

# Gnutella p2p network

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# Introduction

## The network

p2p network for file sharing

“Is this file available on a computer somewhere on the network and, if so, where?”

9 snapshots of days in August 2002

- Not the entire network!

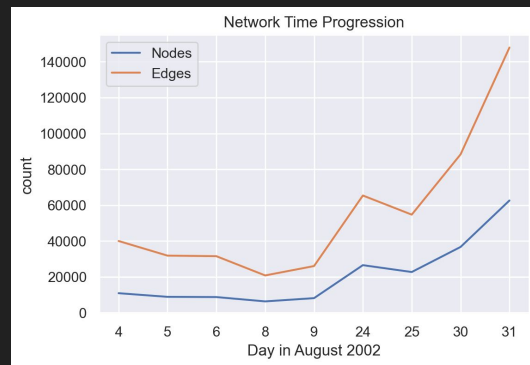
## Nodes and edges

Nodes: laptops and desktops

#Nodes > 190.000

Edges: connections through which a file can potentially be found

#Edges = 500.000



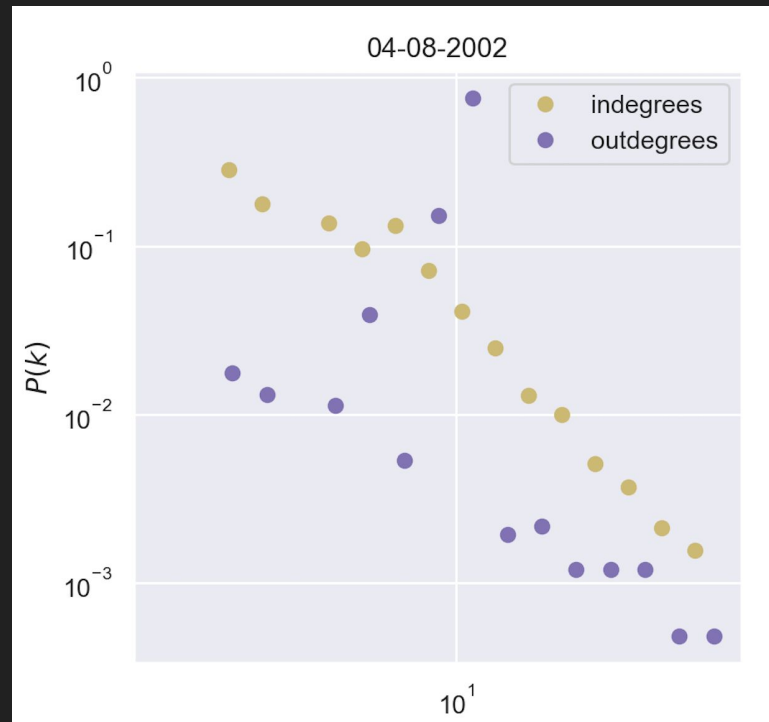
Research question:

How robust is the network to attacks?

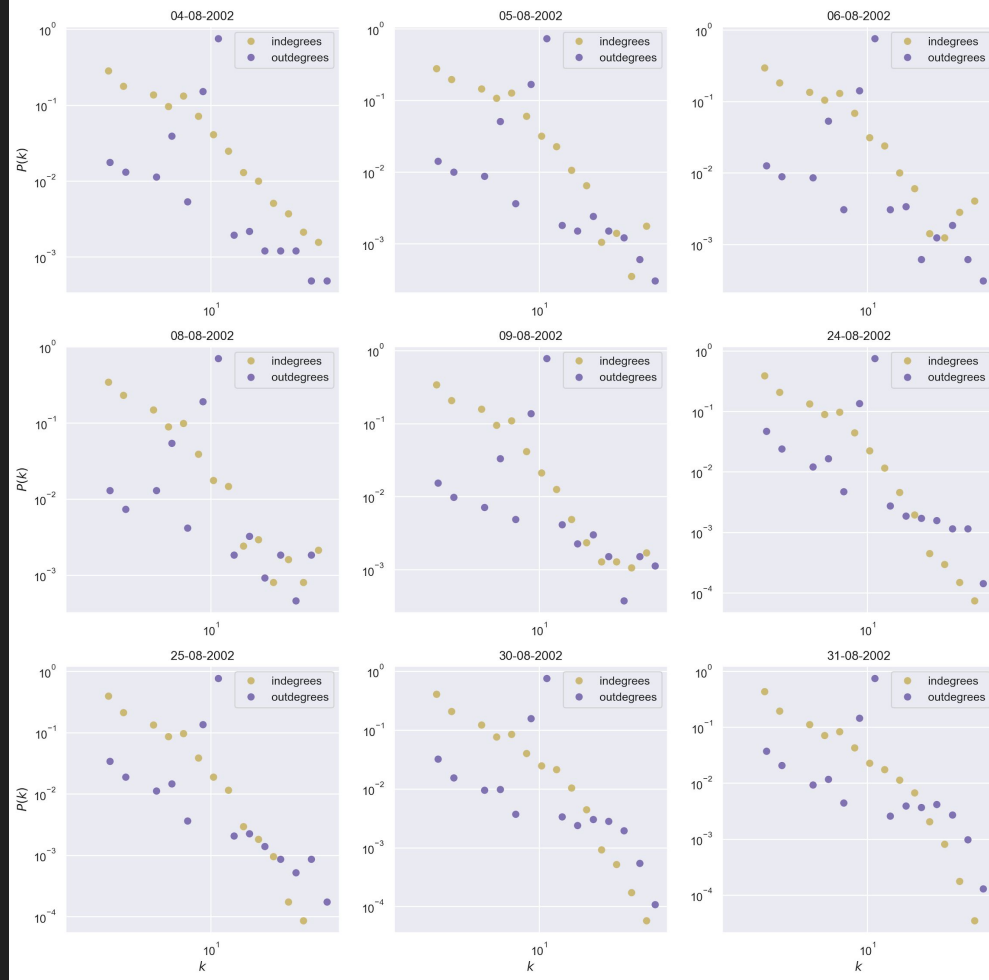
# Network structure: Degree distribution

