Identifying Multi-ID Users in Open Forums

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Who is Using Multiple IDs?

Consider two chatrooms, “letters” and “numbers”

letters

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dogg: hey anna, Z rocks!
anna: hey dogg whats new
mack: what’s that dogg?
dogg: not much
dogg: Z is the best
```

numbers

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mack: i love 5
catt: i don’t
joop: 27 rules!
catt: i agree joop :)
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Multi-ID Users

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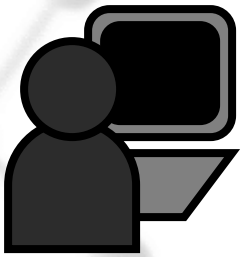

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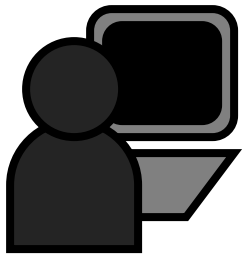

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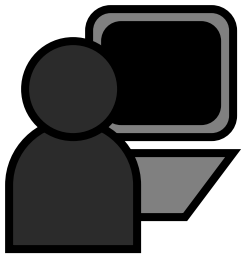

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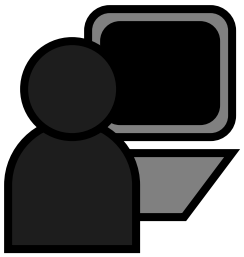

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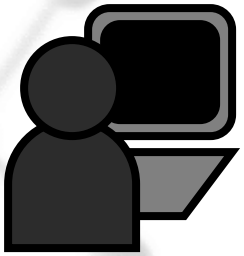

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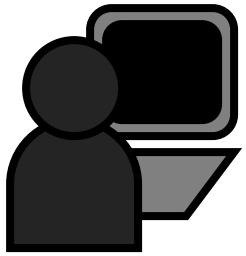

