Throttling Tor Bandwidth Parasites

USENIX Security, 2012

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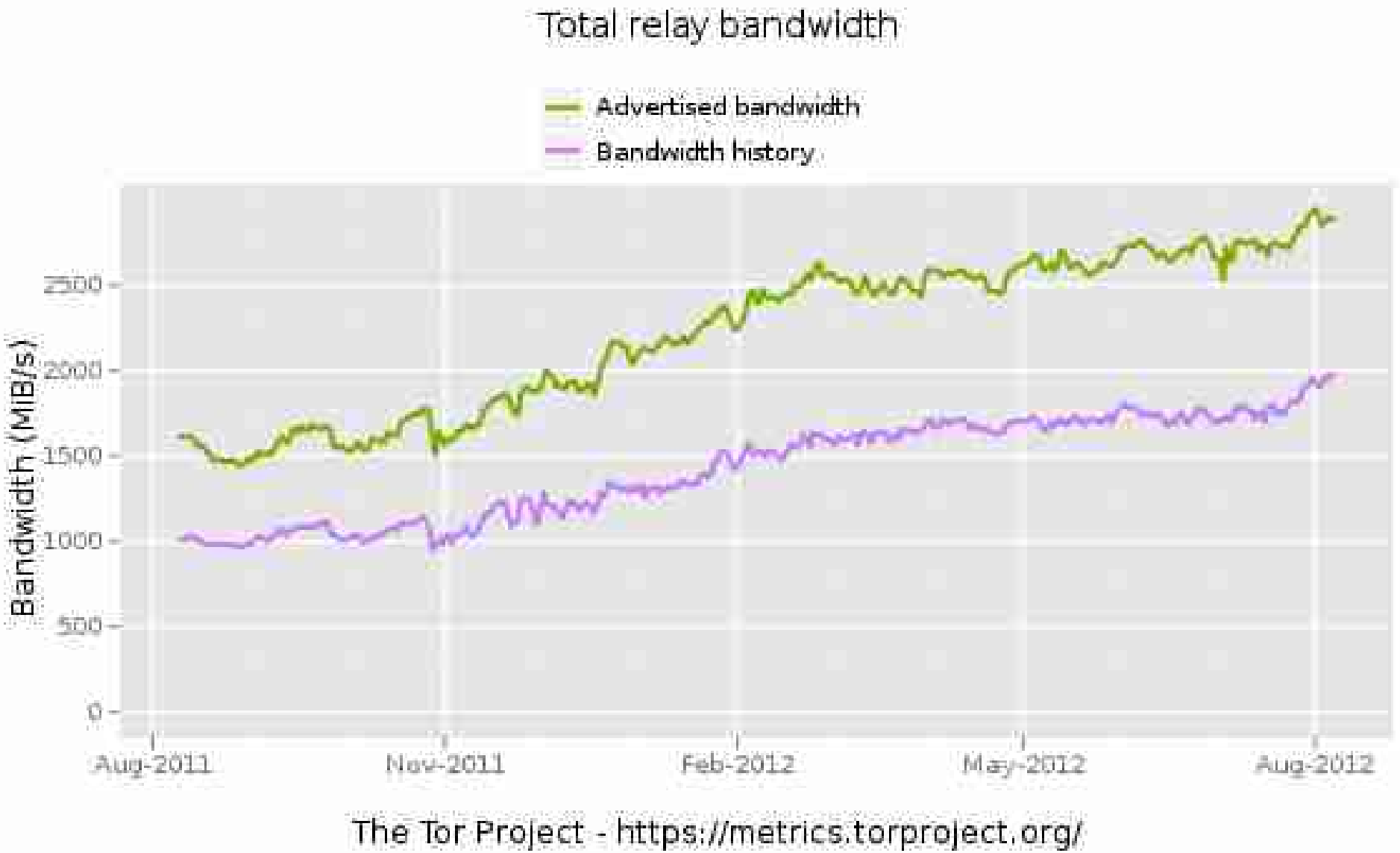
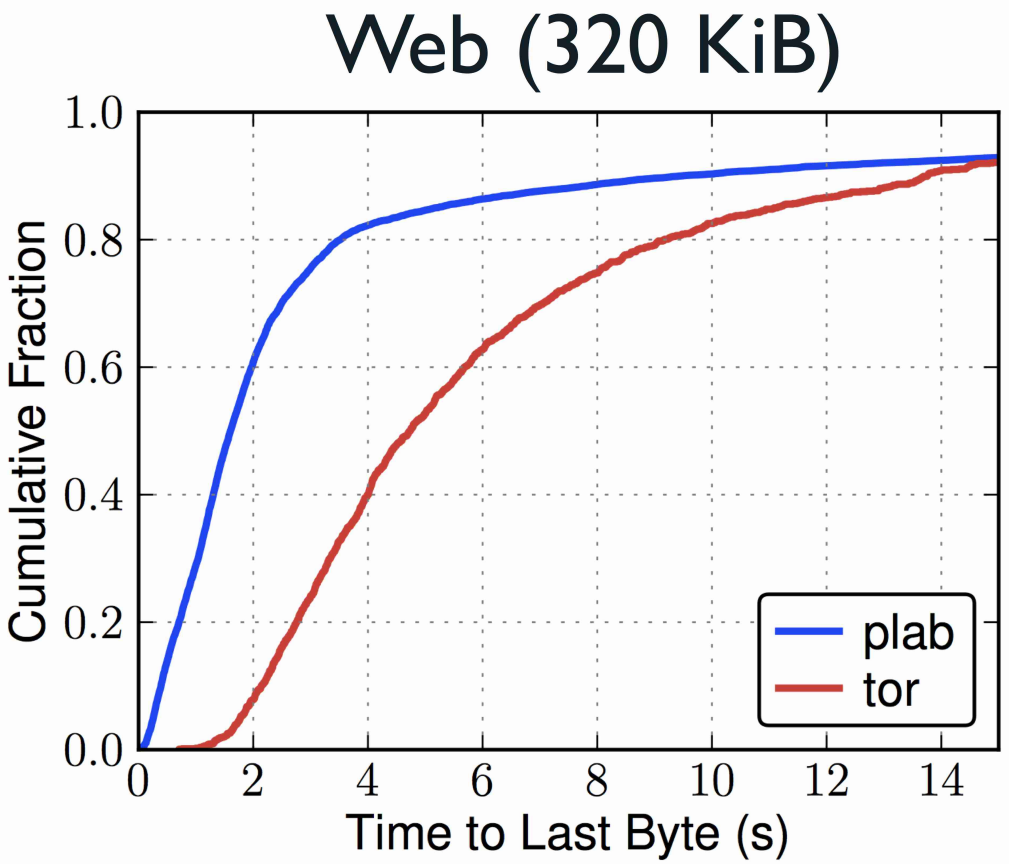
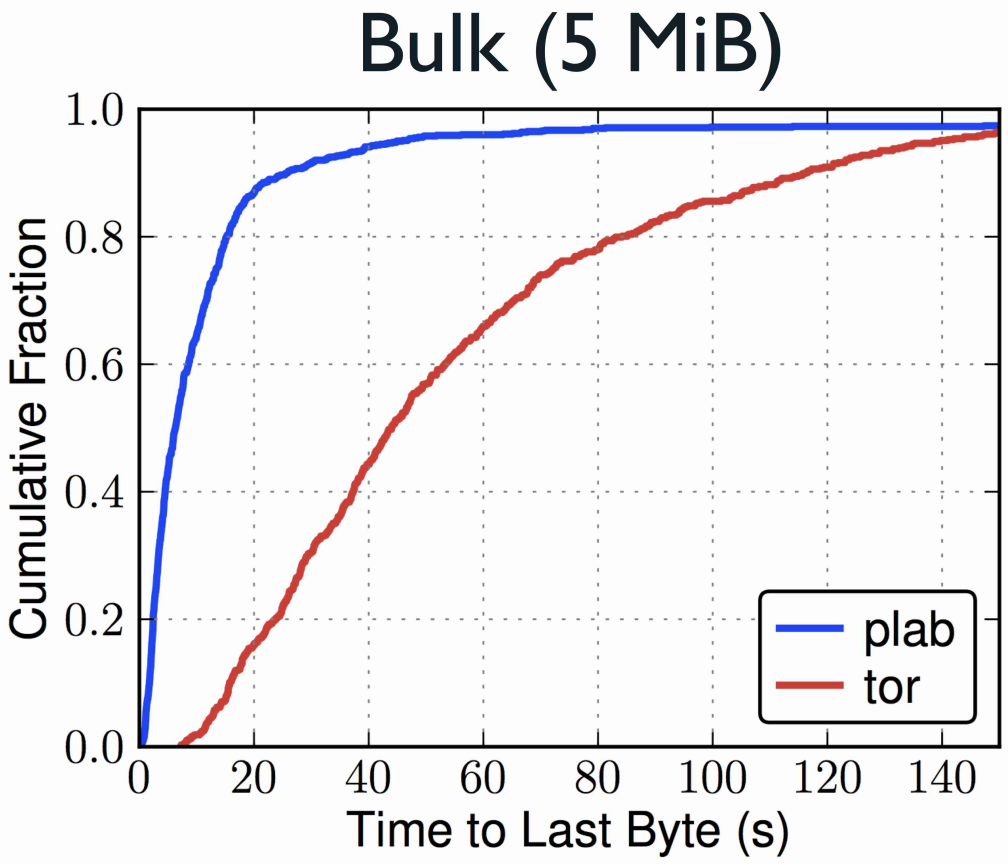
Anonymity with Tor