Random spike at 10

Could look like scale-free



Log Binned Degree Distribution Plot



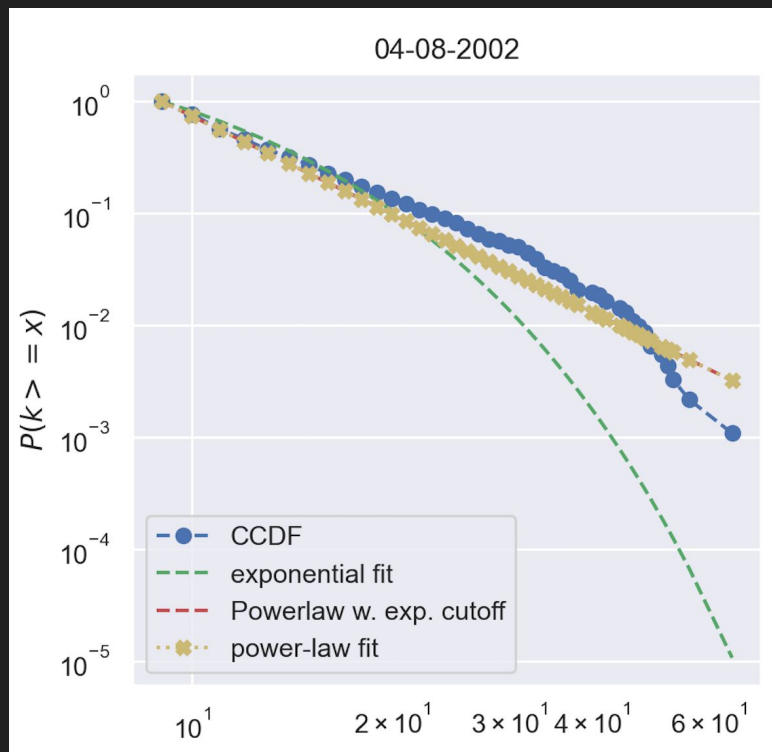
# Network structure: Fitting

Scale free network or random network?