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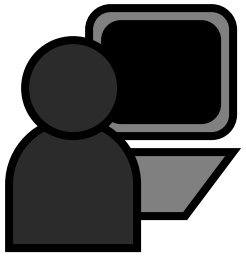

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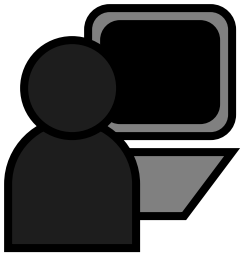

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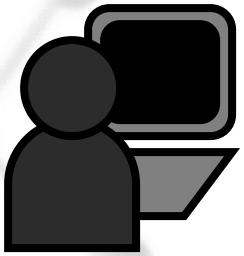

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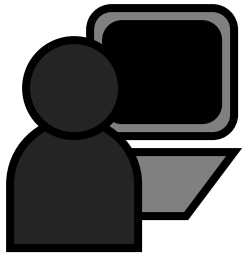

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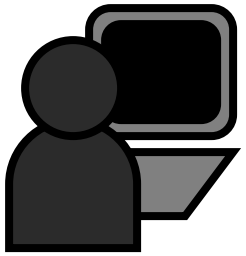

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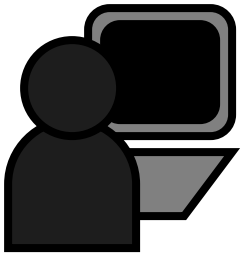

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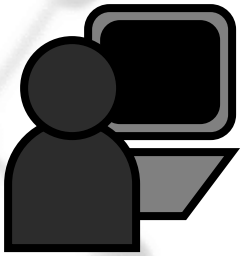

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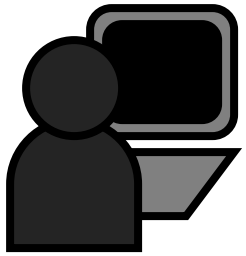

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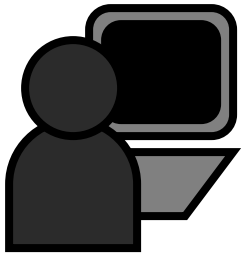

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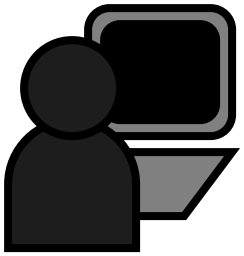

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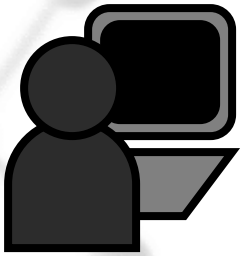

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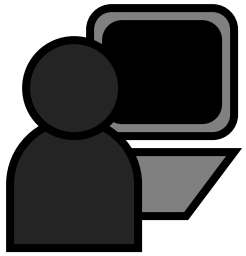

