



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

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19th International World Wide Web Conference (WWW2010)

Twitter, a microblog service

twitter

What's happening? 140

|

Latest: <http://gigglehd.com/zbxe/3998449> 구글 역시 머리 좋다능. 클 라우드를 거쳐서 프린터로 인쇄. 이렇게 되면 크롬 OS 클라이언트가 점점 가벼워 질 수 있겠지;; 근데 이러면 프린터는 무조건 외부랑 통신되어야 되나?; 29 minutes ago

[Tweet](#)

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

 **sanghoon_kim** 아아악. 커피 n잔으로 충분히 충전했다 생각했는데 bitmap 인덱스 하나를 계산하지 못하겠어 ㅠ 벌써 몇시간째야 ㅠ
1 minute ago via web

 **minariboy** 이런 이름의 의원도 있었군. 이란 말을 아까 빼먹었어서; RT
@jinalsi: 한나라당 조전혁 의원이 기어이 전교조 명단을 공개했습니다.
법원의 공개금지명령을 어겼는디 본인은 헌법기관이니 법 위에 있다는 게
공개이유ㅋ<http://j.mp/b0BYAU>
2 minutes ago via Osfoora

Home Profile Find People Settings Help Sign out

 **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 

Saved Searches 
kaist

Lists 
kshs

collaborators

New list | View all

Twitter, a microblog service

The screenshot shows the Twitter homepage. At the top, there's a navigation bar with links for Home, Profile, Find People, Settings, Help, and Sign out. Below the navigation is a large input field labeled "What's happening?" with a character count of 140. A magnifying glass icon is positioned over this field. To the right of the input field is a profile card for user "haewoon", which includes a small profile picture, the name "haewoon", the number of tweets (1,656), and statistics for following (278), followers (329), and listed (33). Below the profile card is a definition for the term "one·forty": "n. a place to find Twitter apps." On the left side of the main content area, there are three tweets displayed. The first tweet is from "red_nude" (@EGGPUDING) and includes a link to a photo on Twitpic. The second tweet is from "sanghoon_kim" and discusses bitmap indexing. The third tweet is from "minariboy" (@jinalsi) and discusses a political scandal involving a lawmaker. At the bottom of the page, there are links for Home, Direct Messages (30), Favorites, Retweets, and a search bar. There are also sections for Saved Searches (kaist), Lists (kshs), and Collaborators, along with links to New list and View all.

Home Profile Find People Settings Help Sign out

What's happening? 140

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Tweet

Home

write a short message

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haewoon 1,656 tweets

278 329 33

following followers listed

one·forty
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New list | View all

Twitter, a microblog service

The screenshot shows the Twitter homepage with a magnifying glass icon on the left.

Header: Home Profile Find People Settings Help Sign out

User Profile (haewoon):

- Profile picture: haewoon
- Tweets: 1,656
- Following: 278
- Followers: 329
- Listed: 33

Definition: one·forty
n. a place to find Twitter apps.

Home Timeline:

- red_nude:**刚刚 봤어요. 작은 경당이네요. 그 자체로 기도인듯..RT
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Text overlay: 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.”

Following = subscribing tweets

The screenshot shows a Twitter interface. At the top, there's a magnifying glass icon on the left and a navigation bar with 'Home' (highlighted in green), 'Profile', 'Find People', 'Settings', 'Help', and 'Sign out'. Below the navigation is a search bar with 'What's happening?' and a count of '140' tweets. A text input field is present below the search bar. To the right, a user profile for 'haewoon' is shown, featuring a profile picture, the name 'haewoon', the number '1,656 tweets', and stats for '278 following', '329 followers', and '33 listed'. A definition for the term 'one·forty' is provided: 'n. a place to find Twitter apps.' On the left, the 'Home' tab is selected, showing three recent tweets from users 'red_nude', 'sanghoon_kim', and 'minariboy'. Each tweet has a small profile picture next to it. Two arrows point from the text 'recent tweets of followings' to the names 'red_nude' and 'sanghoon_kim' in the list. The right side of the screen shows a sidebar with links for 'Home', '@haewoon', 'Direct Messages', 'Favorites', 'Retweets', 'Saved Searches', 'Lists', 'kshs', 'collaborators', and buttons for 'New list' and 'View all'.

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.



©2009 Ian D. Marsden - www.marsdencartoons.com

<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

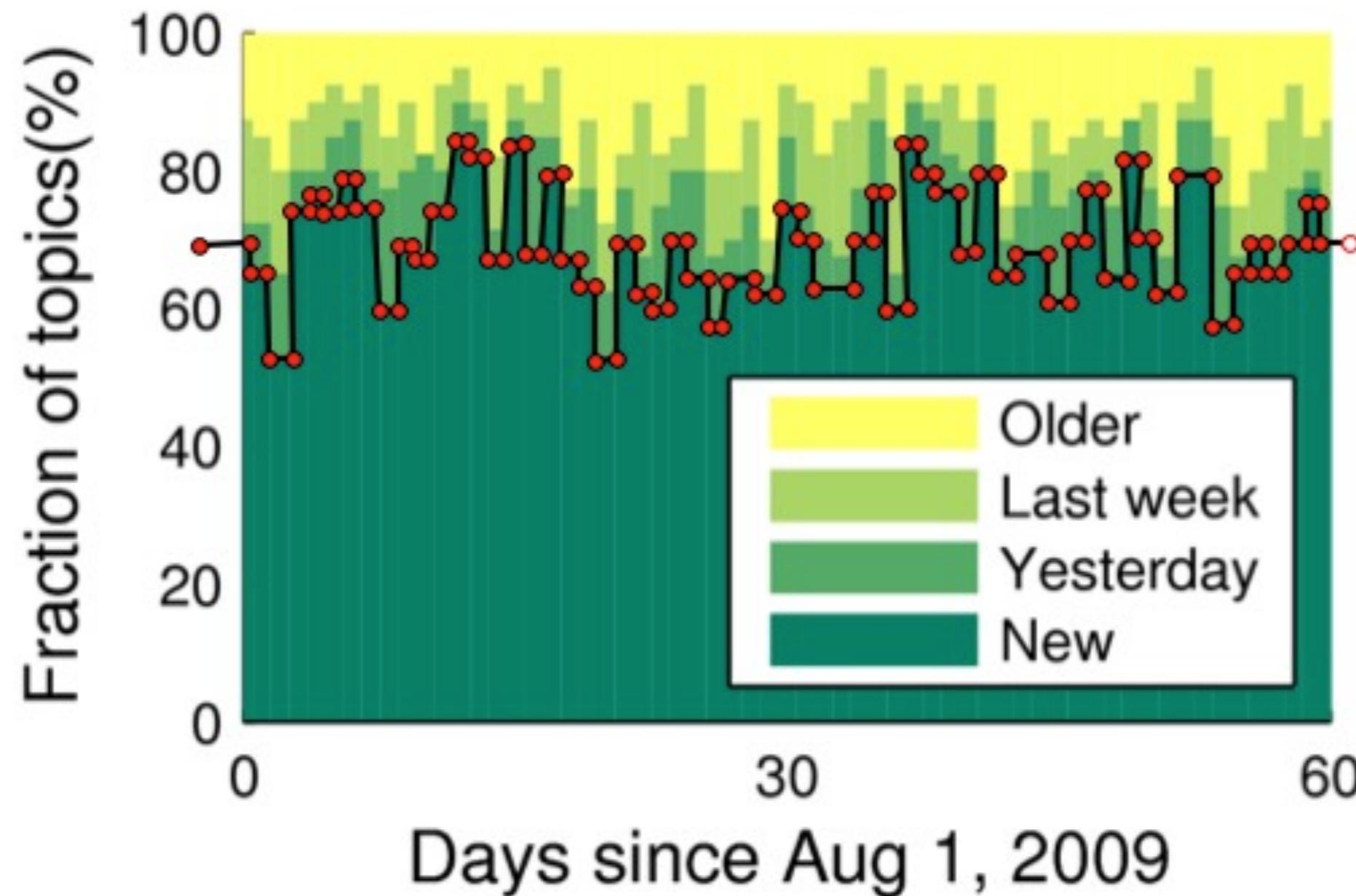
Low reciprocity of following

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

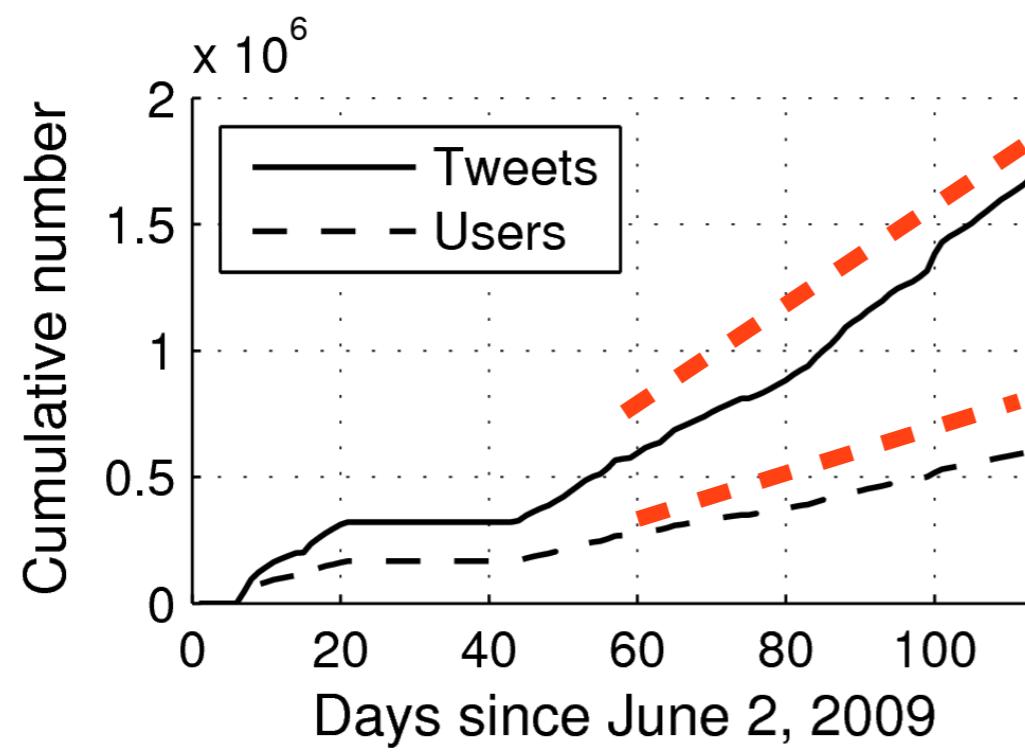
Part II.

- 
- I. Following is mostly not reciprocated (not so “social”)
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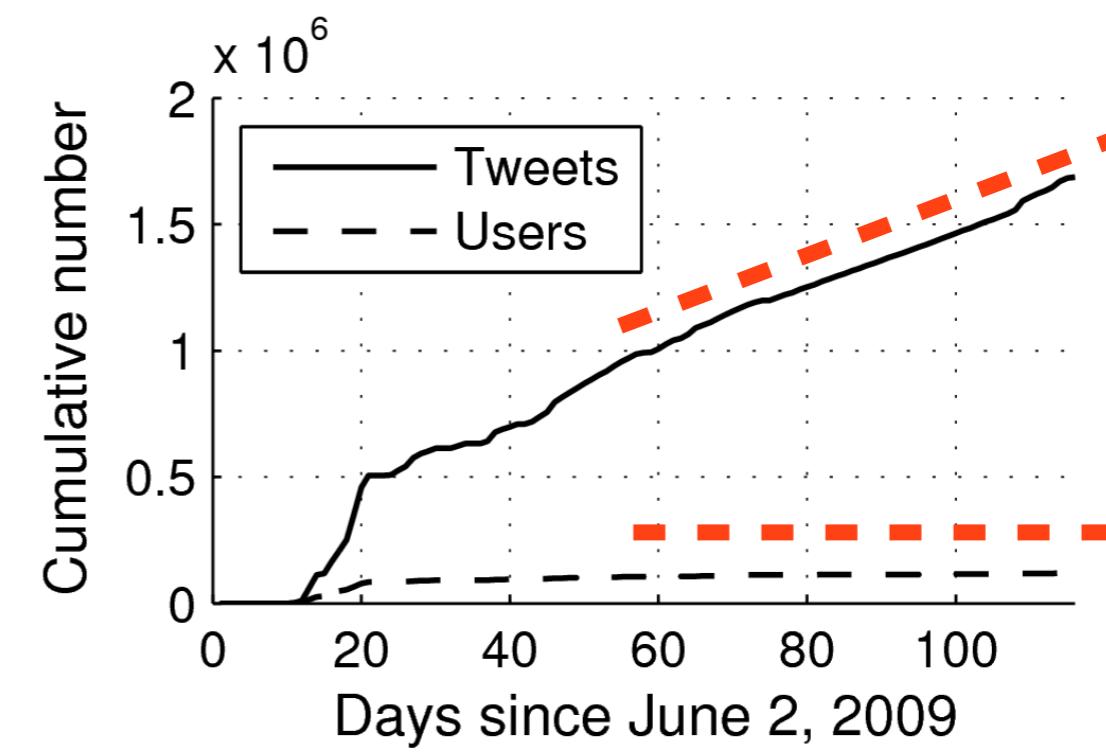
Dynamically changing trends



User participation pattern can be a signature of a topic



(a) Topic 'apple'

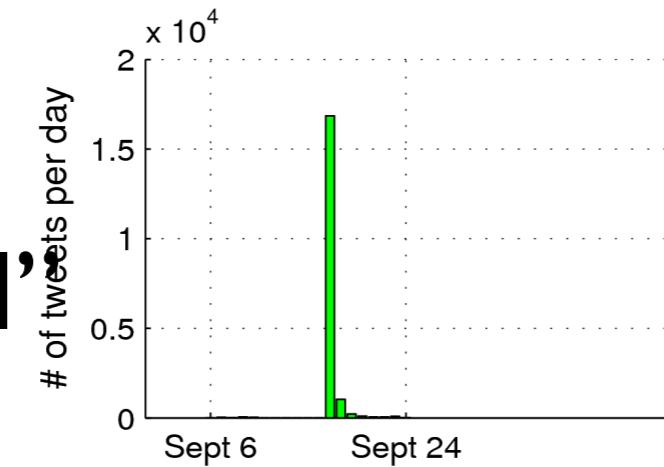


(b) Topic '#iranelection'

Majority of topics are headline

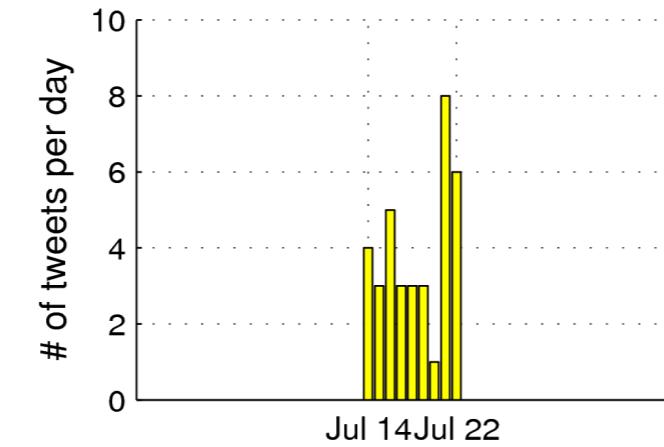
31.5%

“ephemeral”

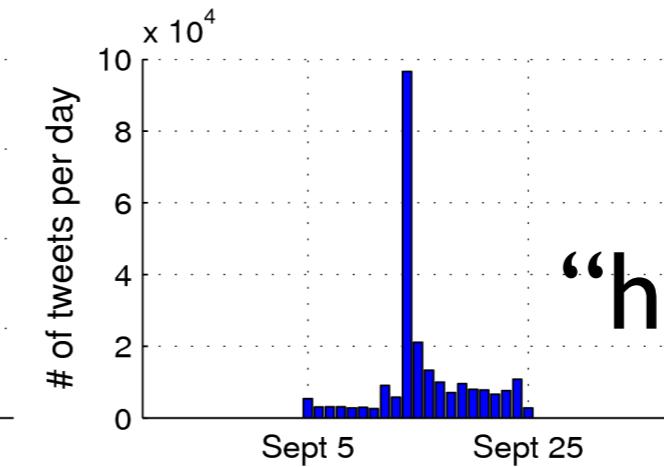


(a) Exogenous subcritical
(topic ‘#backintheday’)

6.9%



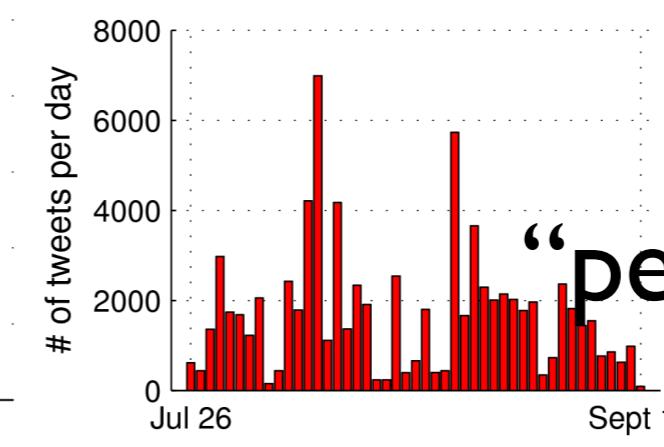
(c) Endogenous subcritical
(topic ‘lynn harris’)



(b) Exogenous critical
(topic ‘beyonce’)

54.3%

“headline news”