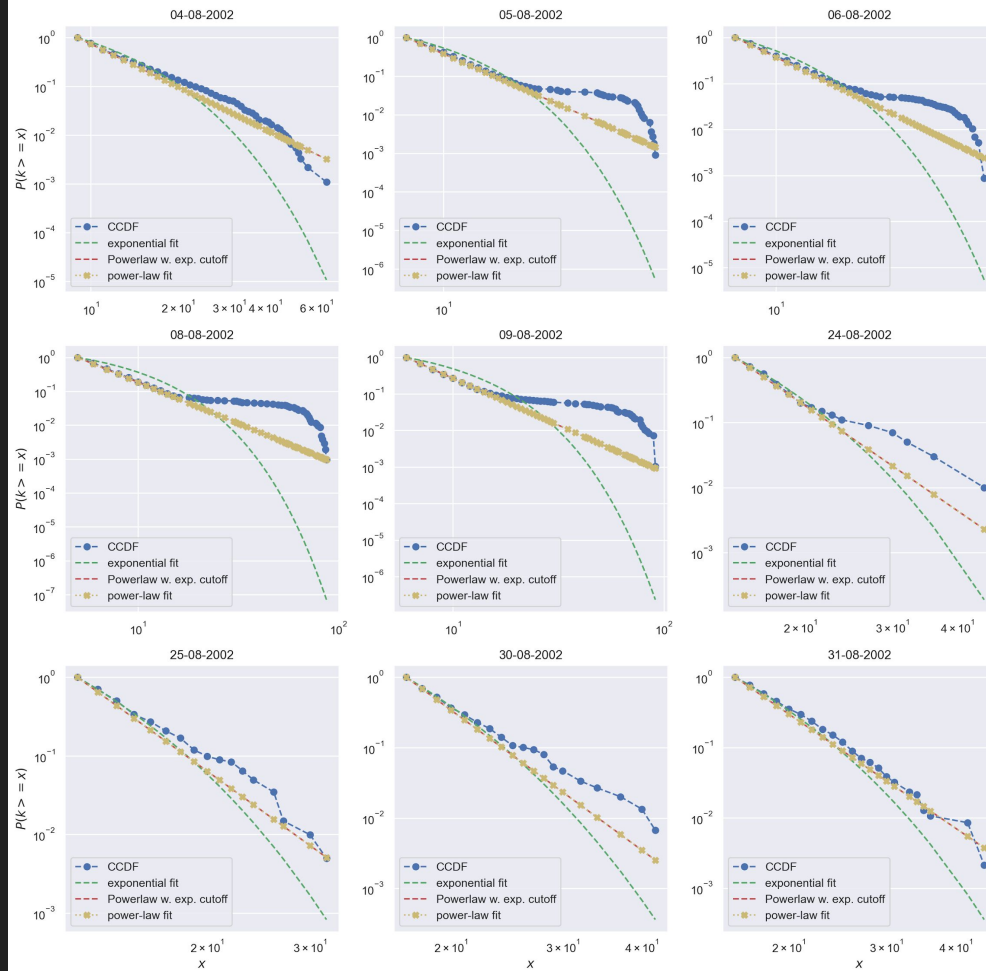
Not exponential fit

Gamma of 3.9 and  $\langle k^2 \rangle$  of 102.7

Expectations for future robustness

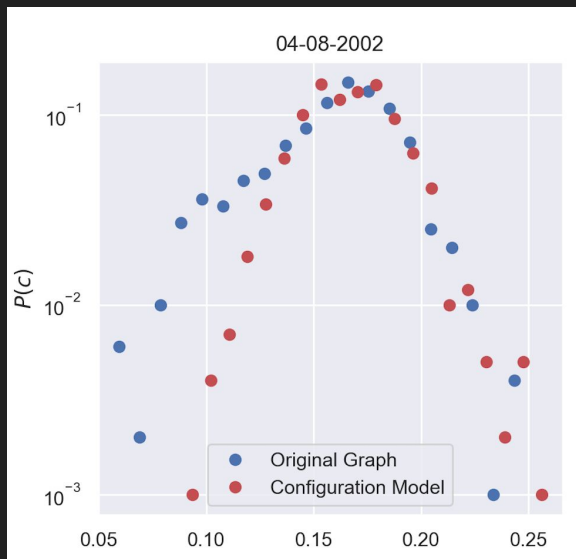


In Degree Fitting Plots (cdf based)

