

Social features of online networks: The strength of intermediary ties in online social media

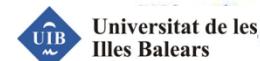
J.J. Ramasco, P. Grabowicz, E. Moro,
J.M. Pujol, V.M. Eguiluz



Instituto de Física Interdisciplinar y Sistemas Complejos



Universidad
Carlos III de Madrid

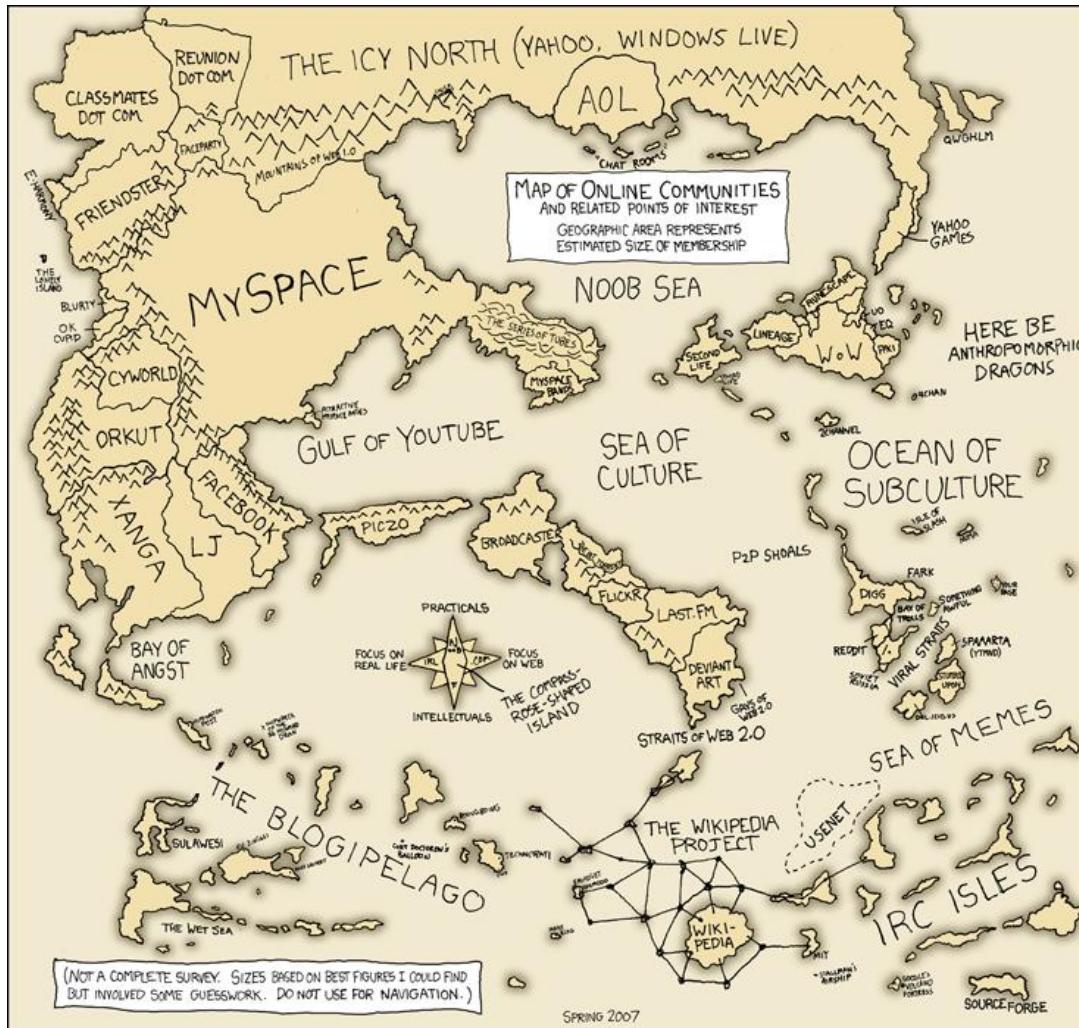


Universitat de les
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Outline:

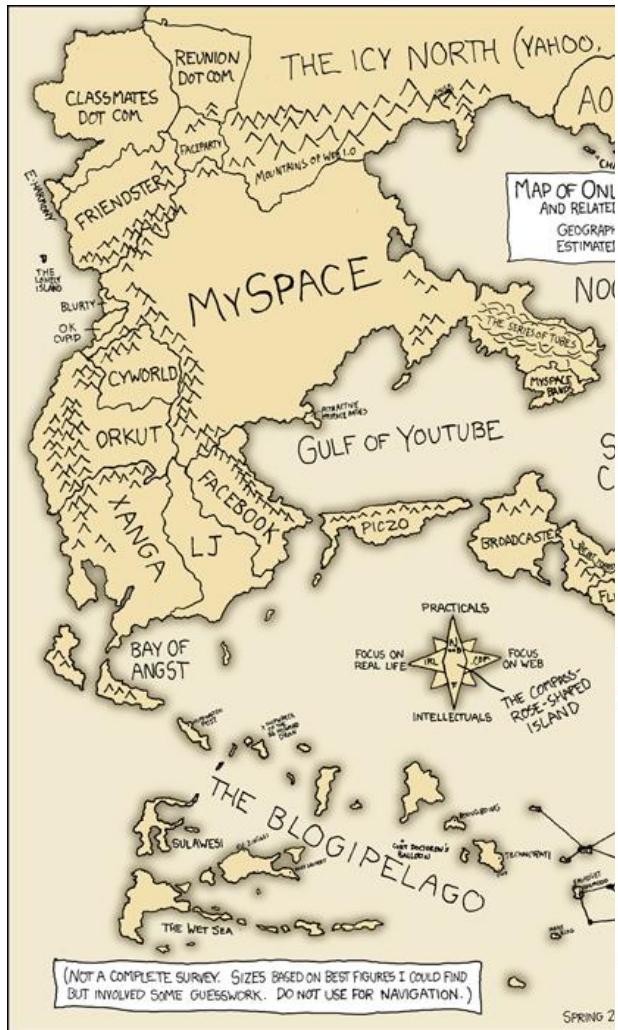
- **Online Social Networks: Twitter**
- **Sociological theories**
- **Network clustering**
- **Results**
- **Conclusions**

Online Social Networks



by R. Munroe <http://xkcd.com/256>

Online Social Networks



by R. Munroe <http://xkcd.com/256>



Online Social Networks

facebook

Profile edit Friends Networks Inbox (8) home account privacy logout

Search + Applications edit

- facehook
- Photos
- Groups
- Events
- Marketplace
- My Questions
- Top Friends
- more

Stanford Flyer

Malaria Vaccine Study



The Stanford-LPCH Vaccine Program is seeking adults for a research study of an experimental malaria vaccine. You must be 18-45 yrs old and in good health. Participants will be compensated.

[create | see all] Share +

Gina Bianchini

Update your status...

Networks: Stanford Alum

Mini-Feed edit See All

Displaying 10 stories.

Today

Gina added the Handbell Podcast Player application.

June 19

Gina and Paul Weller are now friends. 12:02am

June 18

Gina and Jay Tannerbaum are now friends. 4:45pm

June 17

Gina added the Ning Network Creator's Video.

Gina and Sam Jadallah are now friends. 7:51pm

Gina and Ian McCarthy are now friends. 7:51pm

Gina added the House of Kyle Latest Photos a

Gina added the Top Friends application. 7:48pm

Gina added the My Questions application. 7:48pm

Gina and Brooke Hammerling are now friends.

Information

Contact Info [edit] Email: gina_bianchini@stanfo

To fill out the rest of your profile, click here.

Education and Work

Education Info [edit]

College: Stanford Political Science

High School: Lynbrook High

Work Info [edit]

Employer: Ning Position: CEO

Time Period: June 2004 - Present

Location: Palo Alto, CA

Handbell Podcast Player [X]

Handbell Podcast 0711fs - Listener F

00:37 00000

Handbell Community

[H] [>] [H] [<]

1. Handbell Podcast 0711fs -

2. Handbell Podcast 071 - An

3. Handbell Podcast 070 fs -

4. Handbell Podcast 070 - Pa

5. Handbell Podcast 069 - Lisi

6. Handbell Podcast 068 - Bat

7. Handbell Podcast 067 - Int

8. Handbell Podcast 068 - Rei

[thefacebook]

home search global social net invite faq logout

Scranton

Profile (This is you)

Picture [edit]



quick search [go]

My Profile [edit] My Groups My Friends My Messages My Away Message My Mobile Info My Account My Privacy

Visualize My Friends Edit My Profile My Account Preferences My Privacy Preferences

Connection

This is you.

Access

is currently logged in from a non-residential location.

Other Schools [edit]

Information

Account Info:

Name: Member Since: January 12, 2005 Last Update: February 3, 2005

Basic Info:

Email: Status: Alumnus/Alumna Sex: Male Year: 2004 Concentration: Computing Sciences Mathematics

Phone: High School: Extended Info:

Screenname: Looking For: Friendship Dating A Relationship Random play Whatever I can get

Interested In: Women Relationship Status: Single Political Views: Liberal

Interests: Drinking, Football, Basketball, Tennis, saying you have that.

Online Social Networks

facebook

Profile edit Friends Networks Inbox (8)

Search + Applications edit

- facehack
- Photos
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Stanford Flyer
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[create] [see all]

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Networks: Stanford Alum

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- Gina added the My Questions application.
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Employer: Ning
Position: CEO
Time Period: June 2004 - Present
Location: Palo Alto, CA



Signs of the social networking times.

Year: 2004
Concentration: Computing Sciences Mathematics

Phone: High School: Extended Info:
Edit My Profile My Account Preferences My Privacy Preferences

Screenname: Looking For:

Friendship
Dating
A Relationship
Random play
Whatever I can get

Interested In: Women

Relationship Status: Single
Political Views: Liberal

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June 19 June 18

Stanford Friends edit See All

13 friends at Stanford.

Valerie Rozicki	Reid Hoffman	David Sze

Steve Vassello	Ian McCarthy	Hollie Moore

Handbell Podcast Player

Handbell Podcast 0711fs - Listener F

00:37 00000

Handbell Community

[create | see all] Share +

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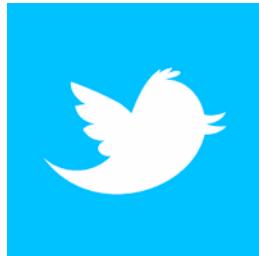
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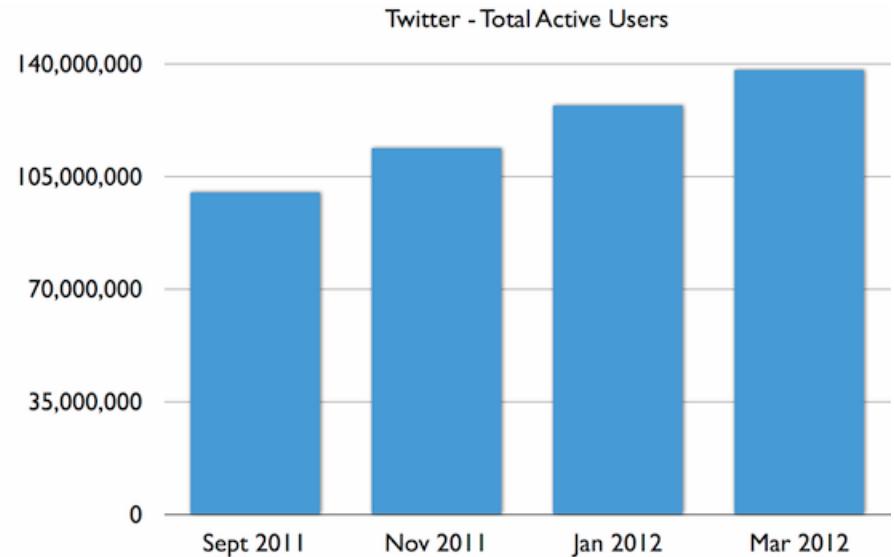
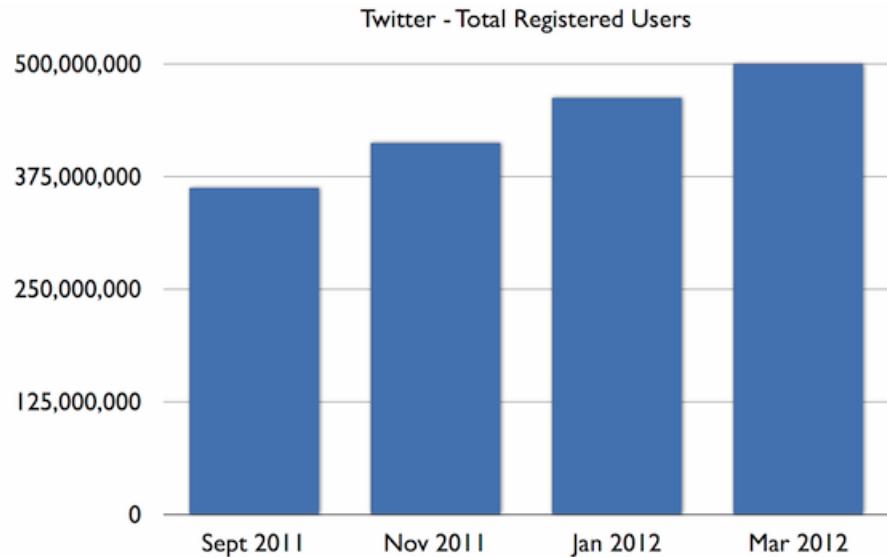
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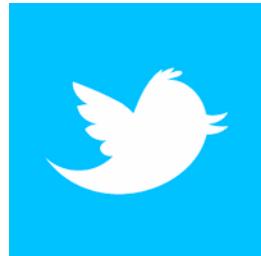
Twitter



