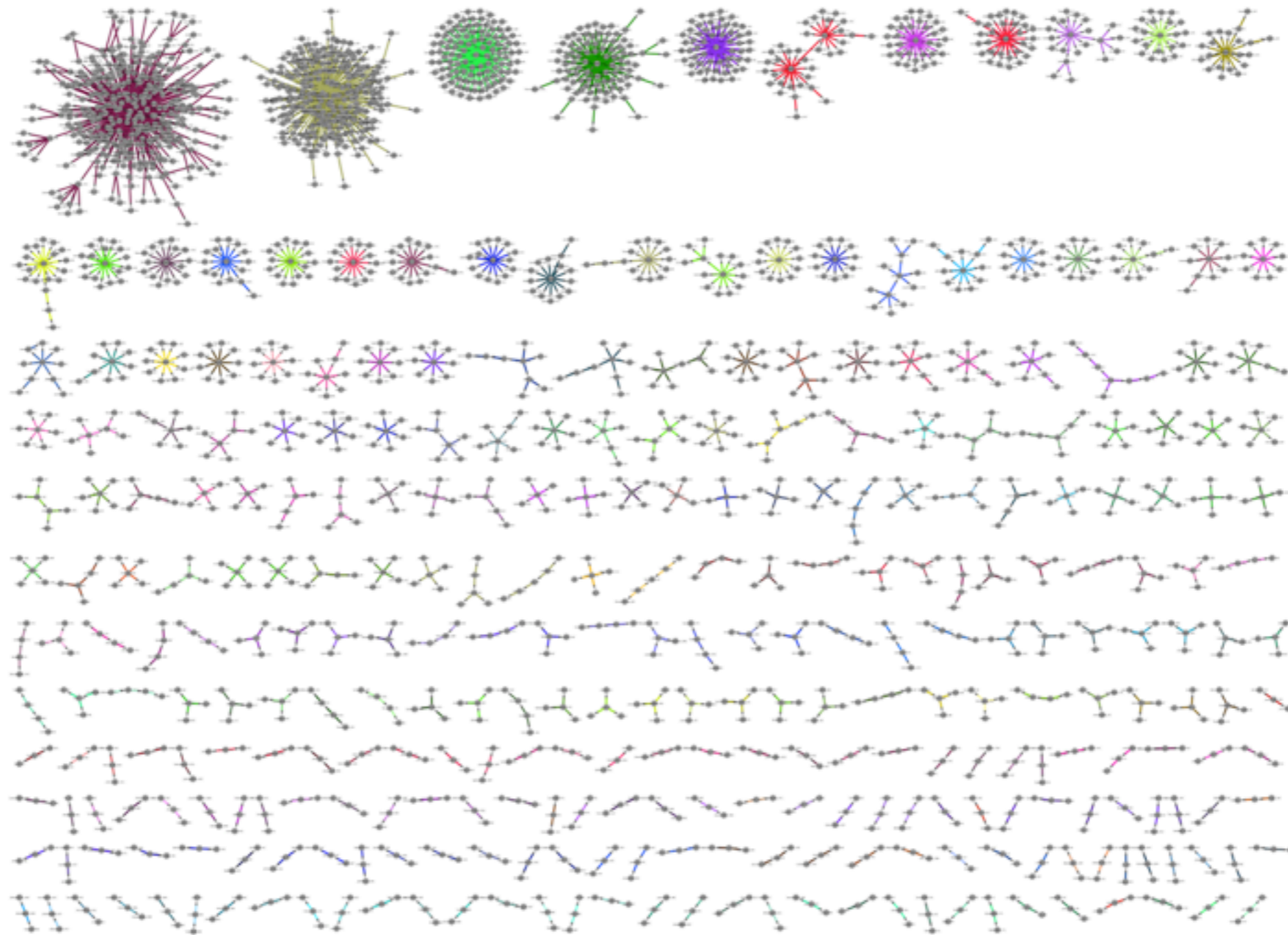


1

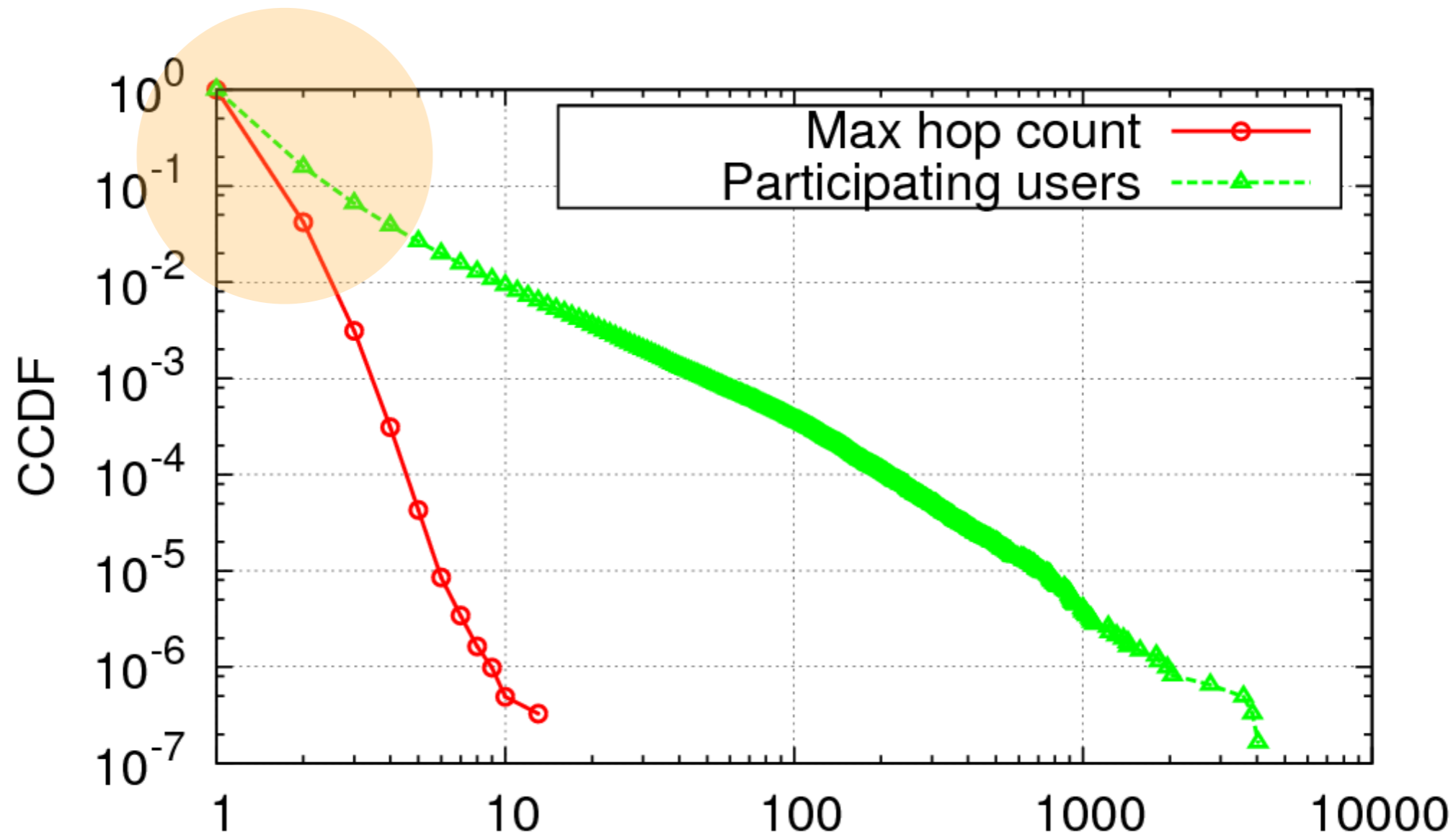


2

# Empirical RT trees