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

7.3%

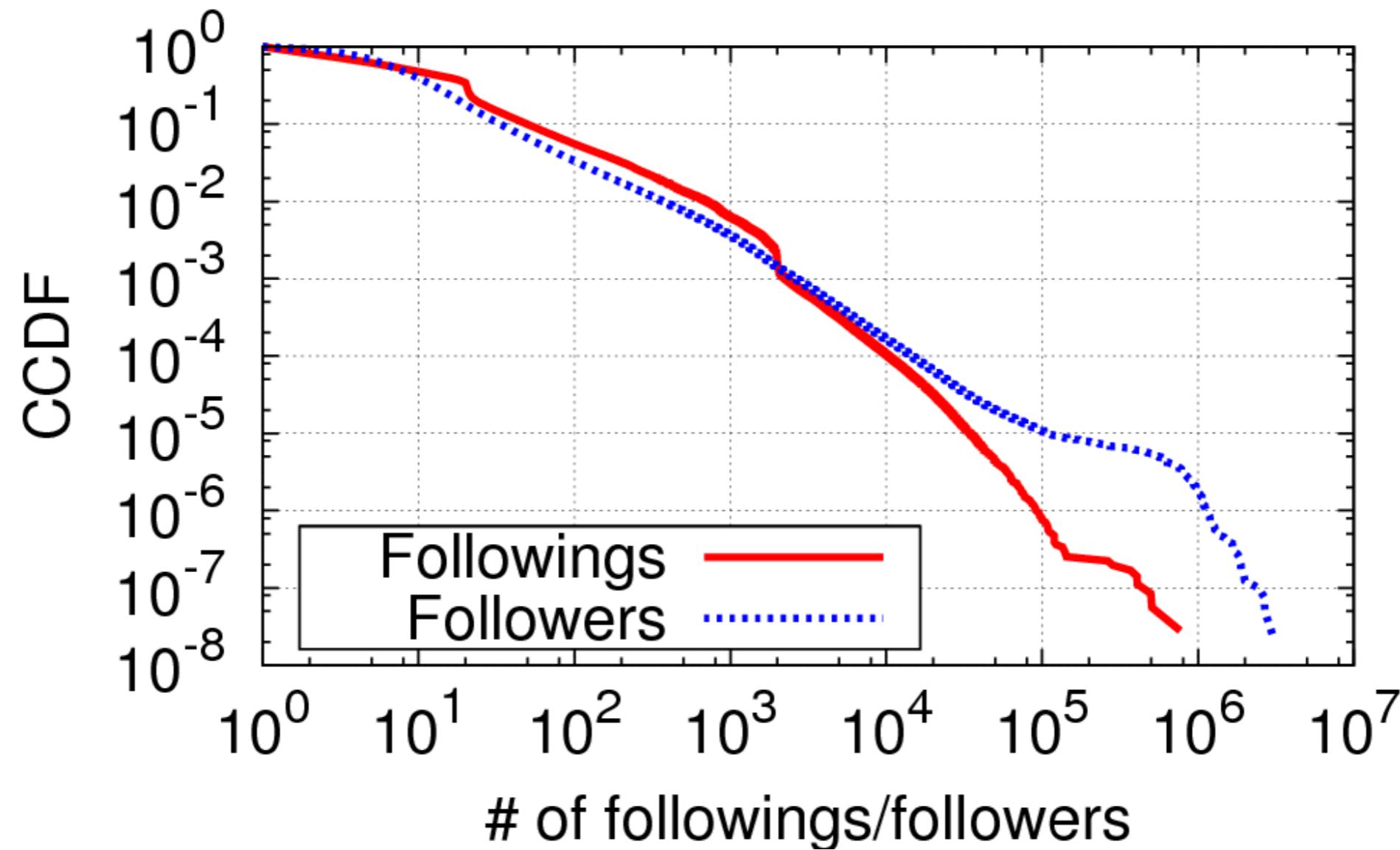
“persistent news”

Part III.

- 
1. Following is mostly not reciprocated (not so “social”)
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How many followers a user has?



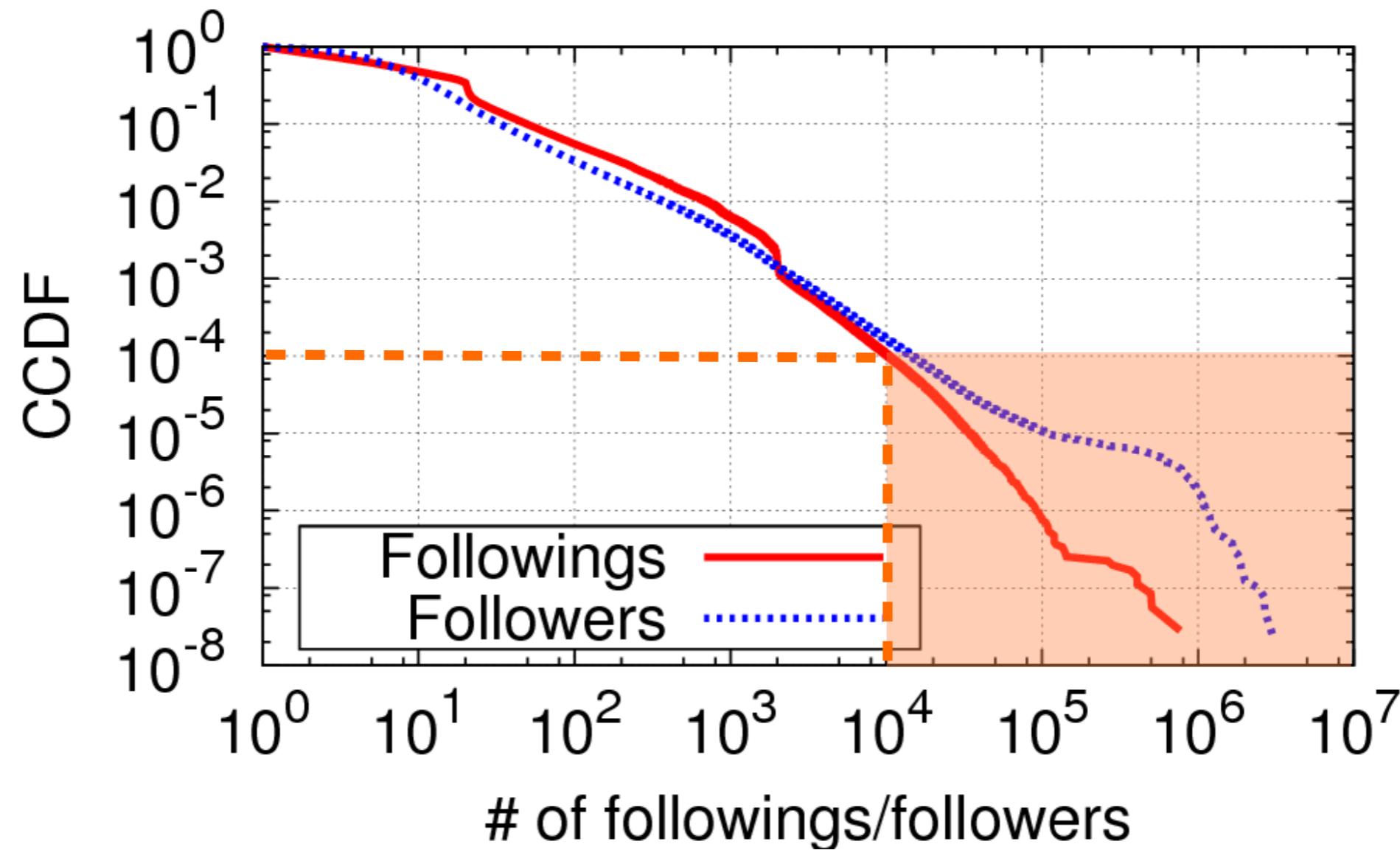


CCDF

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

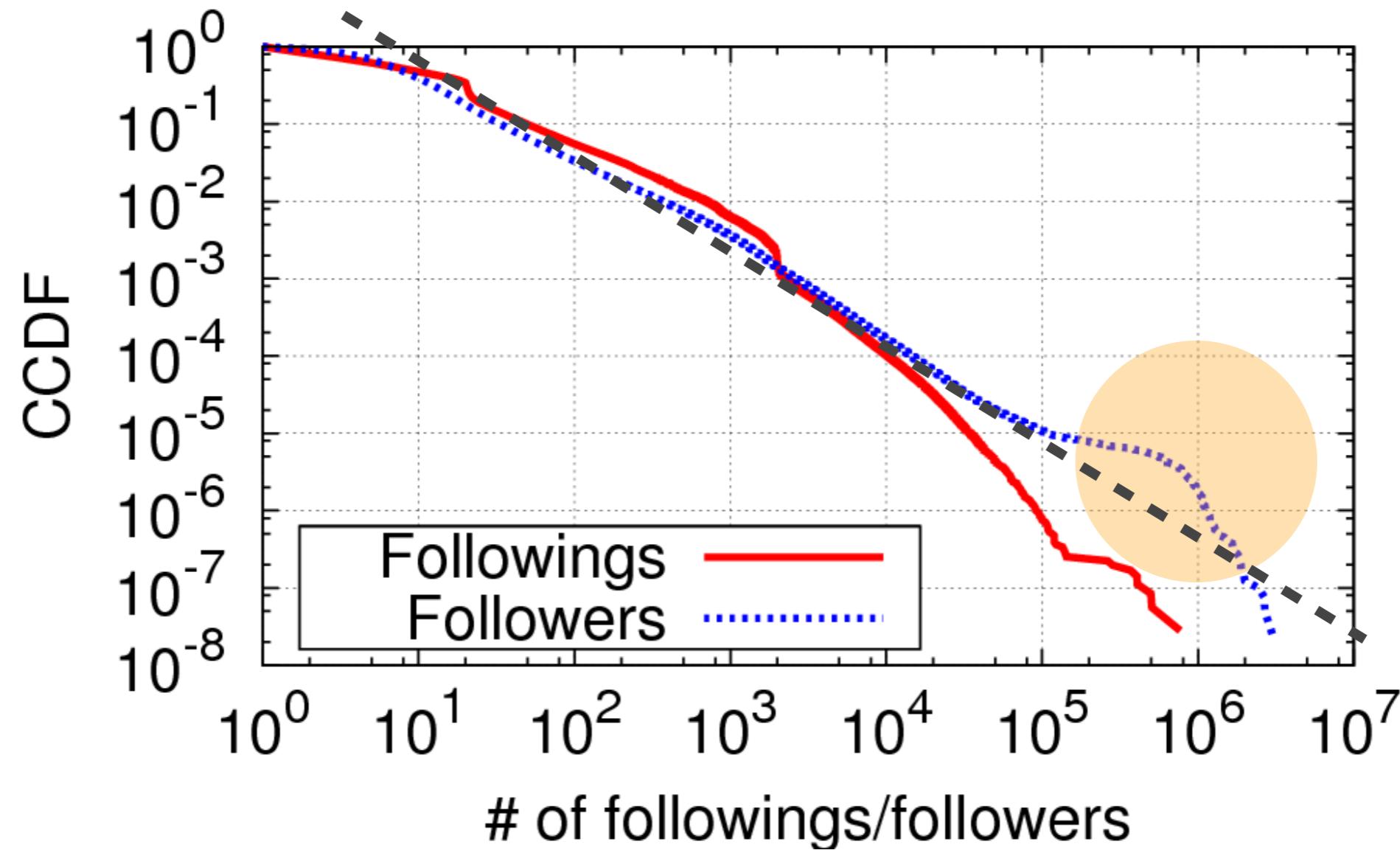


Reading the graph





Plenty of super-hubs

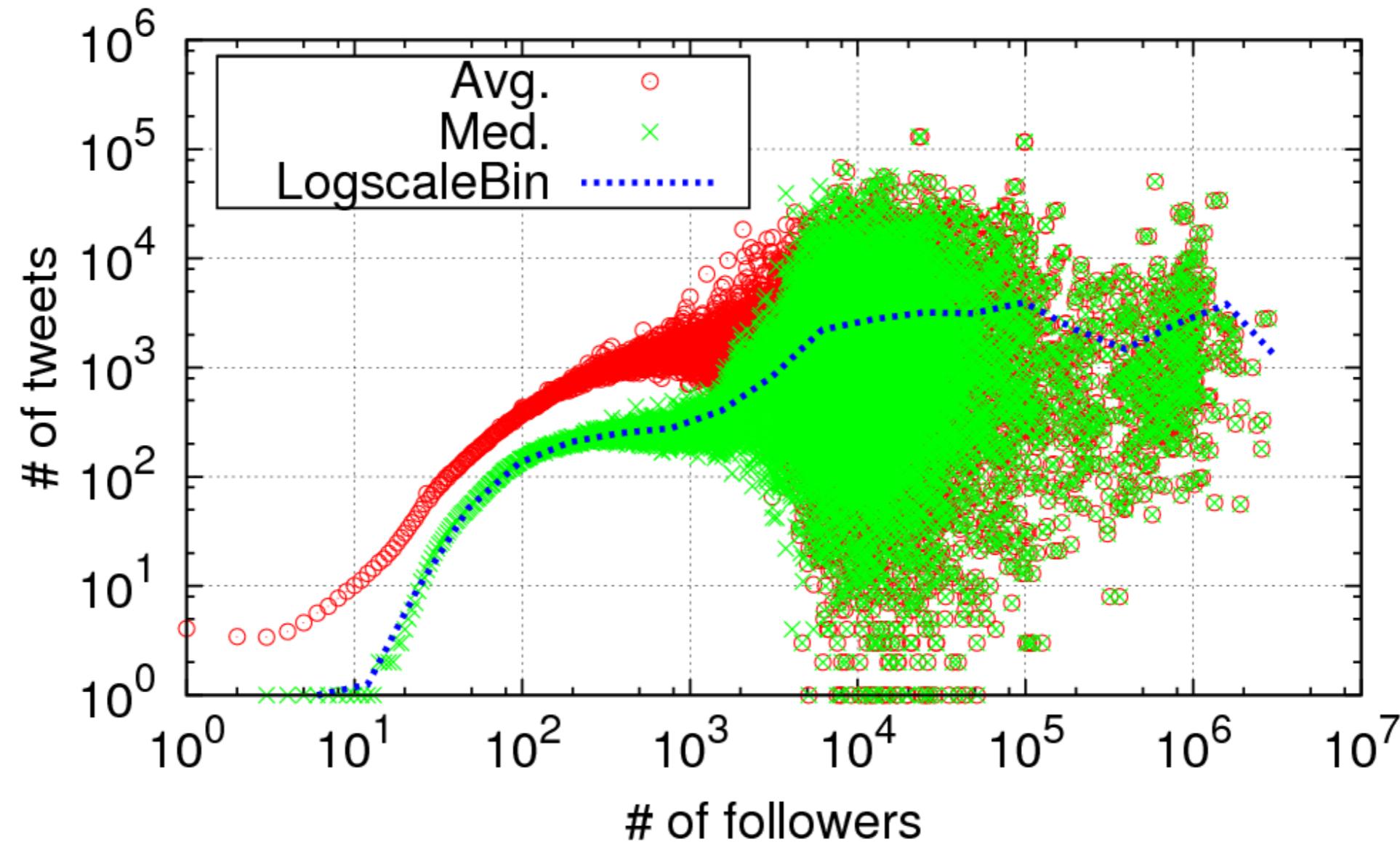




More super-hubs than projected by power-law

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

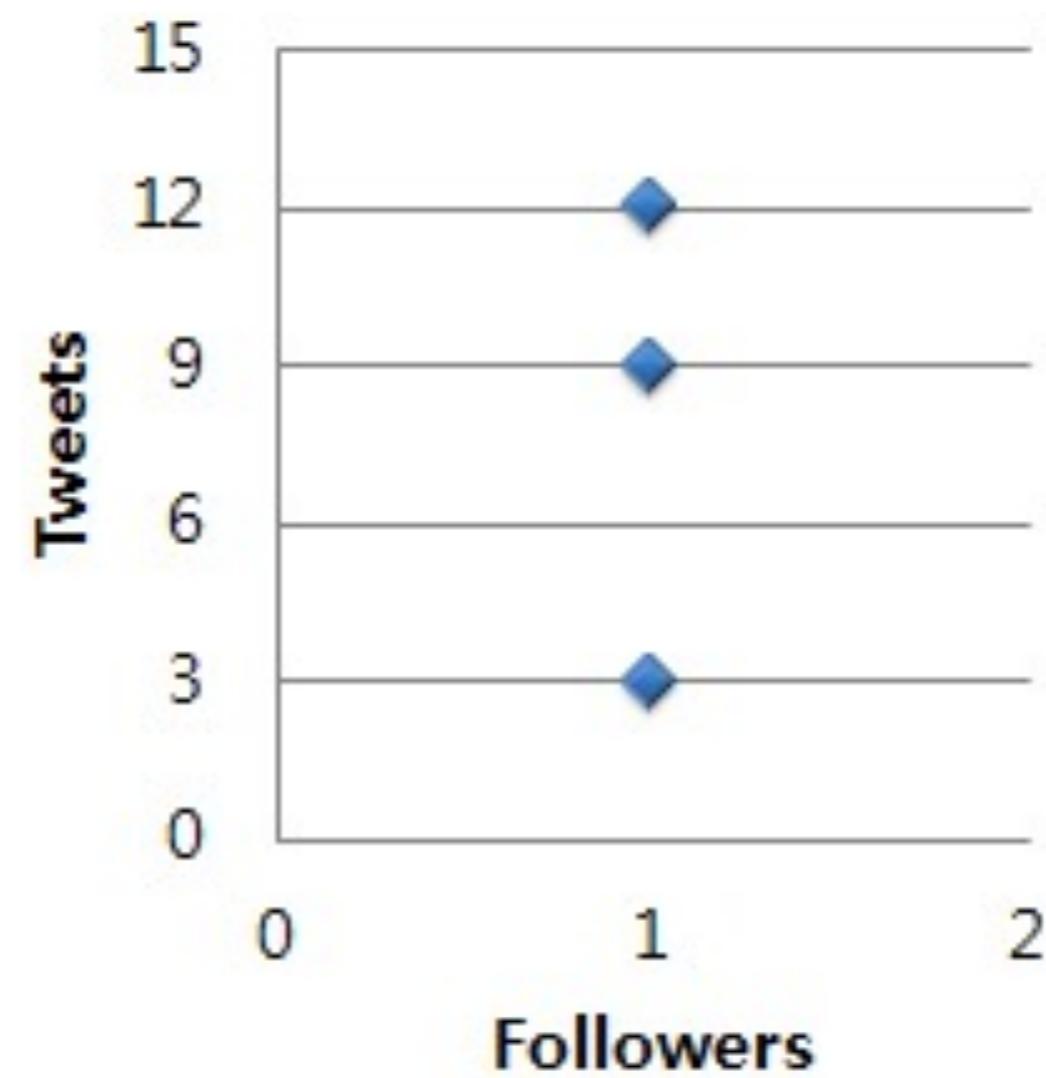
Are those who have many followers active?