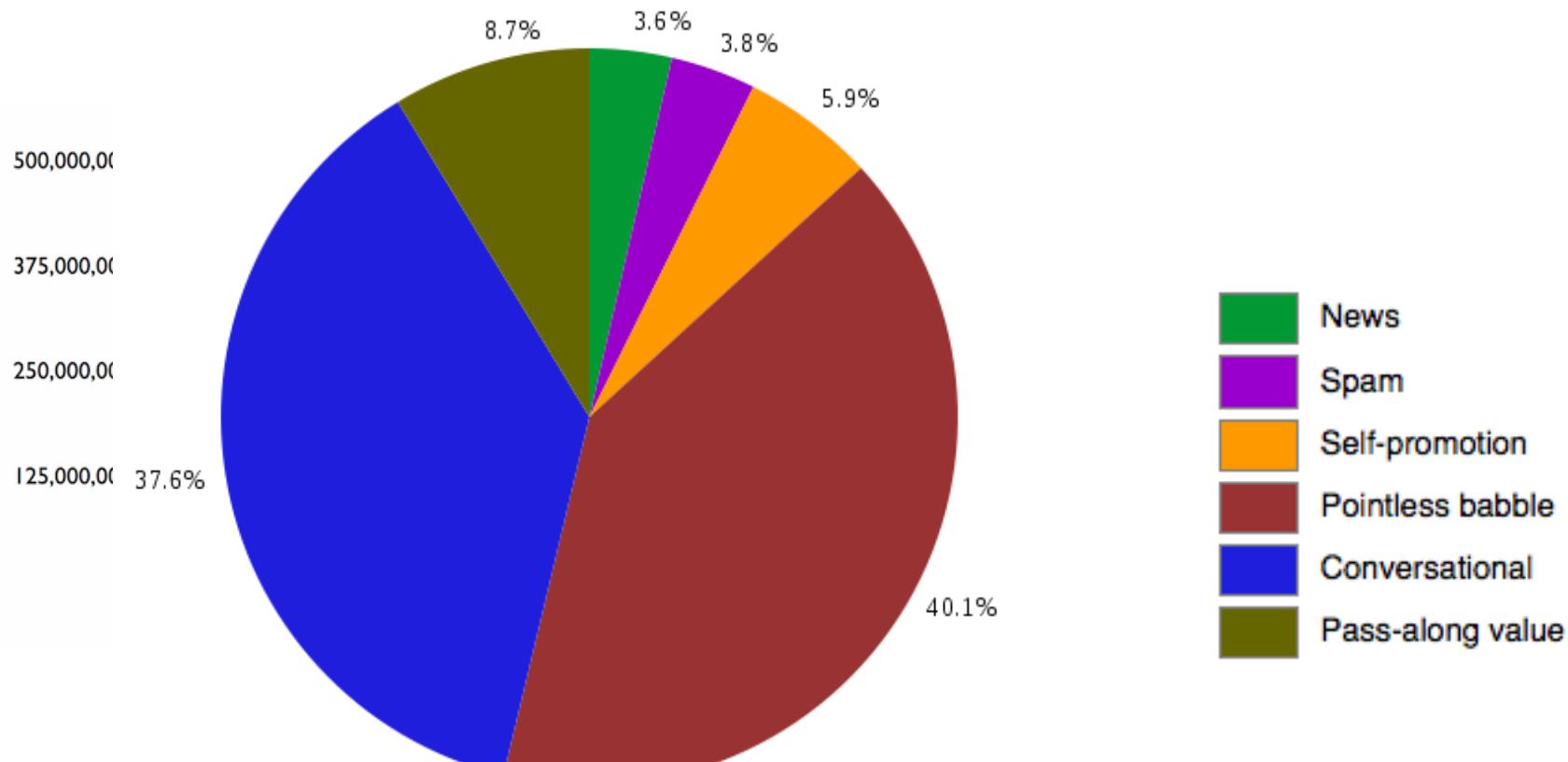
Starting date **2006-2007**



Twitter



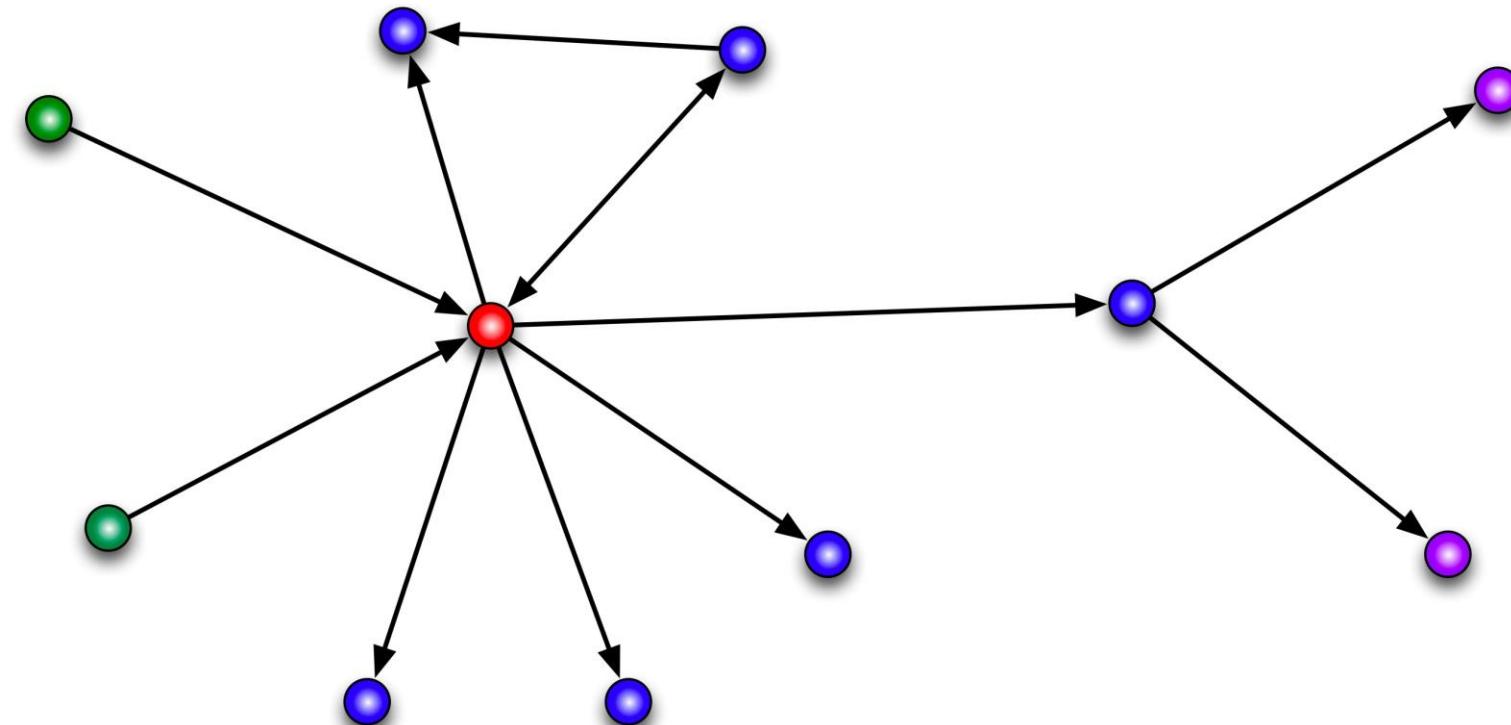
Starting date **2006-2007**



K. Ryan, ed. (2009-), "Twitter Study - August 2009", Pair Analytics

Twitter: structure & use

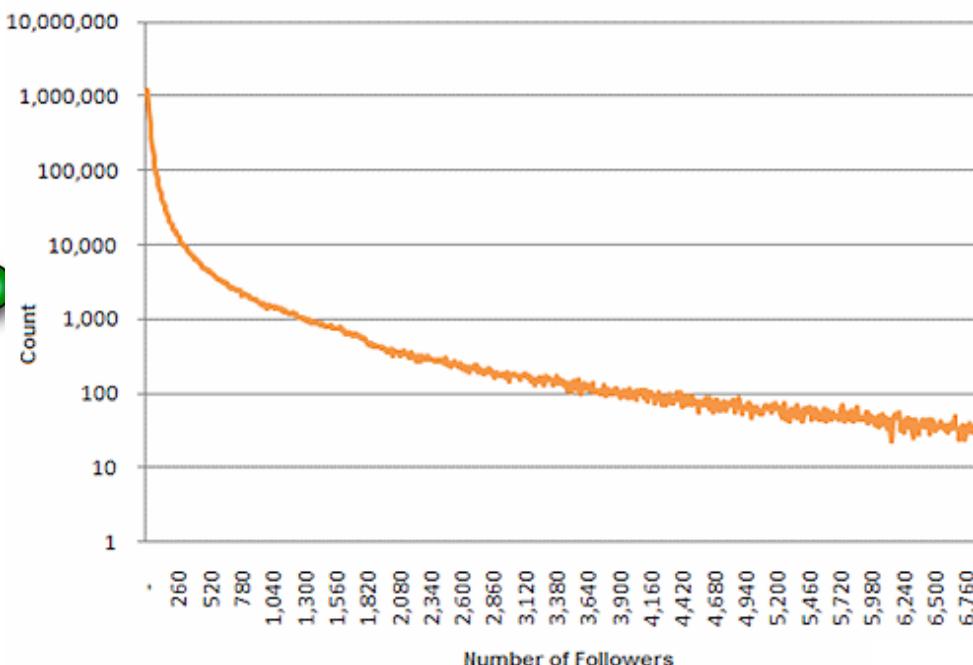
Tweets as basic interactions



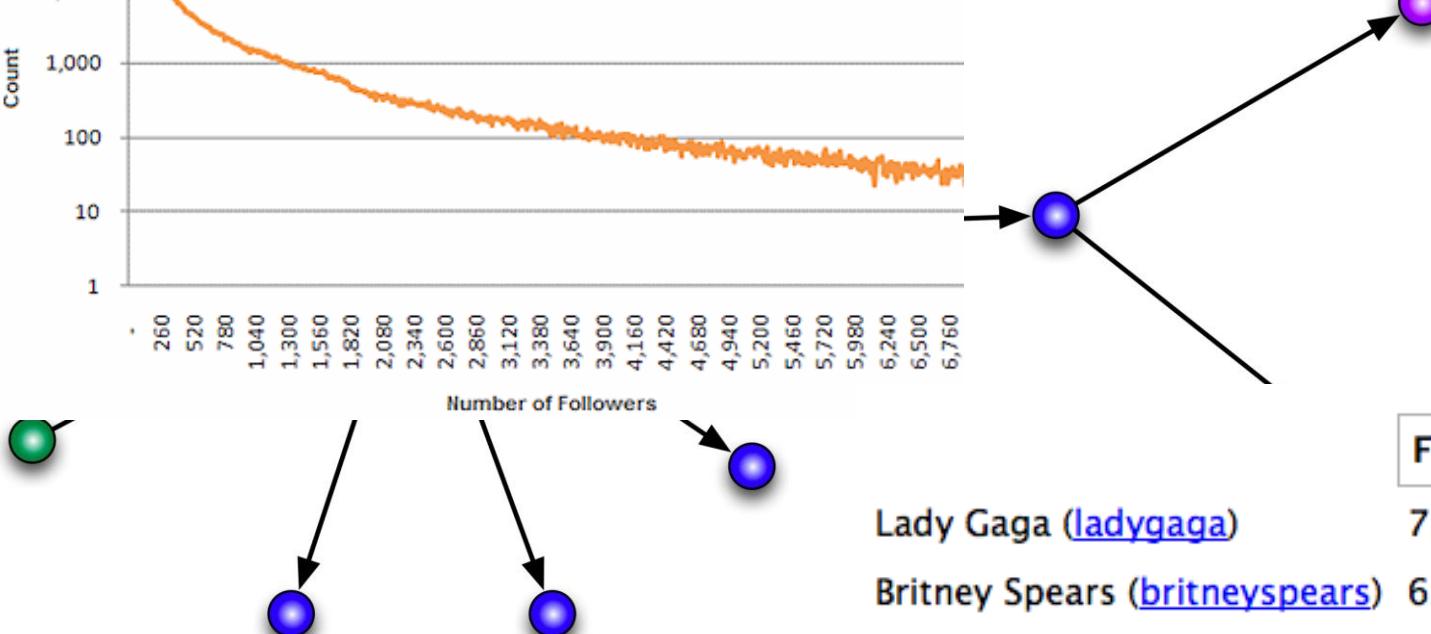
Twitter: structure & use

HubSpot 

Distribution of Follower Counts



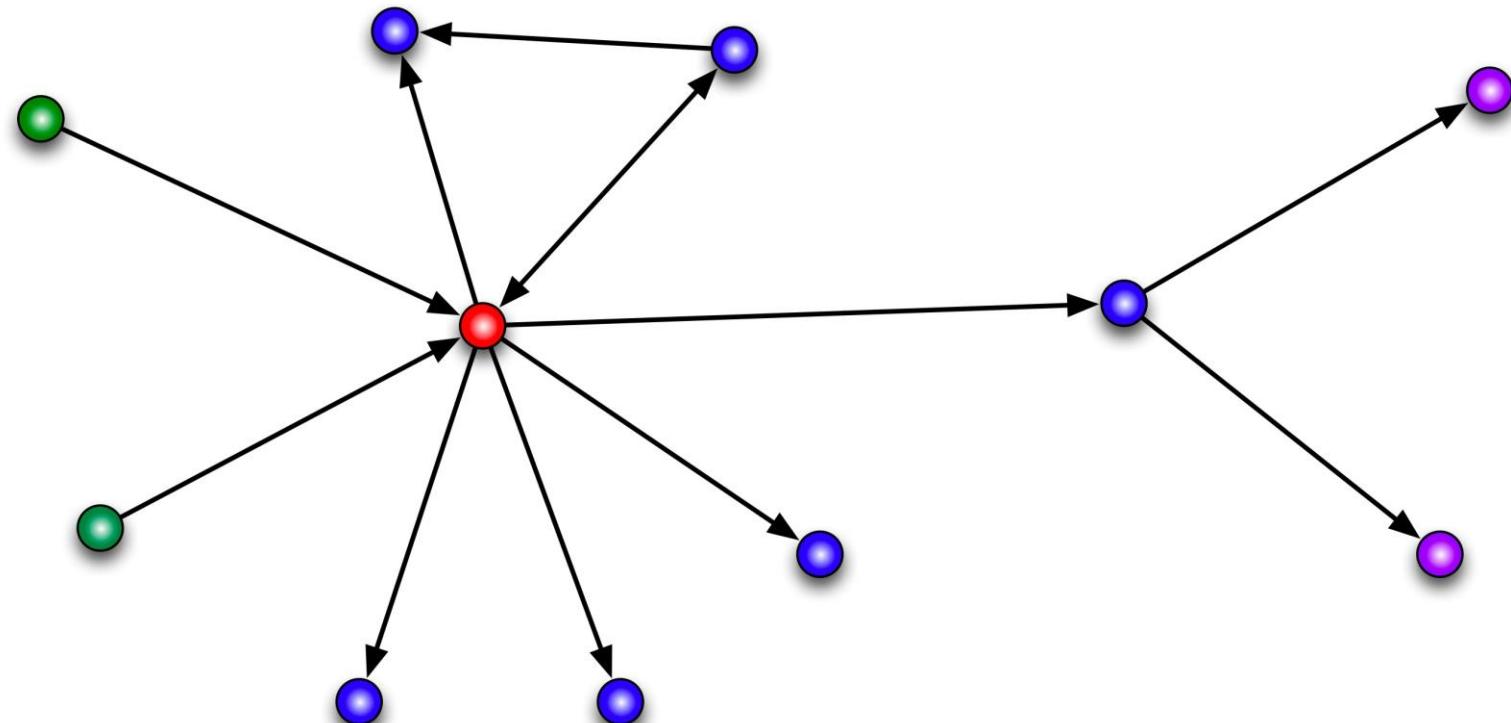
Tweets as basic interactions



	Followers	Following
Lady Gaga (ladygaga)	7,394,362	145,898
Britney Spears (britneyspears)	6,416,696	416,140
Justin Bieber (justinbieber)	6,355,747	95,167