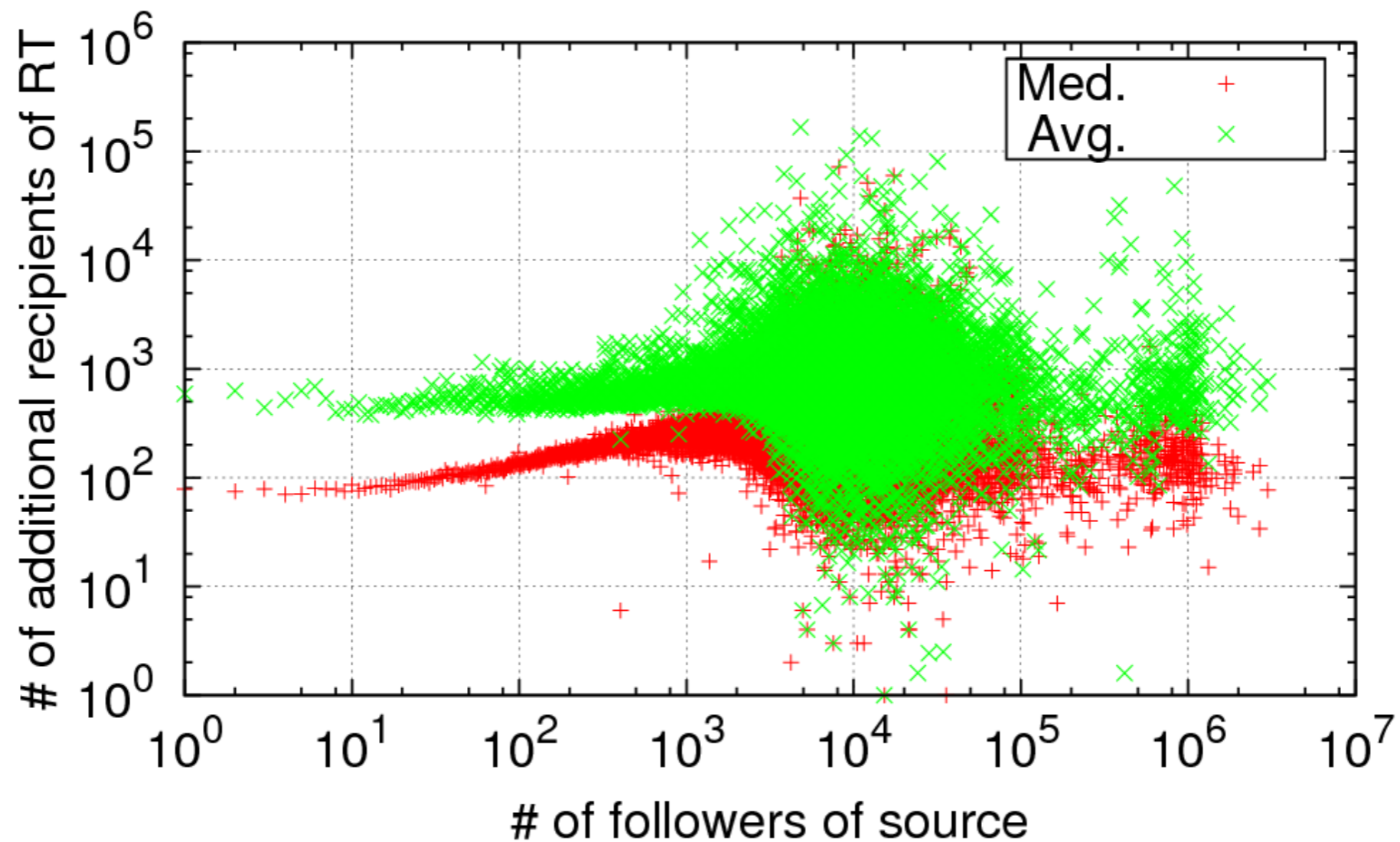


# 96% of RT trees = Height 1

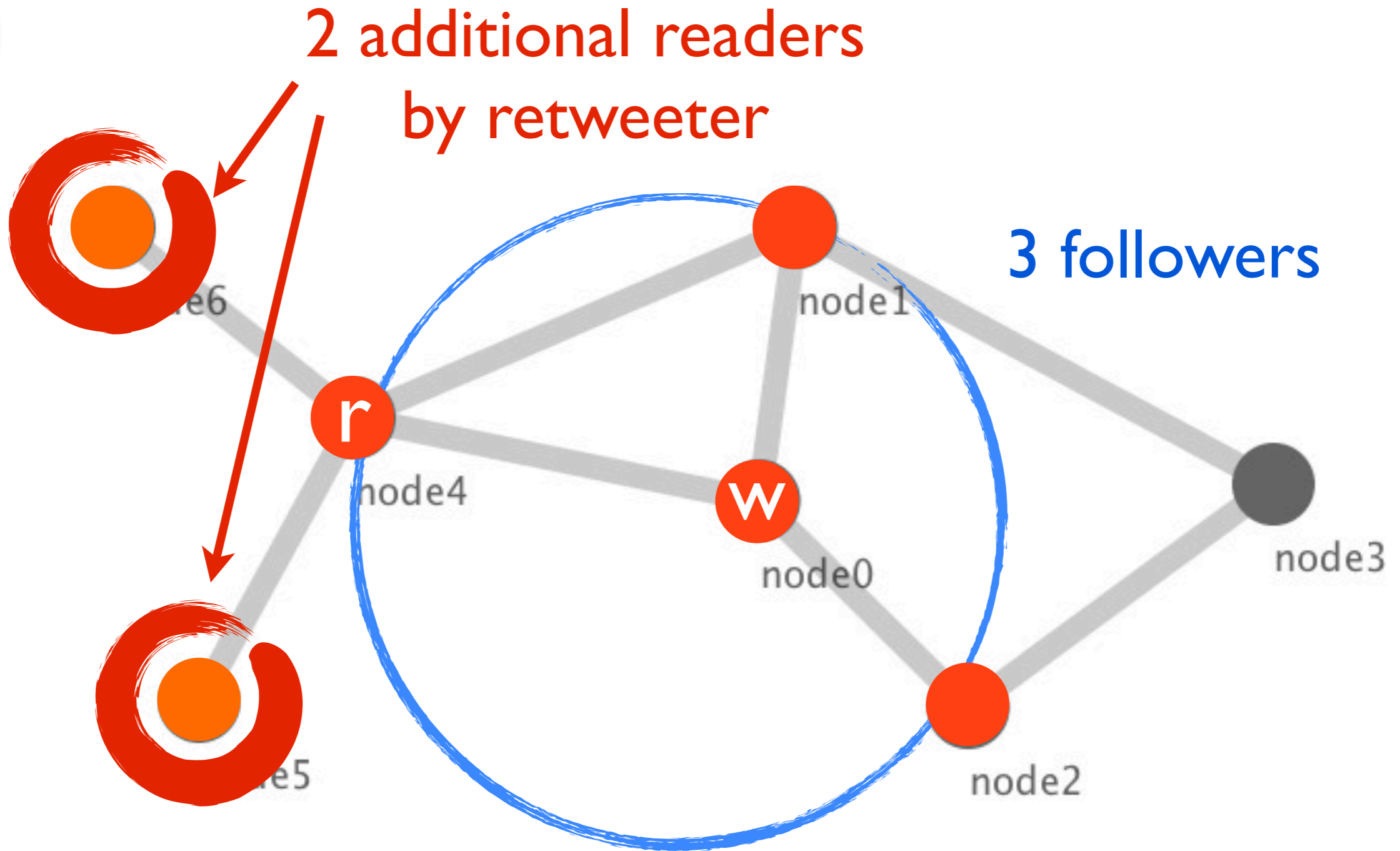