followers	tweets
1	3
1	9
1	12

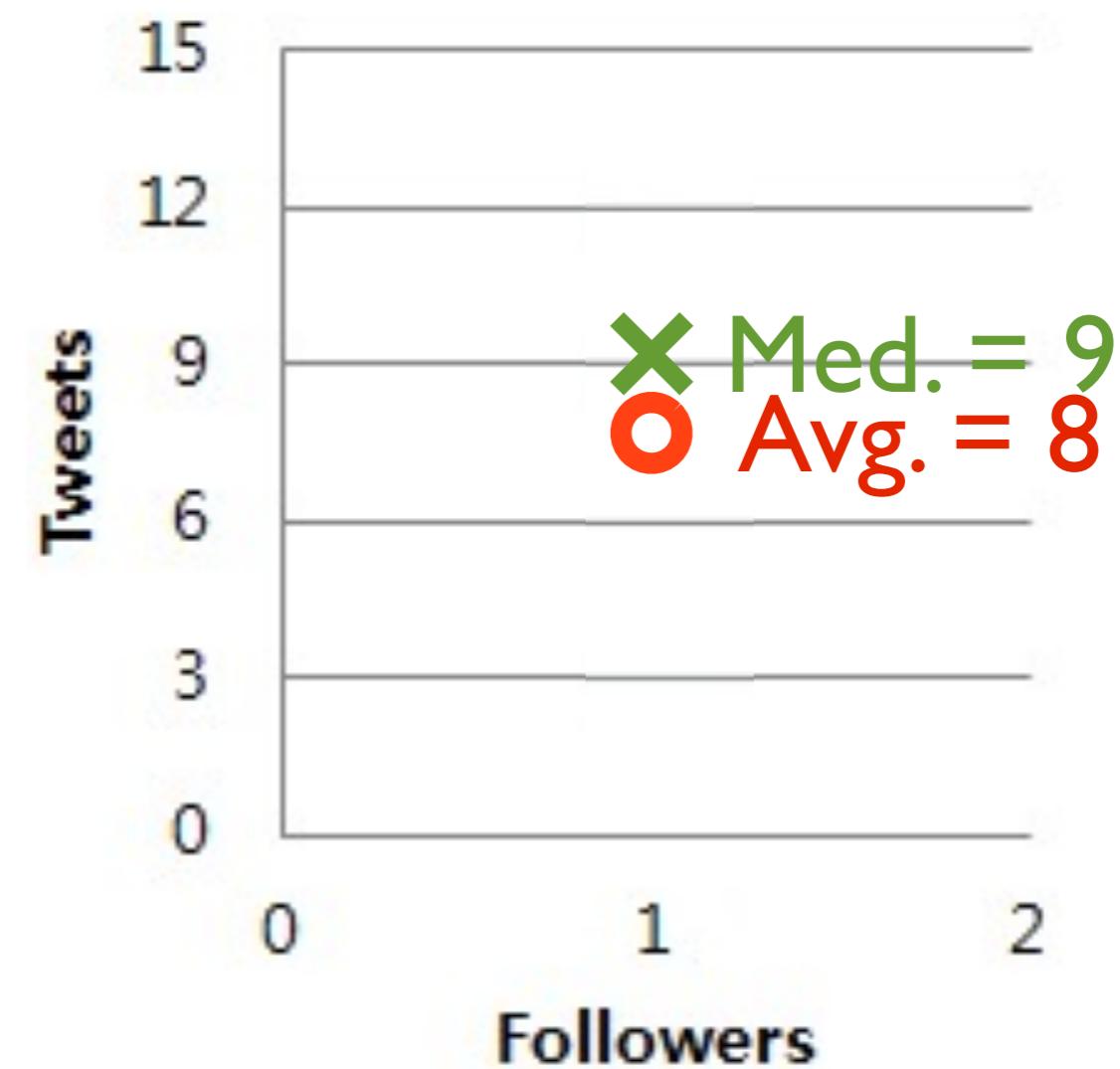
How we plotted





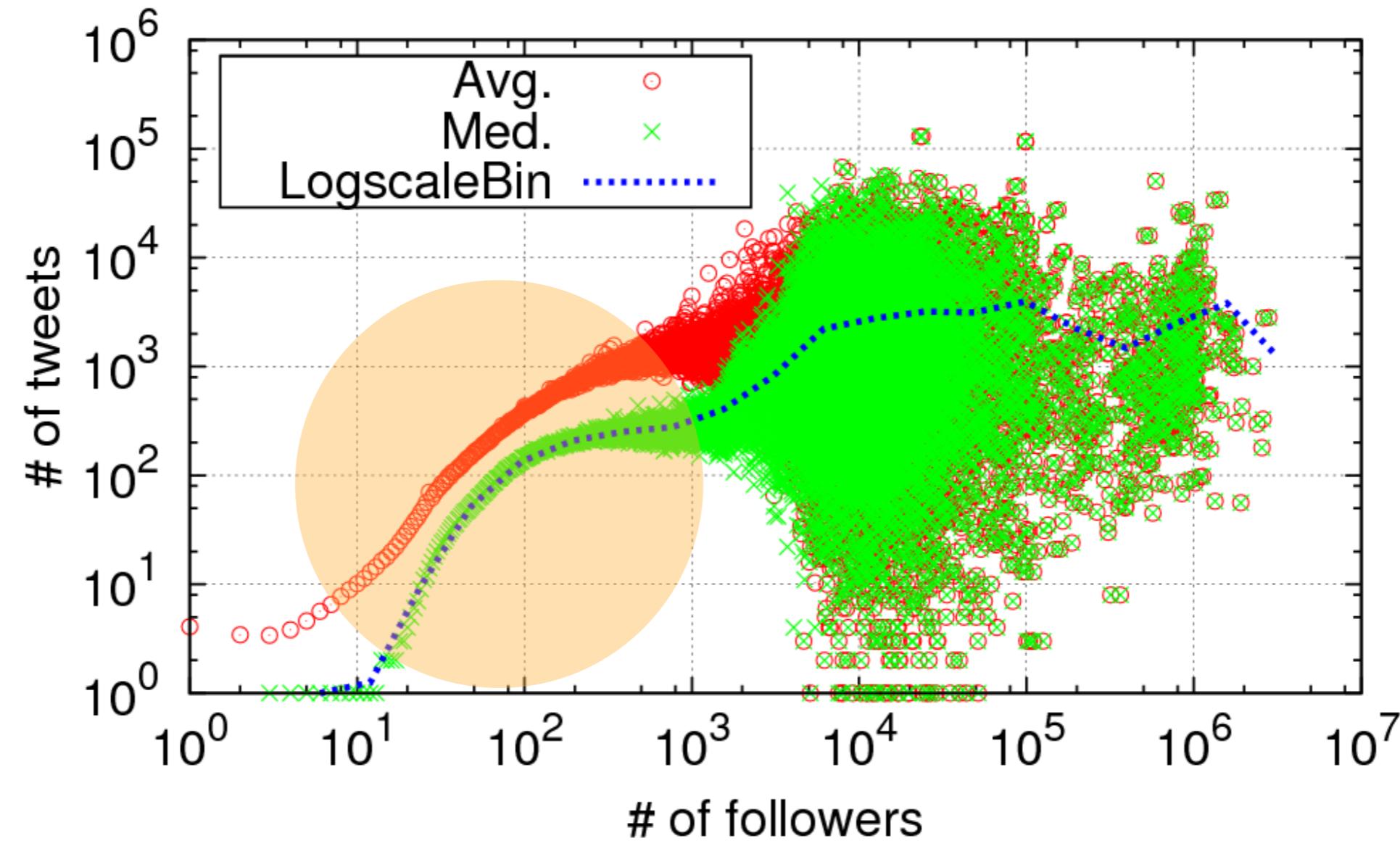
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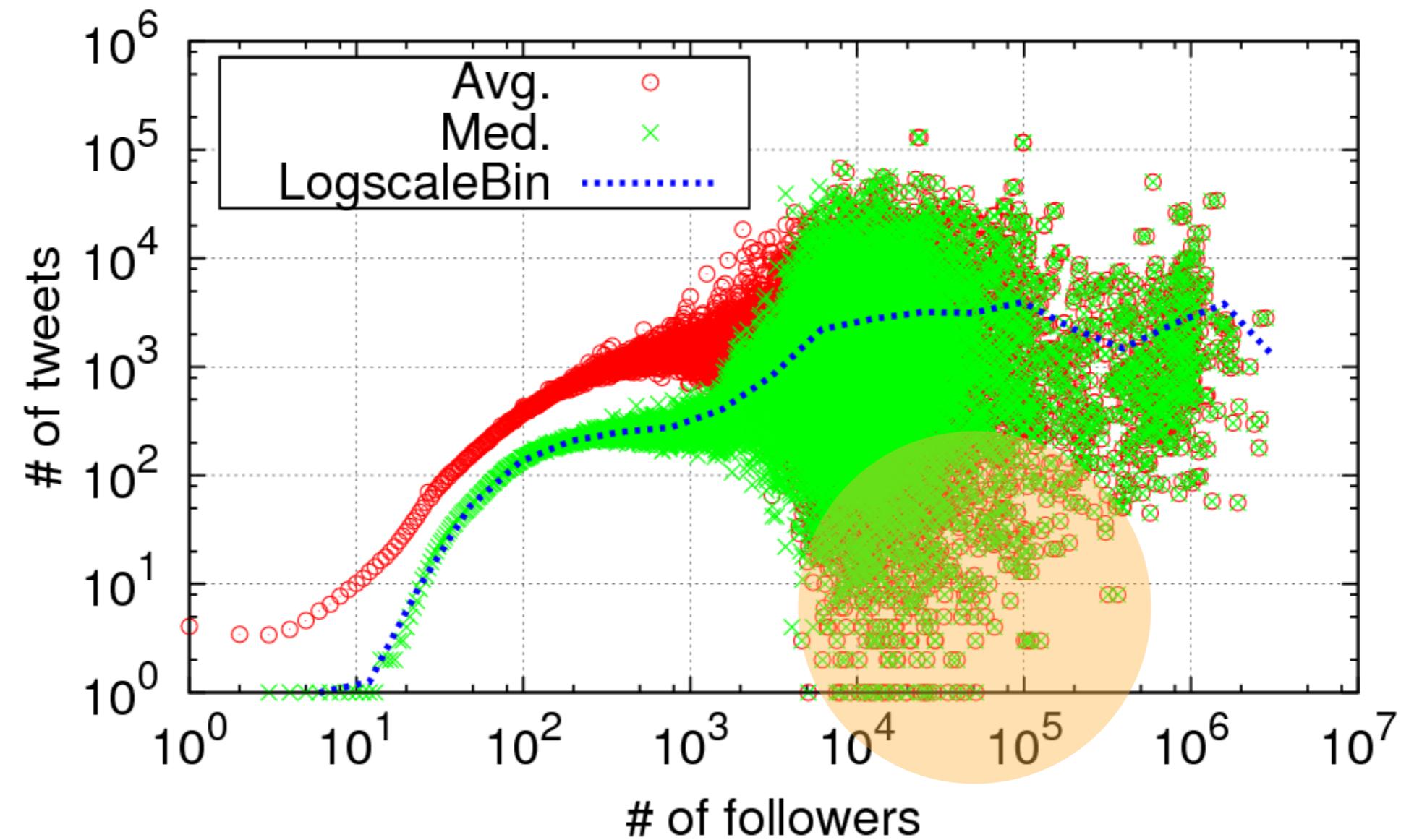




More followers, more tweets



Many followers without activity



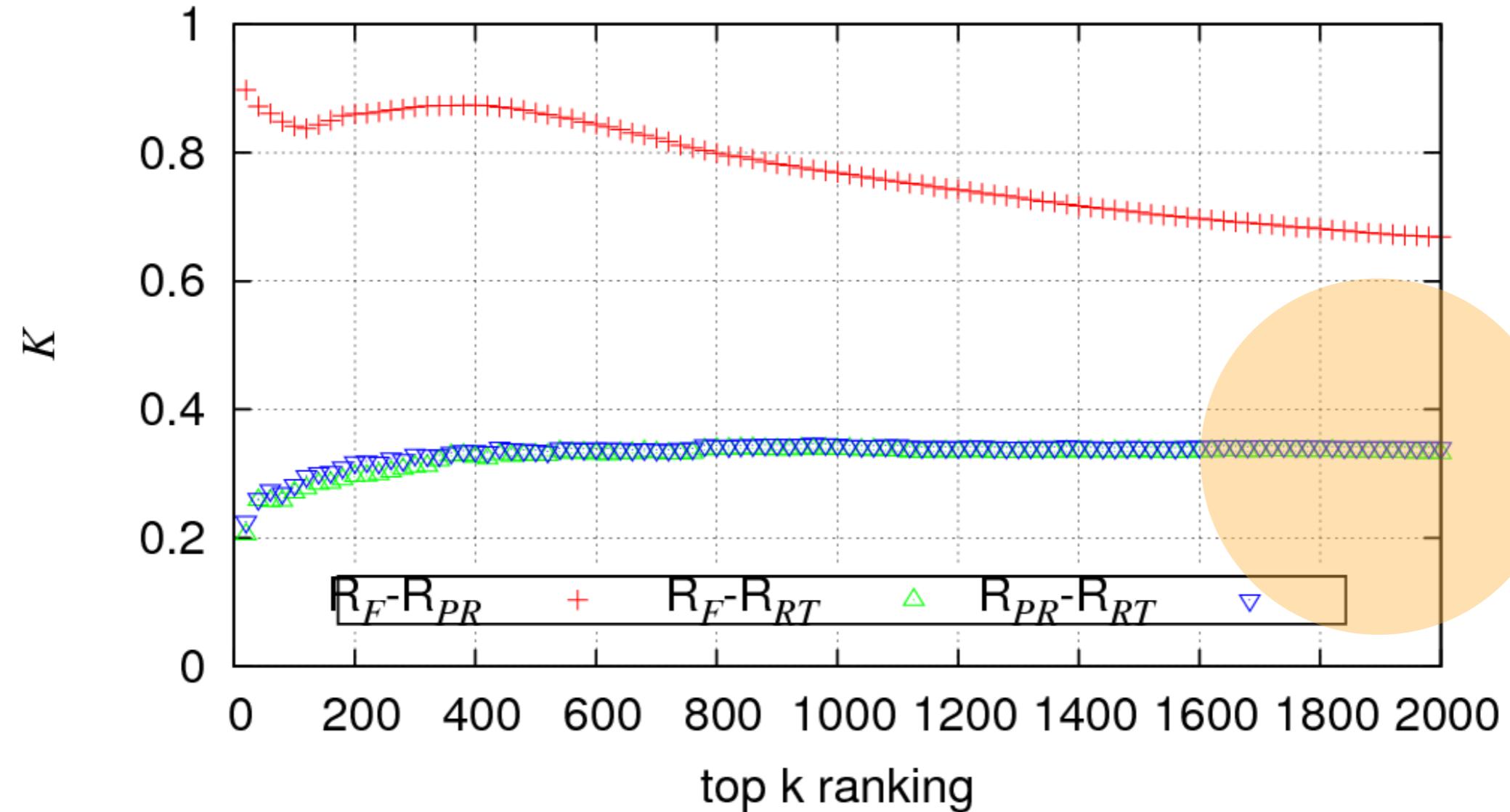
Twitter user rankings by Followers, PageRank and RT

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

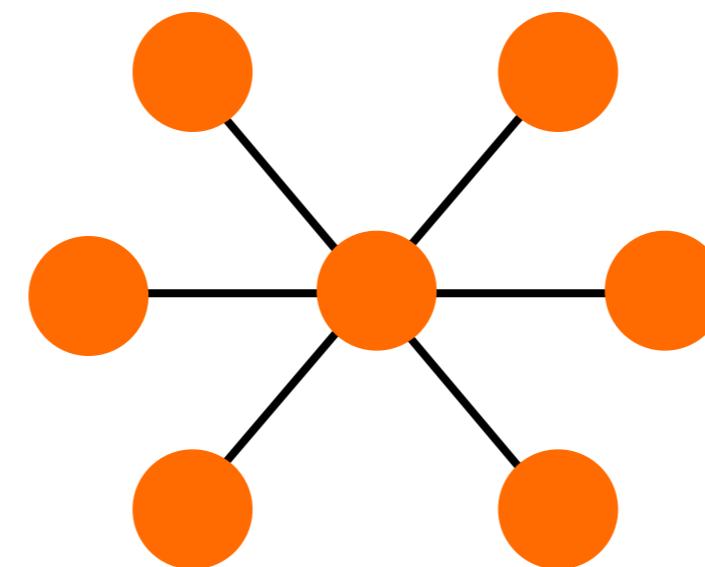
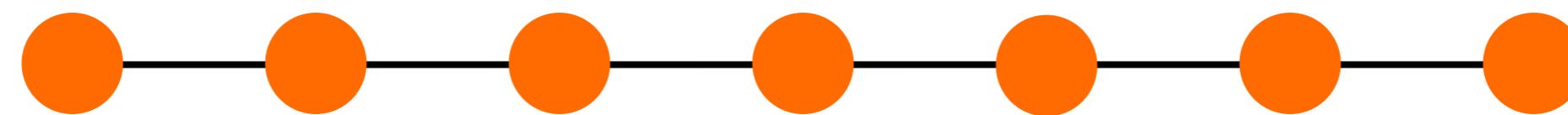


Part IV.