Twitter: structure & use

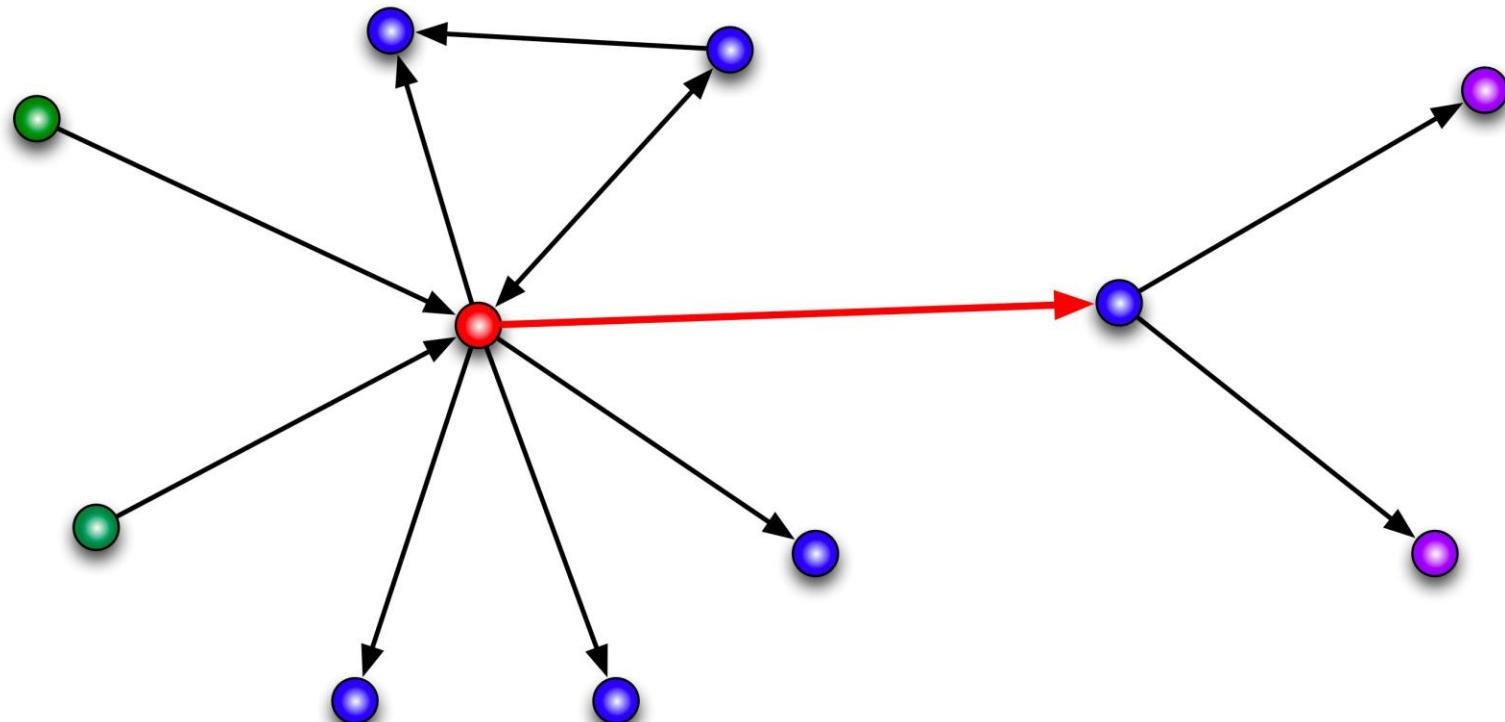
Mentions & Retweets



Twitter: structure & use

Mentions & Retweets

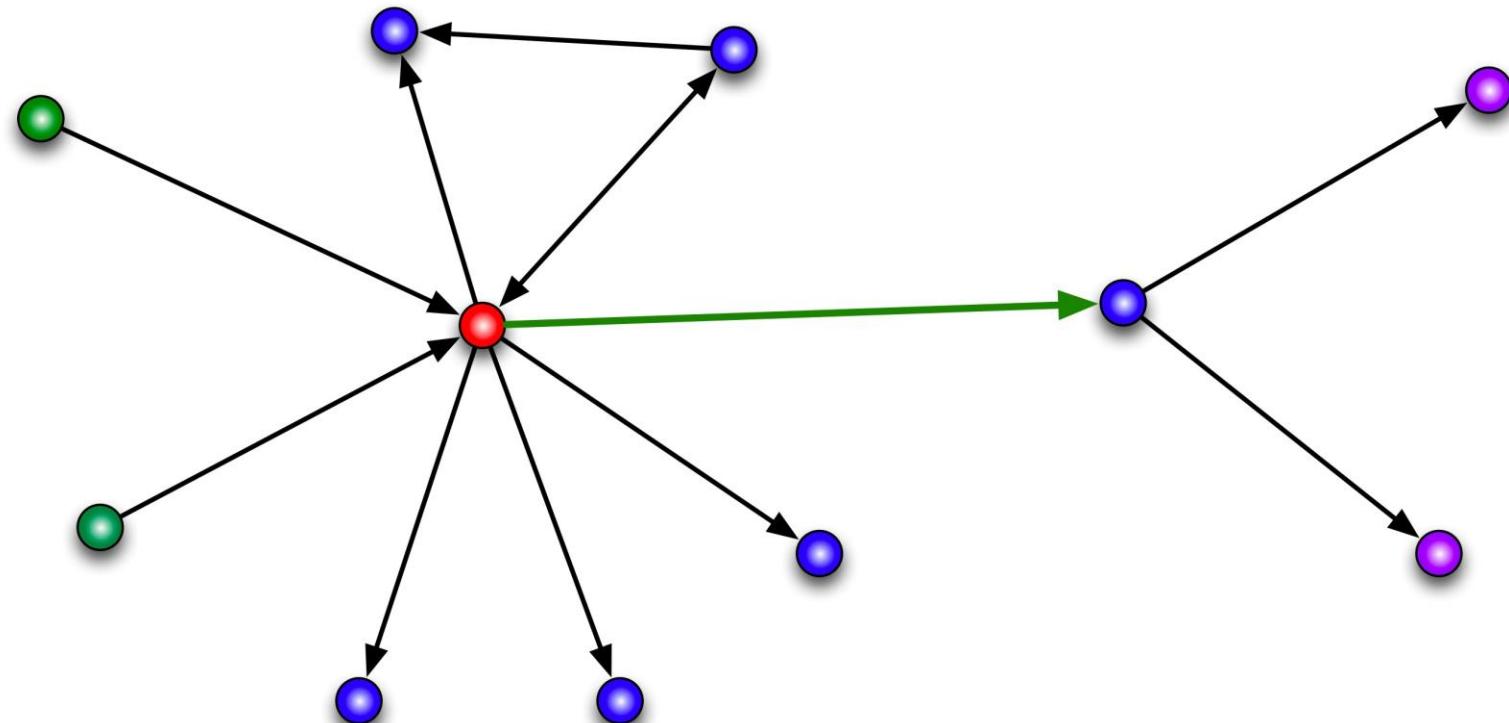
Mentions: @john



Twitter: structure & use

Mentions & Retweets

RT:@sam



Our Twitter database

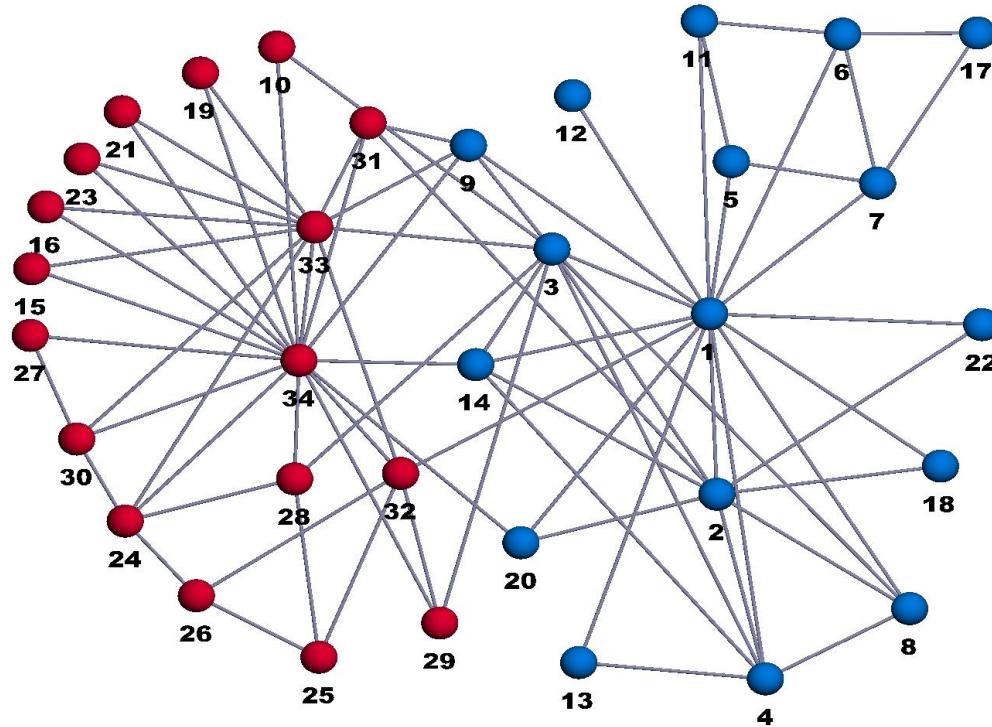
Year: **2008**

Property	Follower links	Links with mentions	Links with retweets
Users	2 408 534	377 760	26 480
Links	48 776 888	1 224 484	32 169
Reciprocity	27%	14%	0.7%

Table 1: Overall characteristics of the follower network and of the interactions taking place on it.

Groups and sociological theories:

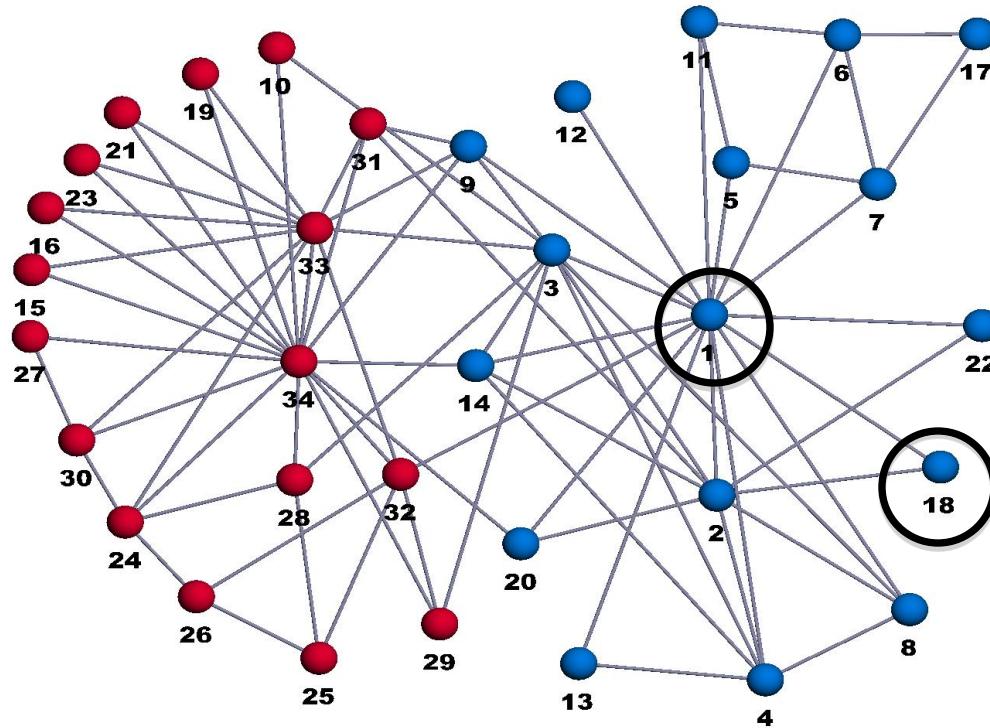
Strength of the weak ties



M. Granovetter, Am. J. Sociology **78**, 1360 (1973).

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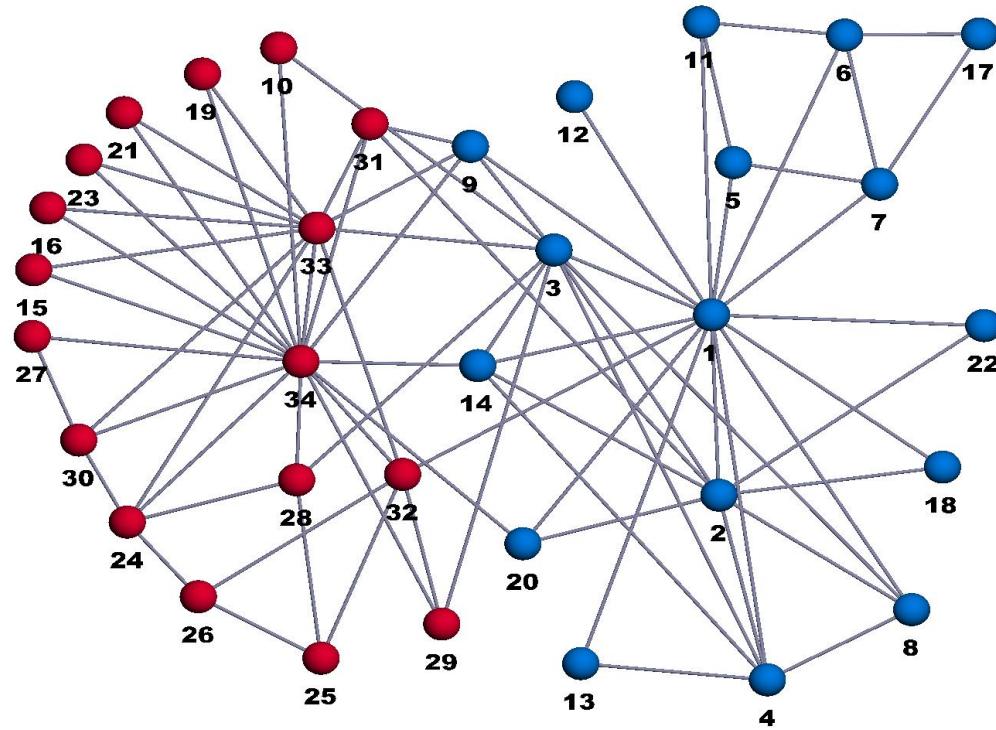
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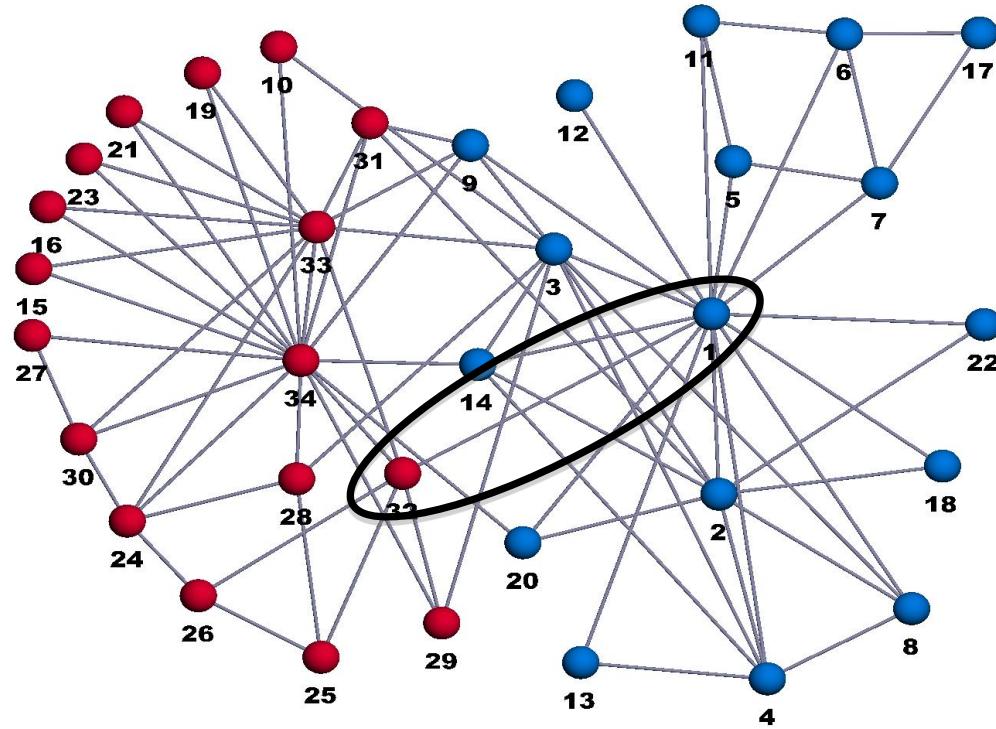
Tradeoff diversity-bandwidth