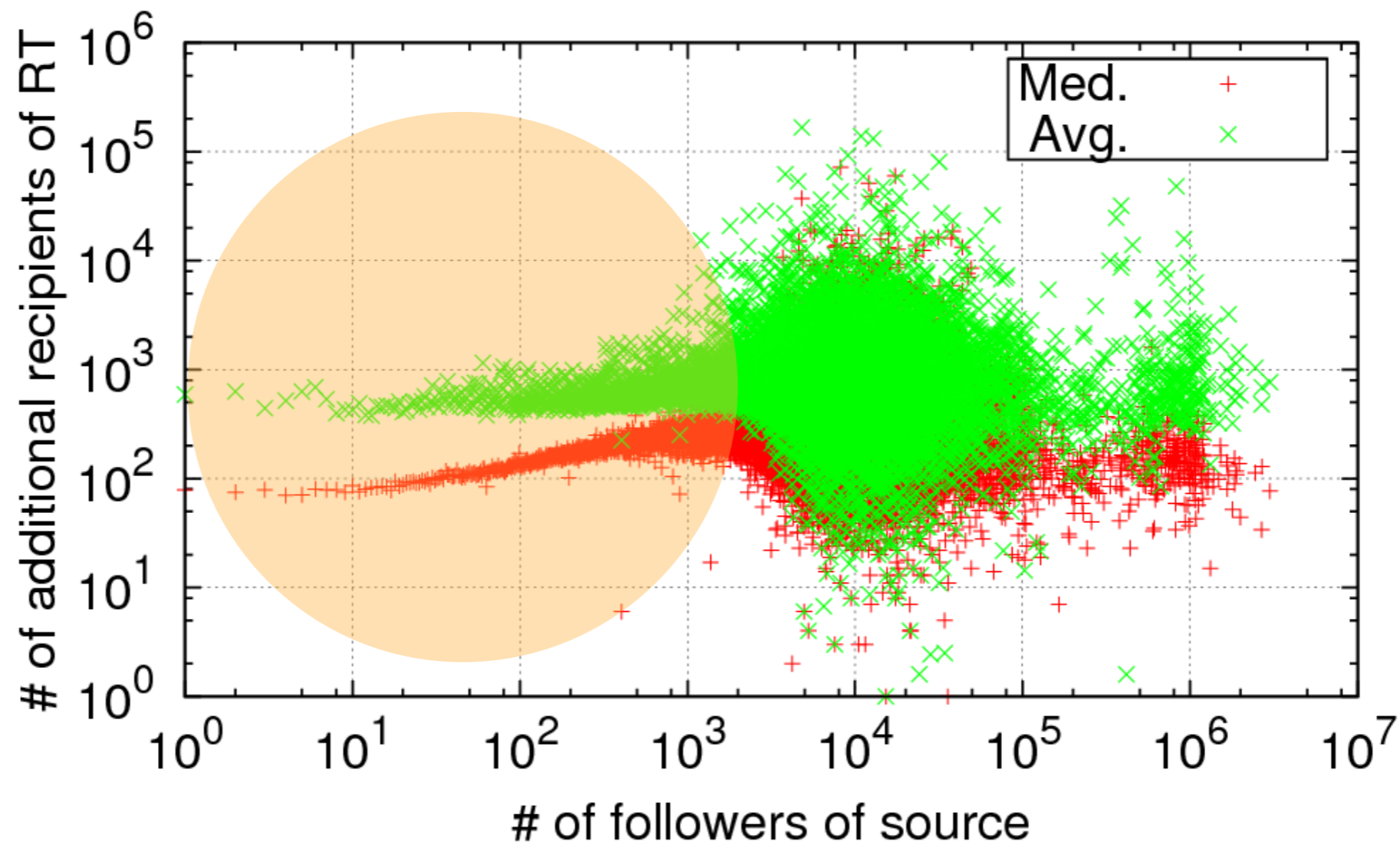
# Boosting audience by RT



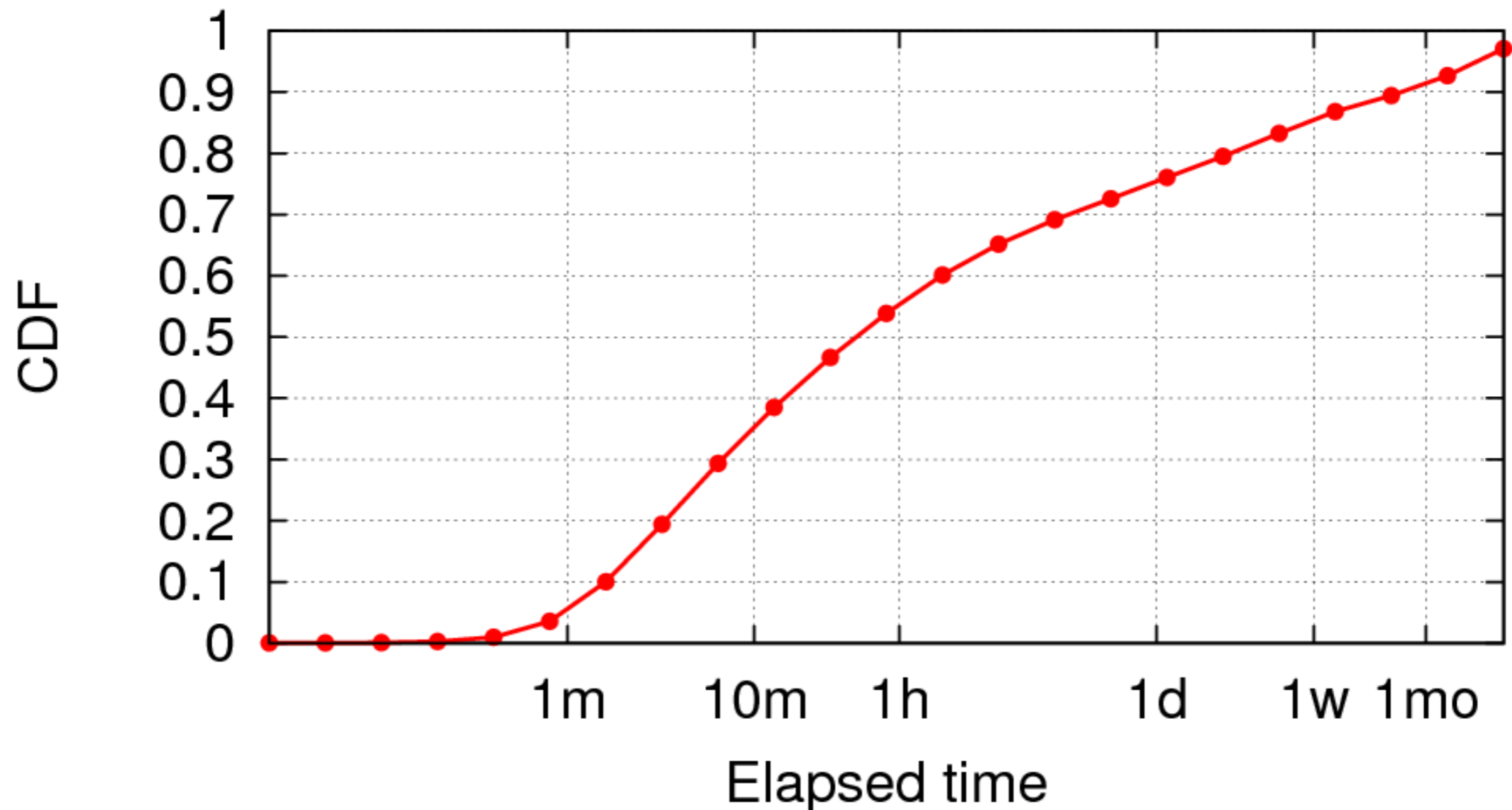