- 
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***WOM: word-of-mouth**

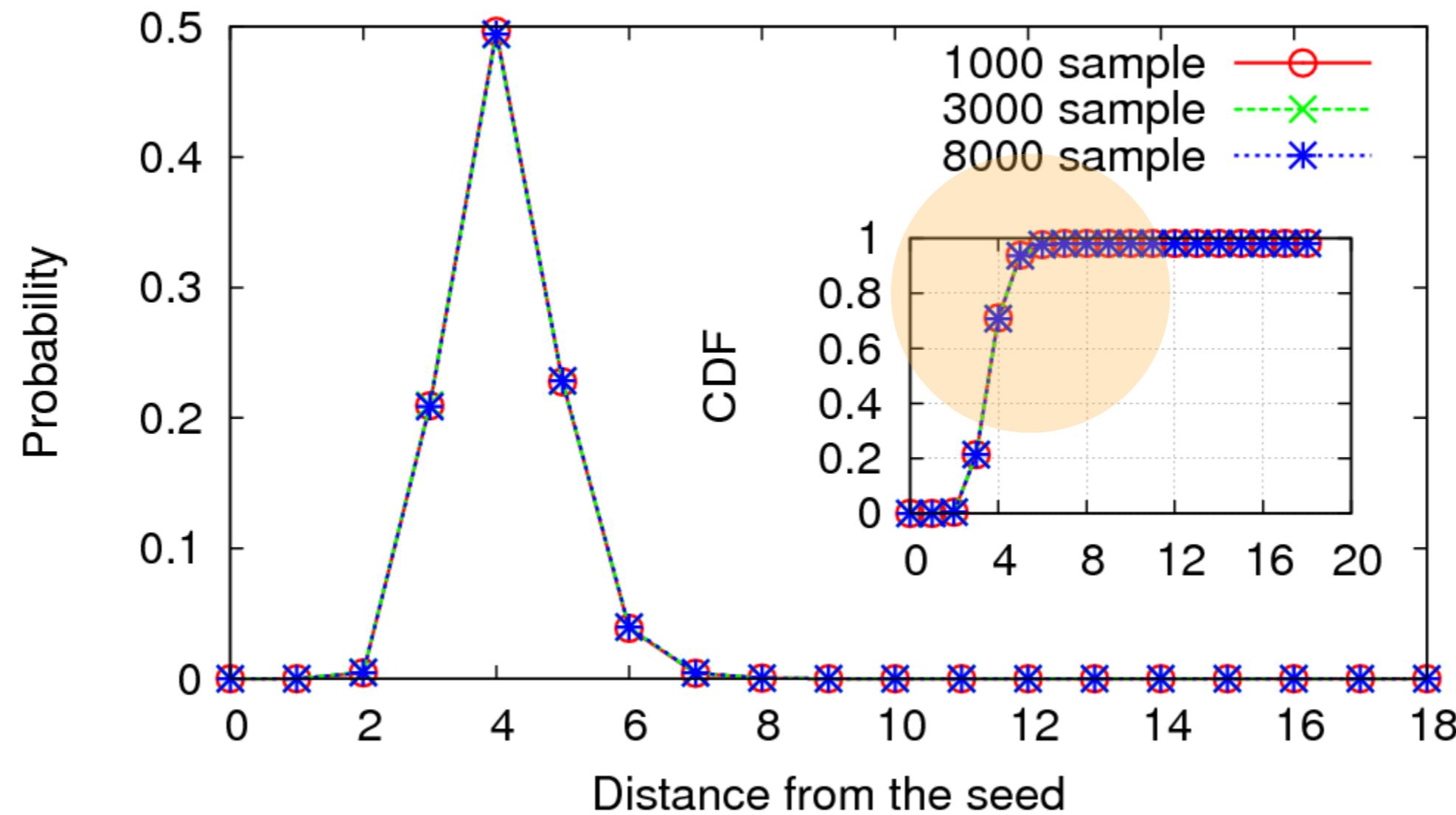
Which is more efficient for WOM?



In Twitter

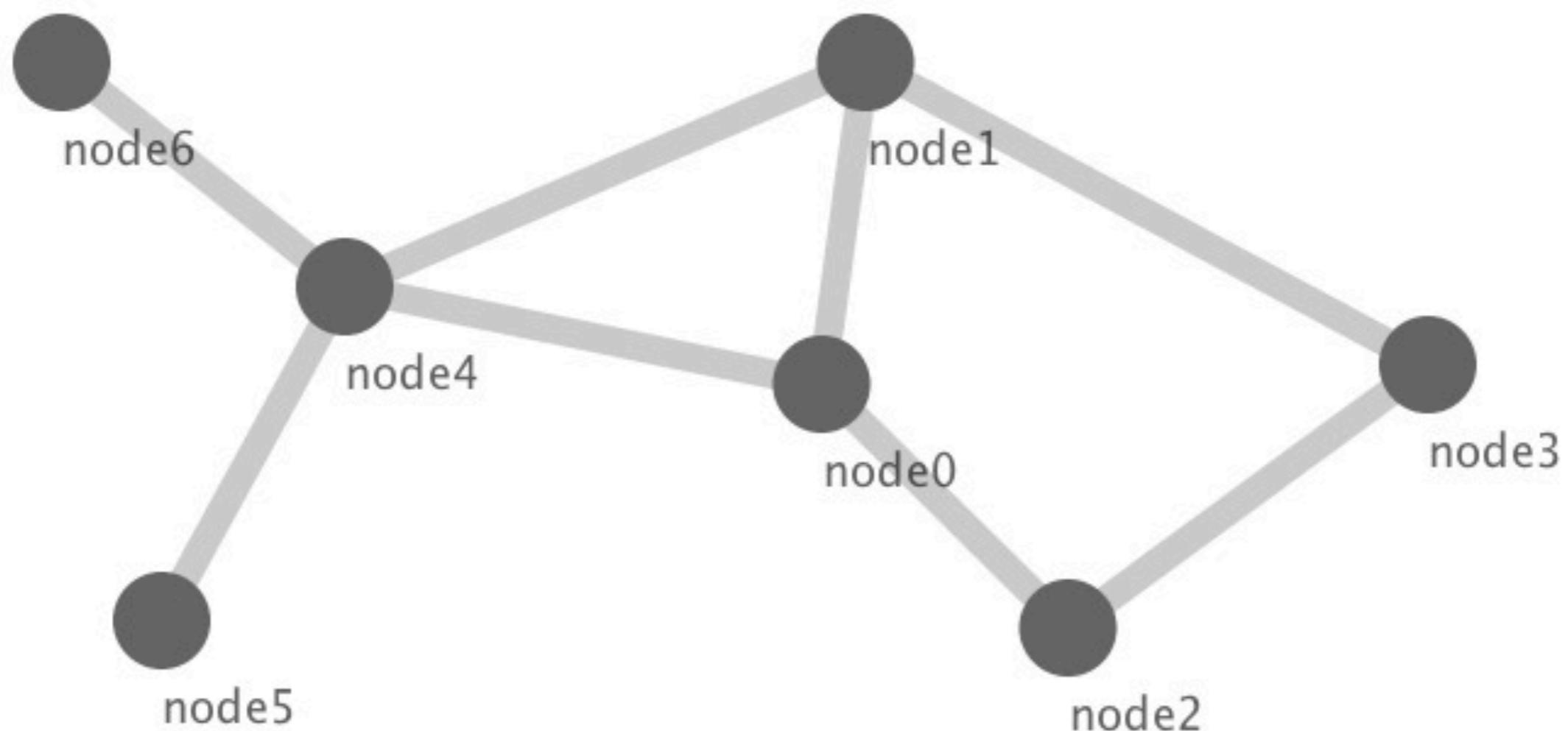


Average path length: 4.1



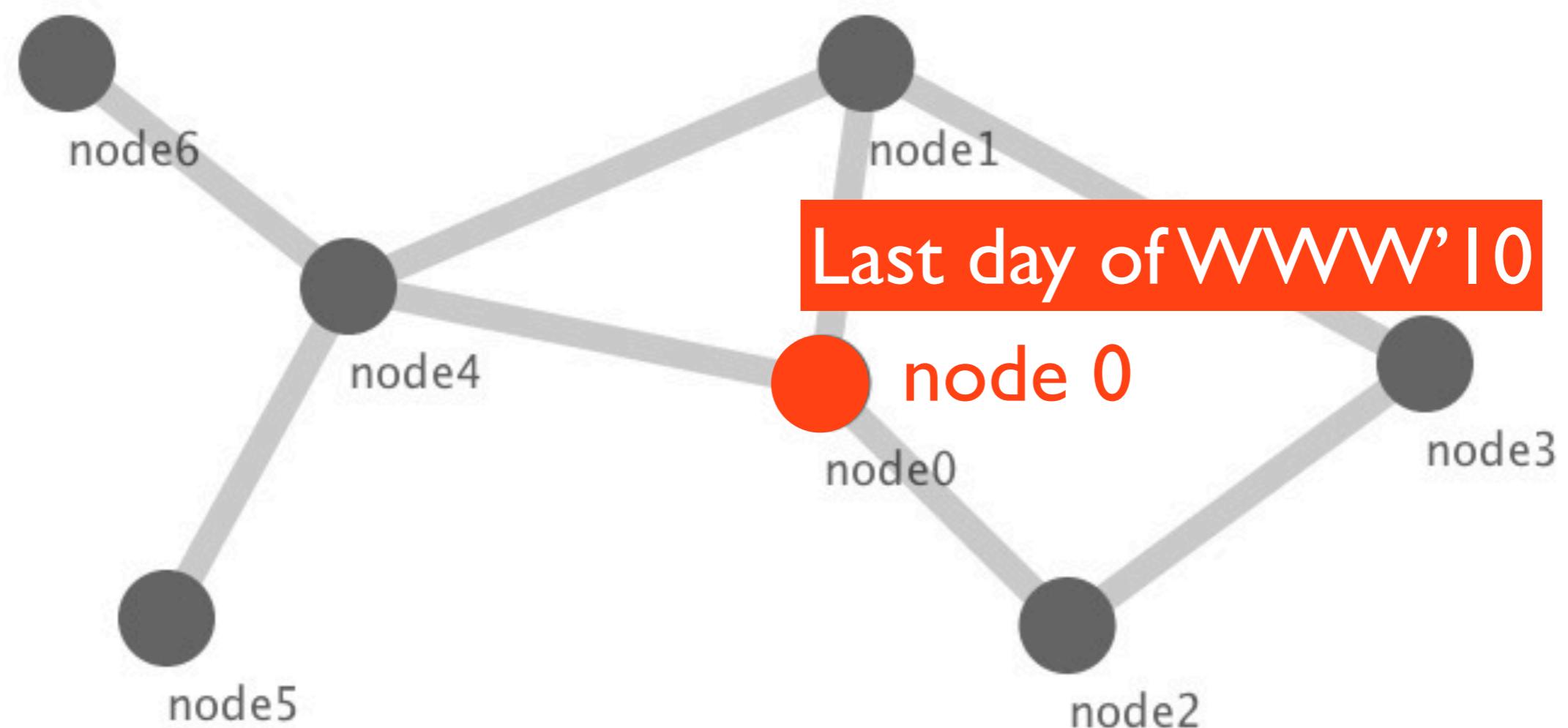
Retweet (RT)

- Relay tweets from a following to followers



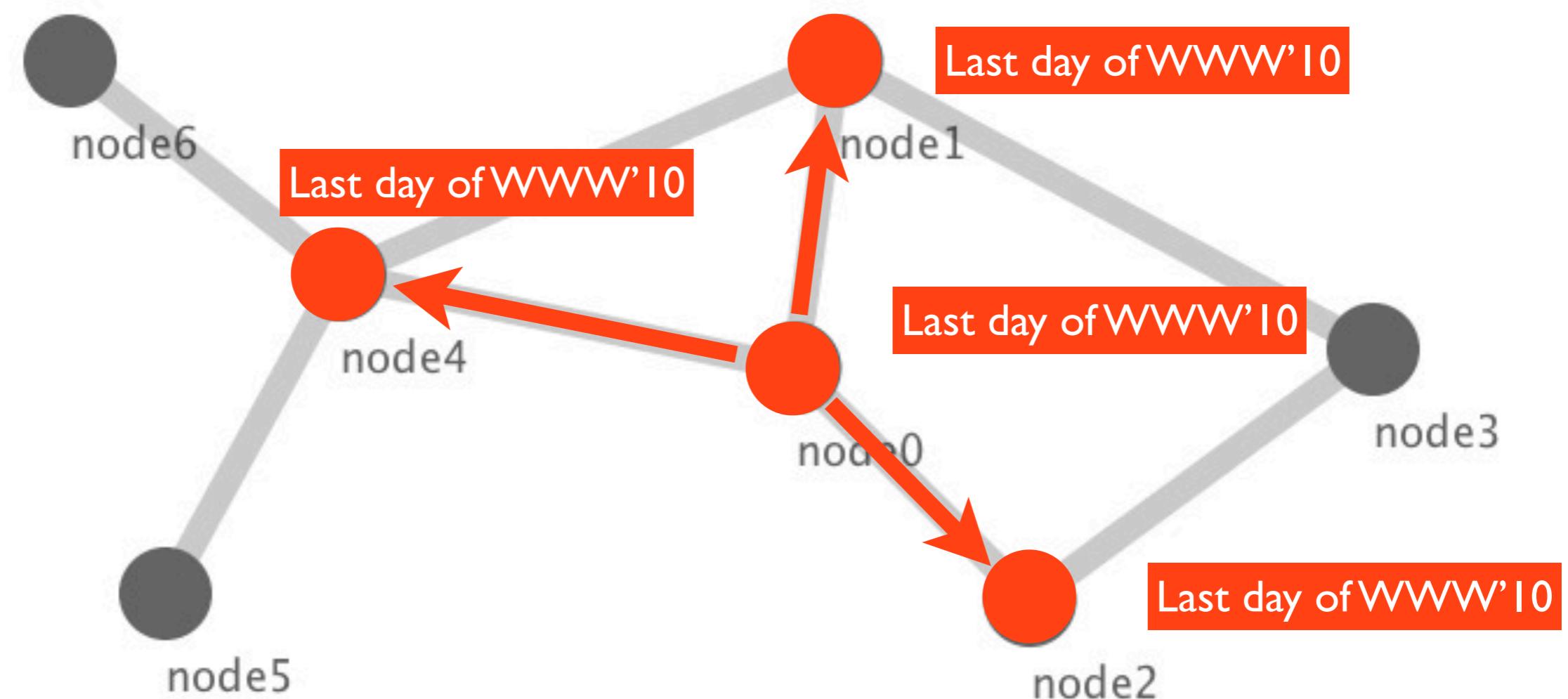
Retweet (RT)

- Relay tweets from a following to followers



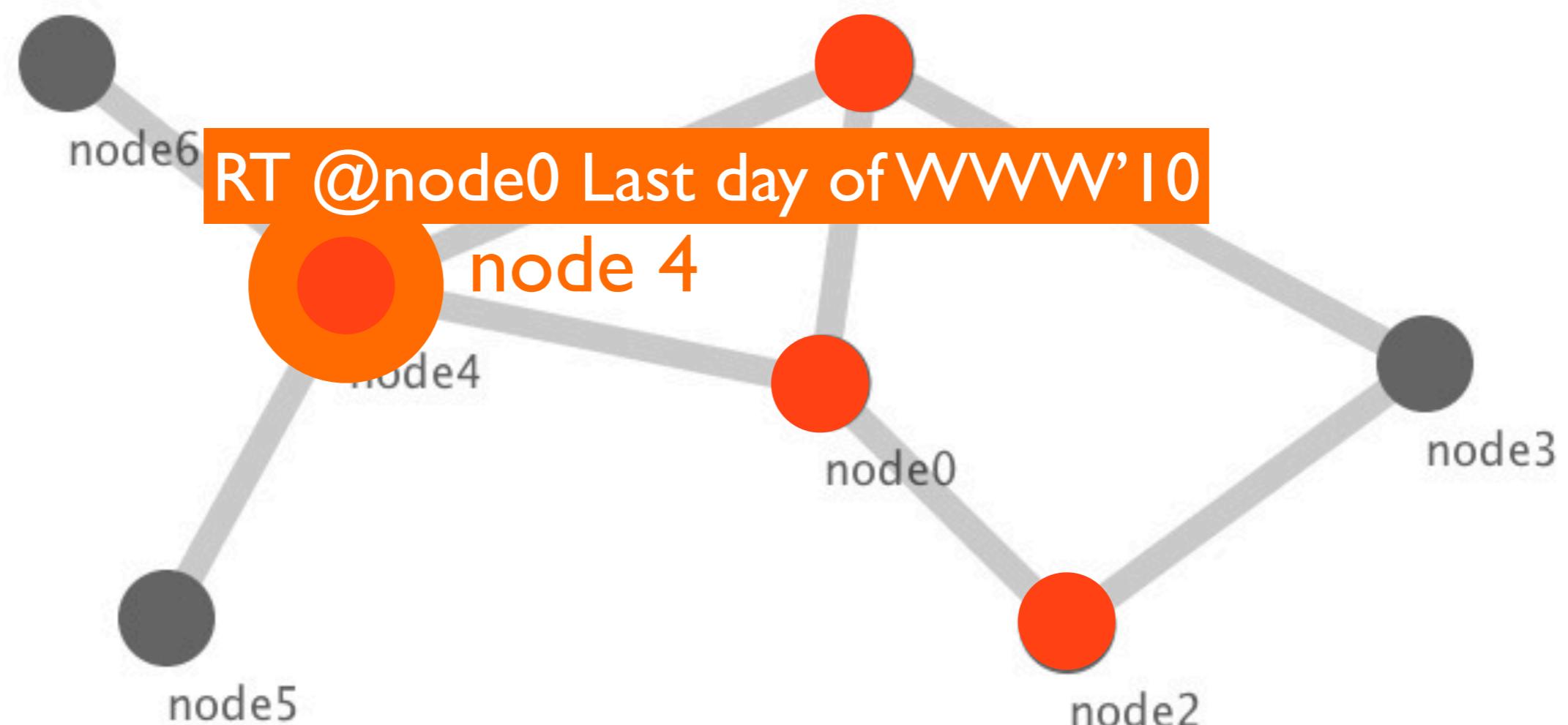
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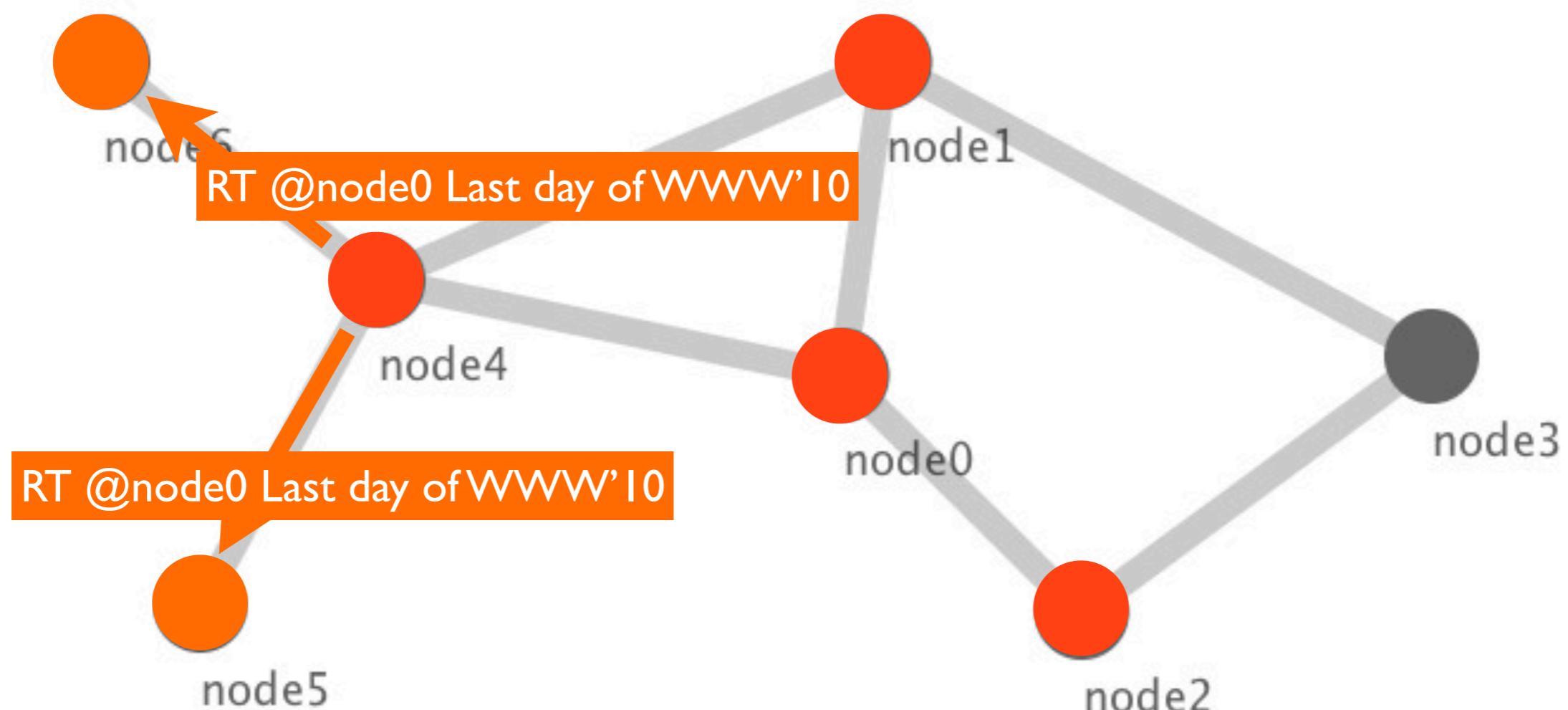
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Retweet (RT)