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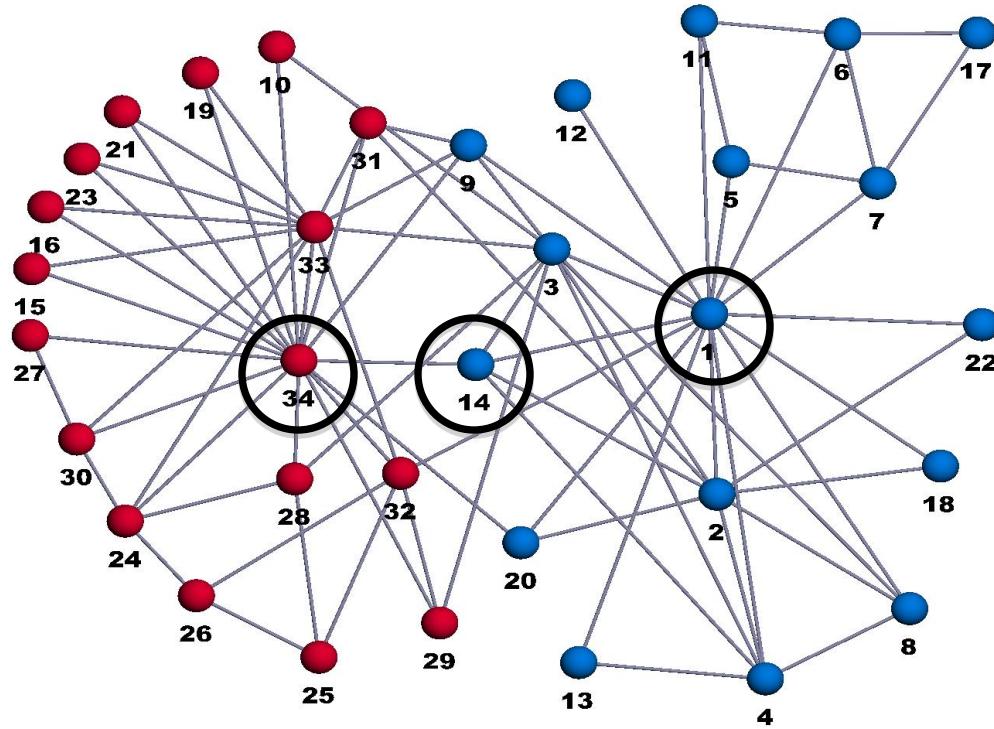
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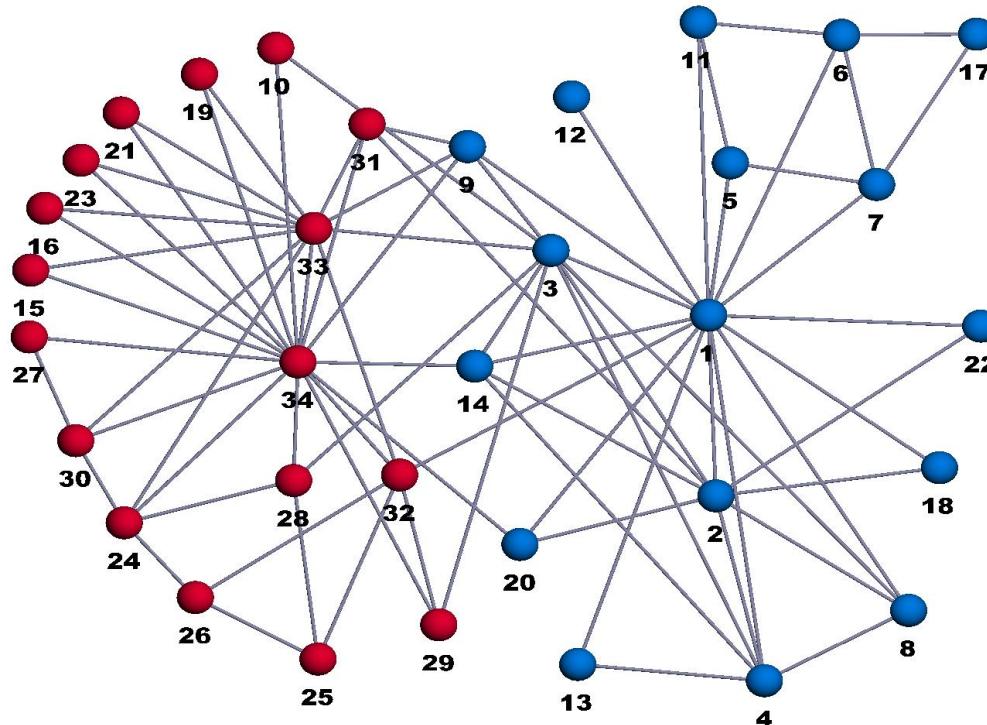
Groups and sociological theories:

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Communities?



S. Fortunato, Community detection in graphs. Physics Reports **486**, 75 (2010.).

Cluster detection

We are applying a number of clustering methods to the follower network of Twitter. The aim is to validate the main results with the groups obtained with different techniques.

Just to name a few:

- Oslom

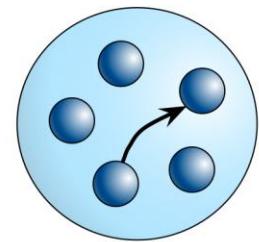
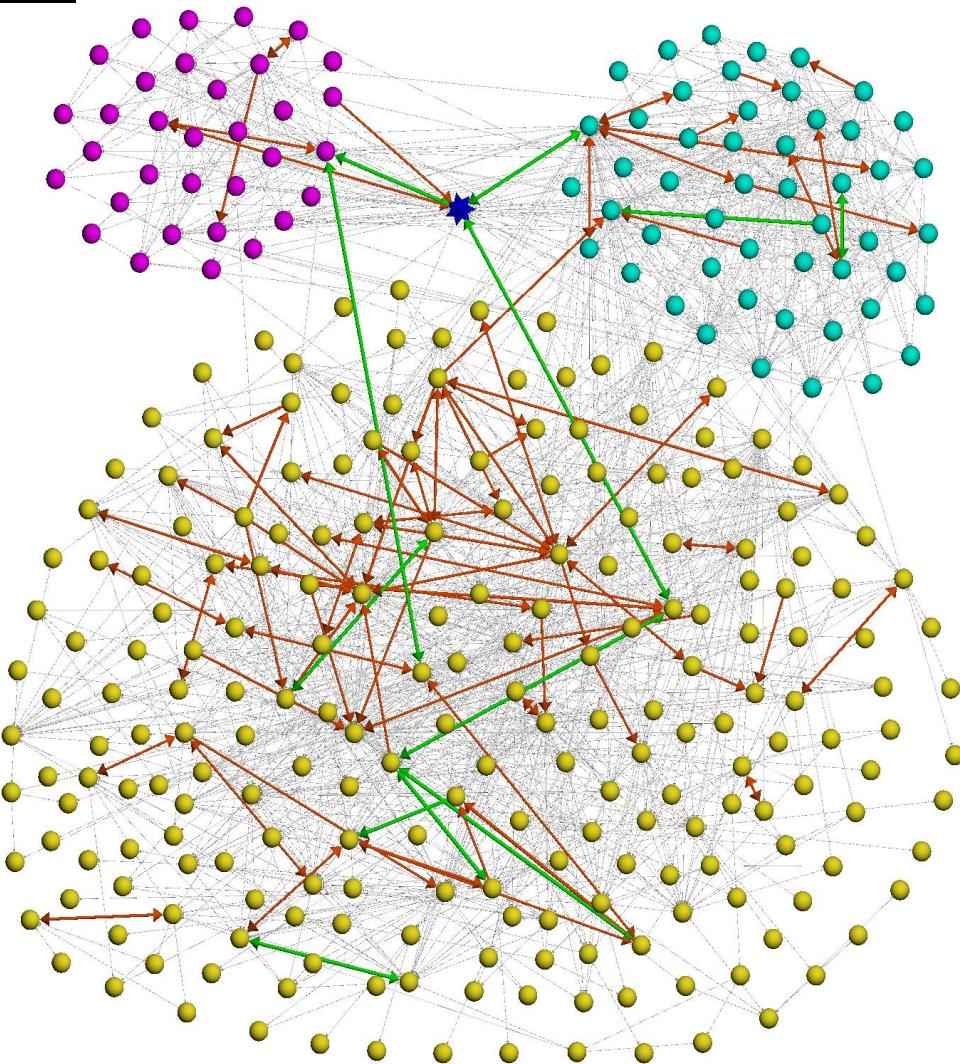


<http://www.oslom.org>

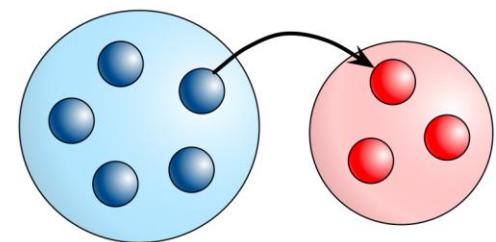
- Infomap

A. Lancichinetti, F. Radicchi, J.J. Ramasco & S. Fortunato, PLoS ONE **6**: e18961 (2011).
M. Rosvall & C.T. Bergstrom, Proc. Natl. Acad. Sci. USA **105**, 1118 (2008).

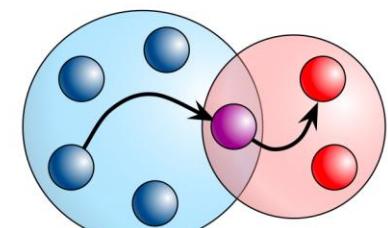
Results



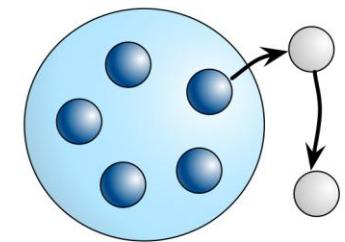
internal links



between groups

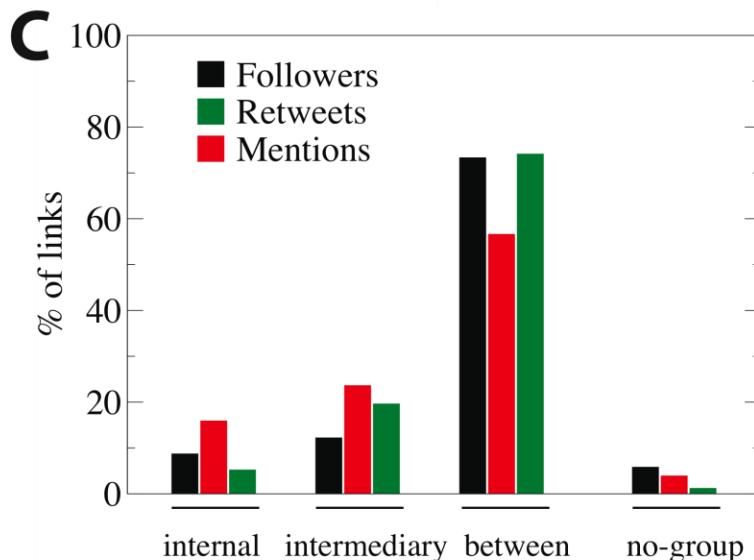
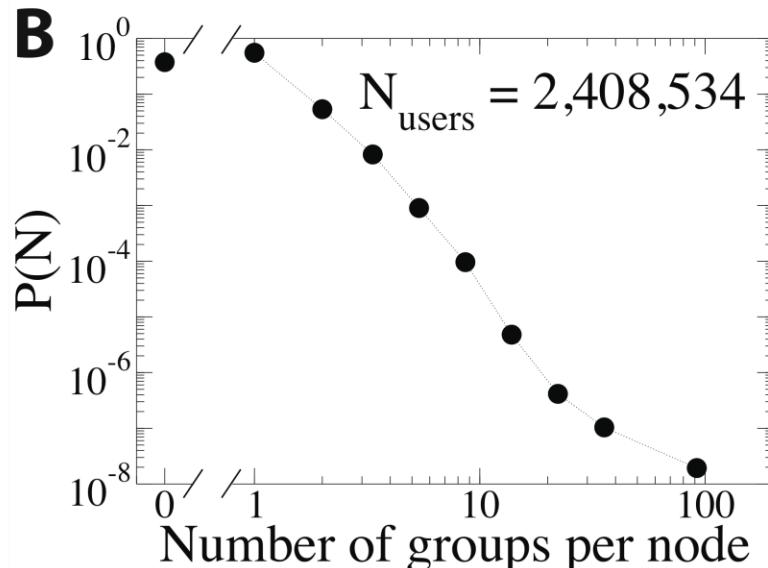
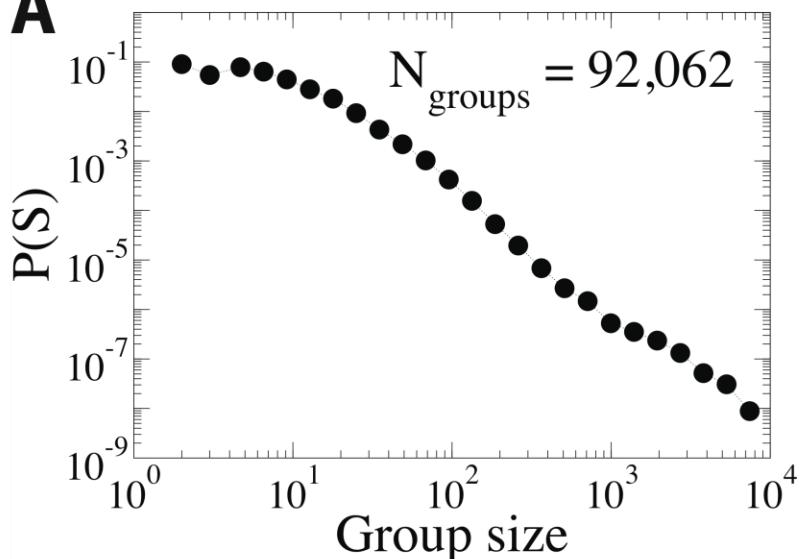