# Additional readers



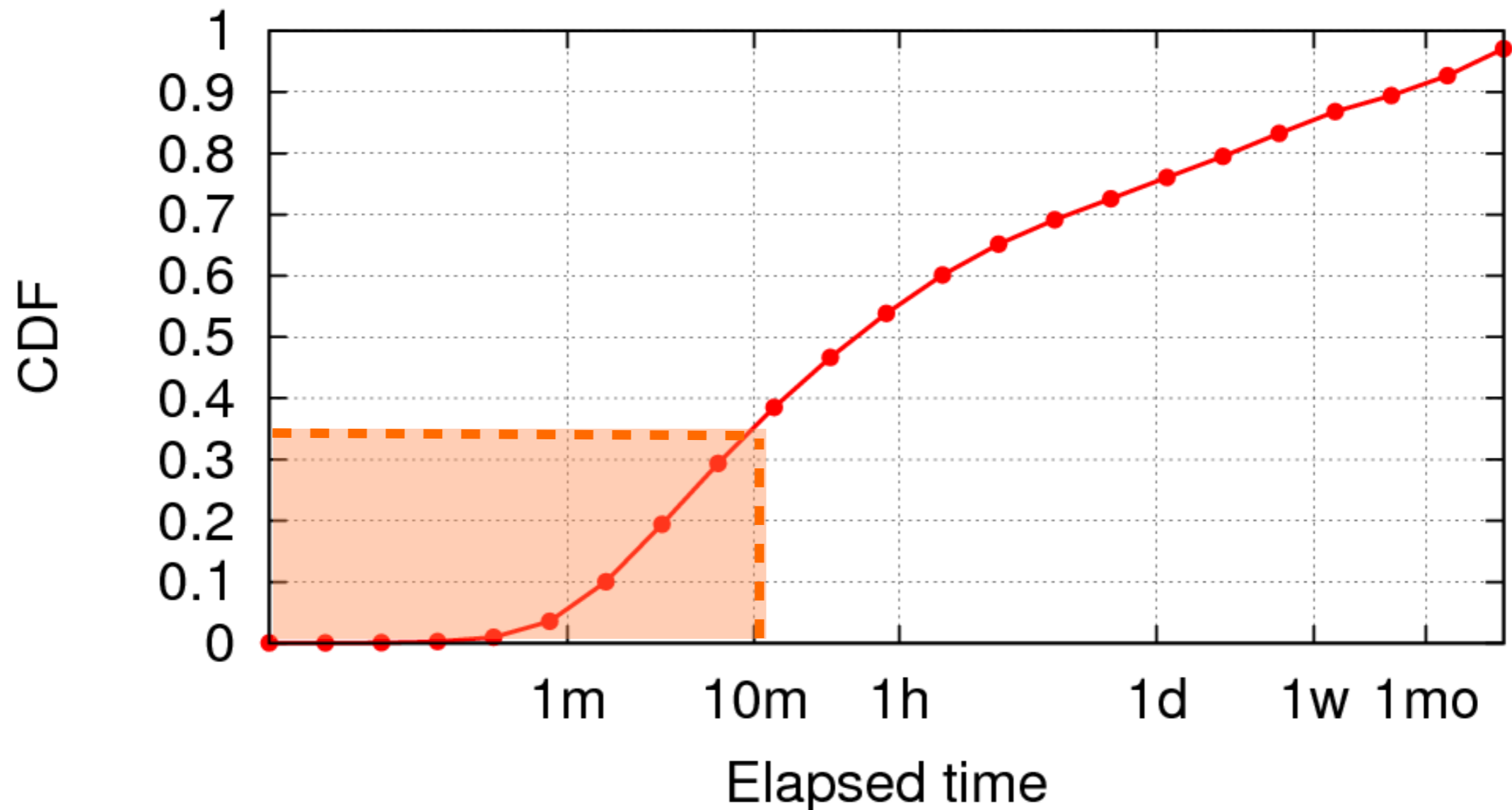
# A retweet brings a few hundred additional readers