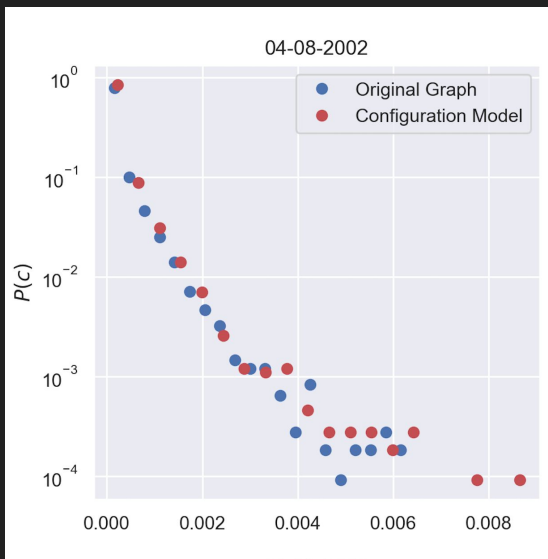


# Network structure: Centrality

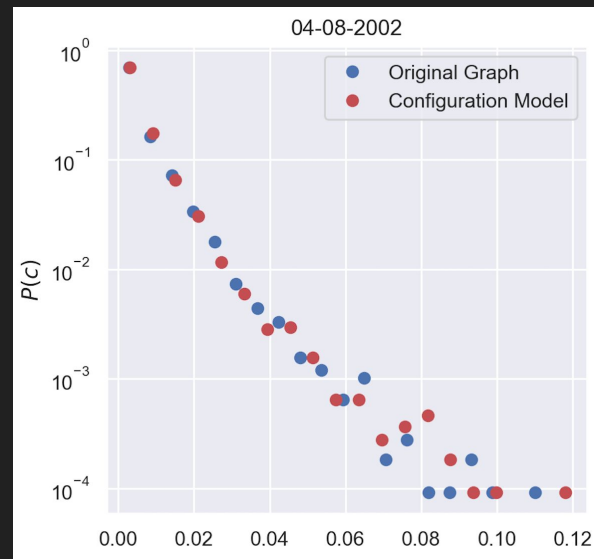
Closeness



betweenness

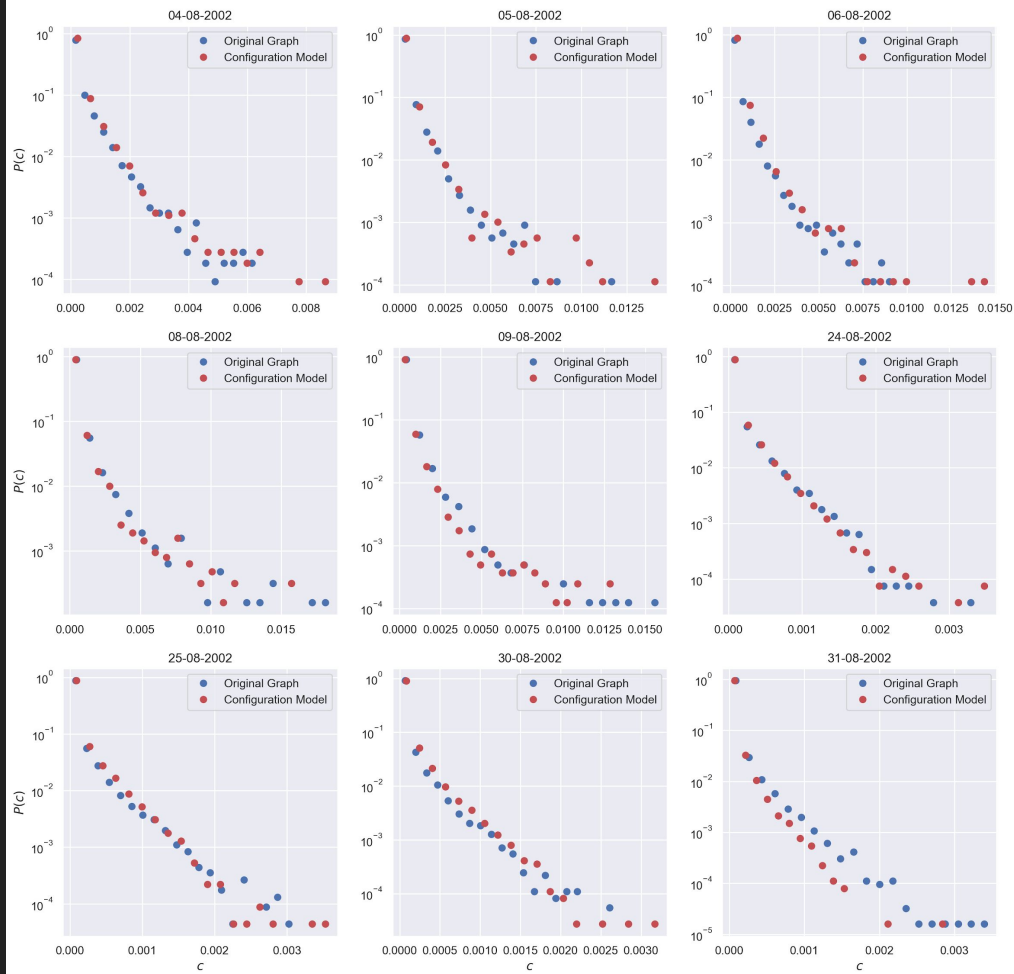


Eigenvector