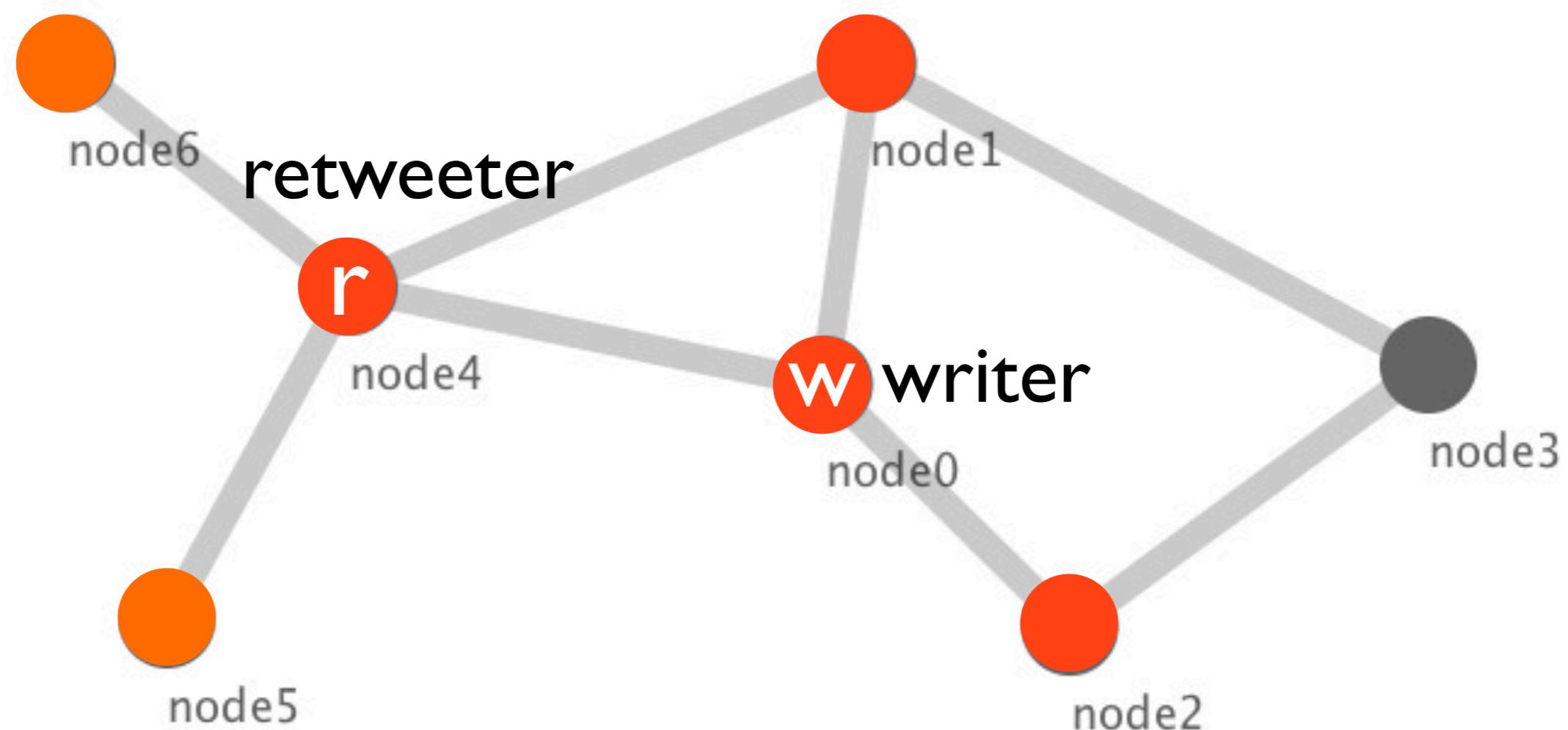
- Relay tweets from a following to followers

RT @node0 Last day of WWW'10



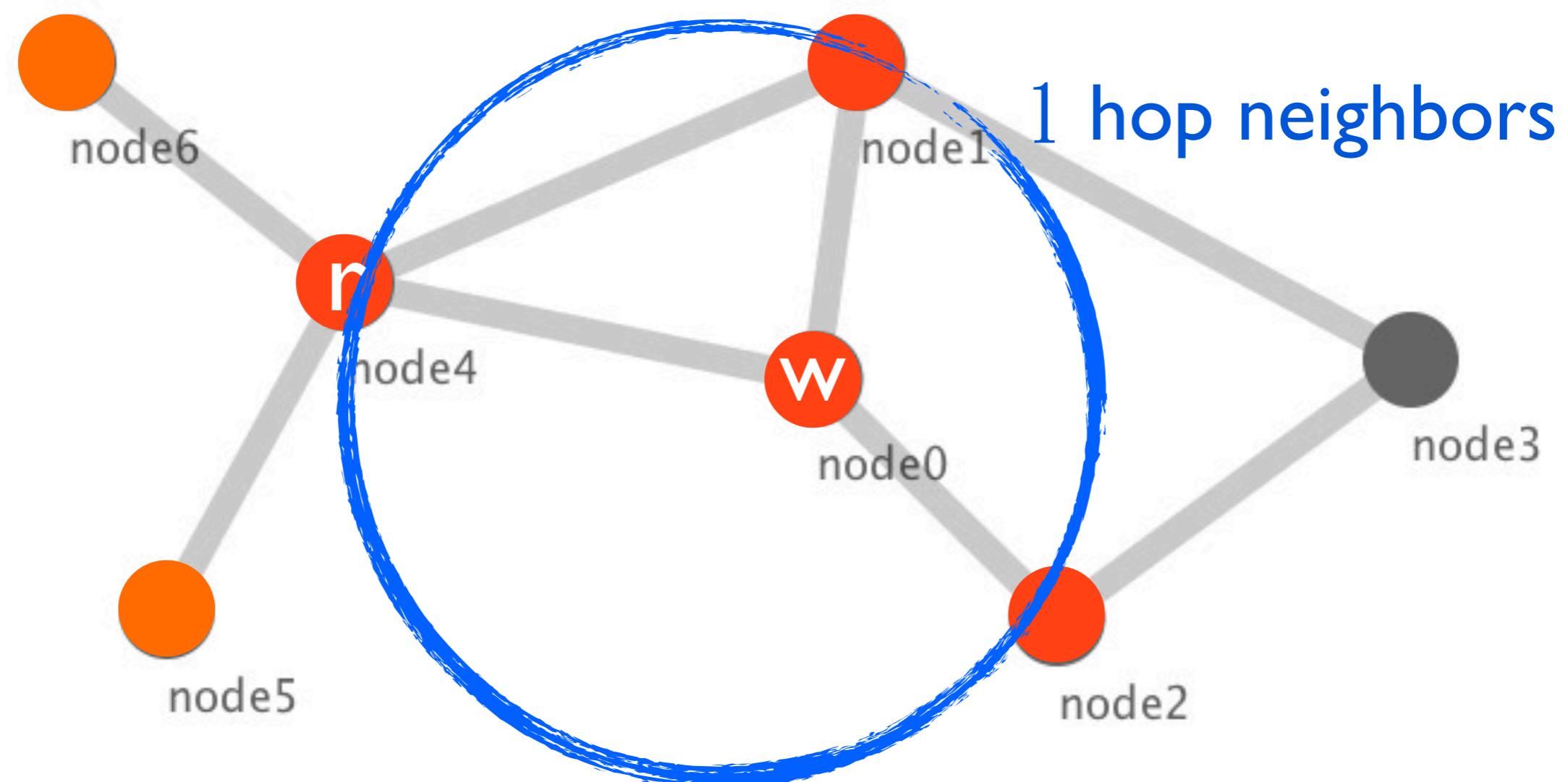
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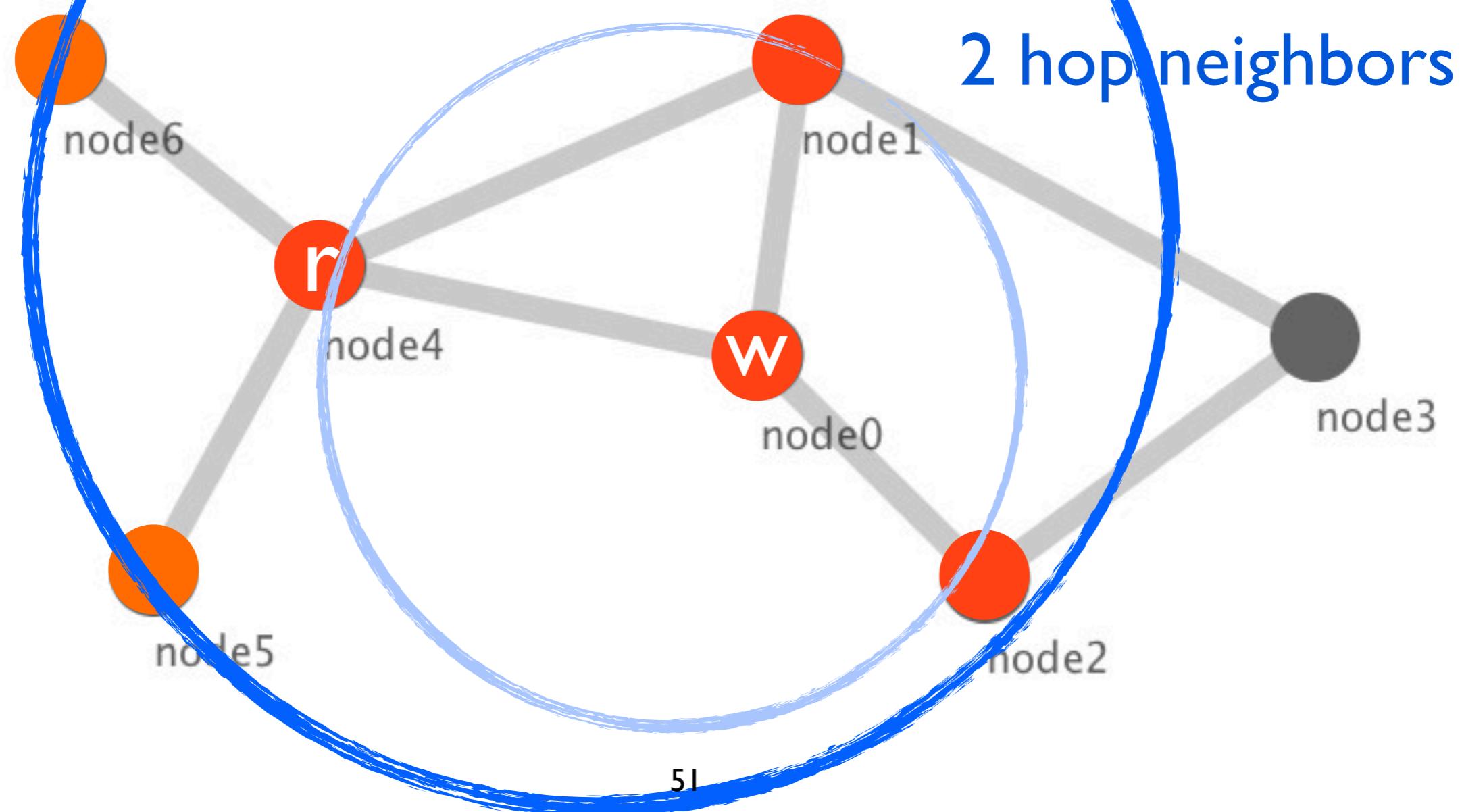
Retweet (RT)

- Not only 1 hop neighbors



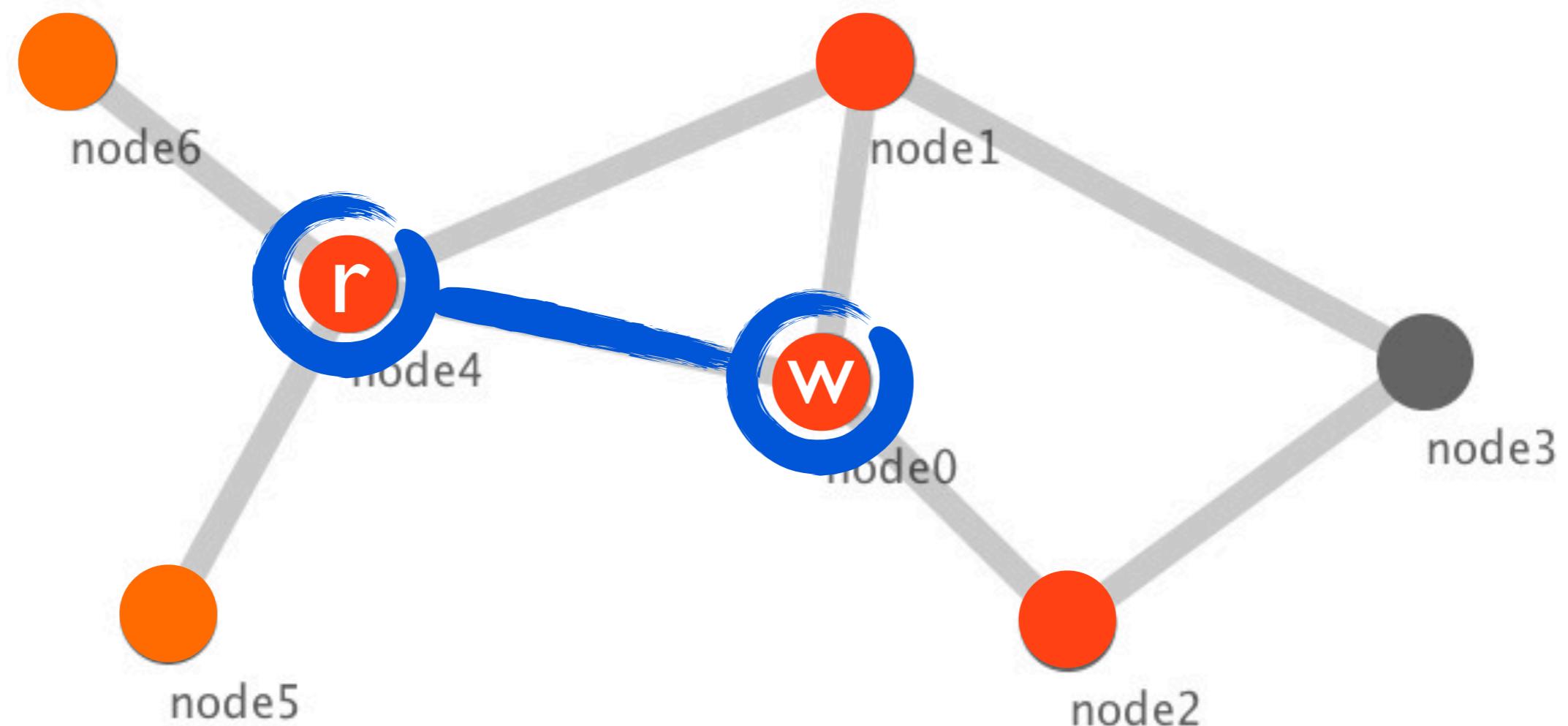
Retweet (RT)

- More goes further

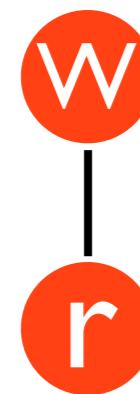


We construct RT tree

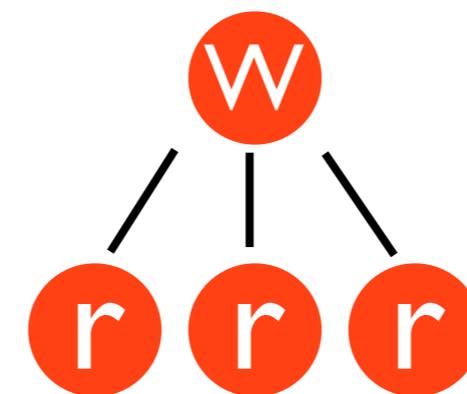
- A tree with writer and retweeter(s)