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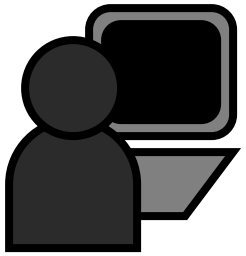

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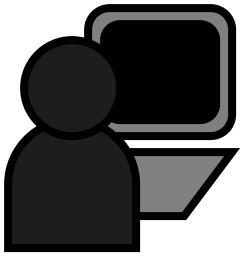

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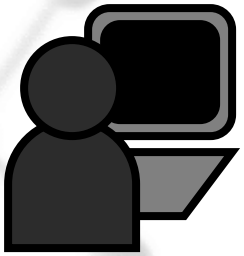

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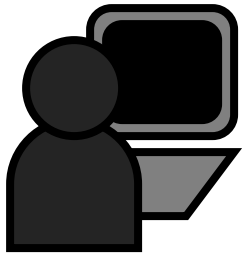

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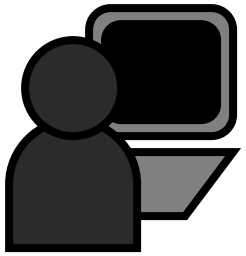

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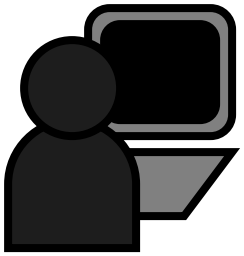

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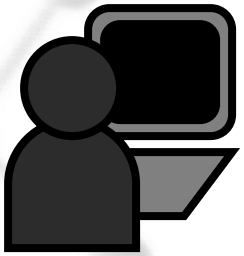

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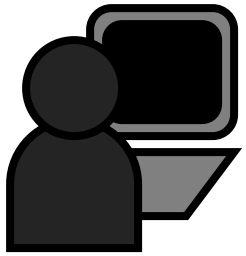

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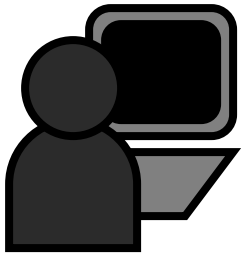

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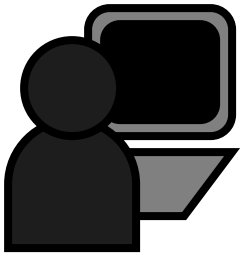

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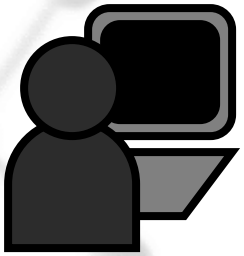