intermediary links

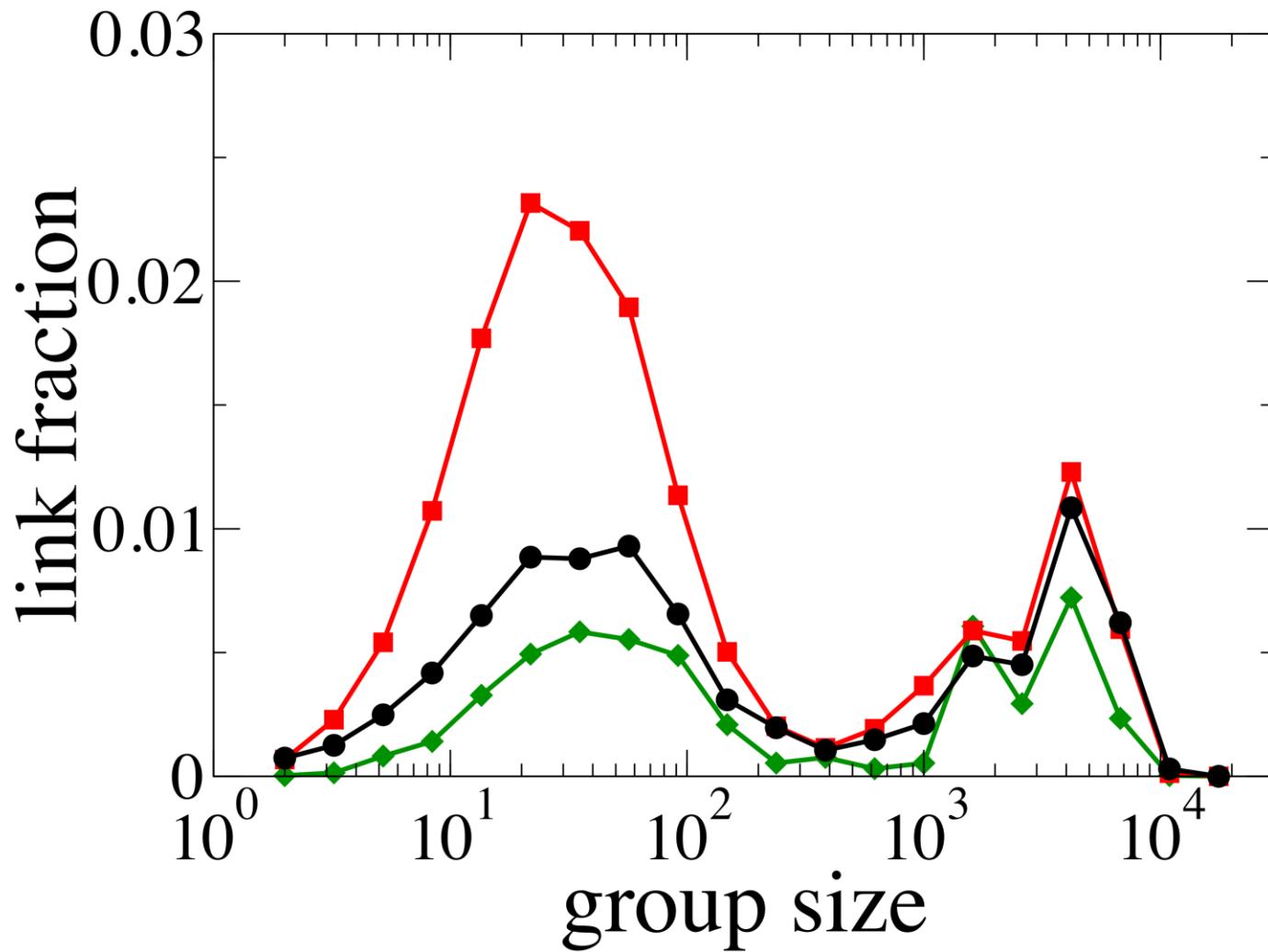


no-group links

Results A

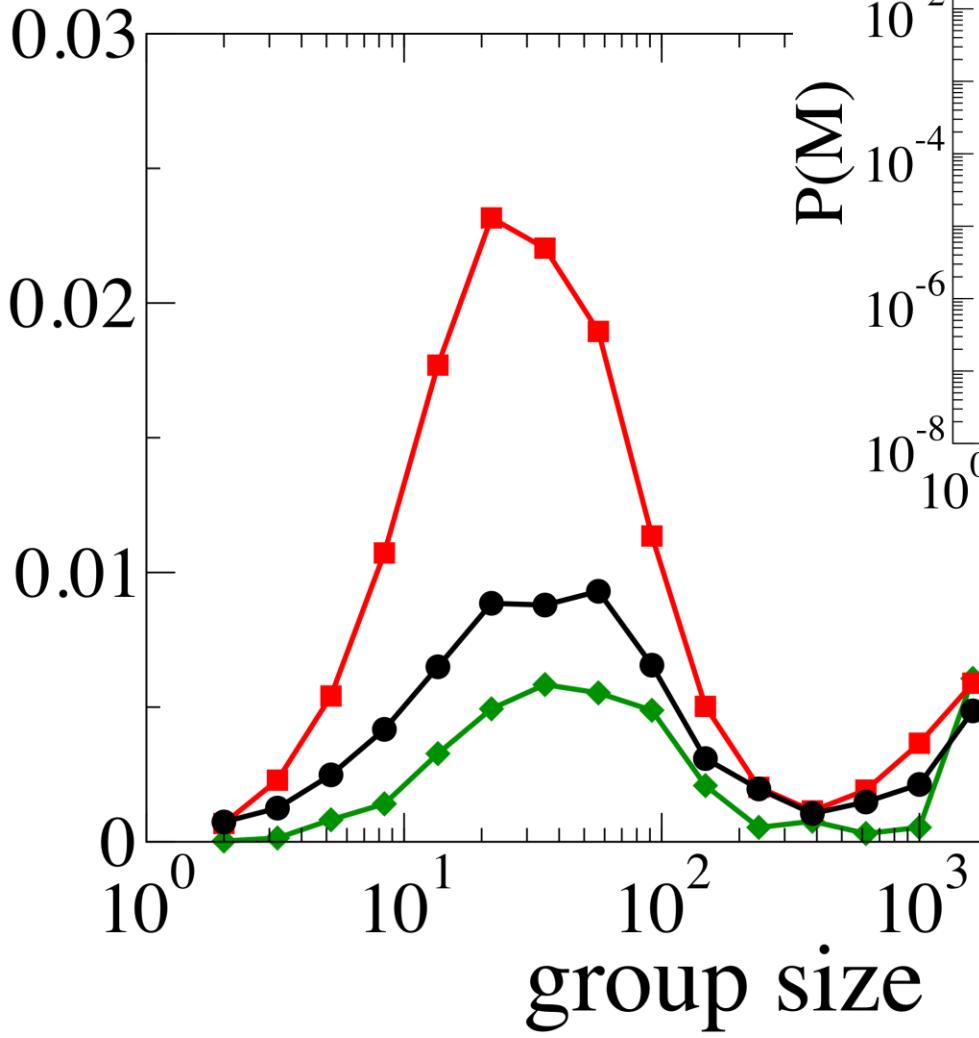


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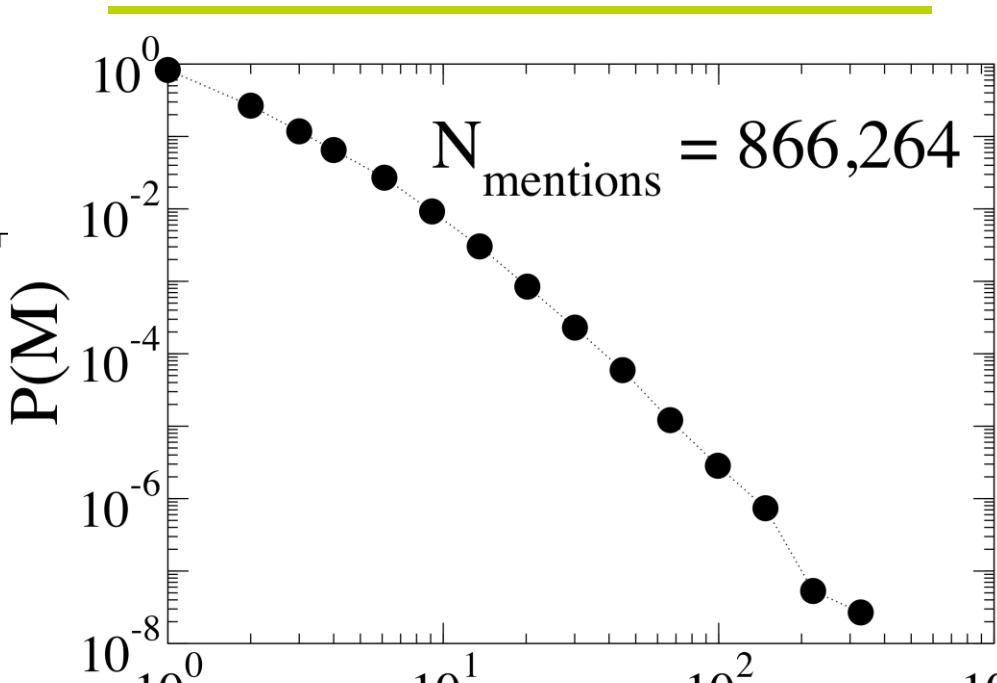