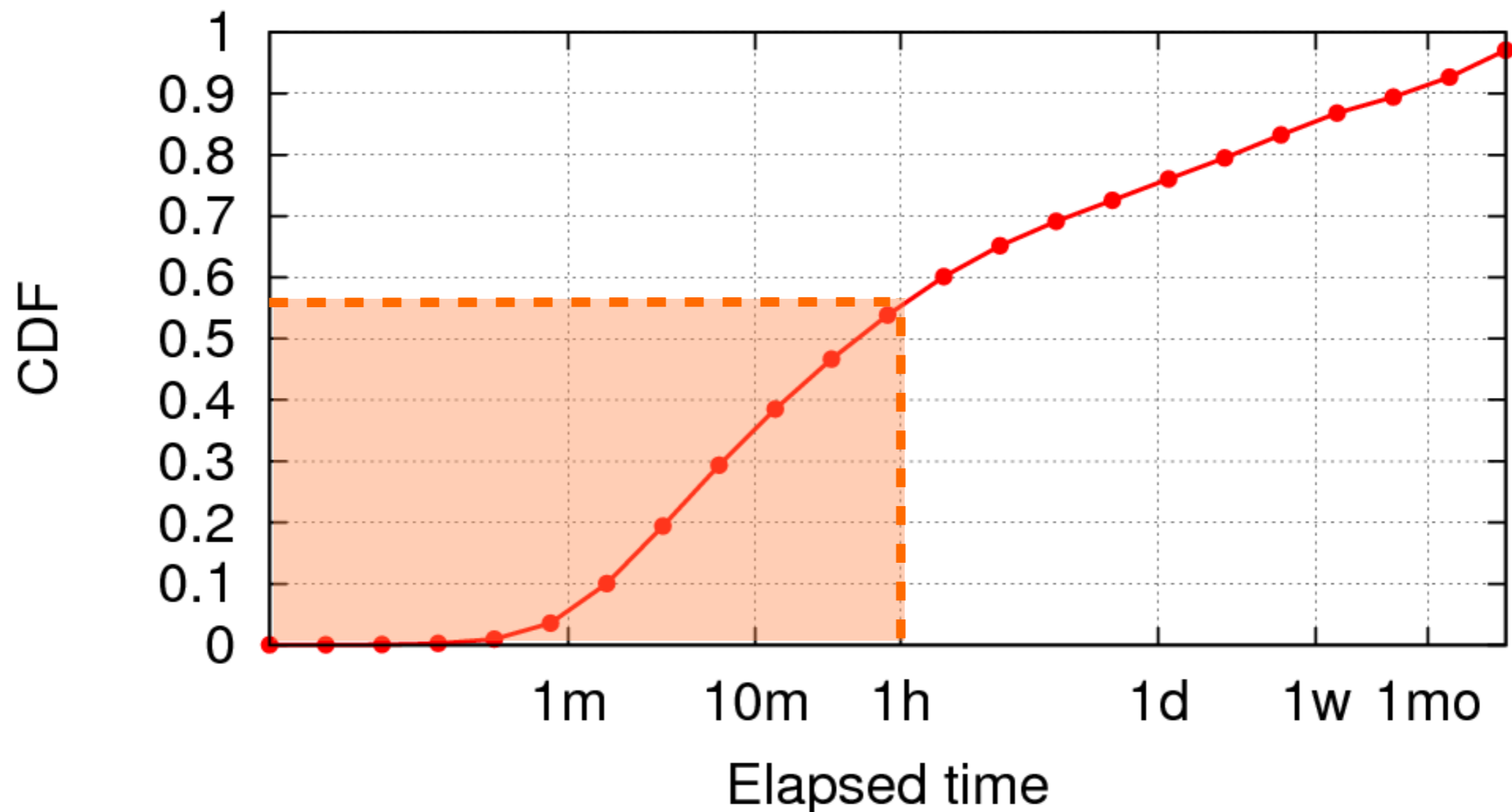
# Time lag between hops in RT tree



# Fast relaying tweets by RT: 35% of RT < 10 min.



# Fast relaying tweets by RT: 55% of RT < 1hr.



# Summary

1. We study the entire Twittersphere
2. Low reciprocity distinguishes Twitter from OSNs
3. Twitter has characteristics of news media:
  - ▶ Tweets mentioning timely topics
  - ▶ Plenty of hubs reaching a large public directly
  - ▶ Fast and wide spread of word-of-mouth



# Resources

- <http://an.kaist.ac.kr/traces/WWW2010.html>



**Supplementary info.**

# About Twitter

“Twitter is a real-time information network powered by people all around the world that lets you share and discover what’s happening now.”

Twitter asks “what’s happening” and makes the answer spread across the globe to millions, immediately.



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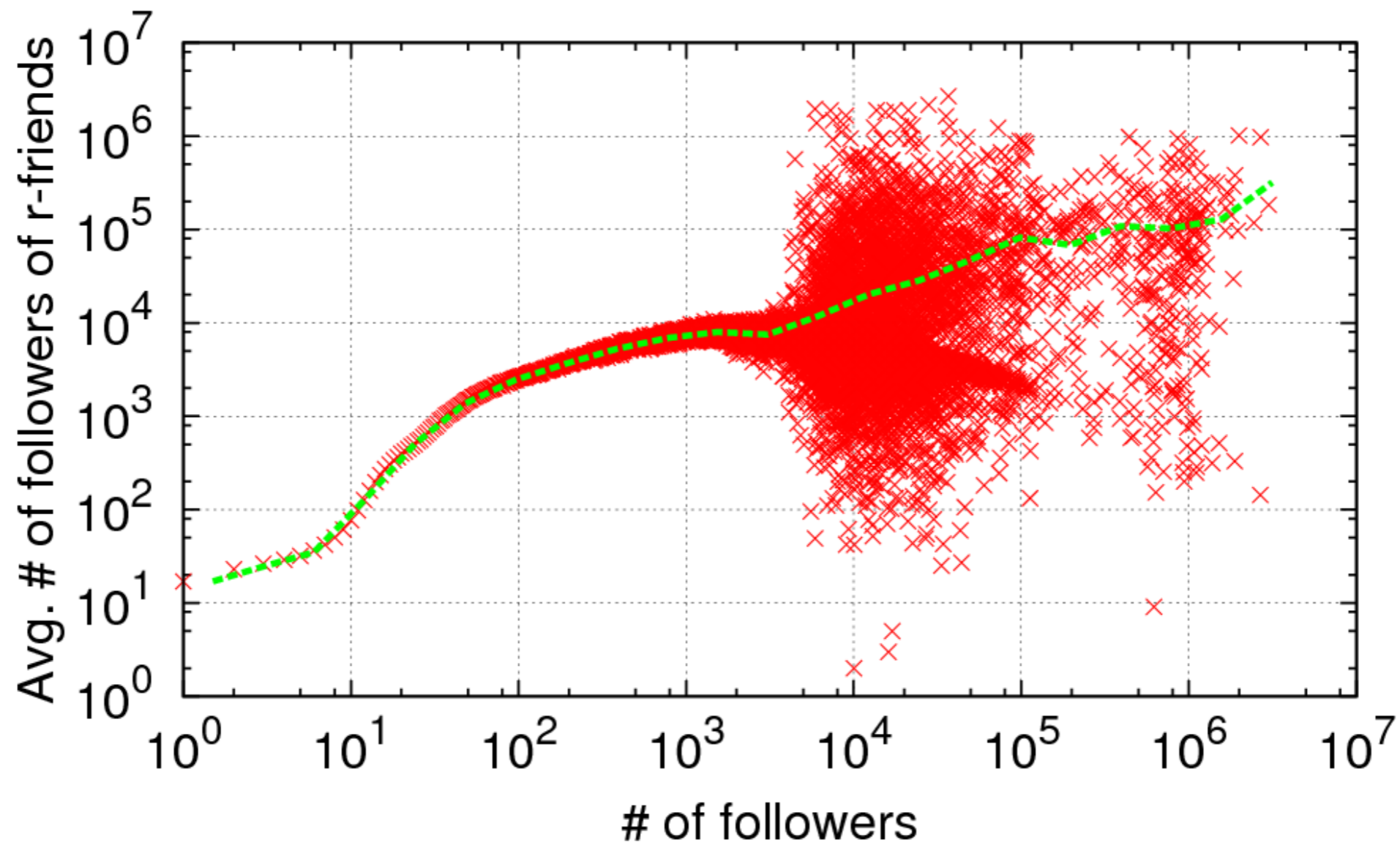


