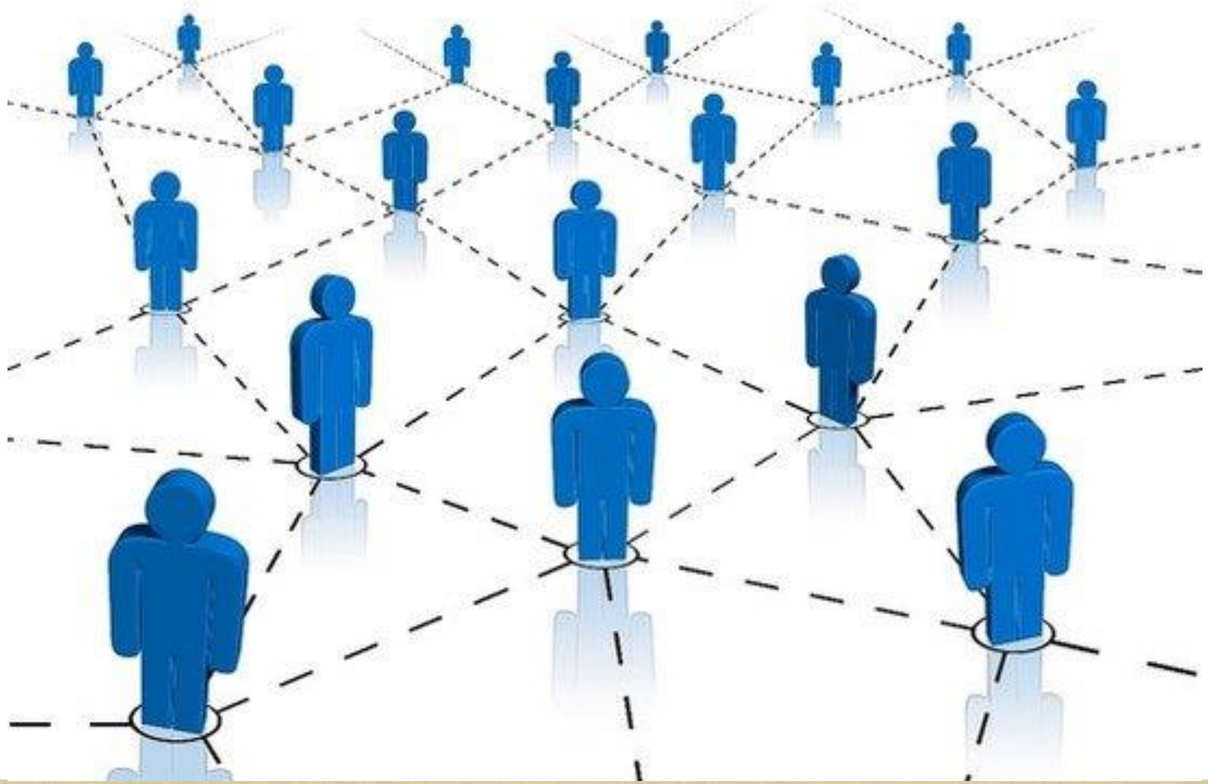

ACM SIGMOD 2014

Programming Contest

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Introduction

Social network analysis system

Four types of query

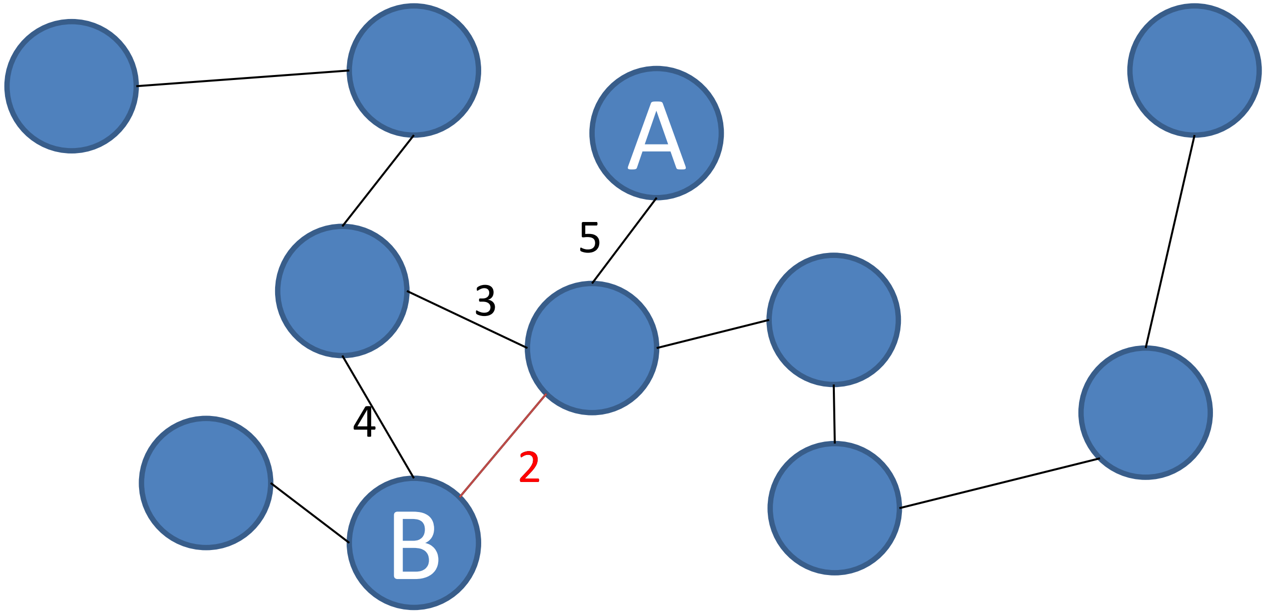
As quickly as possible

What’s for today?

Query Type 1

Definition

- Give *p1, p2, x*
- Minimum hops between *p1, p2*
- At least *x* comments in reply to each other

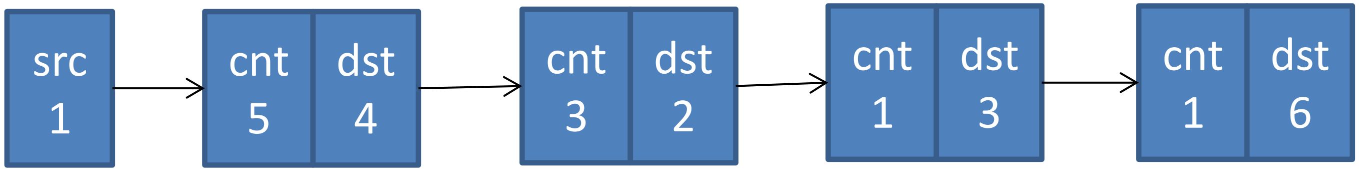


General Idea

- Bidirectional breadth first search

  Search size grows hugely through depth!