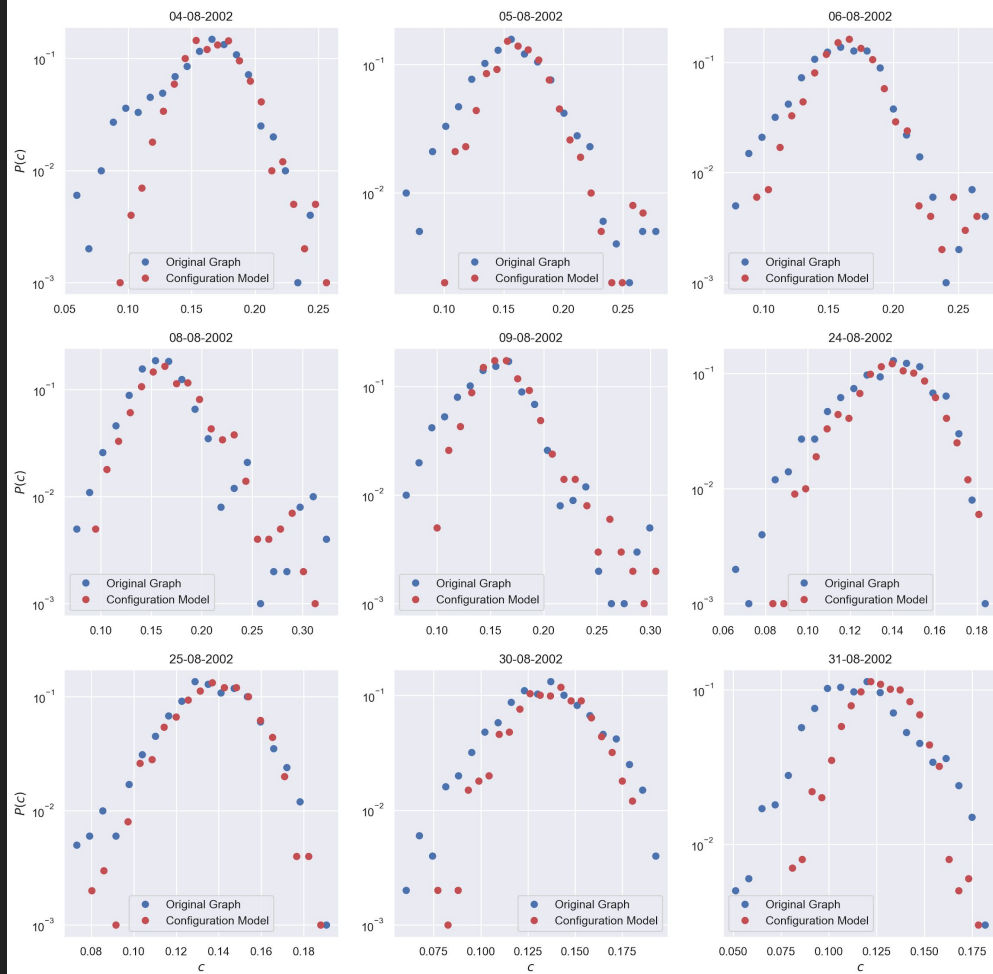




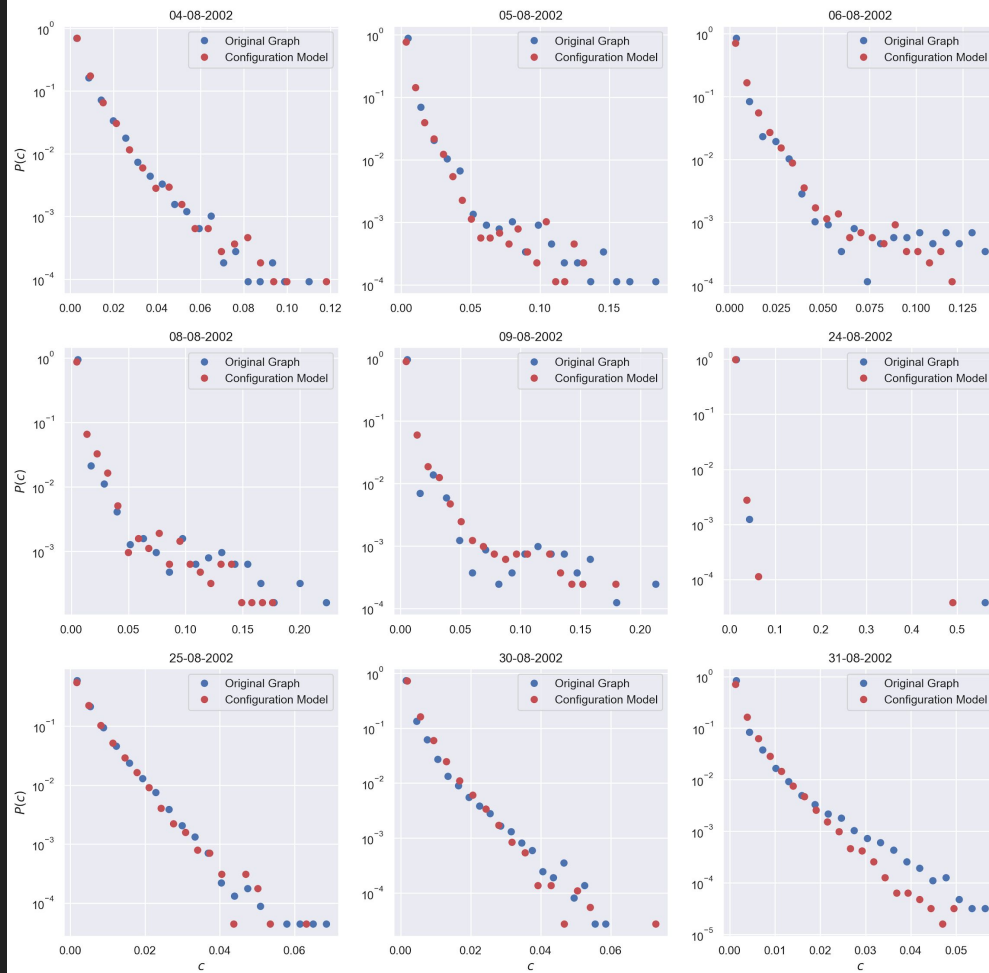
Log Binned Betweenness Centrality Plot



Log Binned Closeness Centrality Plot



Log Binned Eigenvector Centrality Plot