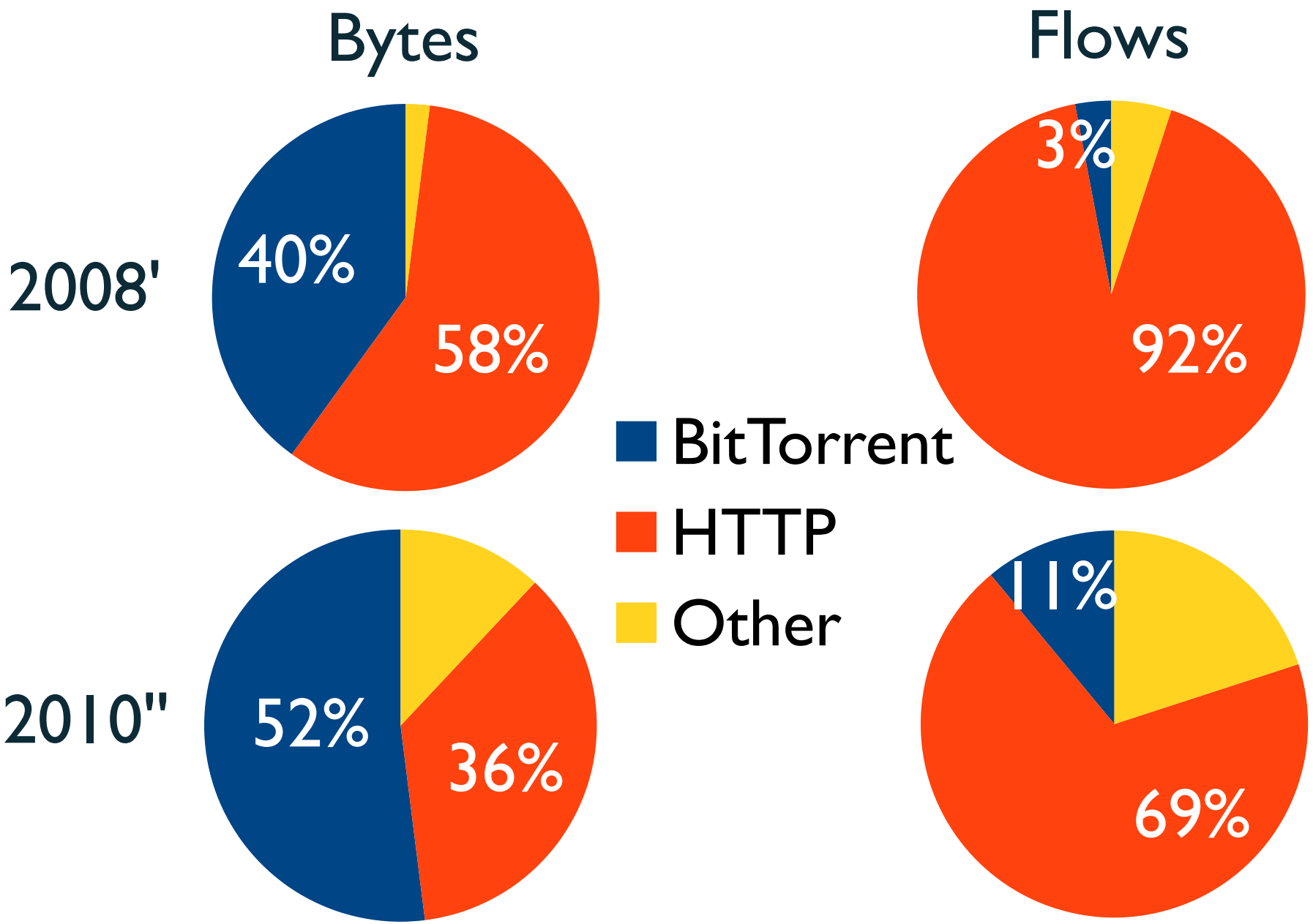
Tor is Efficient: ~65% utilization!