Results

link fraction

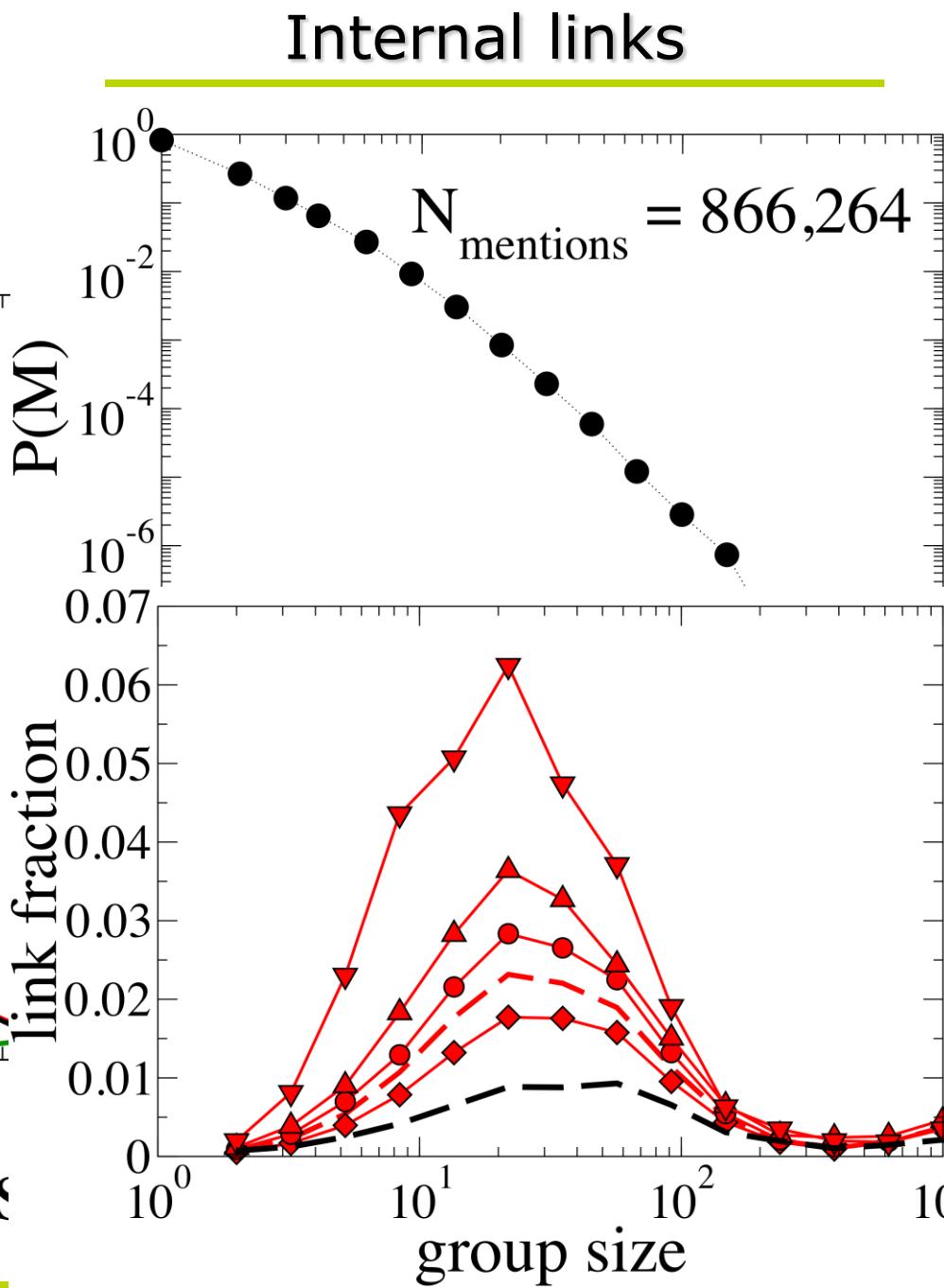
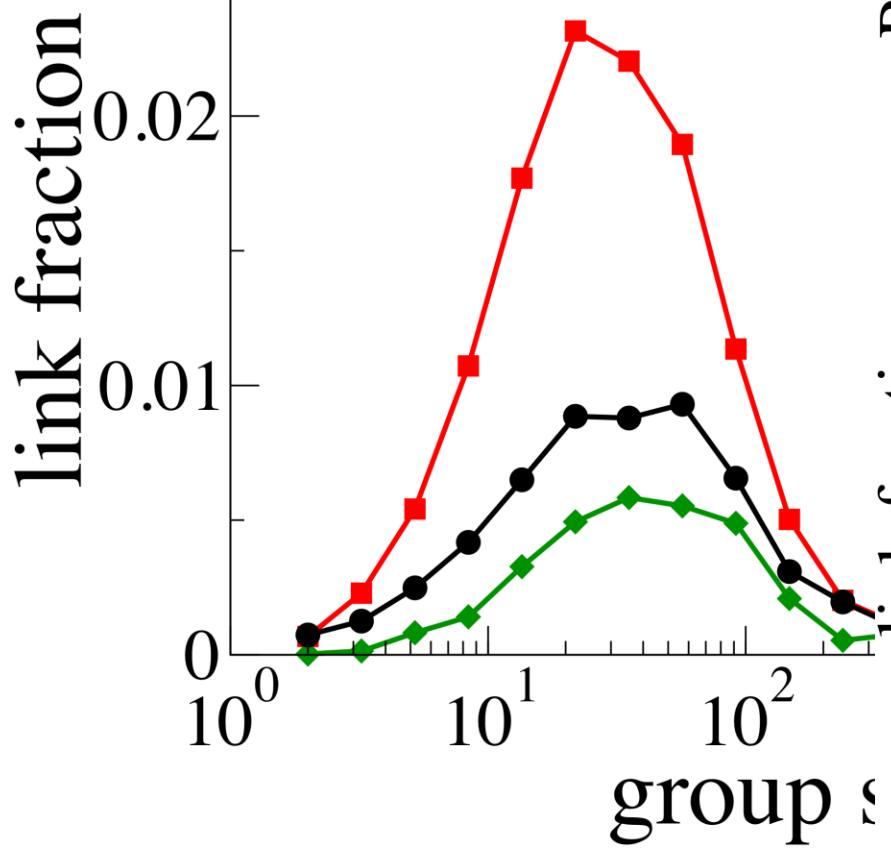


Internal links

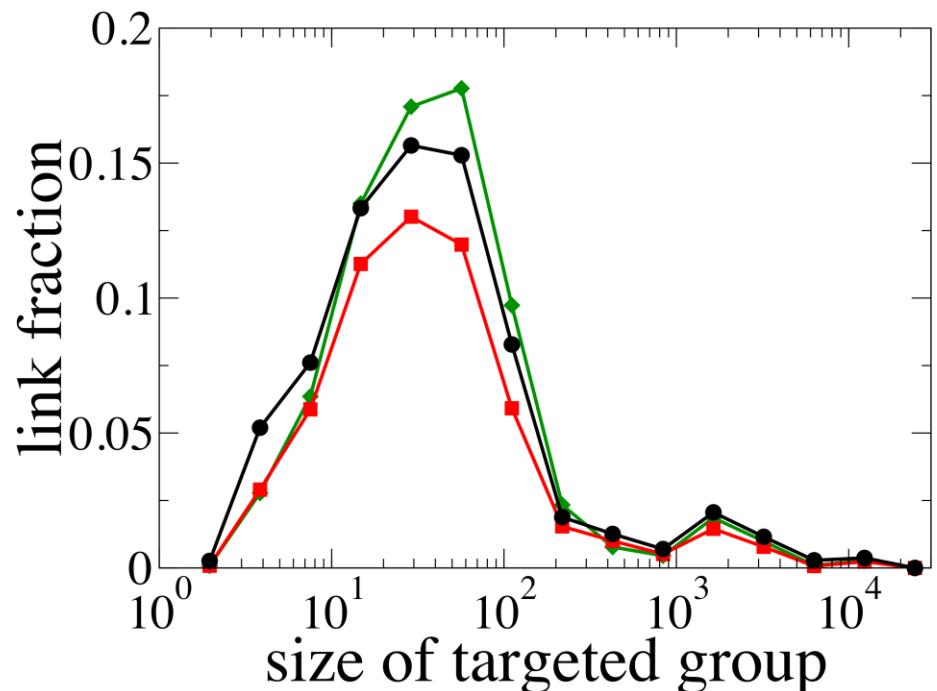
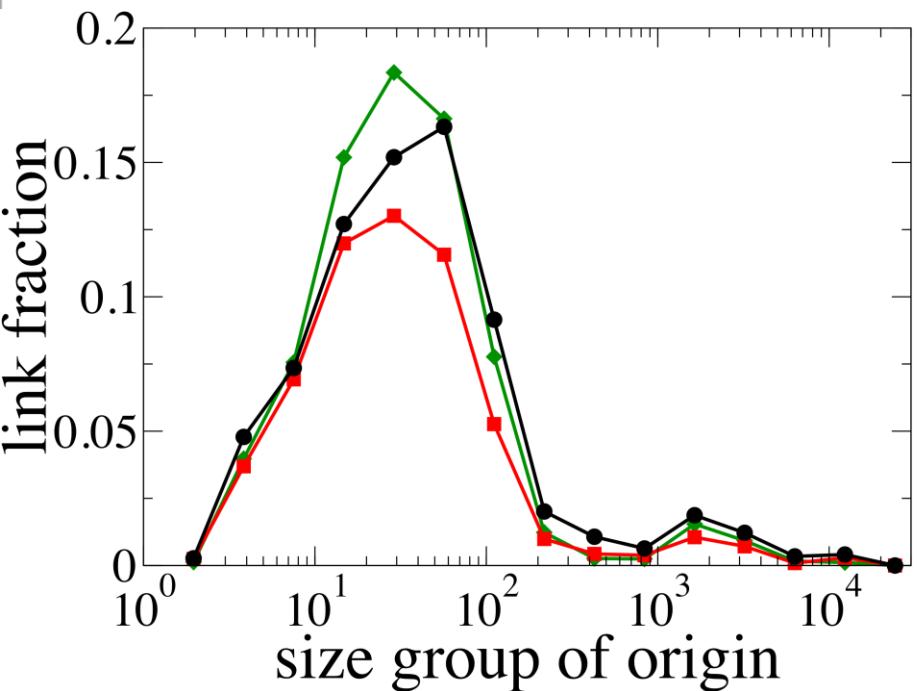