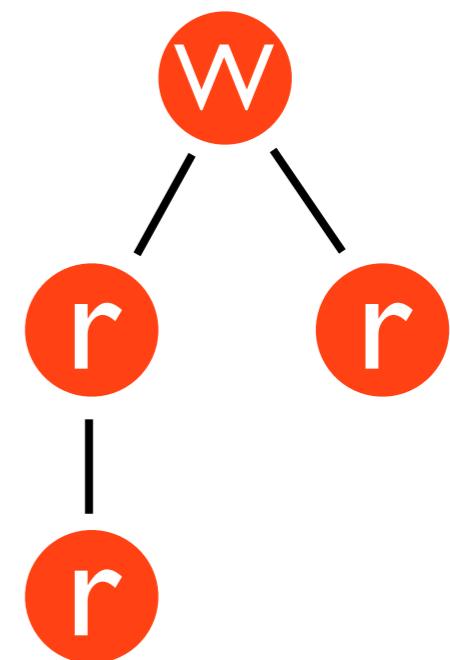
Height of RT trees



1

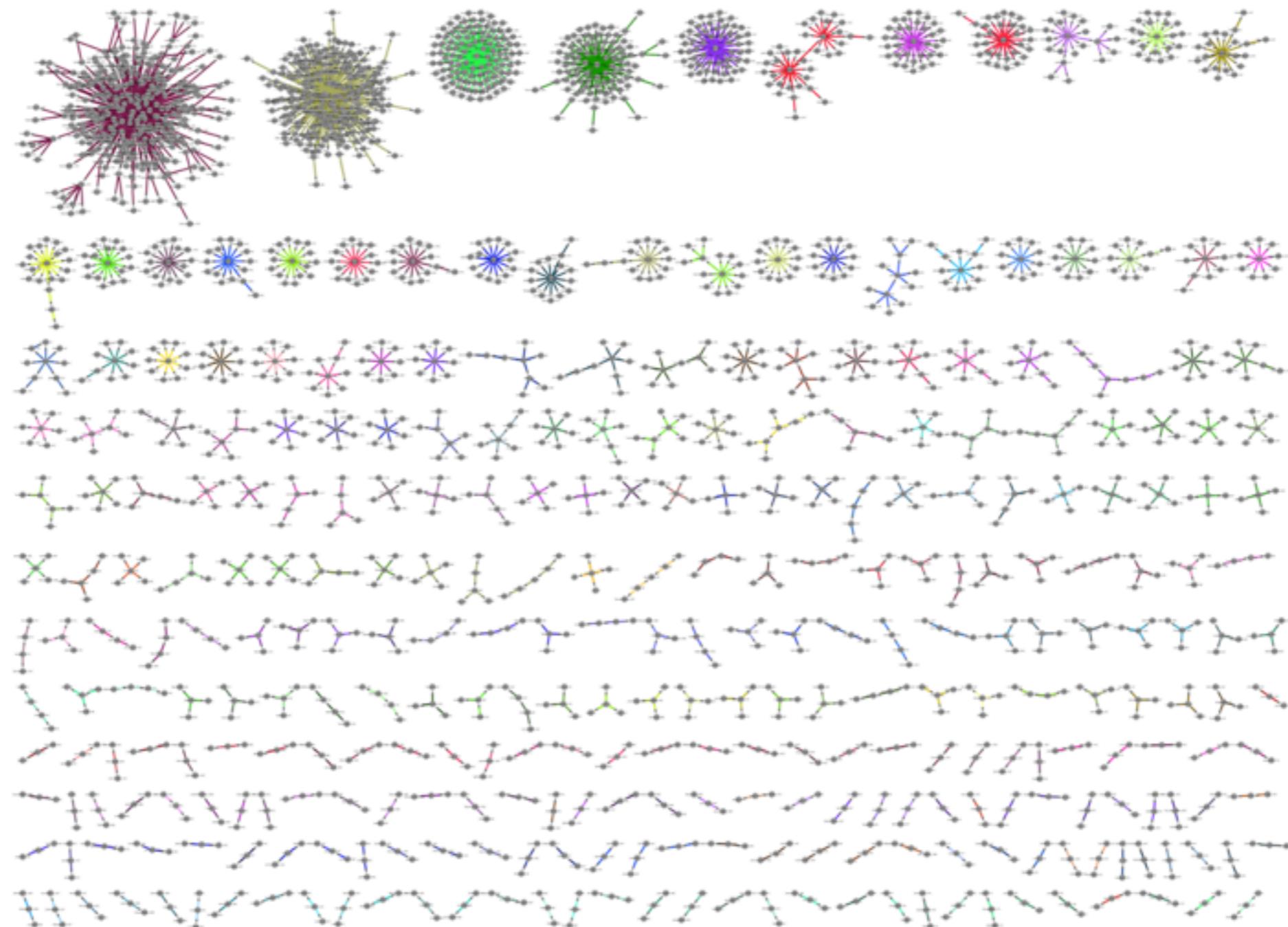


1

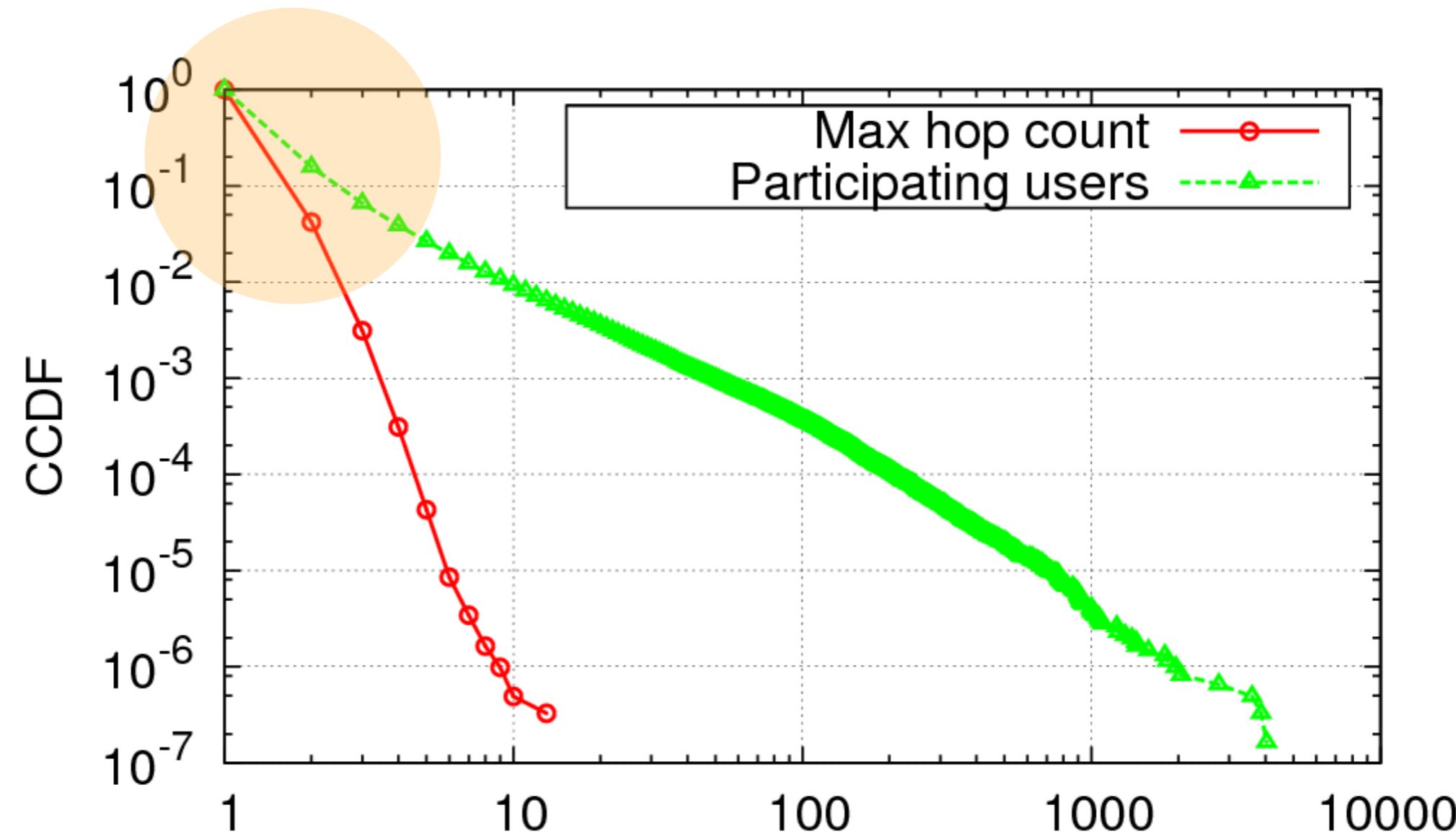


2

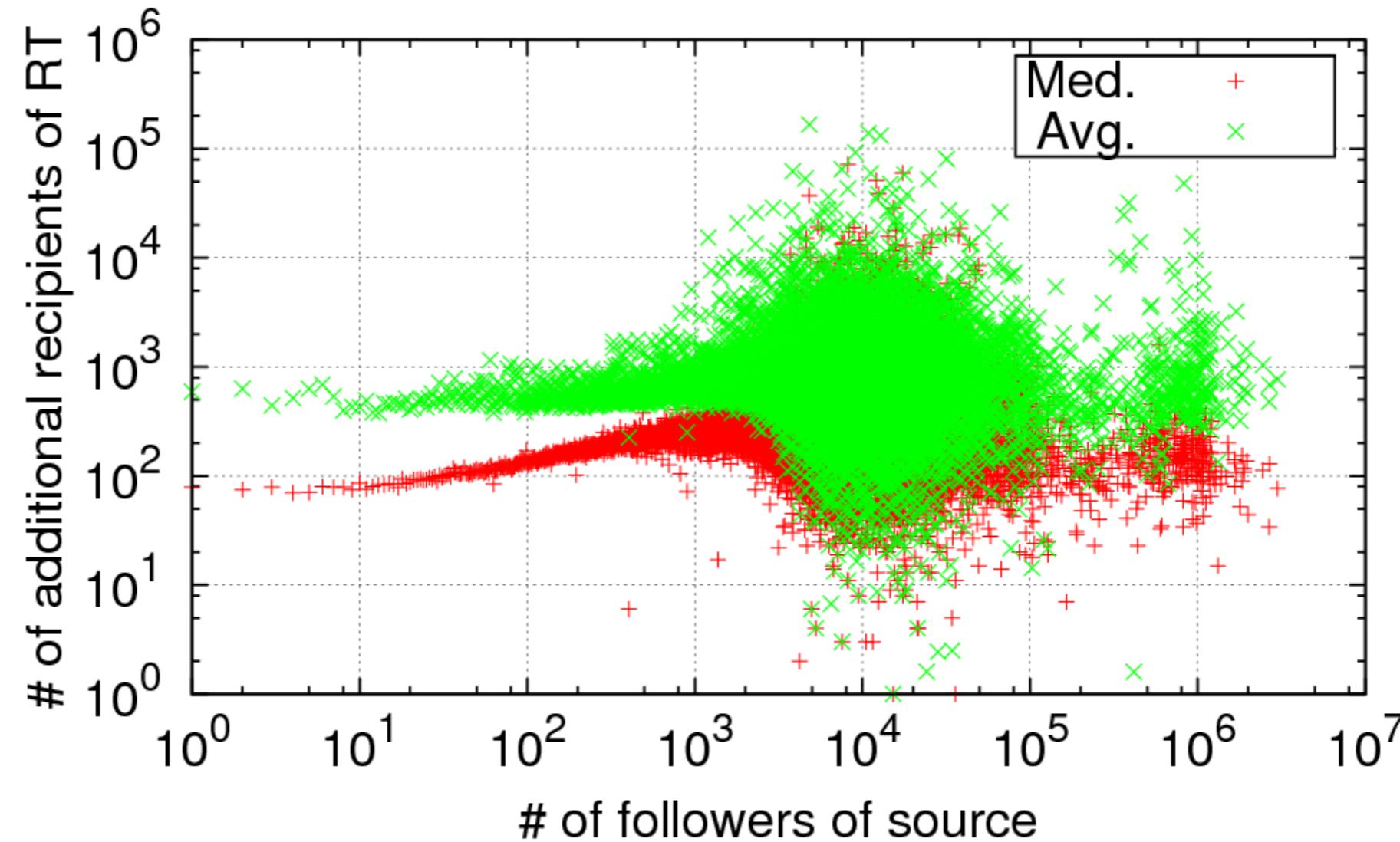
Empirical RT trees



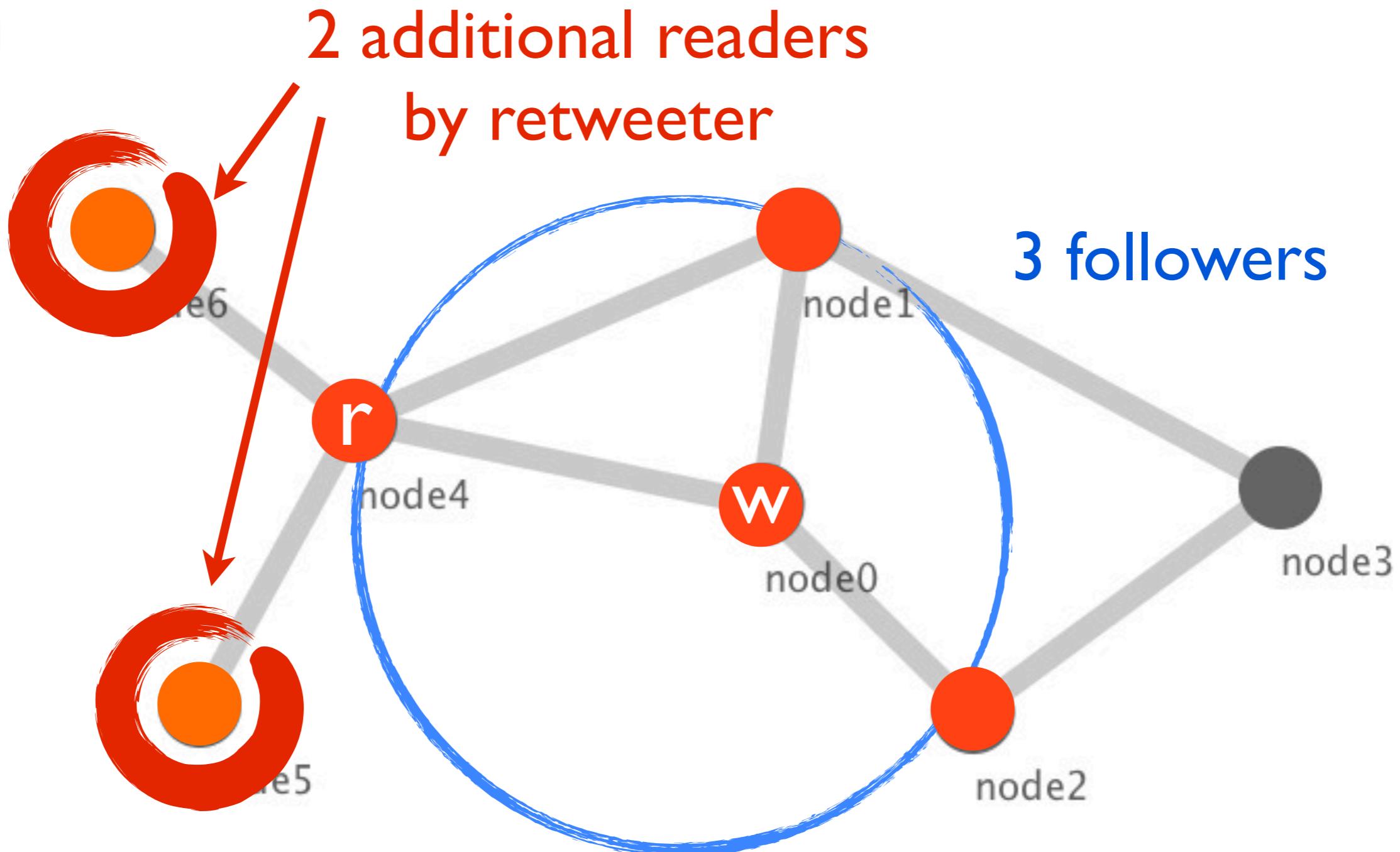
96% of RT trees = Height 1



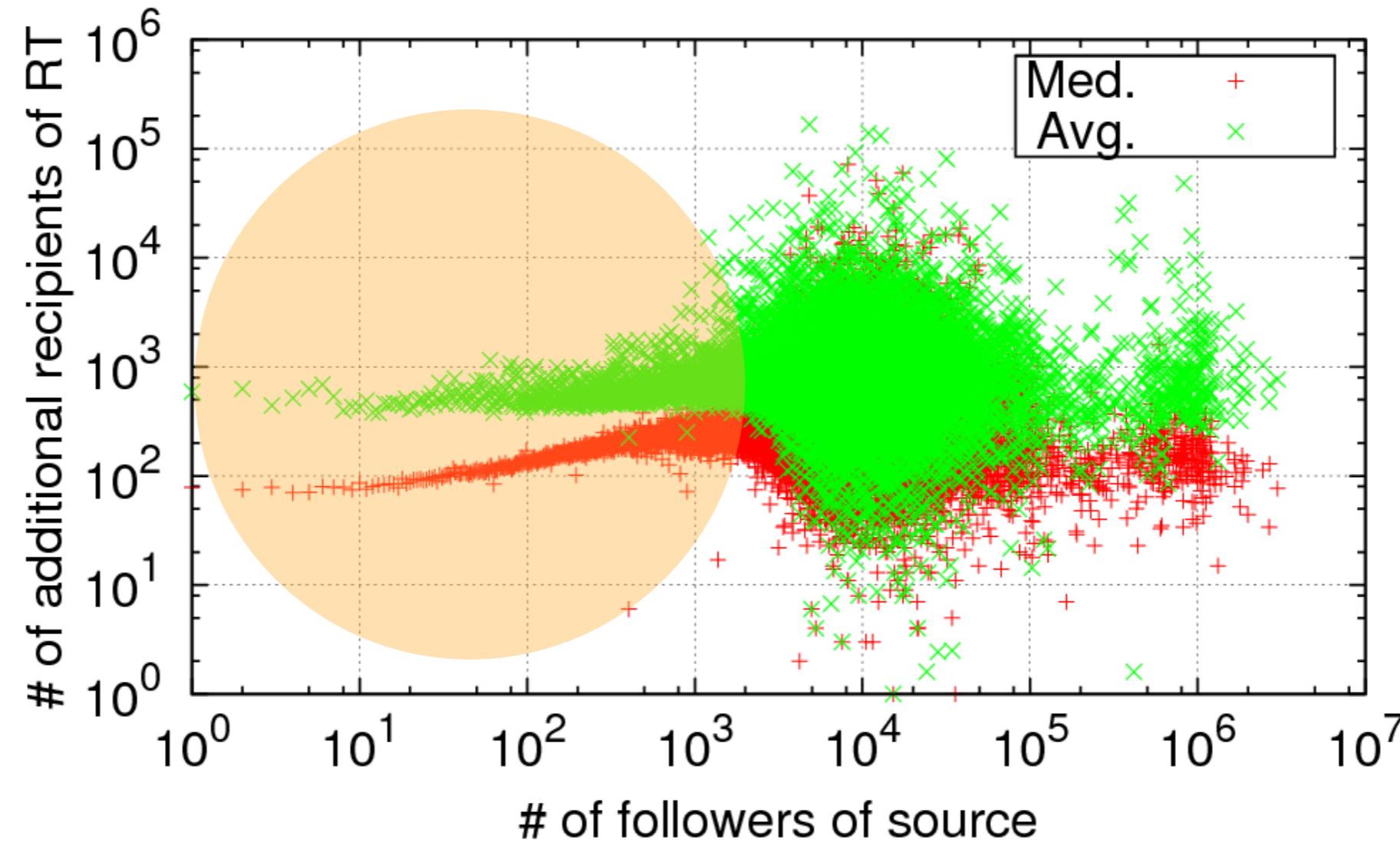
Boosting audience by RT



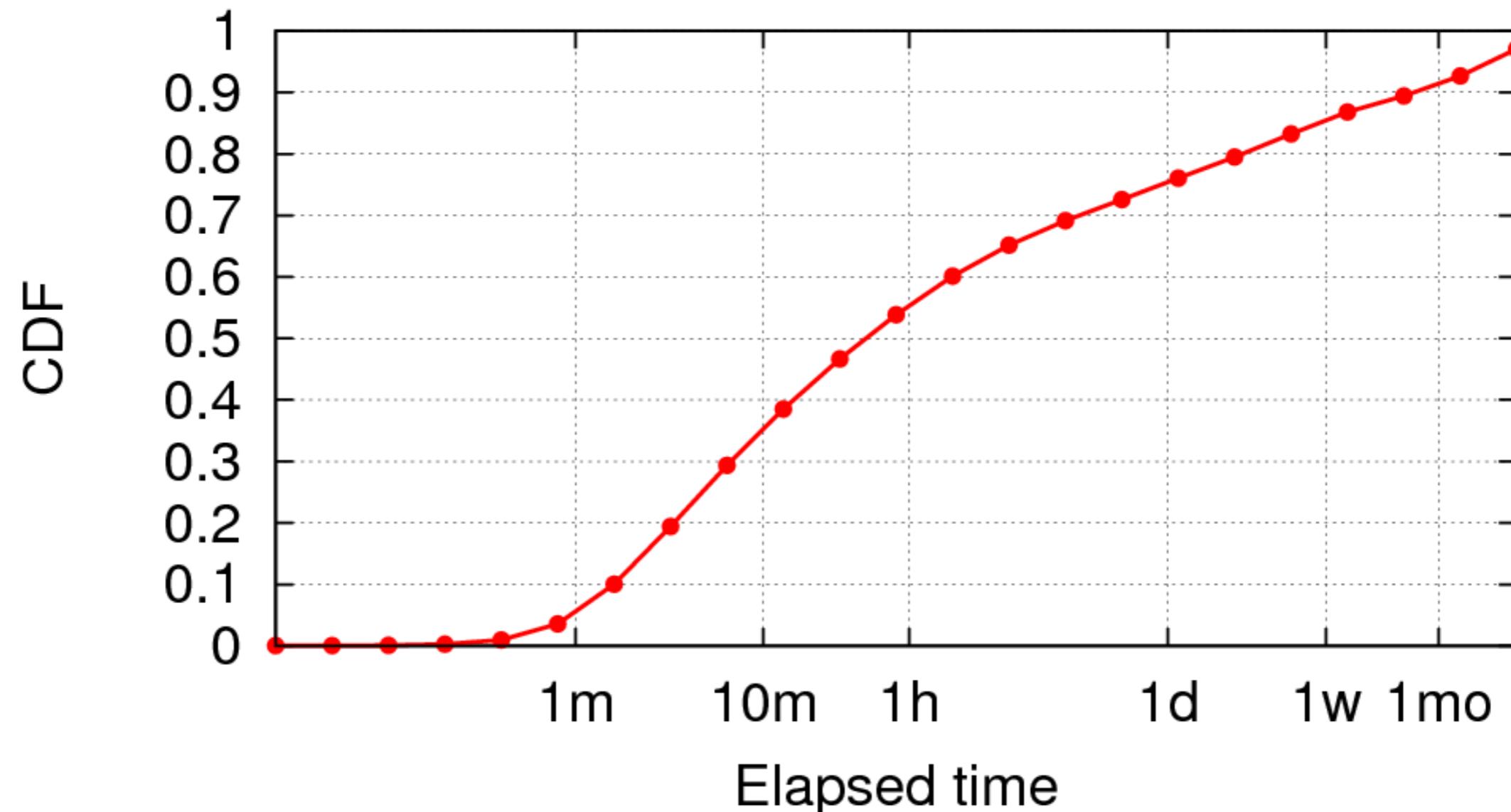
Additional readers