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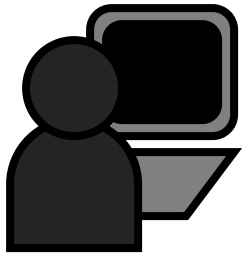

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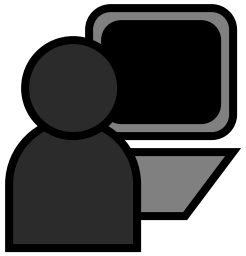

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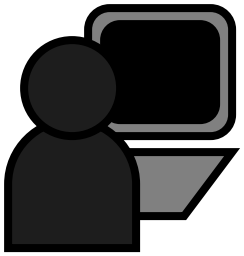

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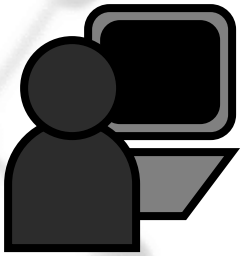

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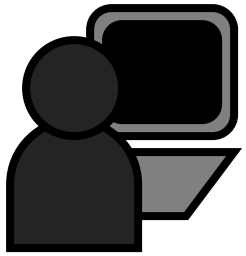

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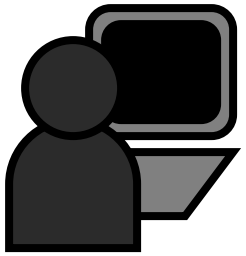

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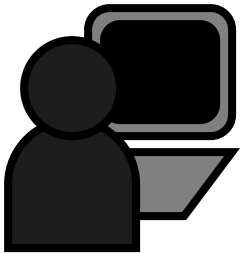

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- A model of a public forum
- Two efficient statistics-based algorithms for identification of multi-ID users
- Simulation results

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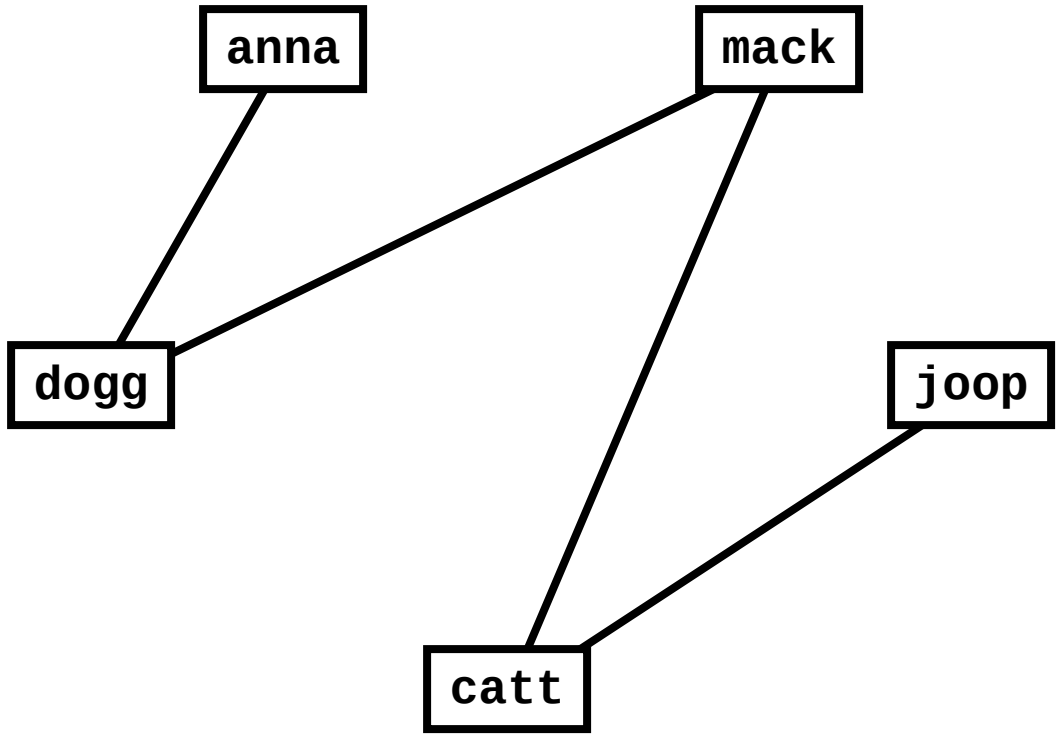
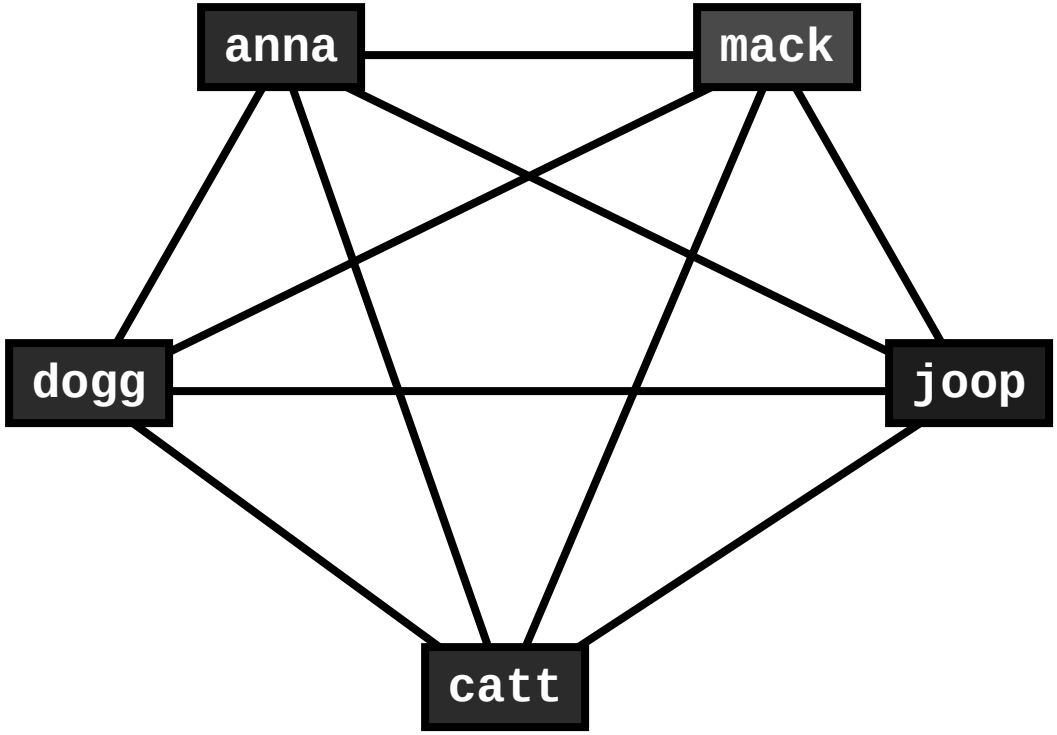
A Model of a Public Forum

- Every actor has one response queue
- Common average and variance of response delay
- The server has a queue to process messages with very short delay