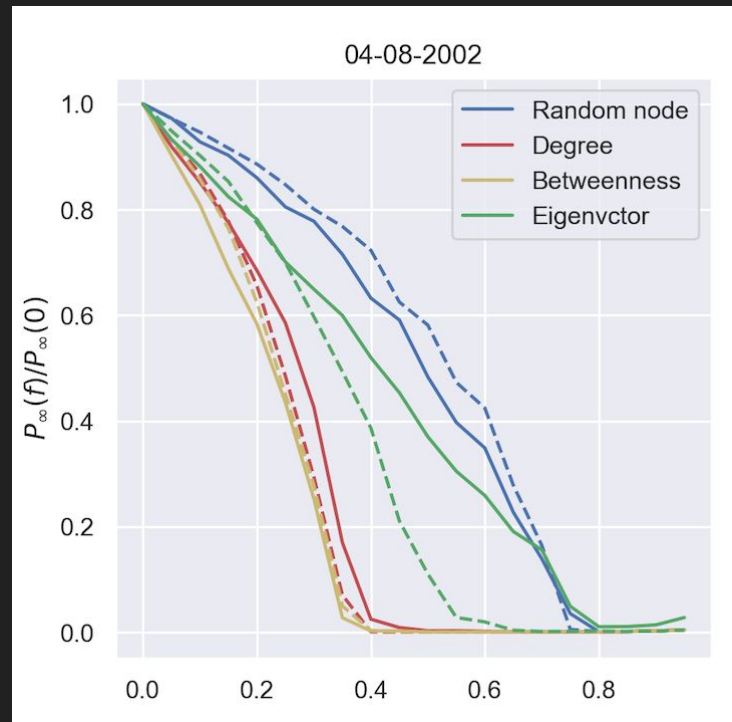
# Robustness

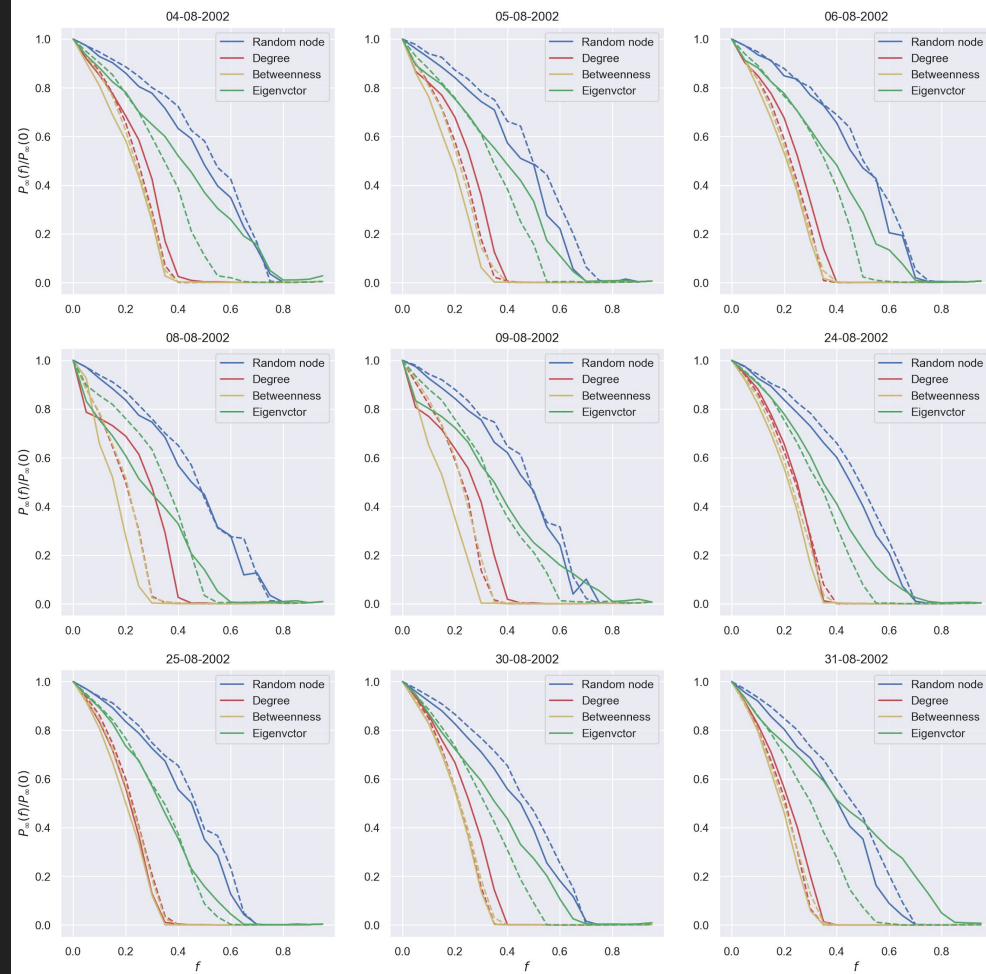
What we expected

Betweenness centrality most effective attack

Most vulnerable: critical threshold around 0.3