Tor is Slow[er]



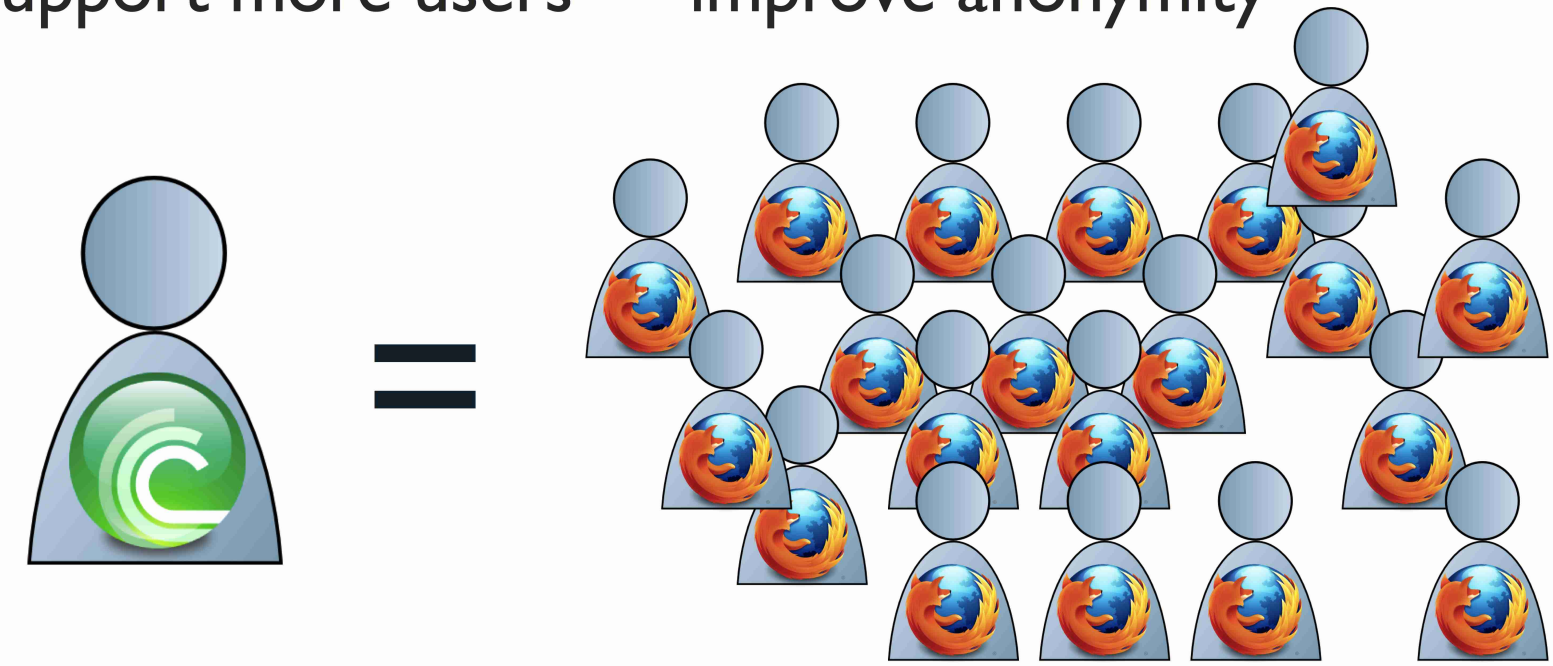




' McCoy et al. PETS 2008, " Chaabane et al. NSS 2010

Bandwidth Parasites

- BitTorrent is leaching Tor's capacity!
- Throttle BitTorrent
  - Improve client performance