Model Friendship Graph

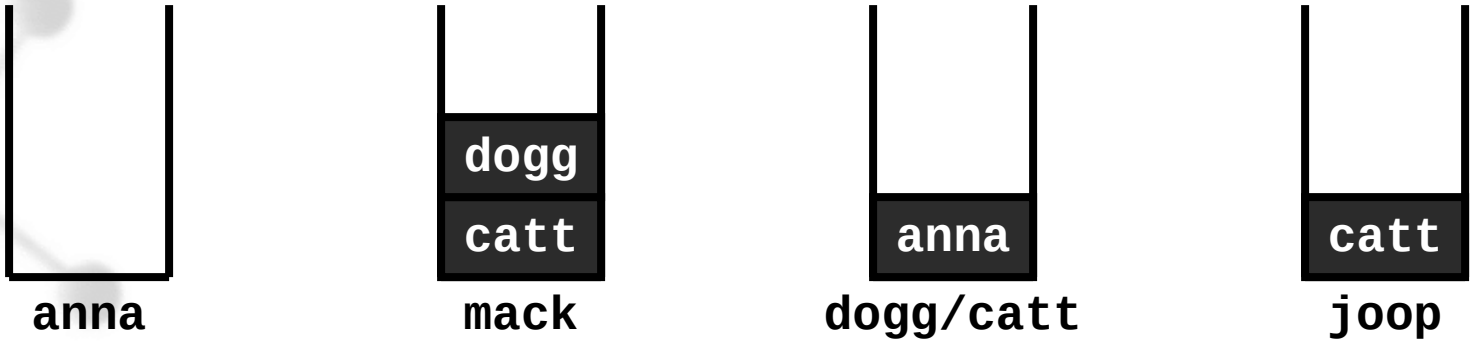


Model Alias Graph



Multi-ID Users

- One response queue for each actor



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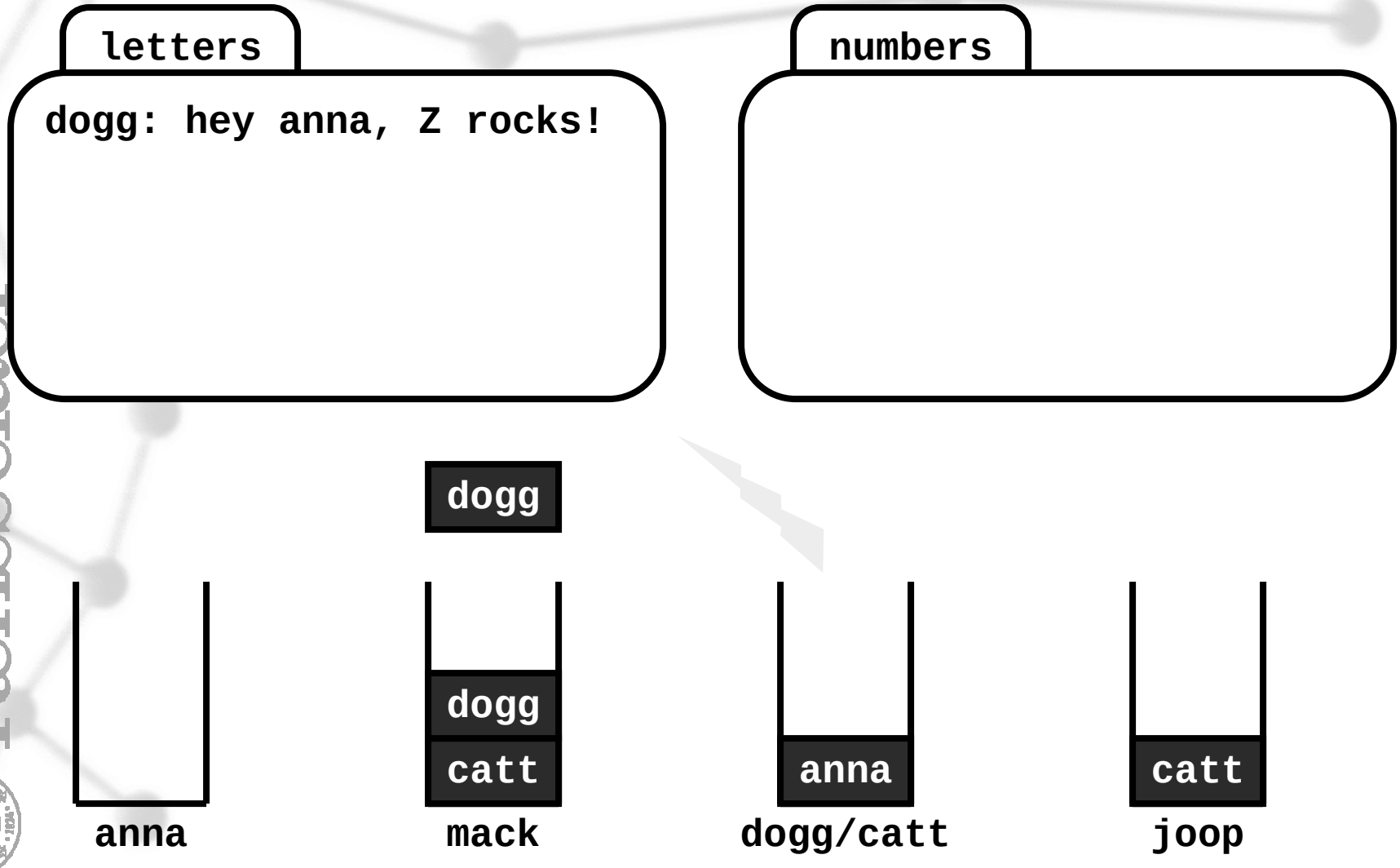

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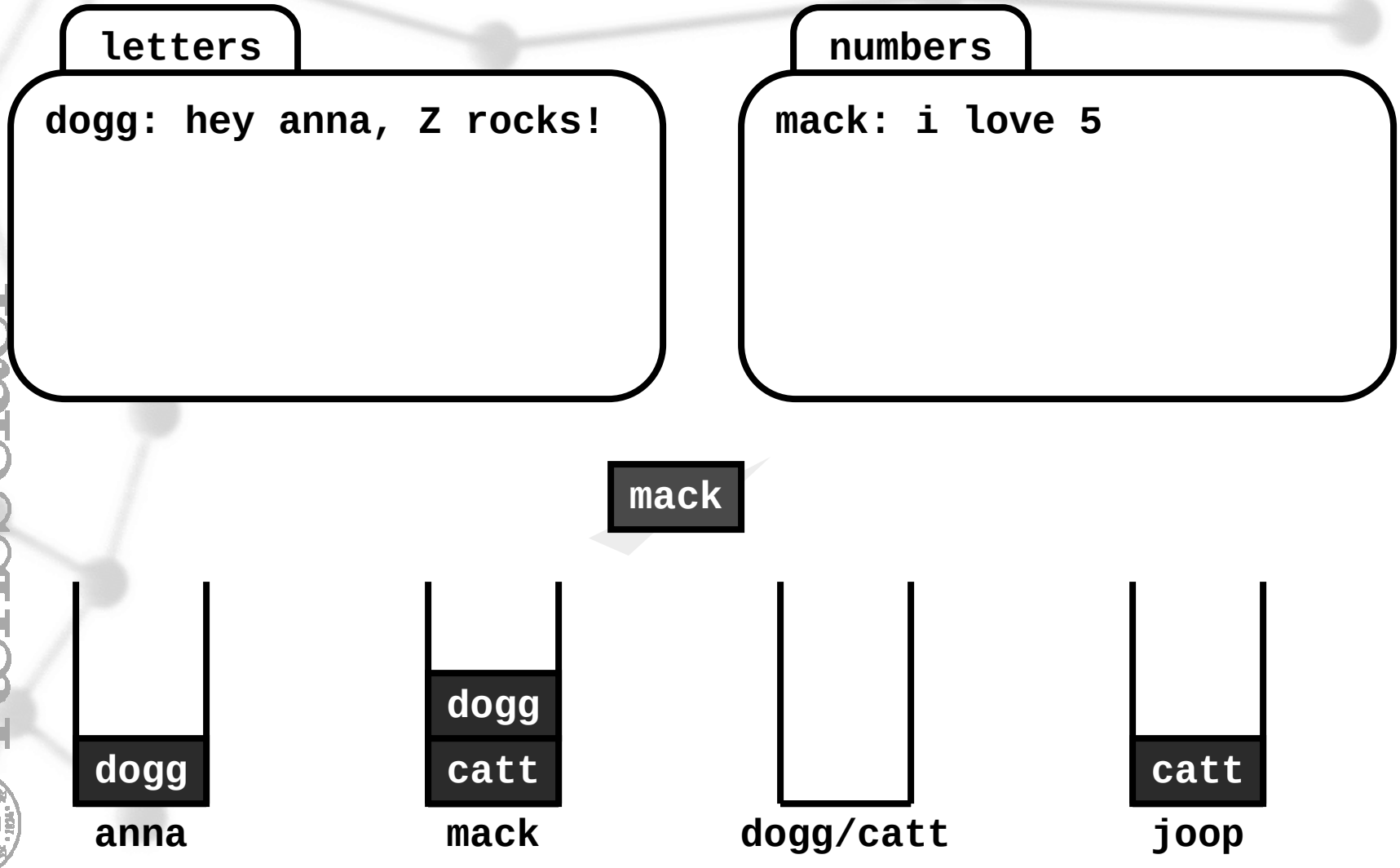

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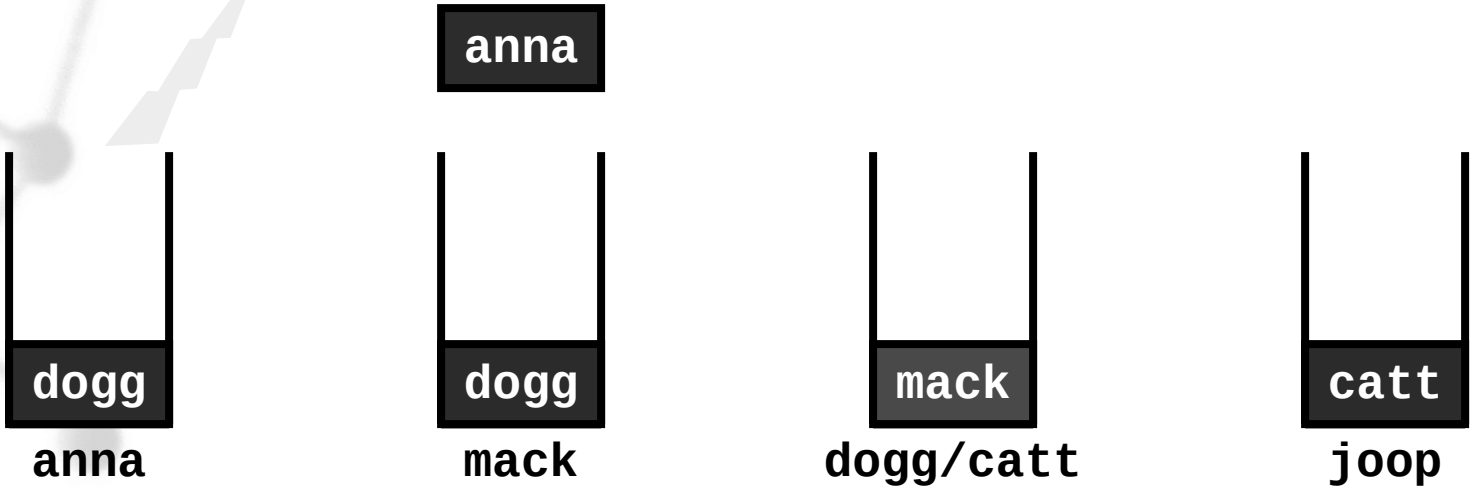

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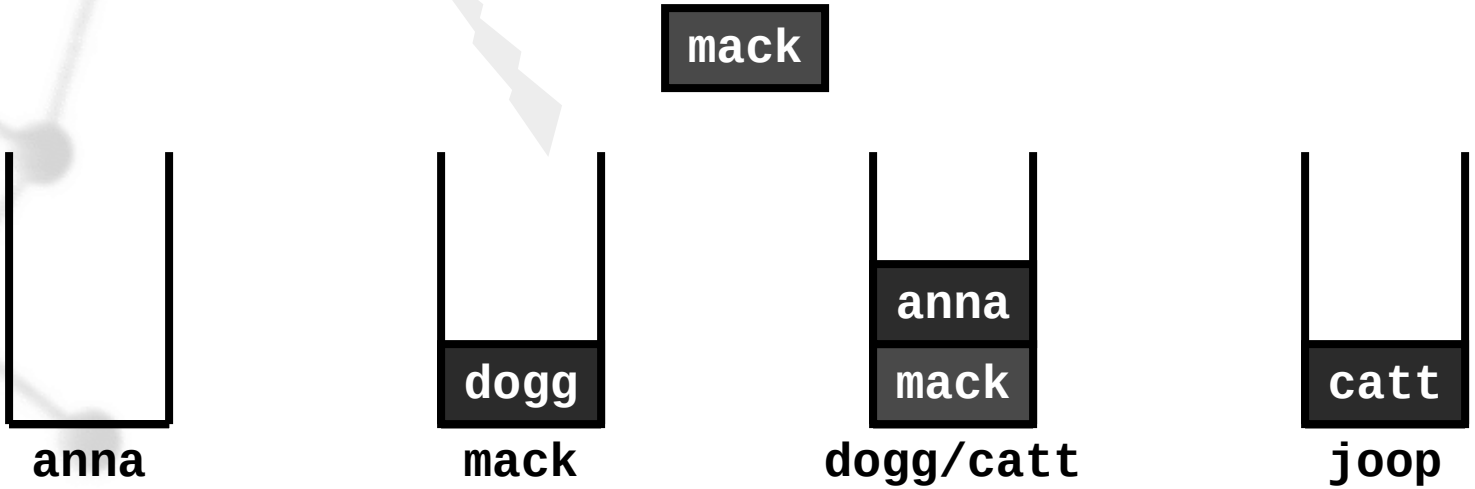

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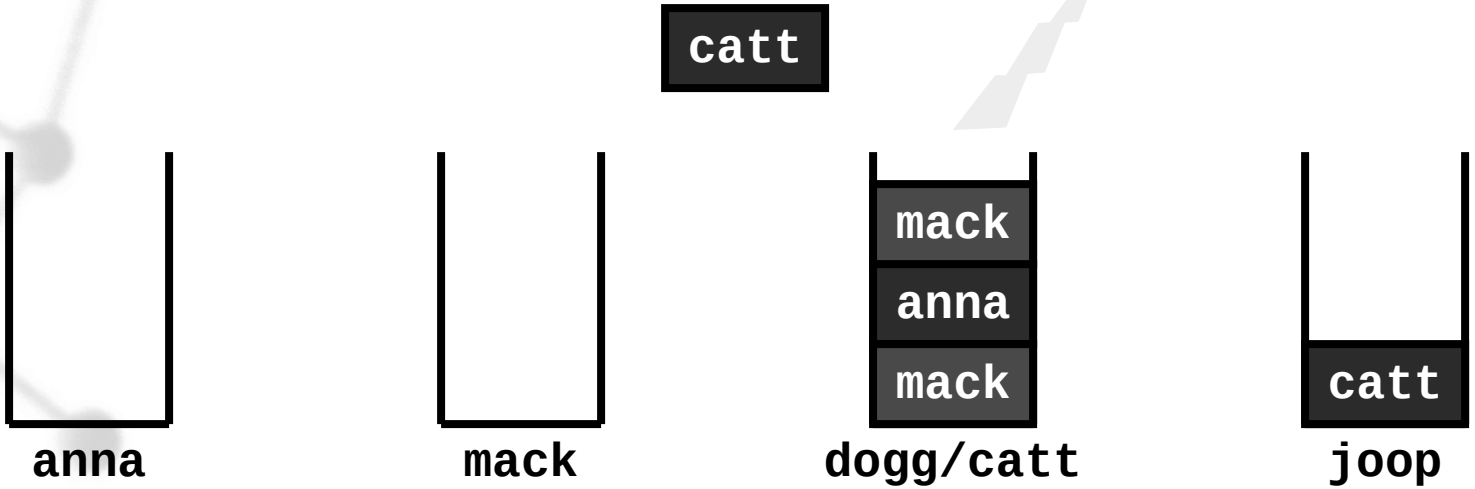

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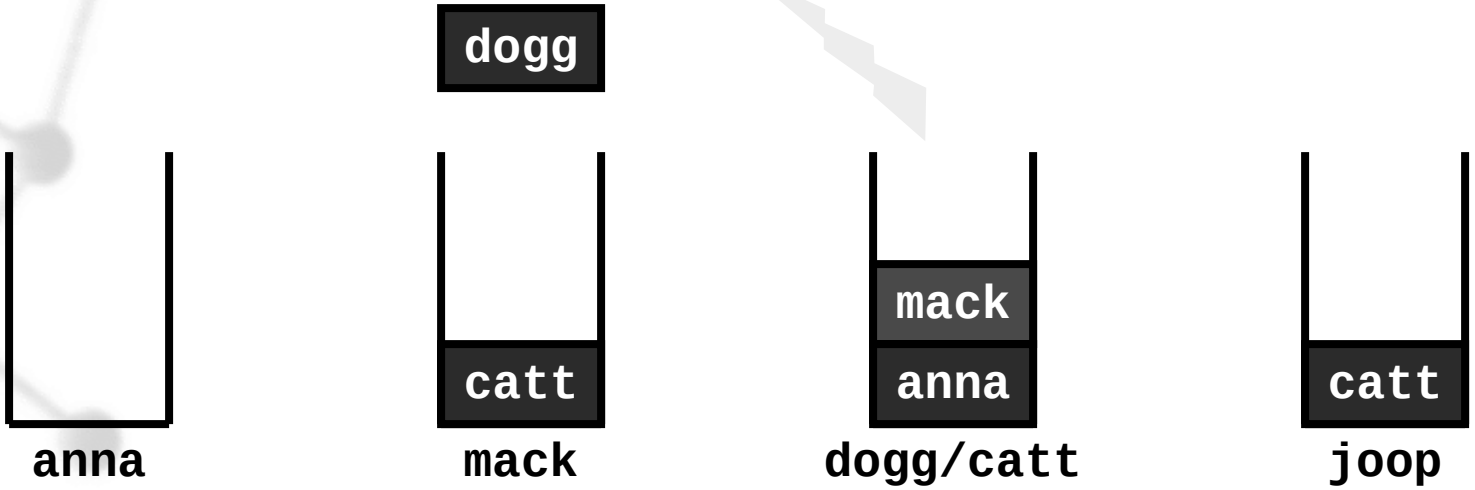

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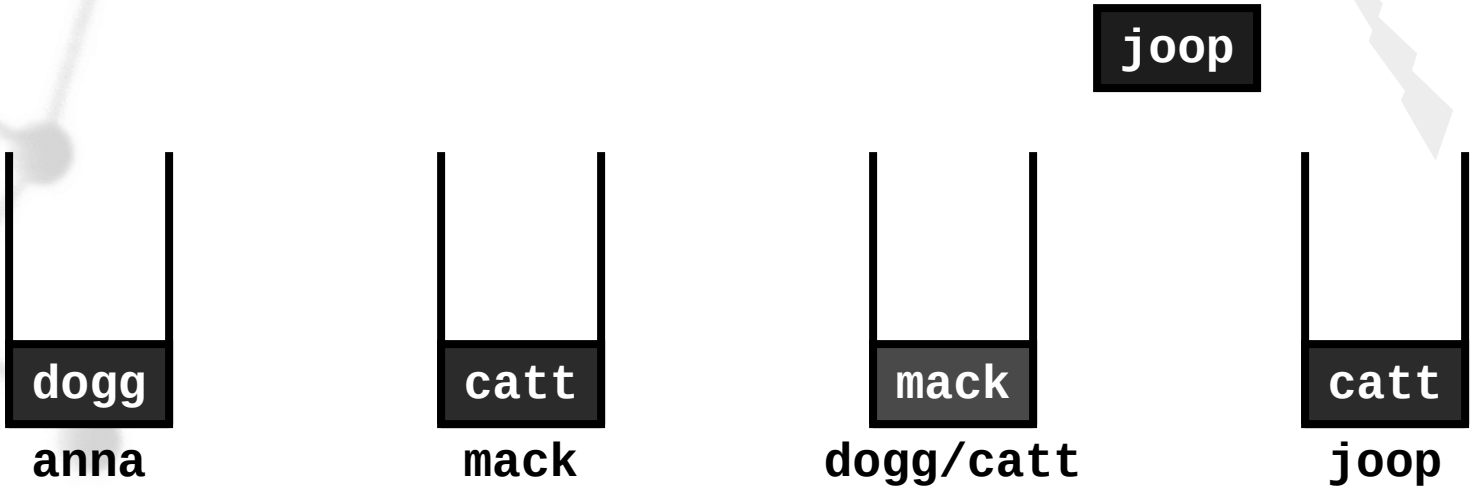

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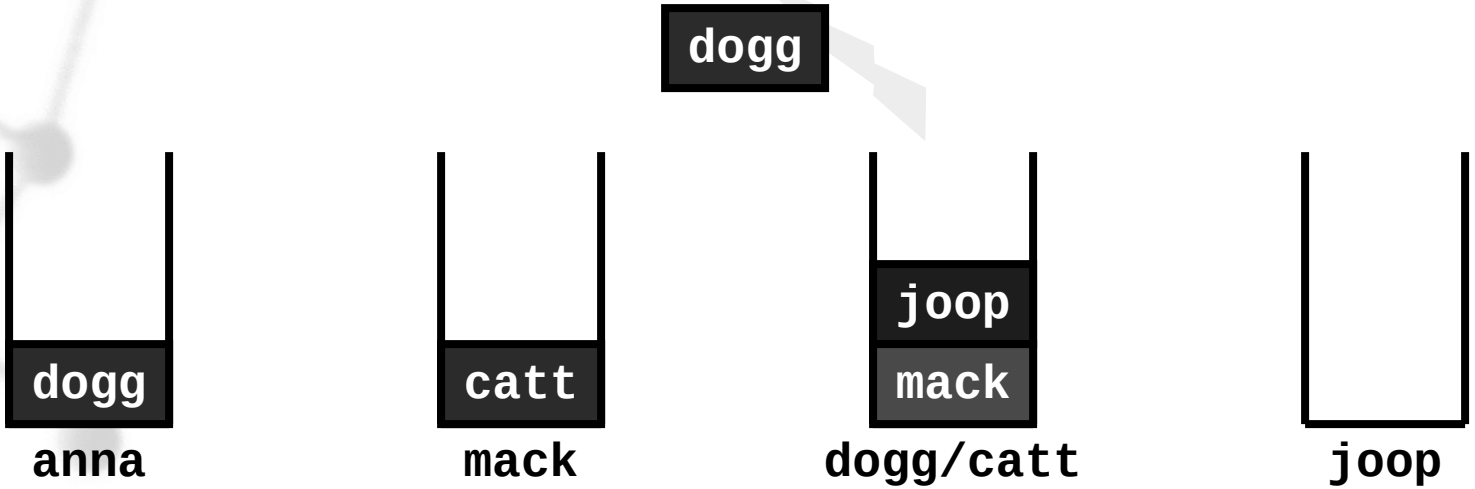

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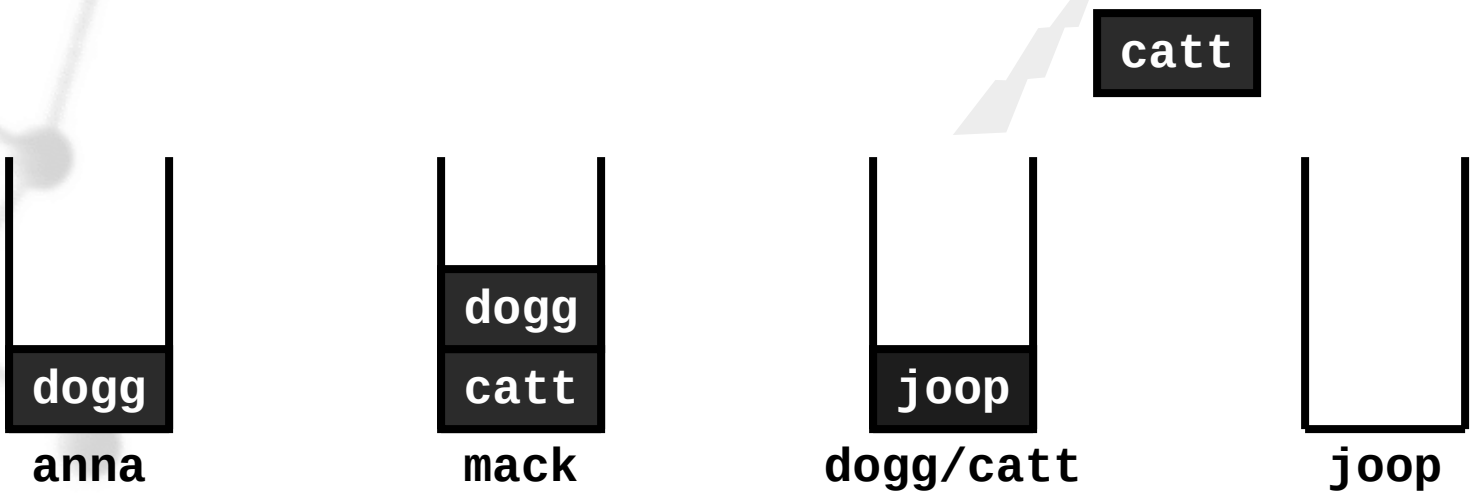

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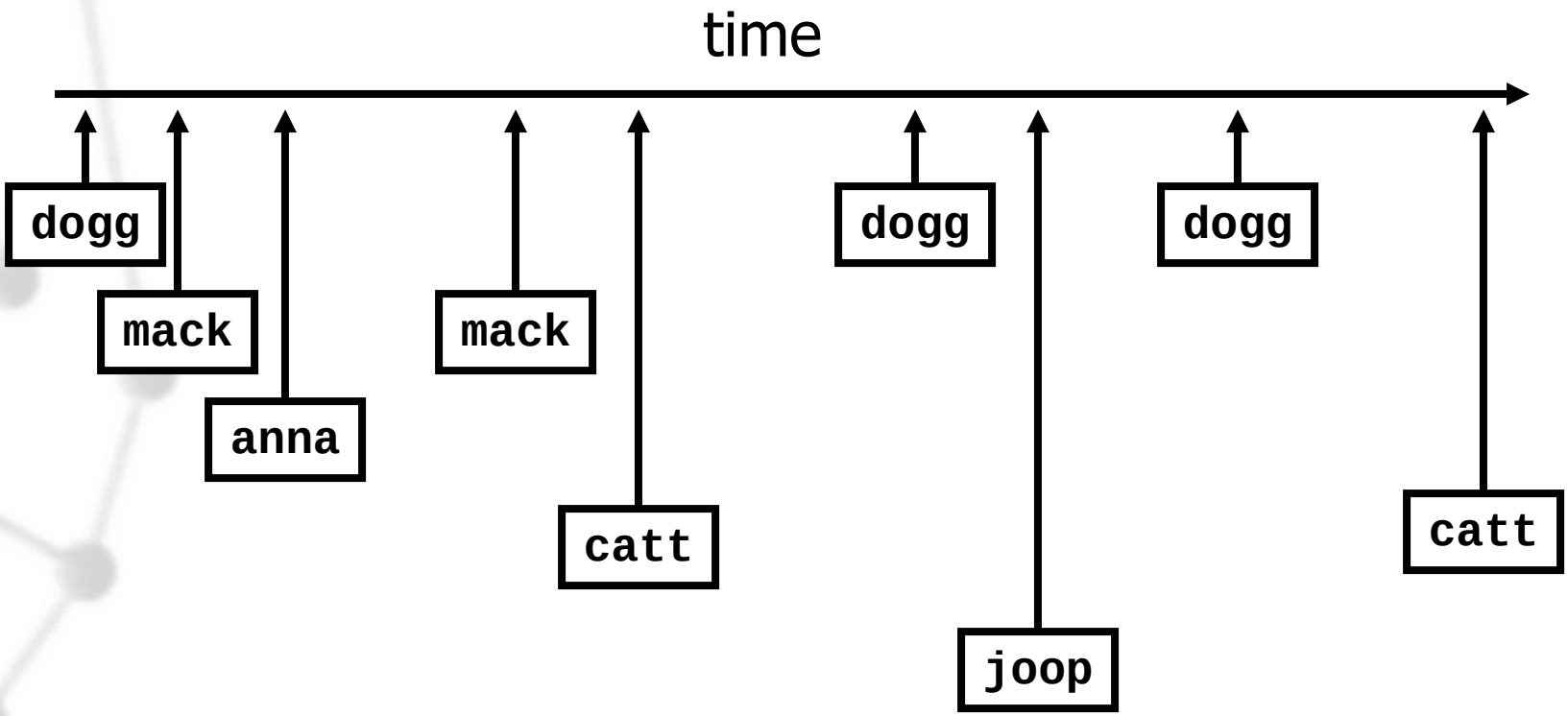
First Algorithm