Mentions per link

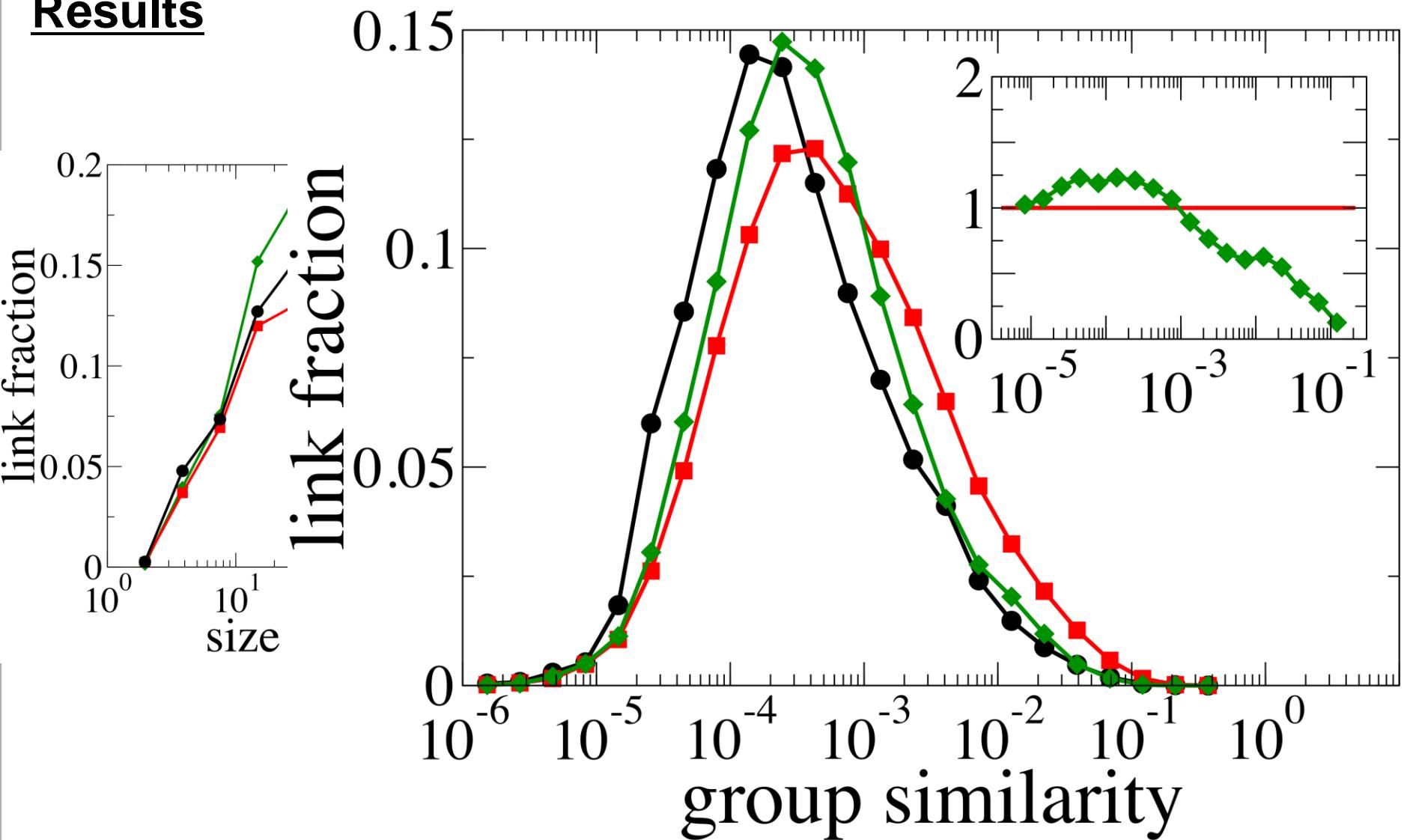
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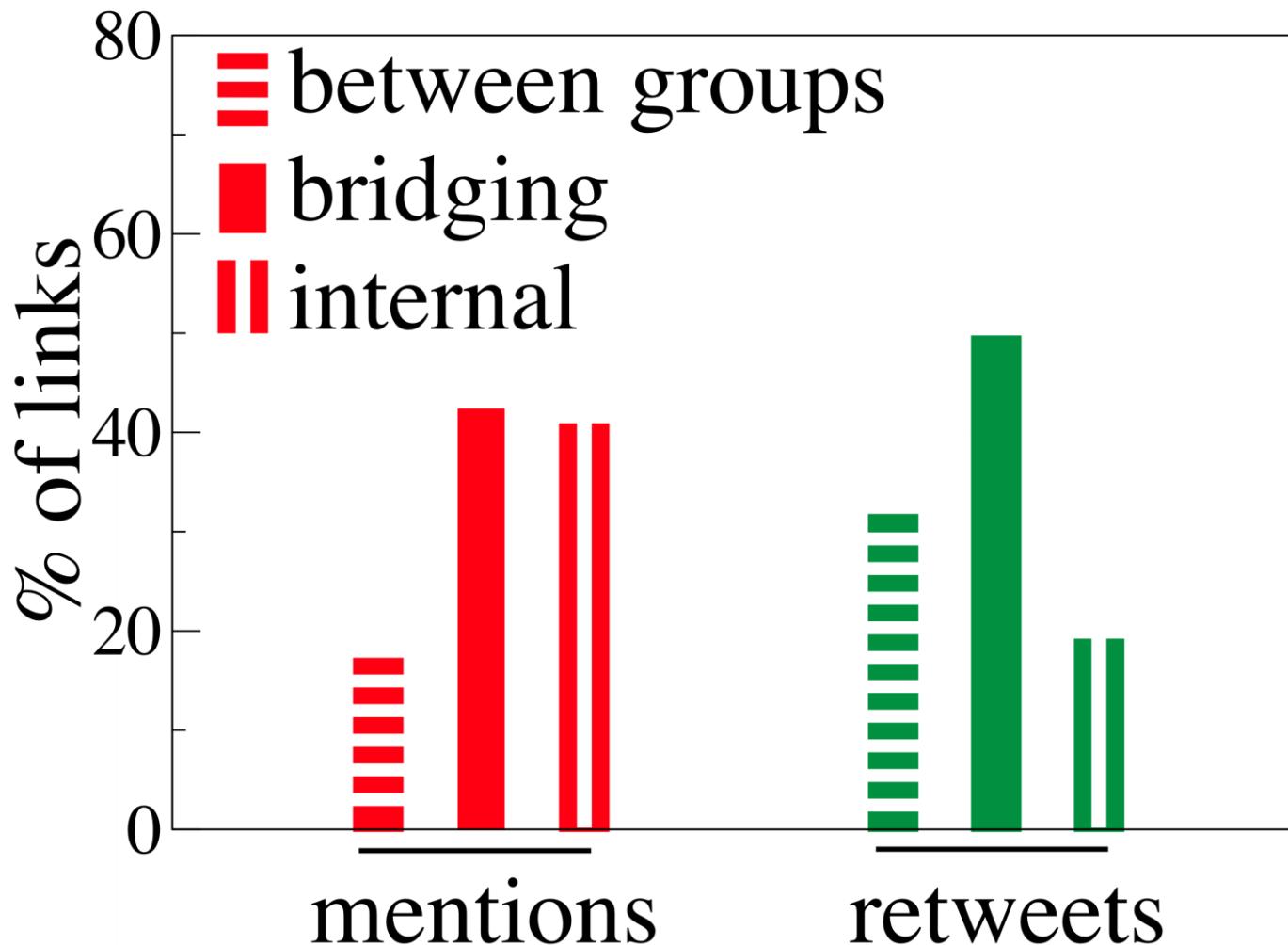
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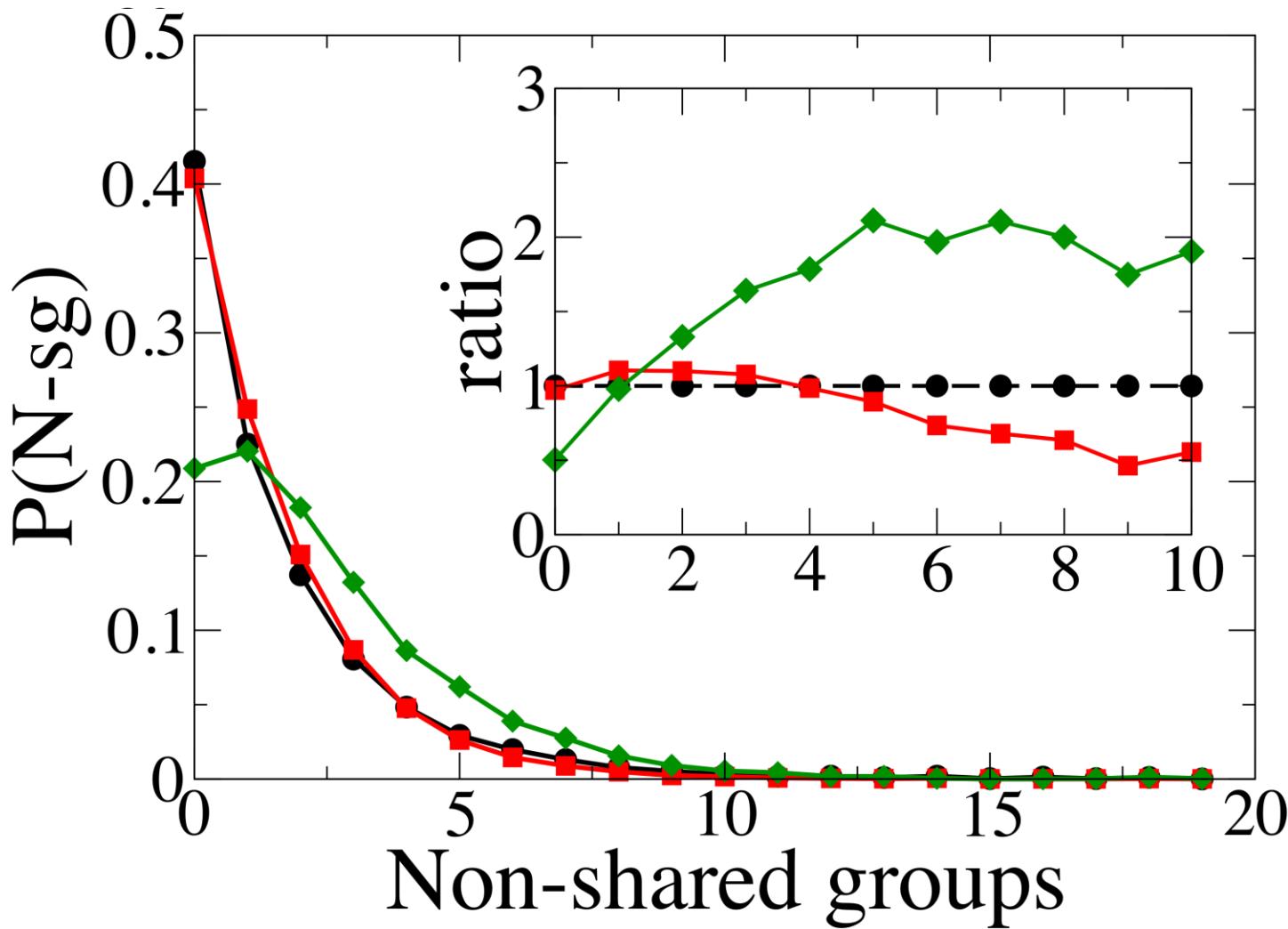
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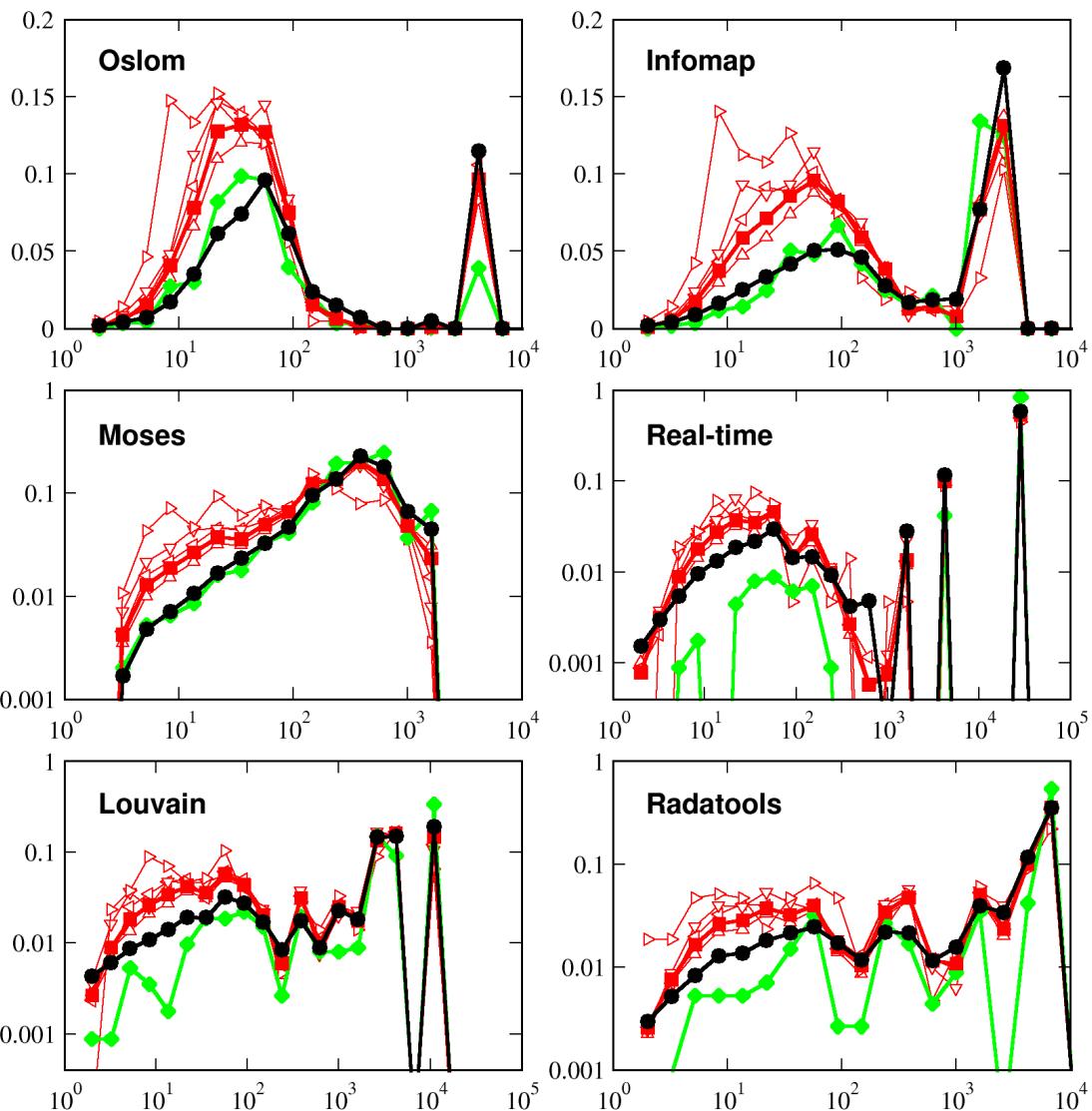
Table 1: Summary of the results regarding internal connections when the groups are obtained with several clustering algorithms for different samples of the network. We measure the trend of the mentions to concentrate in internal connections. Legend: *w* - weak signal, *sg* - signal only for small groups, typically smaller than 10 members, a hyphen is inserted if we have no results.

Network sample	Nodes	Edges	Oslom	Infomap	Moses	Real-time	Louvain	Radatools	Figure
Whole network	2 408 534	48 776 888	✓	✓	-	✓	<i>w</i>	-	S6
Snowball 2 hops	61 492	5 558 036	✓	✓	✓	✗	✗	-	S7
Snowball 3 hops	175 078	10 356 020	✓	✓	✓	<i>w</i>	✓	-	S8
Random 200k	200 000	346 578	✓	✓	✓	<i>sg</i>	<i>sg</i>	<i>sg</i>	S9
No hubs	2 395 415	23 404 103	-	✓	✓	<i>w</i>	✗	-	S10
Oslom groups	99 832	1 216 942	✓	✓	✓	✓	✓	✓	S11

Results

Table 1: Summary of the results regarding internal connections. The results are obtained with several clustering algorithms for the network samples used in this work. We measure the trend of the mentions to the connections. Legend: w - weak signal, sg - signal on smaller than 10 members, a hyphen is inserted if

Network sample	Nodes	Edges	Oslom
Whole network	2 408 534	48 776 888	✓
Snowball 2 hops	61 492	5 558 036	✓
Snowball 3 hops	175 078	10 356 020	✓
Random 200k	200 000	346 578	✓
No hubs	2 395 415	23 404 103	-
Oslom groups	99 832	1 216 942	✓



Conclusions

- **We have analyzed a large-scale online social network correlating groups and user activity**
- **The way the activity localizes with respect to the groups follows rules similar to offline social networks**
- **Users belonging to several groups play an important role for information diffusion**