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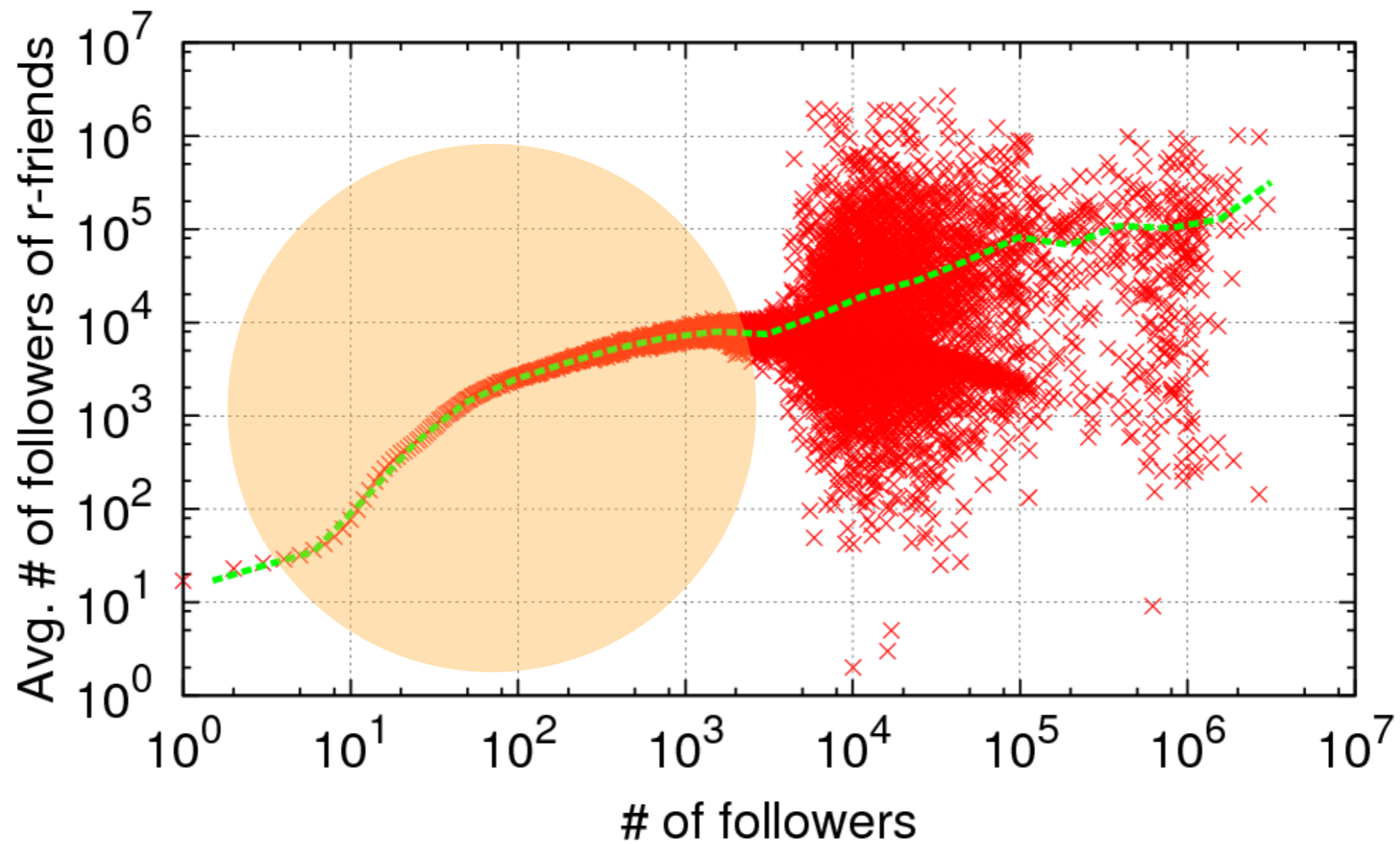
# A few numbers

- 105M registered accounts
- 55M tweets a day
- 180M unique visitors a month
- 19B searches a month