1. Collect information {‹$time_i$, ID_i›}
2. Compute minimum time delay minD for every pair of IDs
3. Cluster the delays using k-means into two groups.
   - Call pairs with larger center suspected to be the same actor (red)
   - Call pairs with smaller center suspected to different (blue)
4. Connected components using red edges are ID groups representing one actor

1. Collect information



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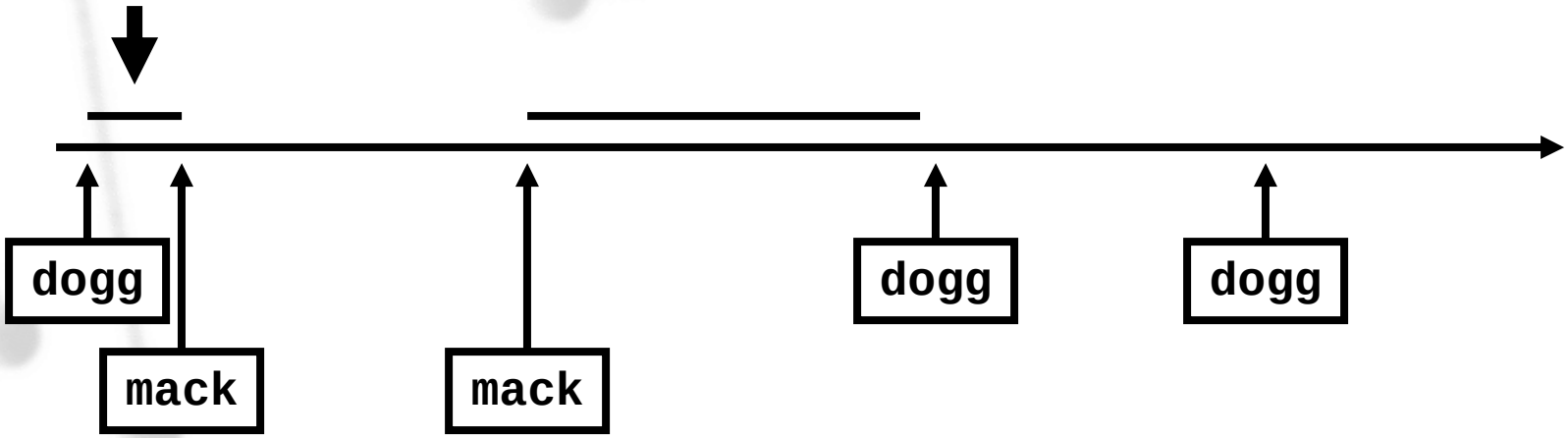
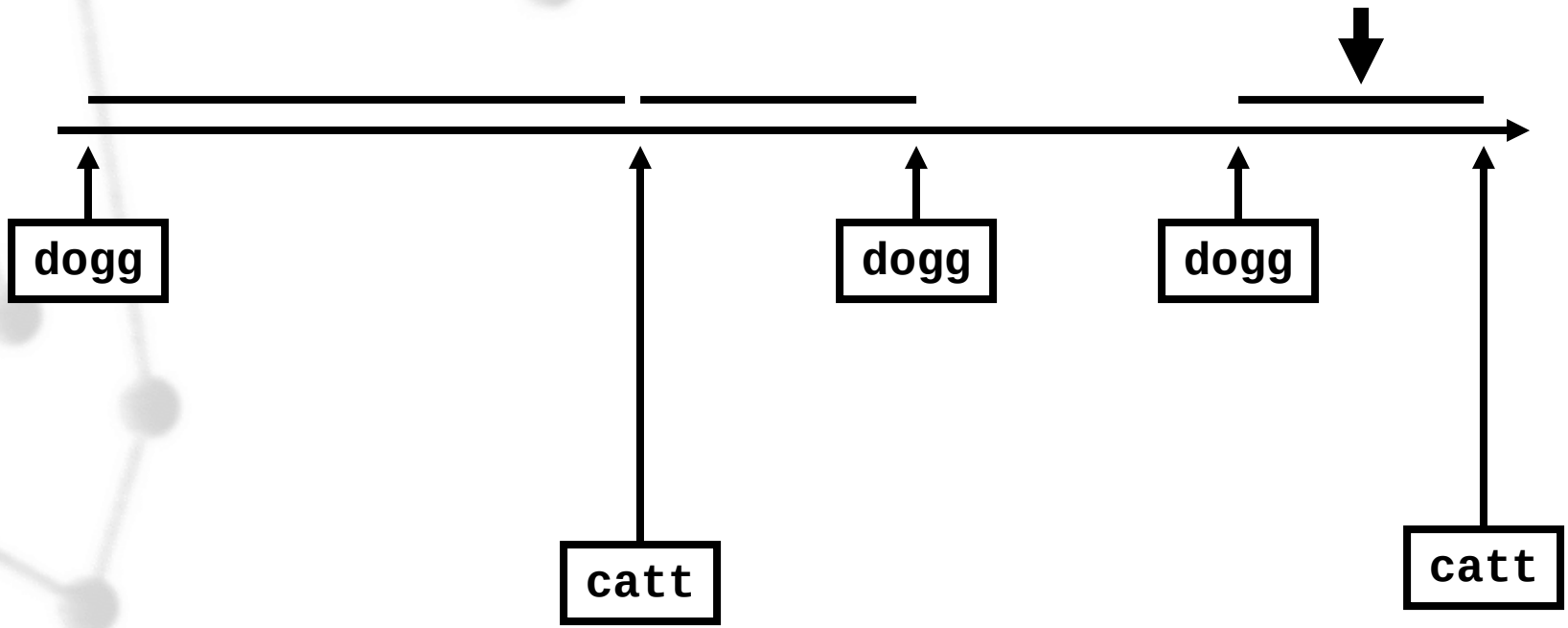
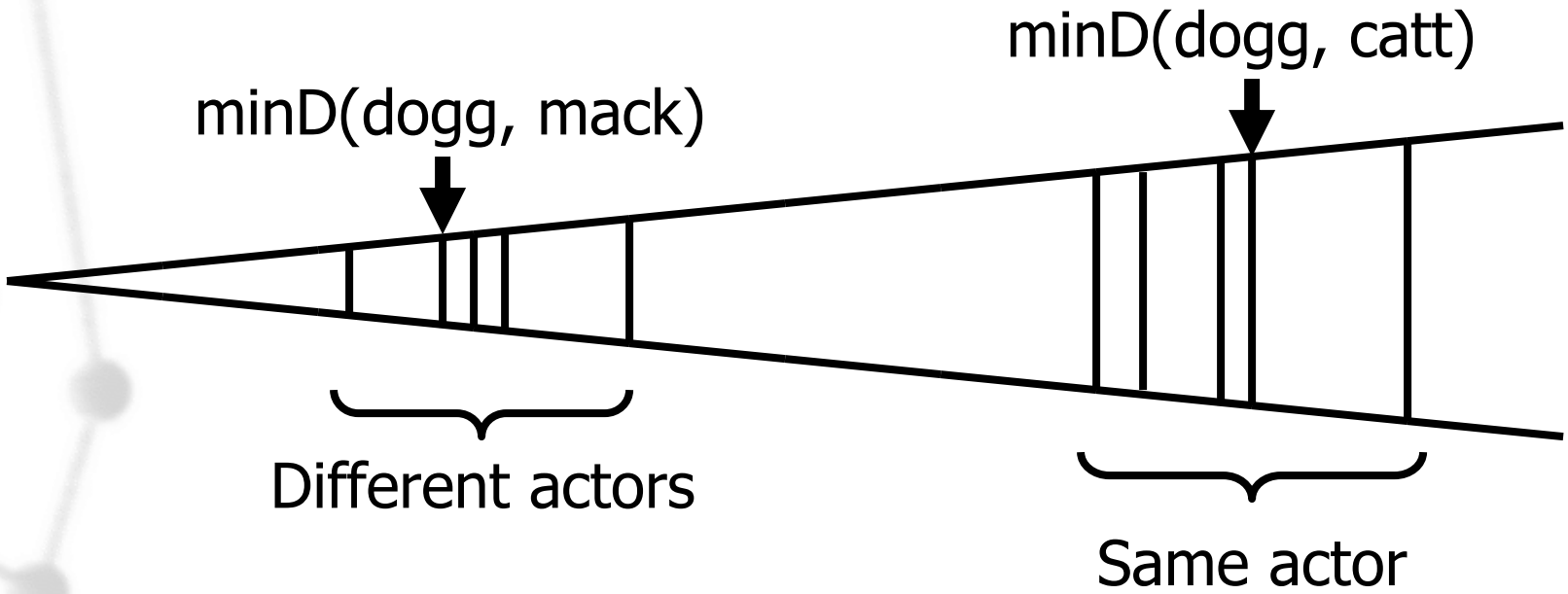


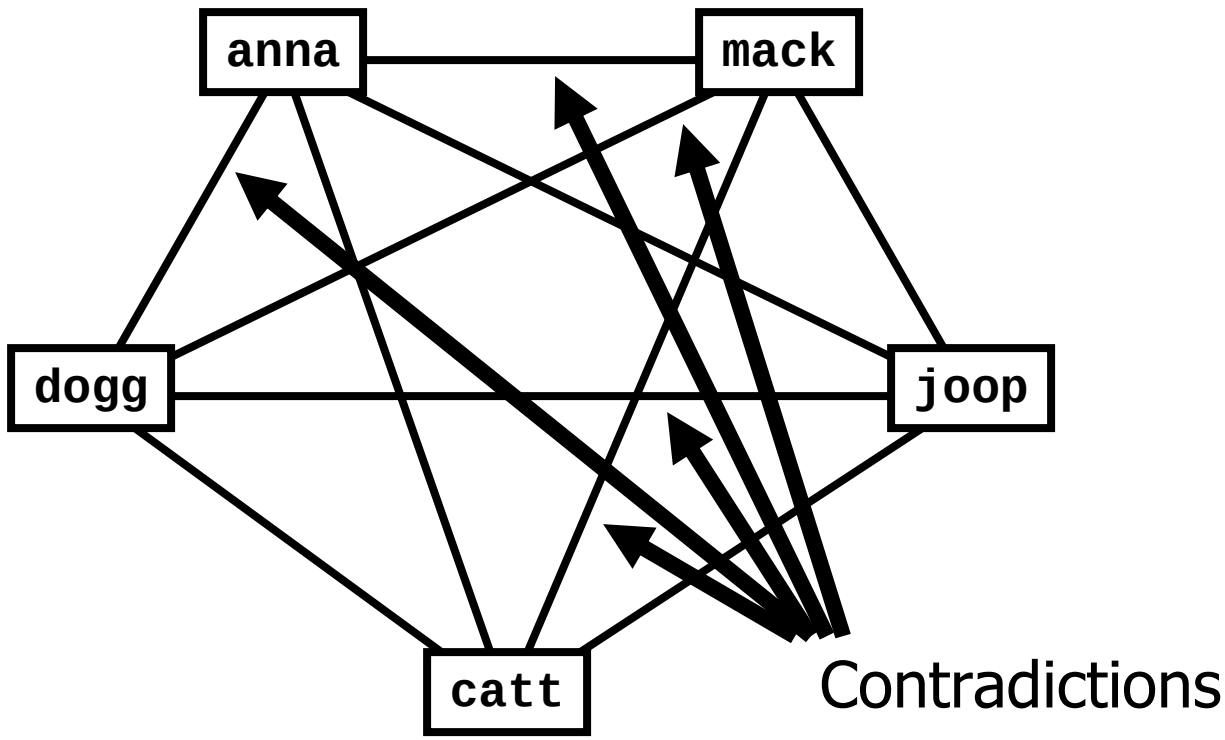