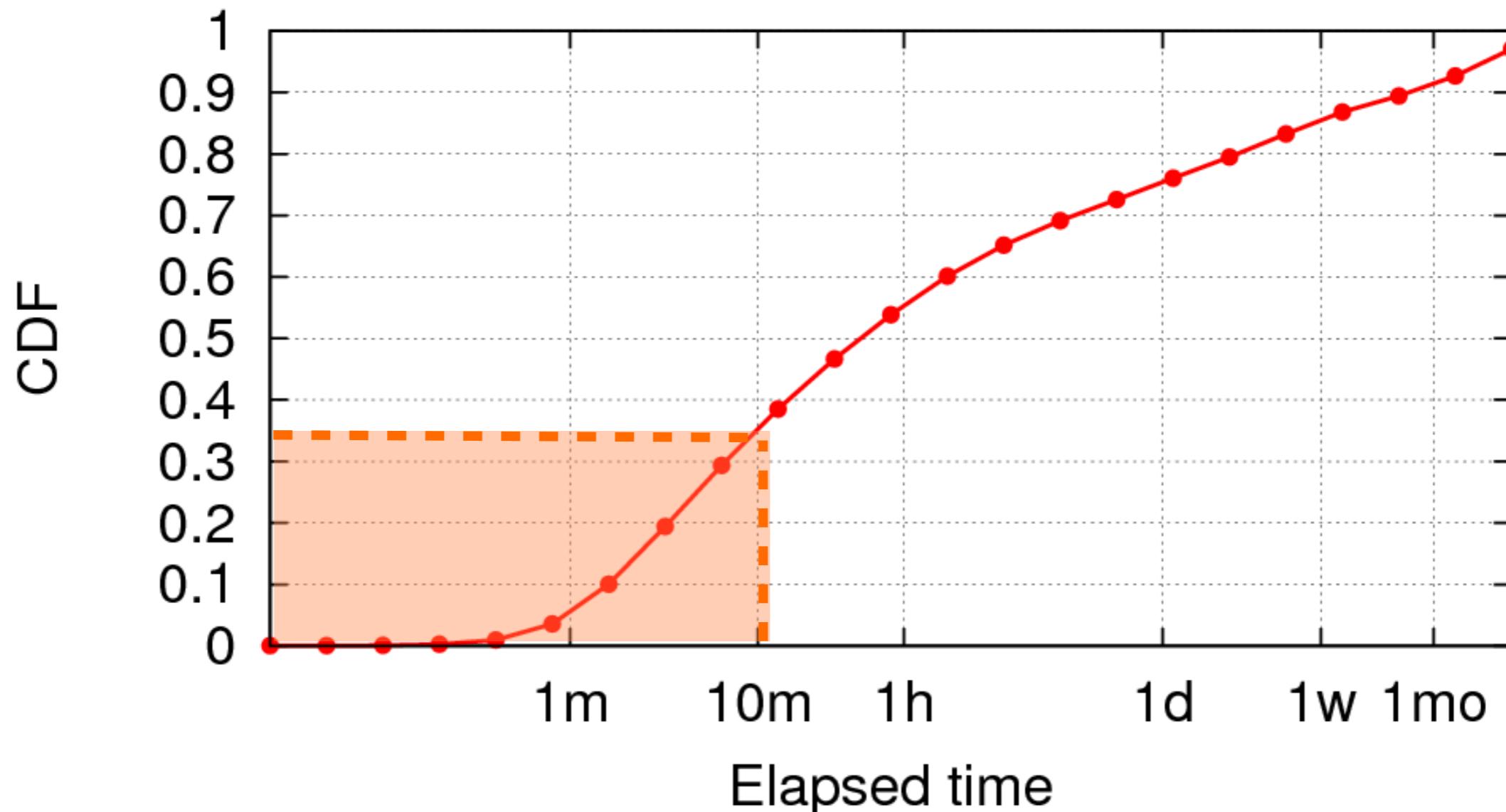
A retweet brings a few hundred additional readers



Time lag between hops in RT tree

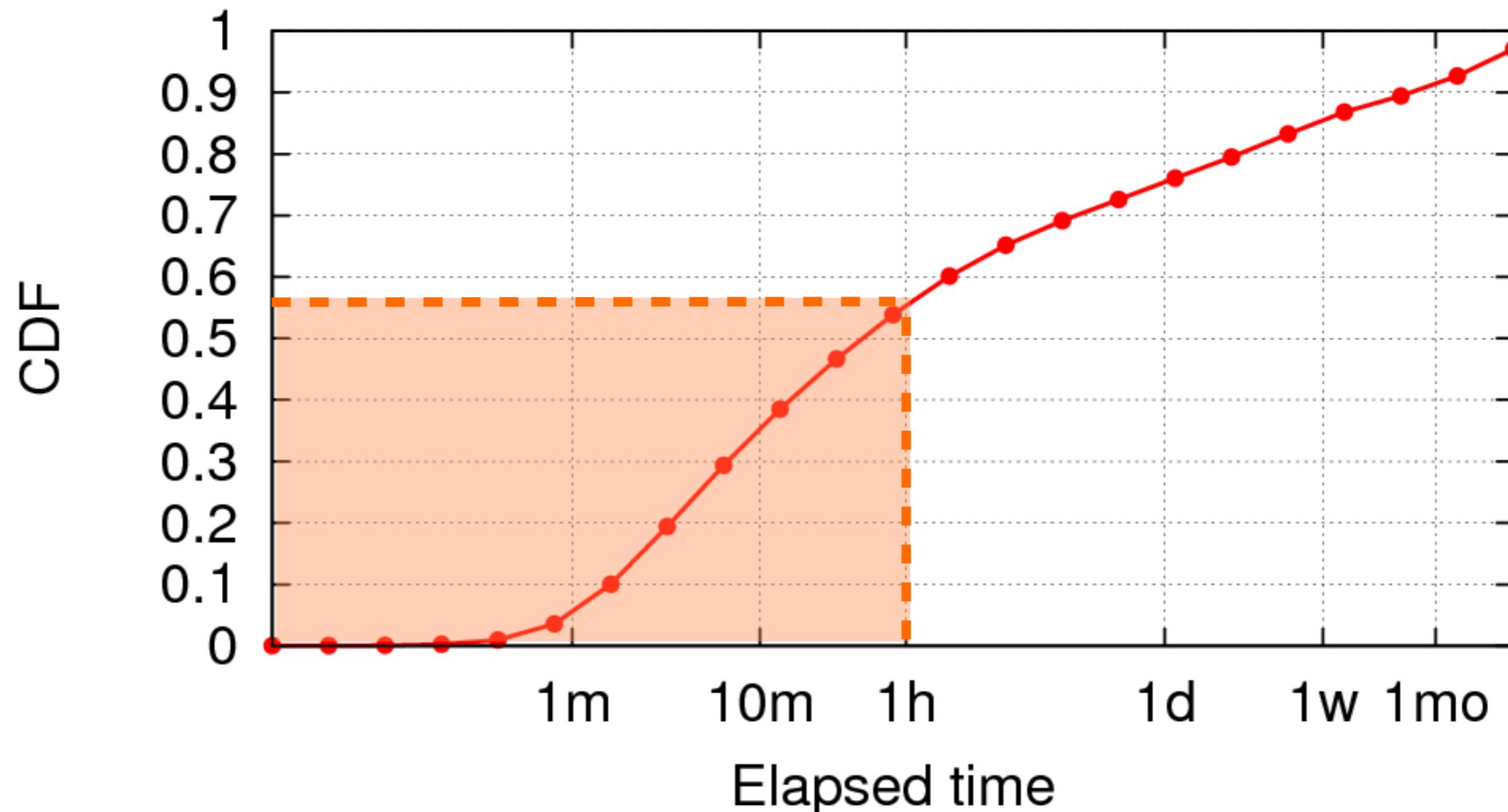


Fast relaying tweets by RT:
35% of RT < 10 min.



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.



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.



makes the answer spread across the globe to millions, immediately.