- Sort all edges in adjacency list based on comment counts



src 1 → cnt 5 | dst 4 → cnt 3 | dst 2 → cnt 1 | dst 3 → cnt 1 | dst 6

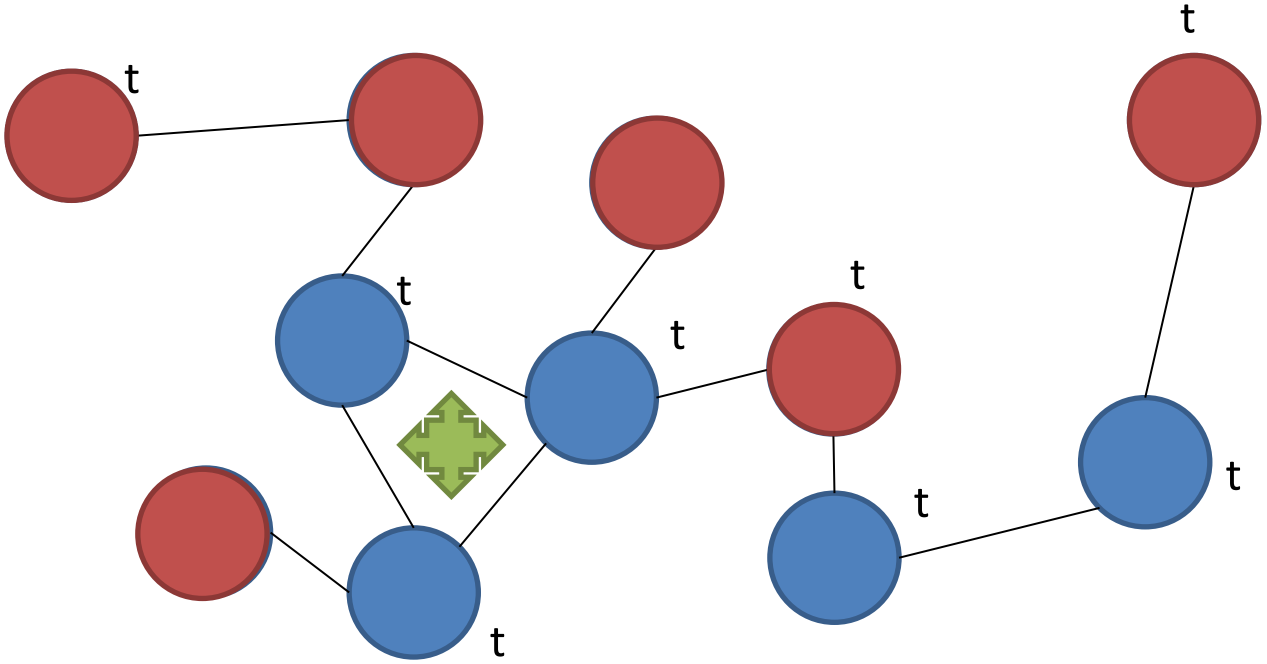
Cost most

Disk I/O 80%~90%

Query Type 2

Definition

- Give *t, d*
- Largest size of connected component
- Have the interest tag *t*
- Born on or later than *d*



Single Tag’s Connected Component

- Disjoint Set and Find-Union Algorithm

Reuse of information?

- Offline Computation. Sort the queries by *d*
- Incrementally add persons to Disjoint Set
- $O(\alpha(n) \cdot (n + m) \cdot T)$

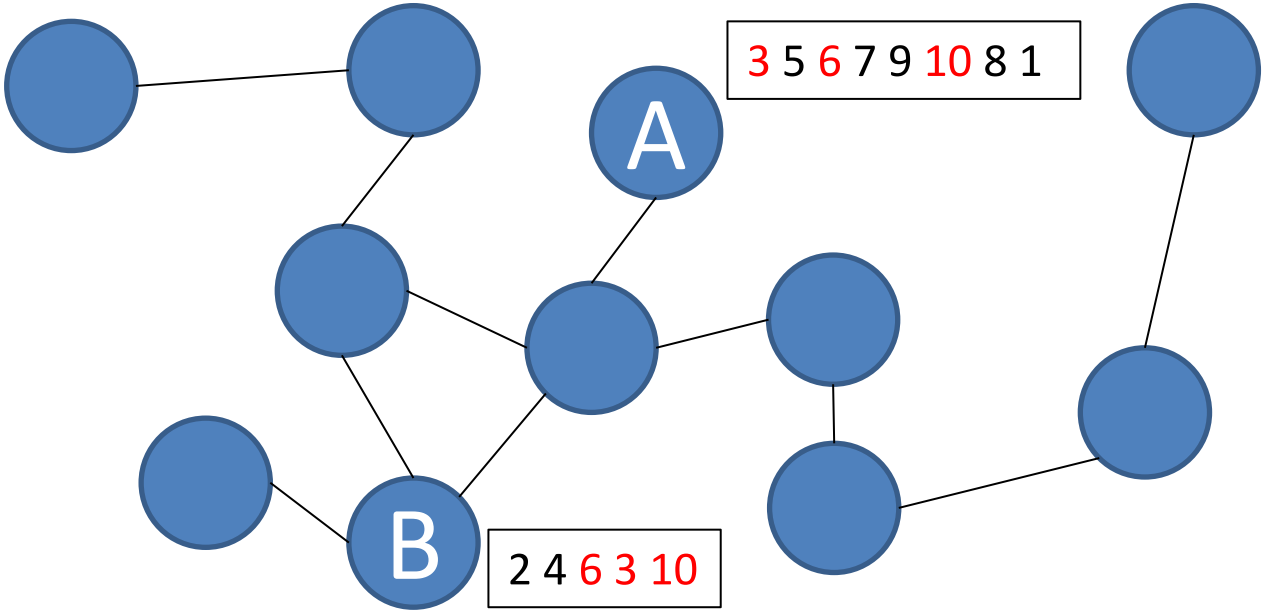
Tag number is relevantly *small*!