2. minD(dogg, catt)



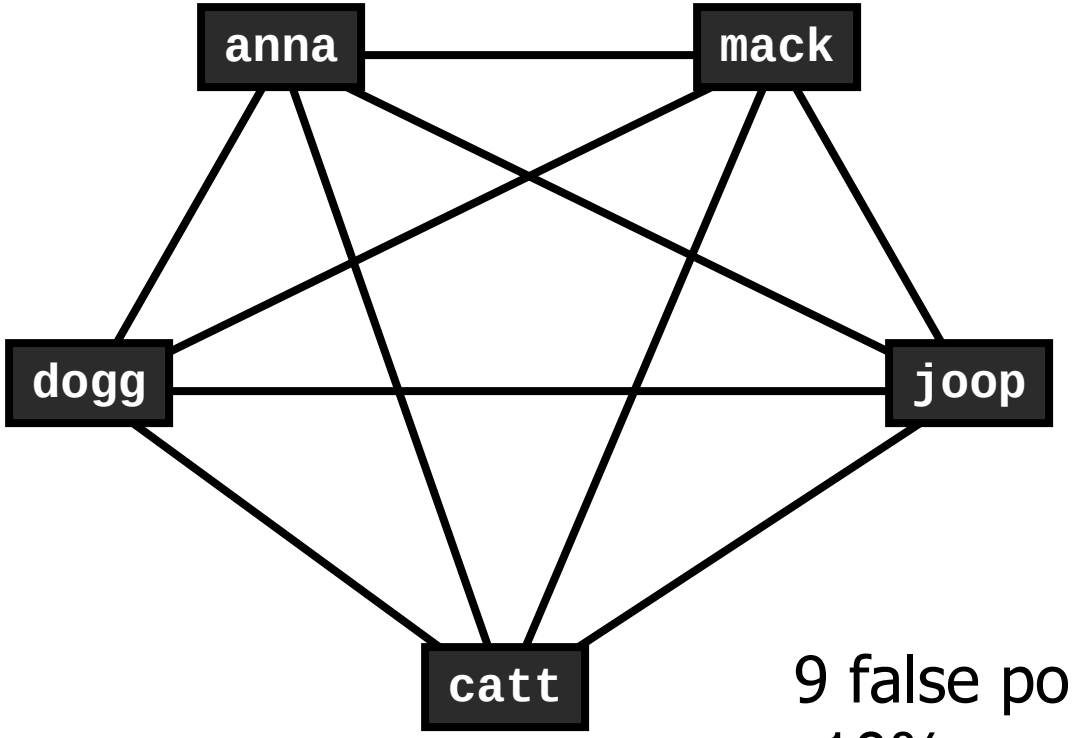
3. Cluster minD values



3. Resulting Alias Graph



4. One Red Component

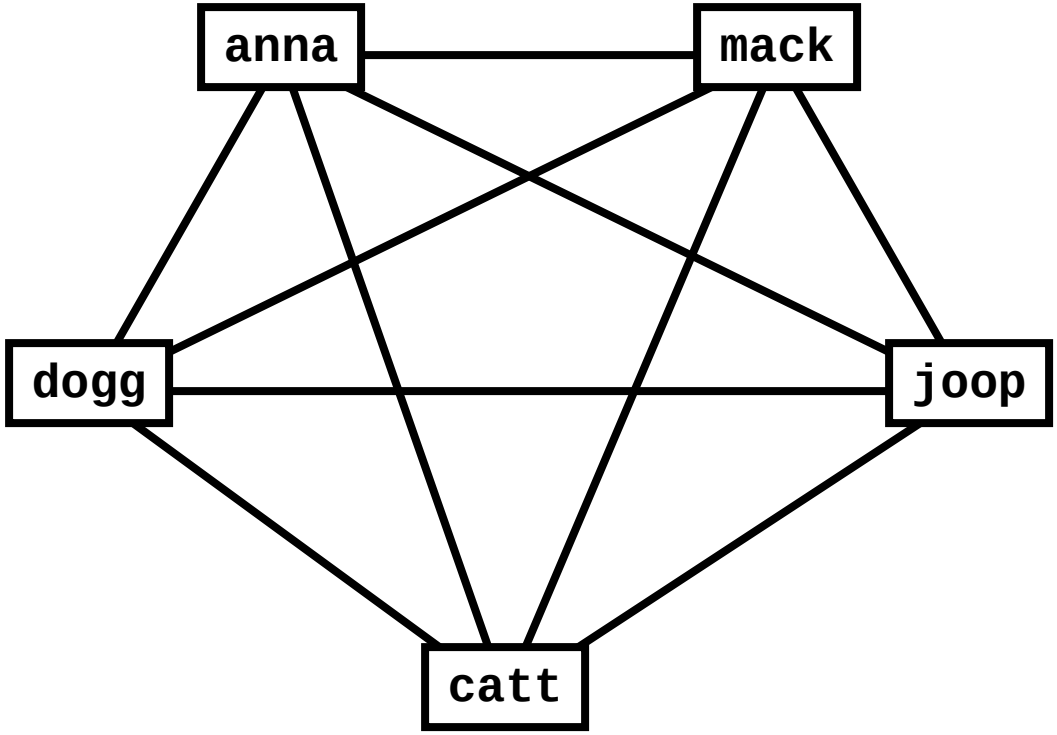


9 false positives
10% accuracy

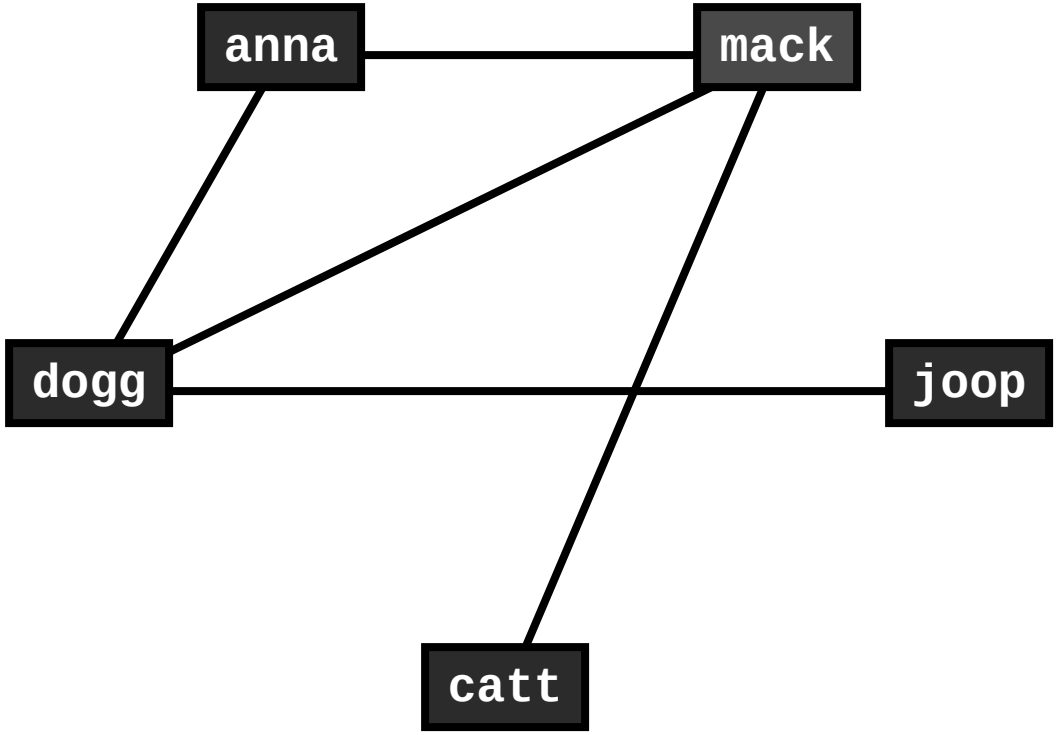
Refinement Algorithm

1.
2. Follow original algorithm
3.
4. Find groups connected with red edges
5. Color IDs into smaller ID groups using blue edges

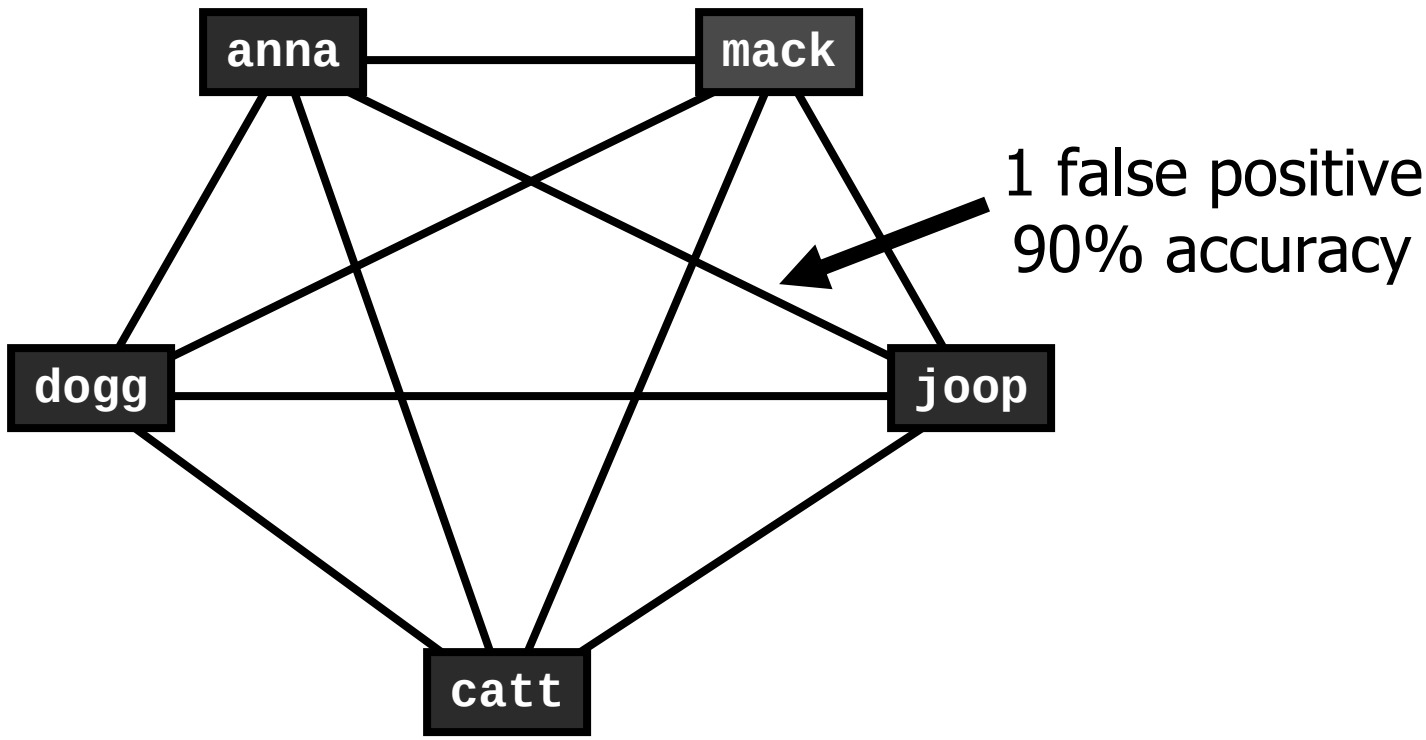
4. One Red Component



5. Color Blue Graph



5. Color Blue Graph



Overview

- A model of a public forum
- Two efficient statistics-based algorithms for identification of multi-ID users
- Simulation results

Simulation results

The average number of messages per pair	Accuracy without coloring (%)	Accuracy with coloring (%)
0.513	70.2797	70.9765
8.274	97.3140	97.3473
87.68	99.7762	99.7826
880.4	99.9995	99.9998

The dependence of Accuracy on the number of messages

Future Work

- Real-life testing
- More sophisticated model
  - Different types of users
  - Short and overlapping online appearances
  - Length of posts
- Algorithm improvements
  - Statistical evaluation of the new models
  - Lexical and semantic analysis