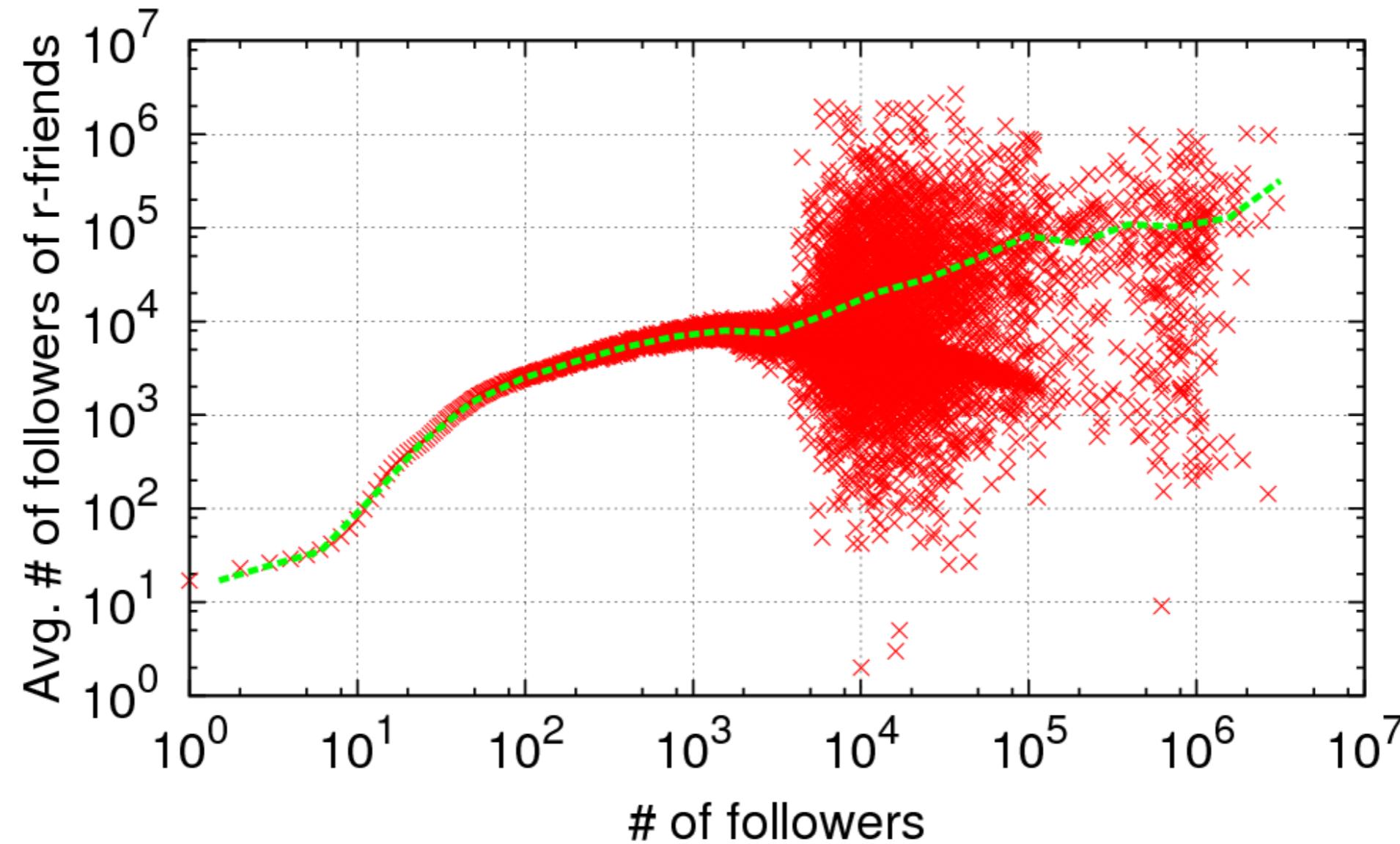




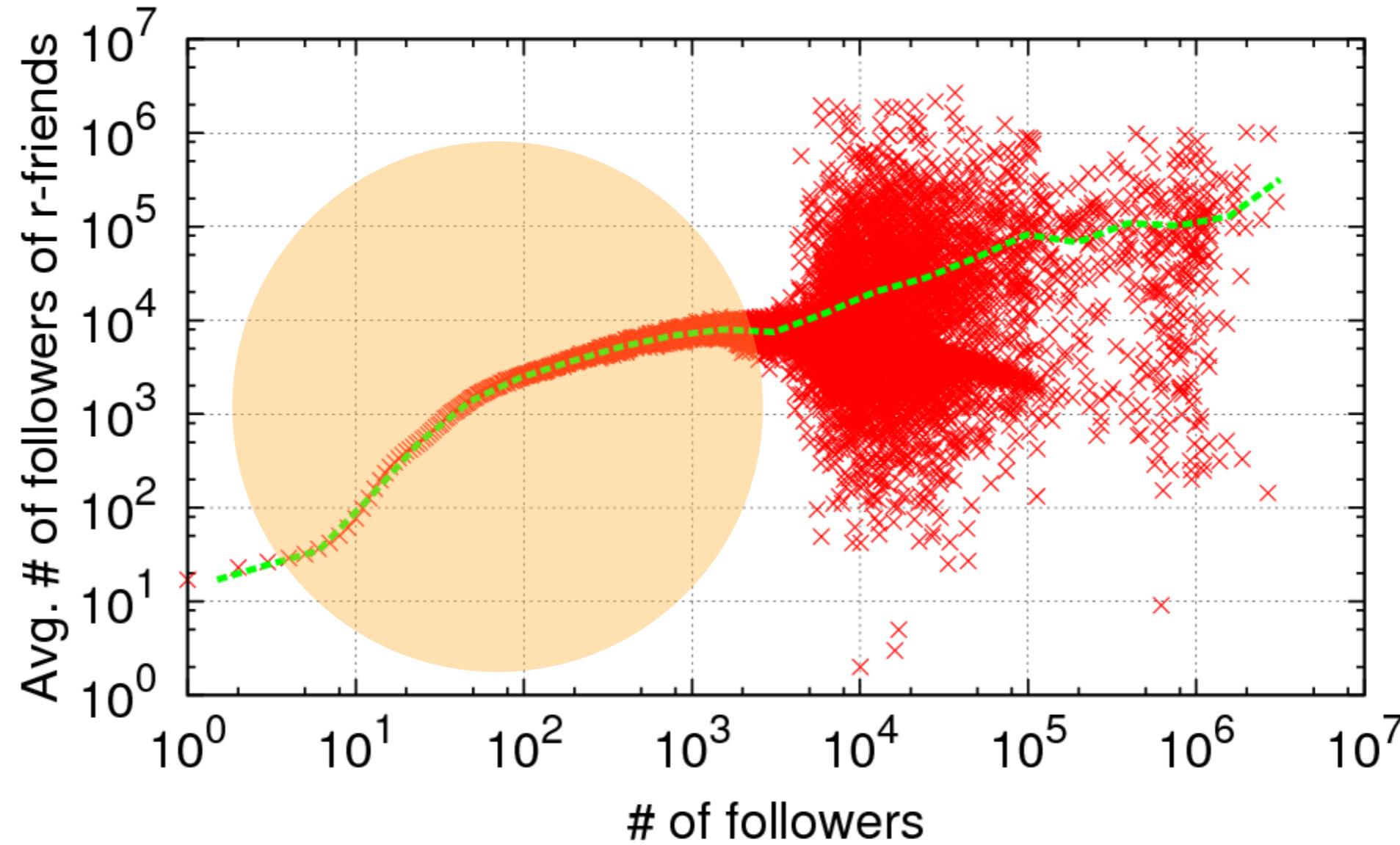
A few numbers

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

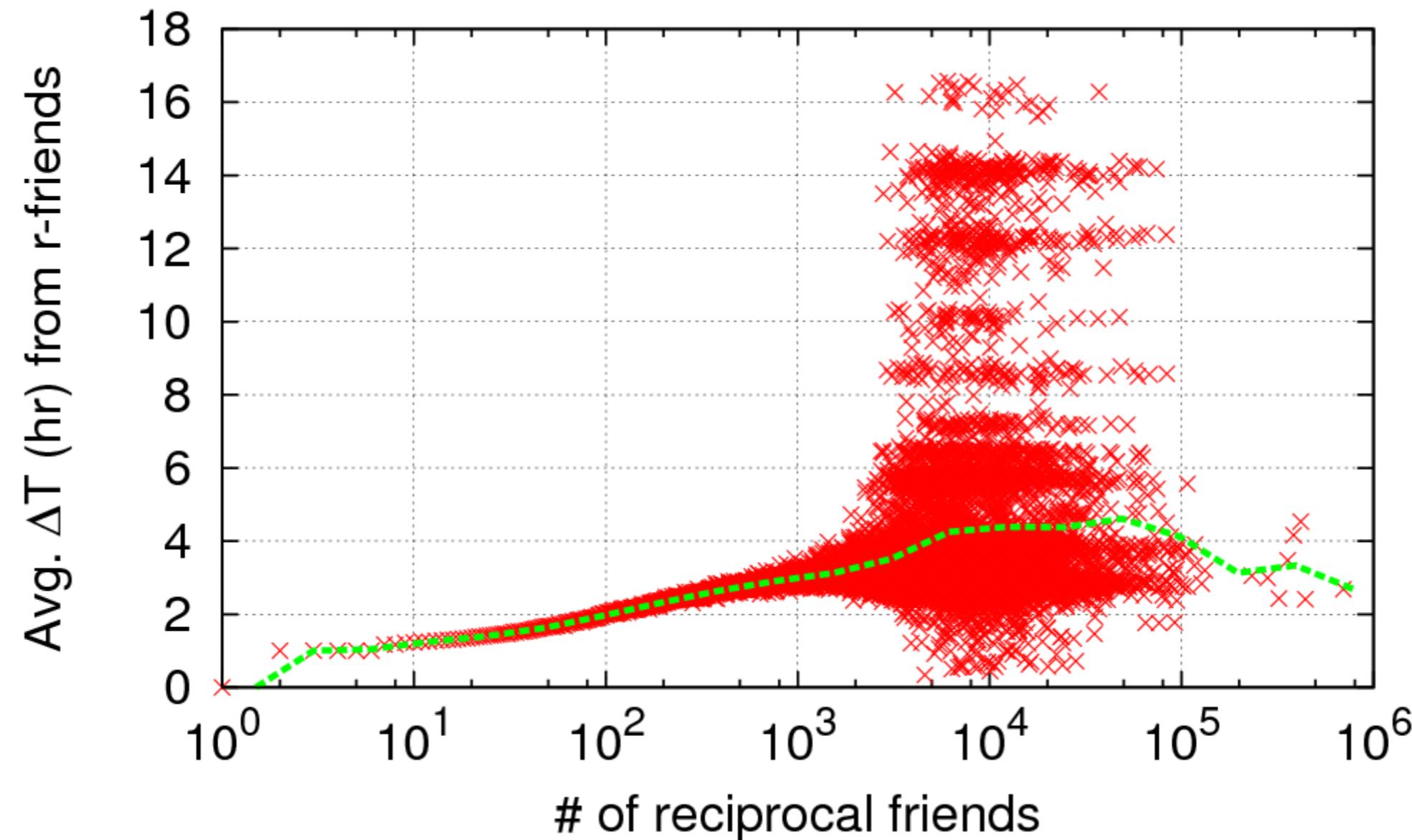
Homophily in terms of followers



Assortative mixing

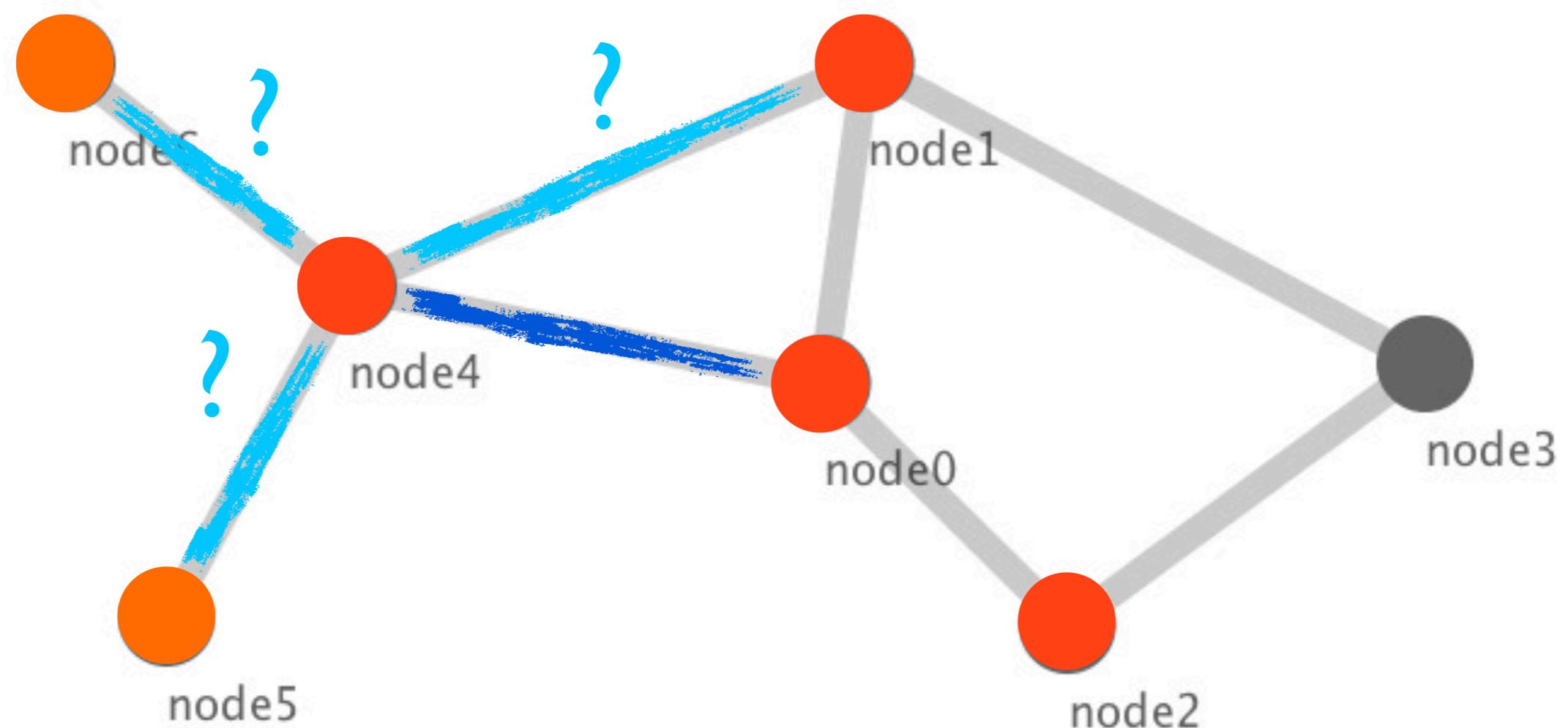


Homophily in terms of location

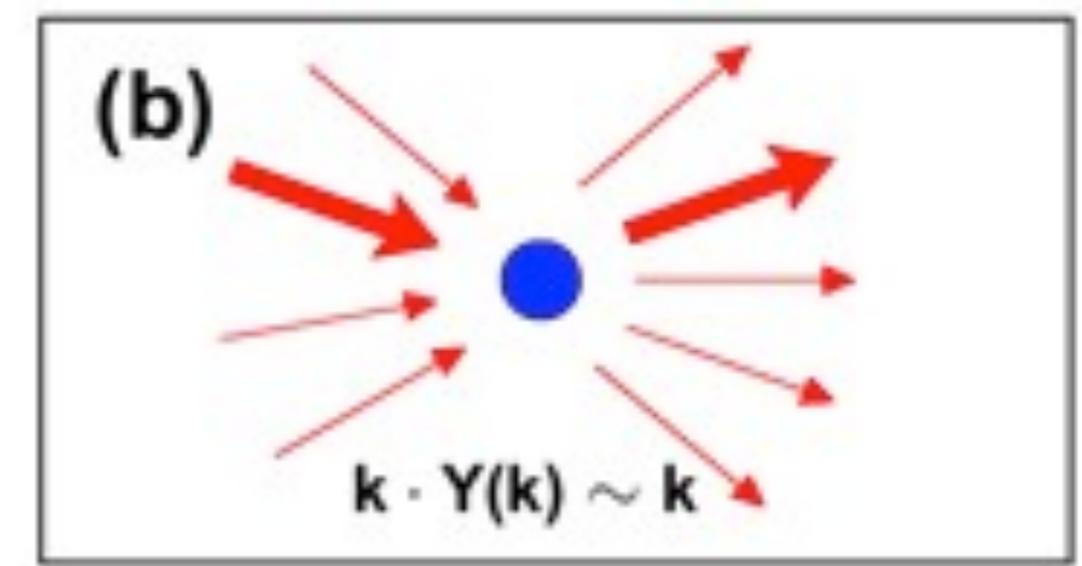
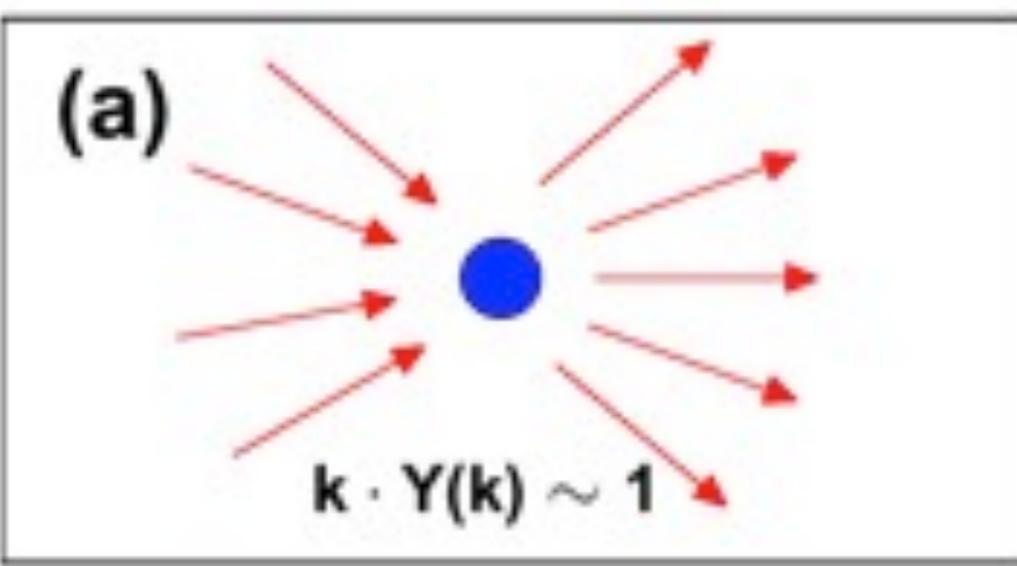


Favoritism in RTs?

- A few informative users?

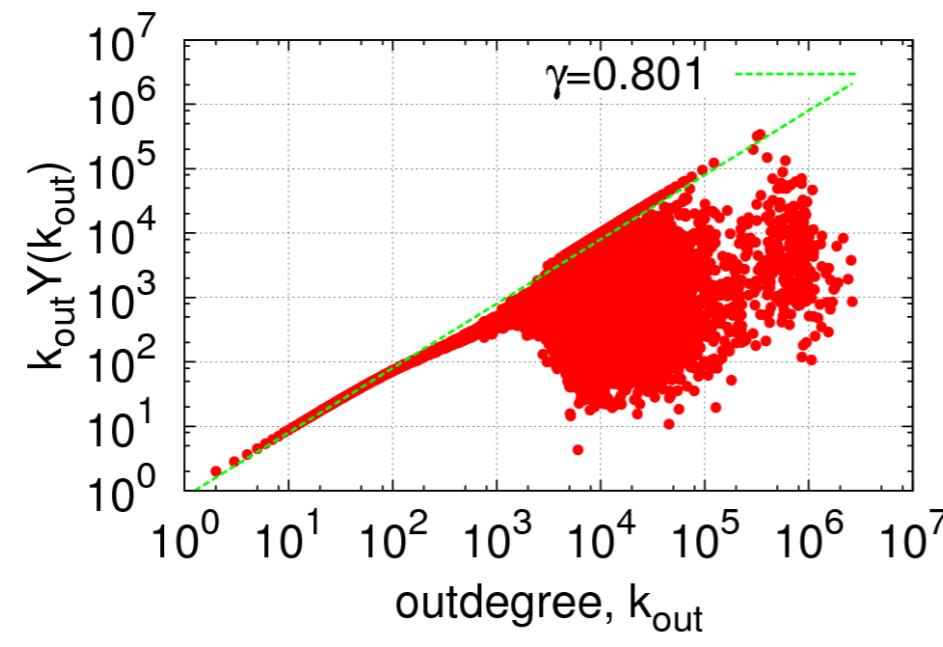


Disparity in weighted network

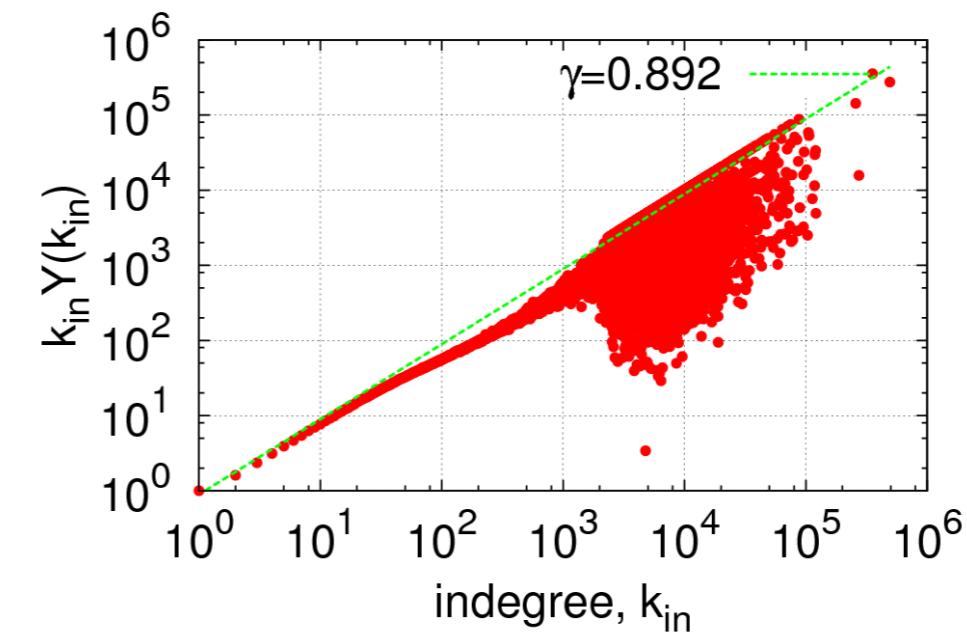


$$Y(k, i) = \sum_{j=1}^k \left\{ \frac{|r_{ij}|}{\sum_{l=1}^k |r_{il}|} \right\}^2$$

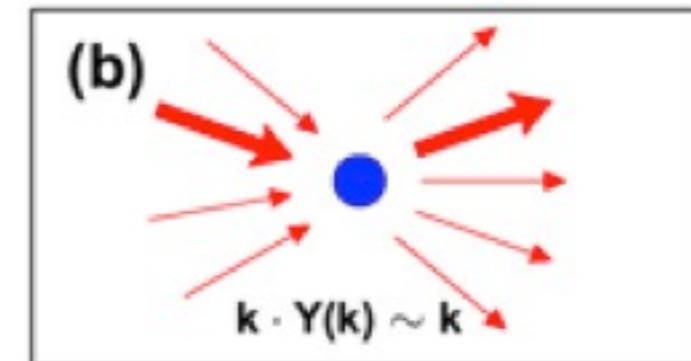
Favoritism in RTs



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



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



Fast WOM by retweet