People Num	1k	10k	100k	1000k
Tag Num	1458	4567	12144	15676

Query Type 3

Definition

- Give *k, h*
- Top-*k* similar pairs of persons (within h hops) based on the number of common interest tags
- Some location limitation (index)



What we do

- Just search each person’s h-hop neighbor

Common interest comparison

1		3		5	6	7	8	9	10
	2	3	4		6				10

Pruning

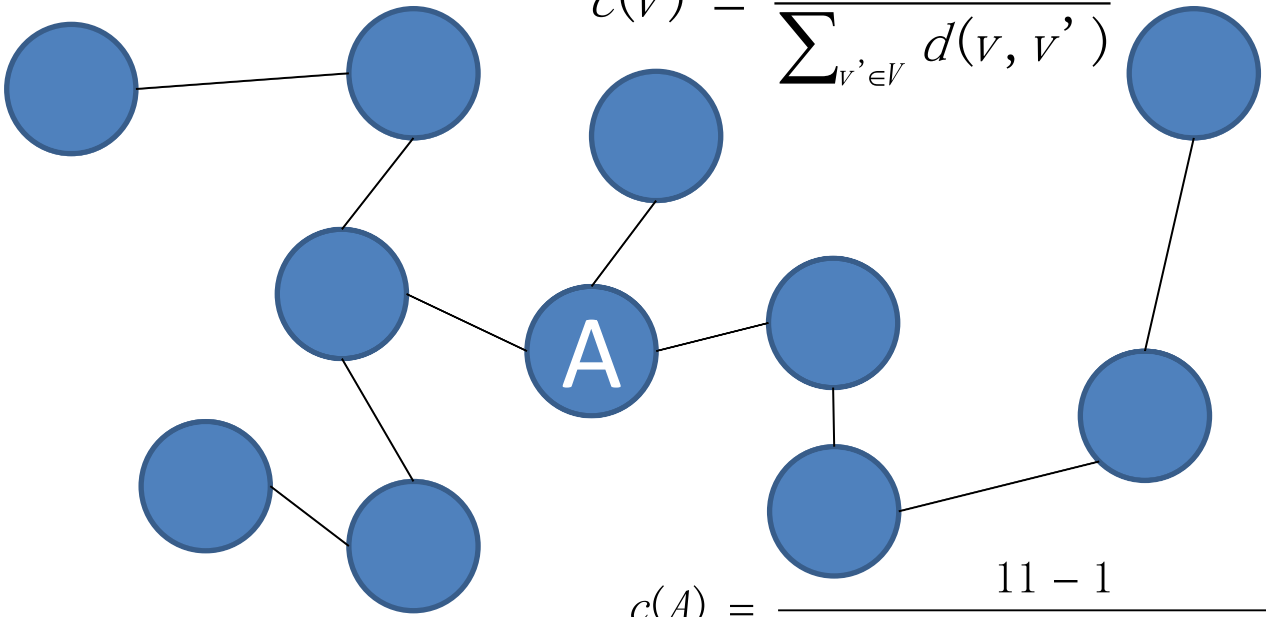
- Eliminate the persons with less tags than top-k common interest tag number

Query Type 4

Definition

- Give *k*, *t*
- Find the *k* persons who have the highest closeness centrality values. Persons must have a given tag *t*.

$$c(v) = \frac{|V| - 1}{\sum_{v' \in V} d(v, v')}$$



$$c(A) = \frac{11 - 1}{1 \bullet 3 + 2 \bullet 3 + 3 \bullet 3 + 4 \bullet 1} = 0.45$$