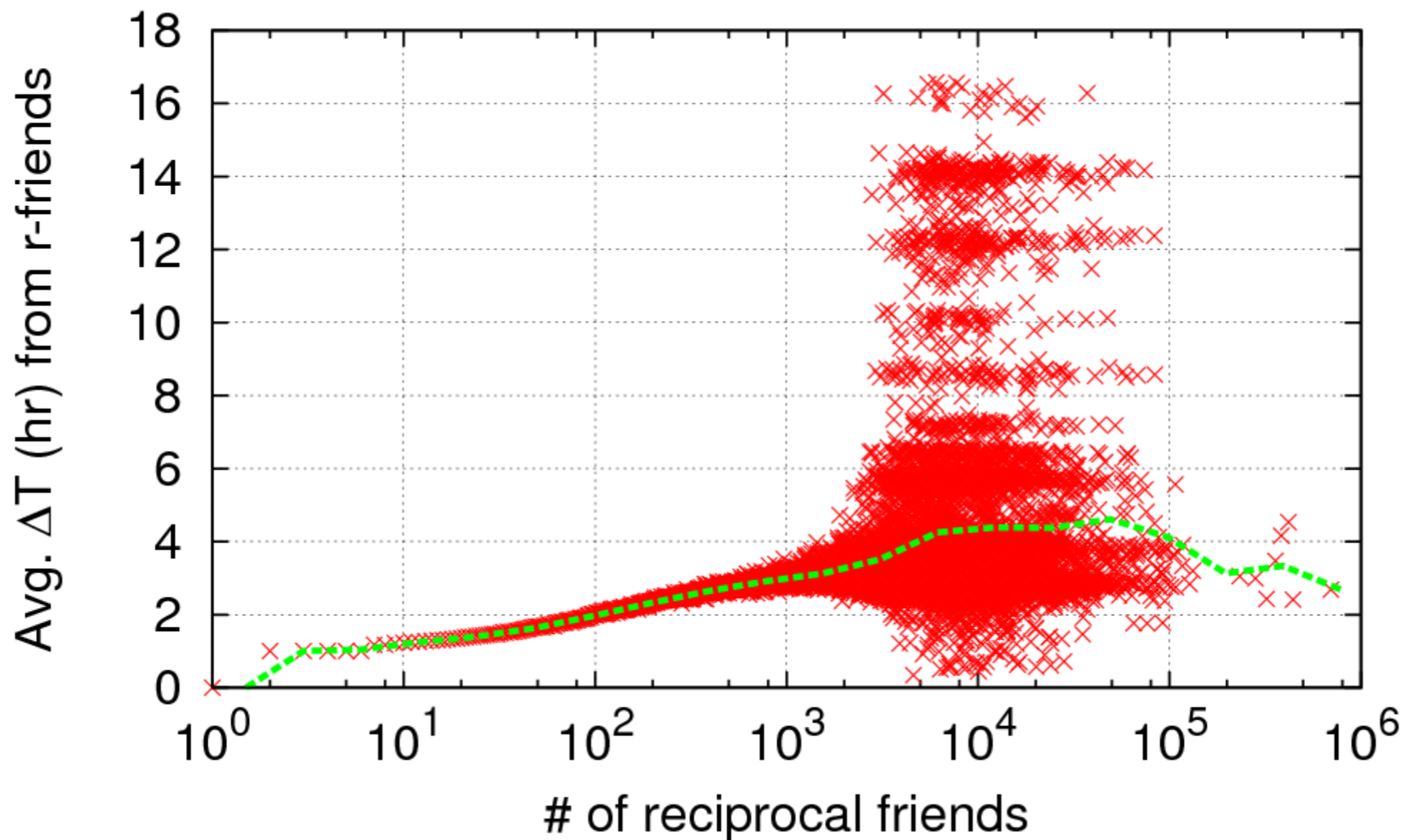
# Homophily in terms of followers



# Assortative mixing

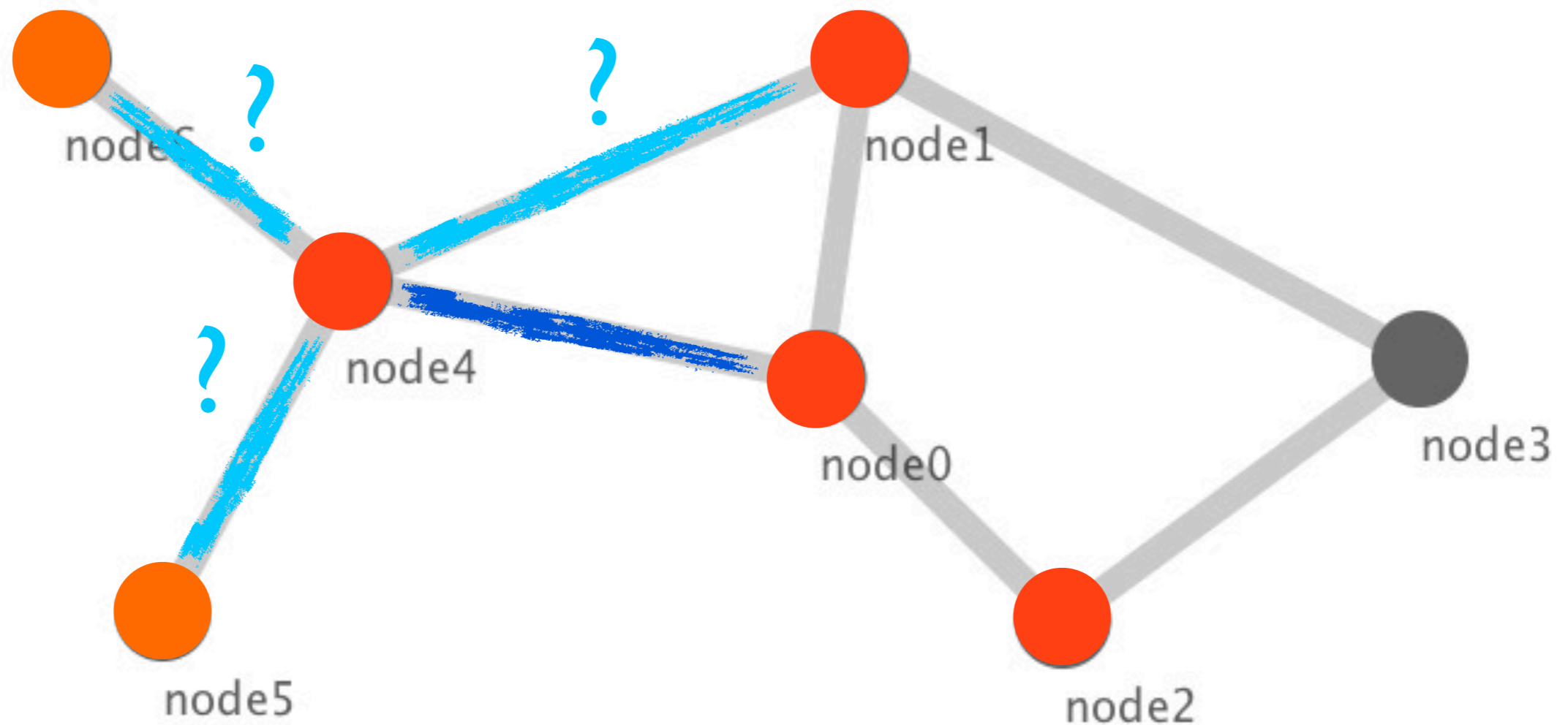


# Homophily in terms of location



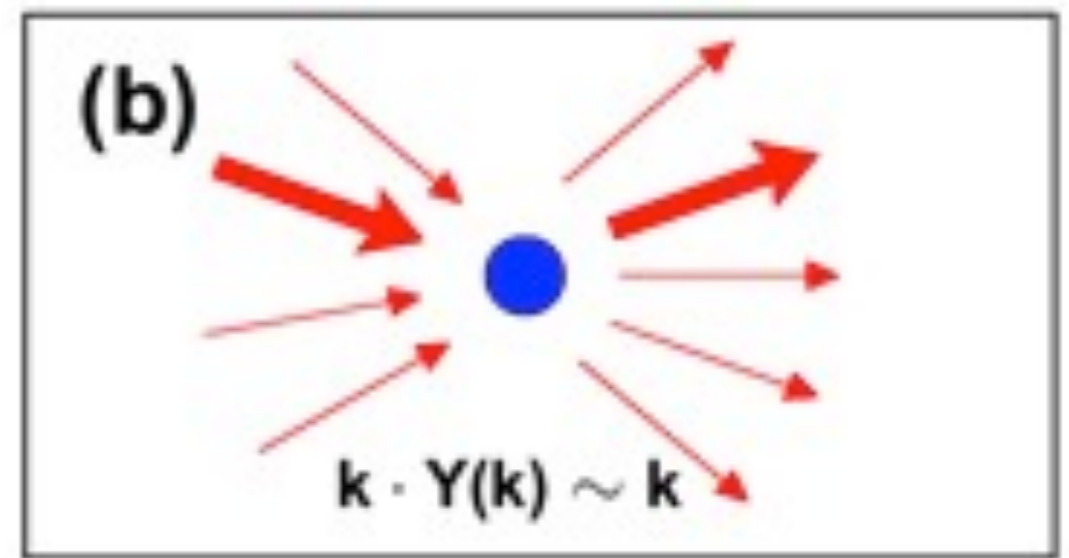
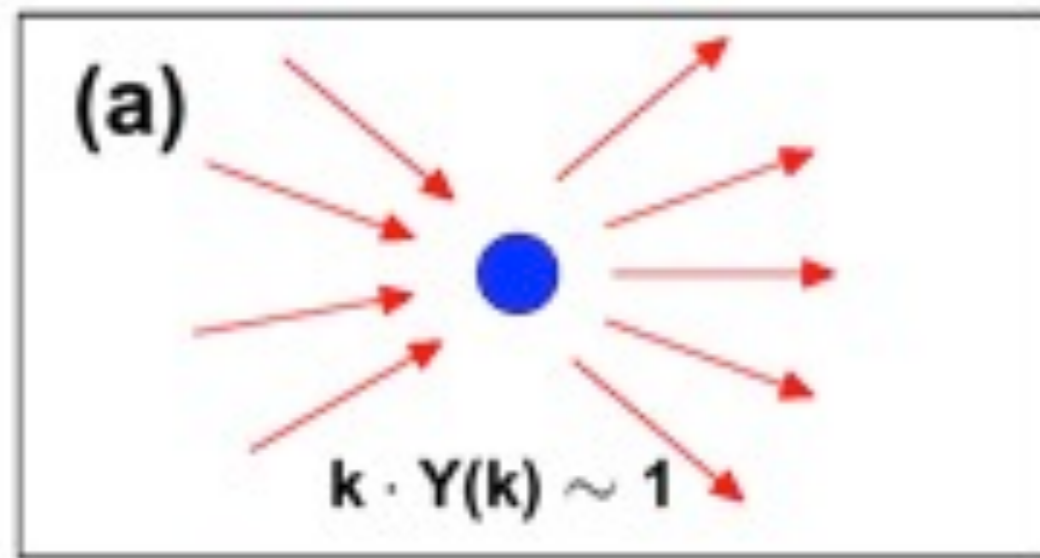
# Favoritism in RTs?