Highest critical threshold: around 0.8





# Discussion

Our expectations

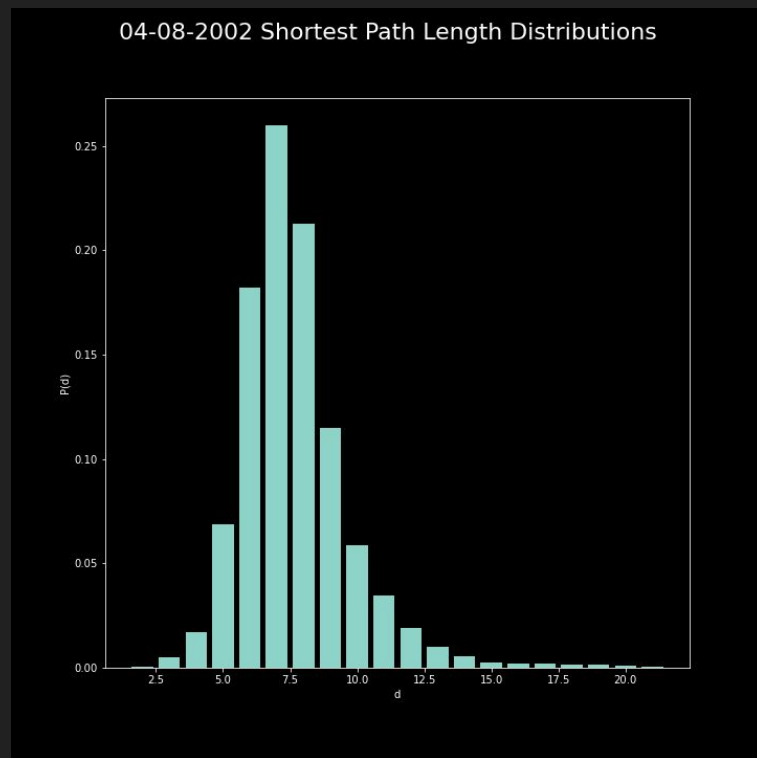
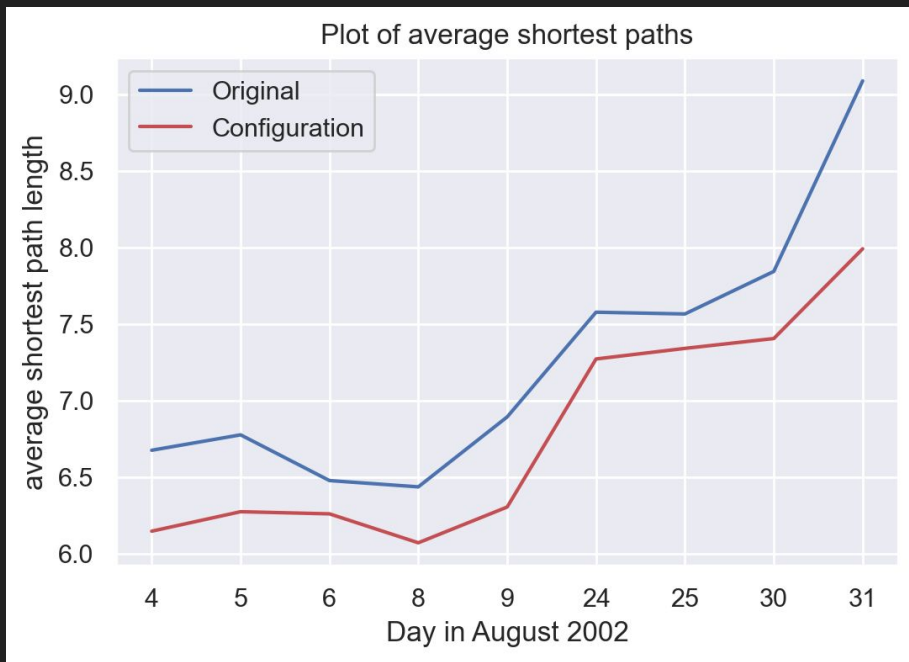
More realistic and effective ways of attacking the network