CHALLENGE

Really time consuming

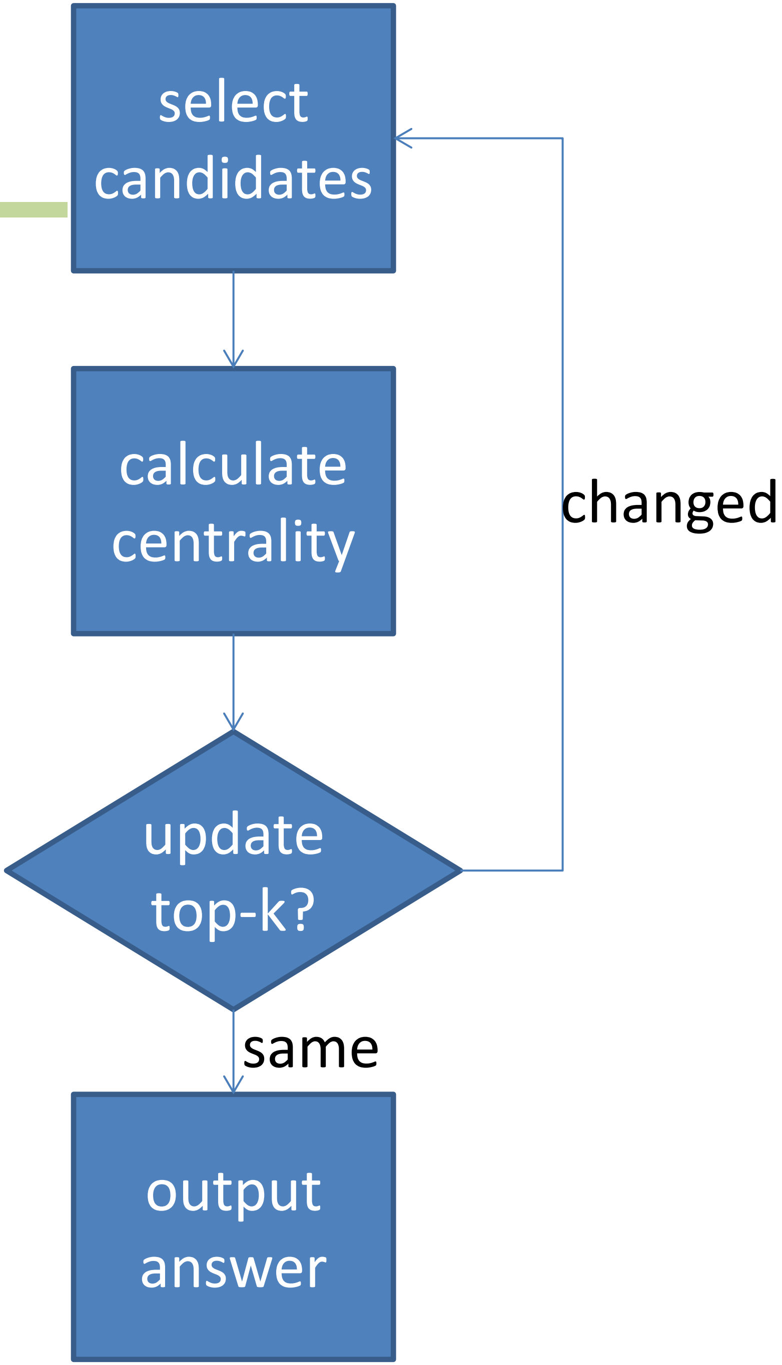
Can’t avoid APSP

Approximate?

Accurate

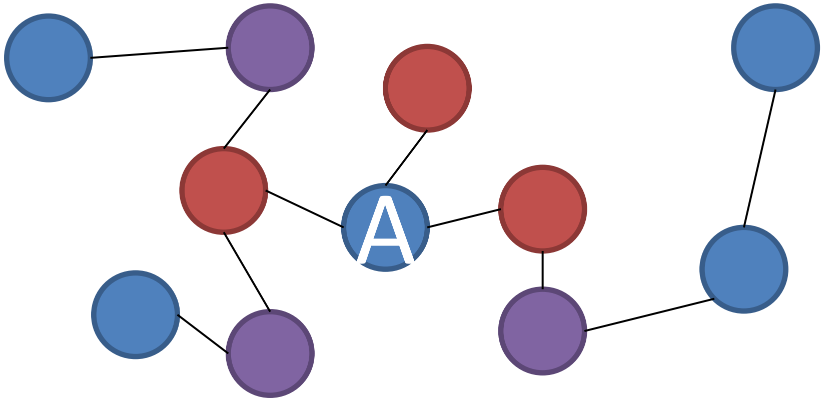
Approximate

Idea


select candidates
calculate centrality
update top-k?
changed
same
output answer

Approximate values

- Tried: Degree Centrality, Random Sampling, FM-Sketch
- Finally: 2-hop neighbors’ number!



Exact values

- Incremental method: Efficient Top-k Closeness Centrality Search, ICDE 2014

Parallelism

Type Level (process)

Limited resource!!

- IO consuming: Query Type 1
- CPU consuming: Query Type 3, 4
- Memory consuming: Query Type1, 4

  (Query Type 1, 3) -> (Query Type 2, 4)

Query Level (thread)

- Share some data structure
- Except Query Type 2

Thanks!
Questions?