- A few informative users?



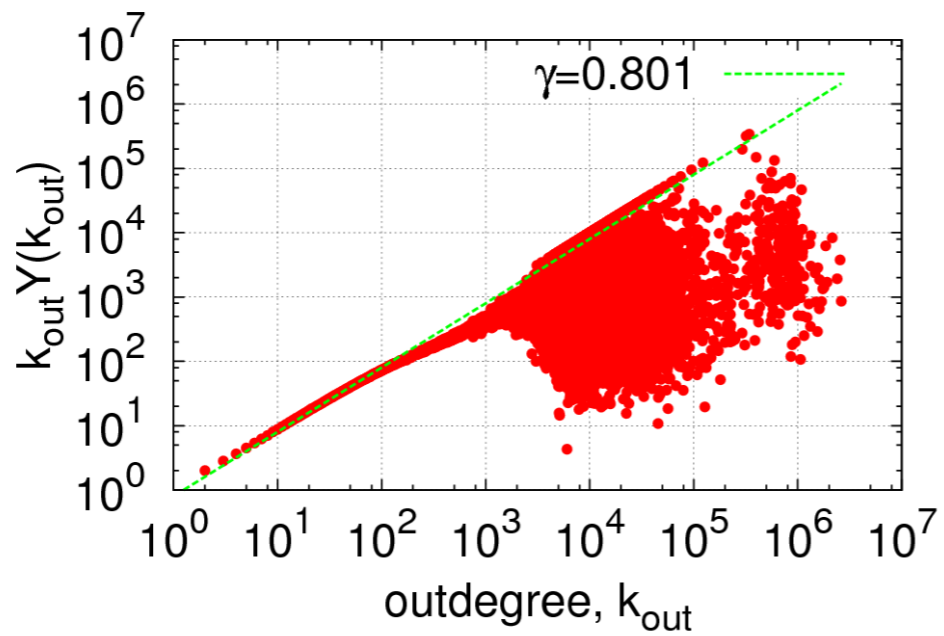


# Disparity in weighted network

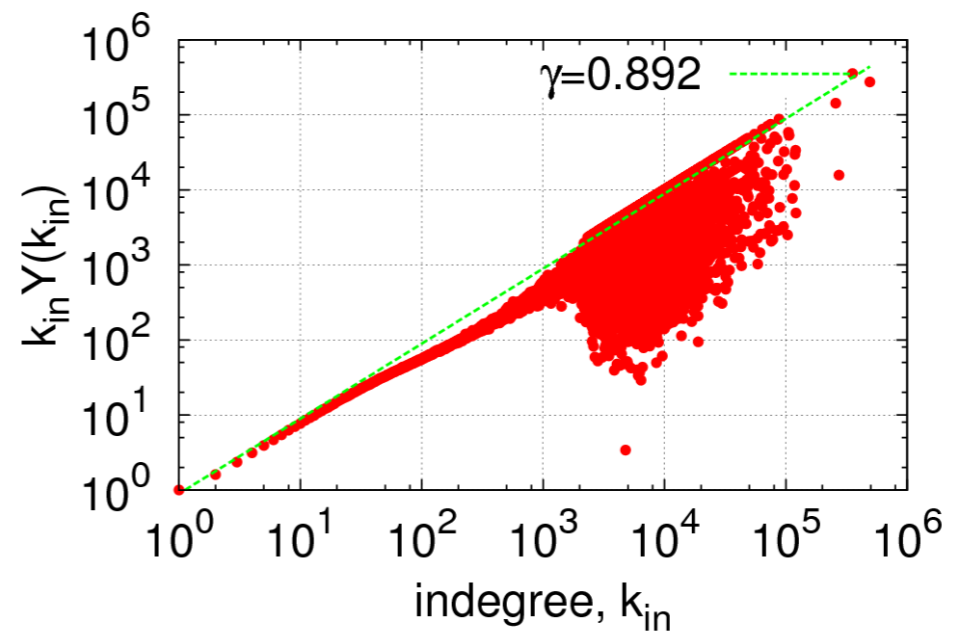


$$Y(k, i) = \sum_{j=1}^k \left\{ \frac{|r_{ij}|}{\sum_{l=1}^k |r_{il}|} \right\}^2$$

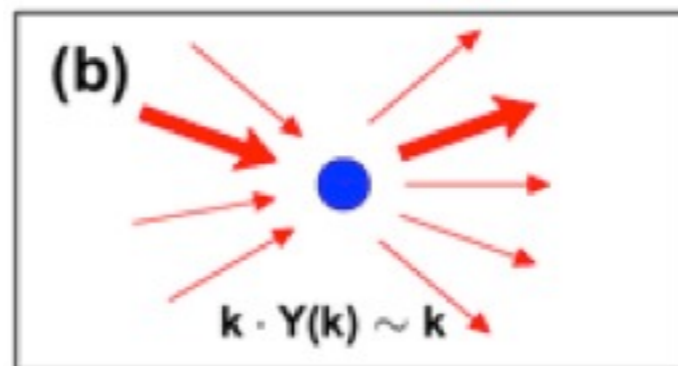
# Favoritism in RTs



(a)  $k_{out} Y(k_{out}) \sim k_{out}$



(b)  $k_{in} Y(k_{in}) \sim k_{in}$



# Fast WOM by retweet