# Conclusion

How robust was the network?

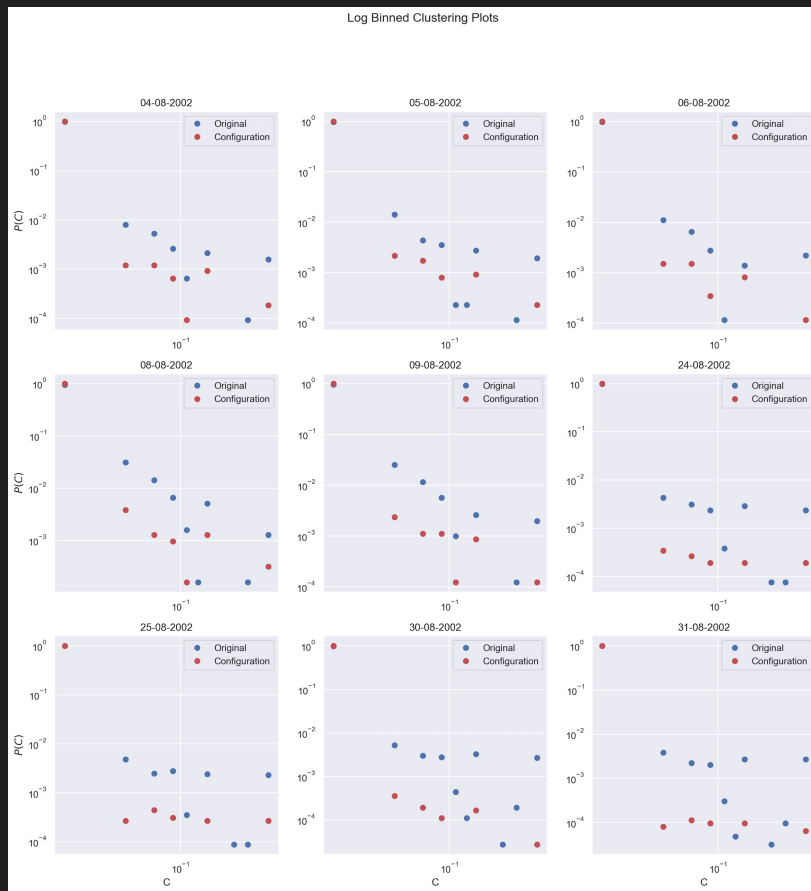
- Most robust to random failure
- Least robust to targeted attack on betweenness centrality
- Remains true over time

# Appendix slide A: shortest paths





# Appendix slide B: clustering



# Appendix slide C: degree correlation