  - Support more users ⟶ improve anonymity

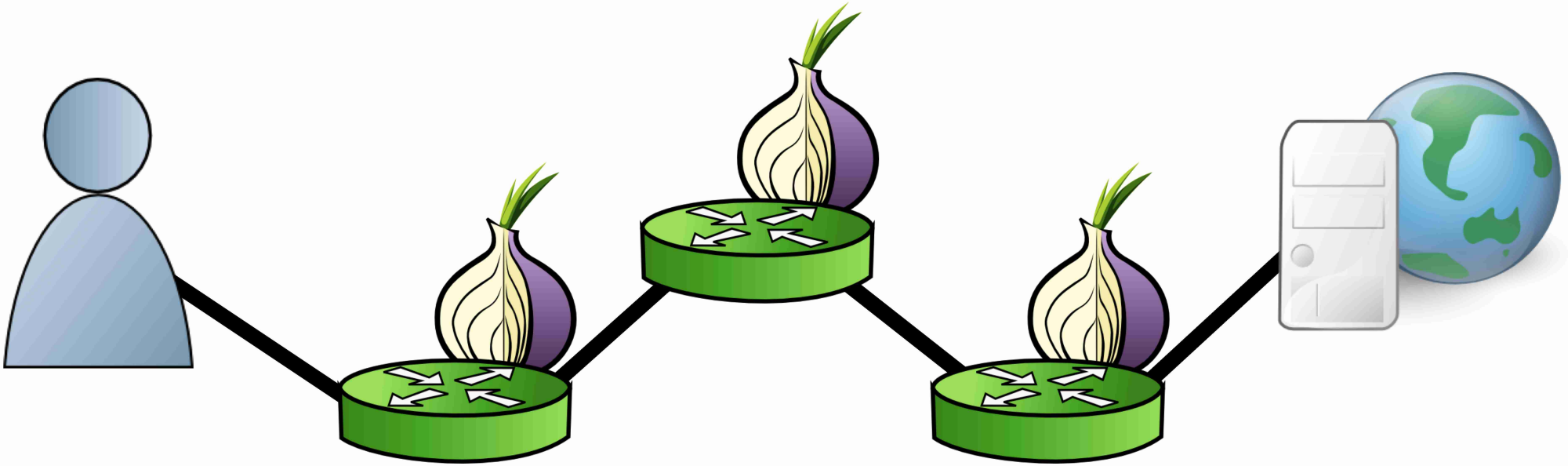


Outline

- Problem and Motivation
- More Tor Details
  - Circuits, Guards, Multiplexing
  - "Static Throttling"
- Adaptive Throttling
- Performance Evaluation
- Anonymity Evaluation

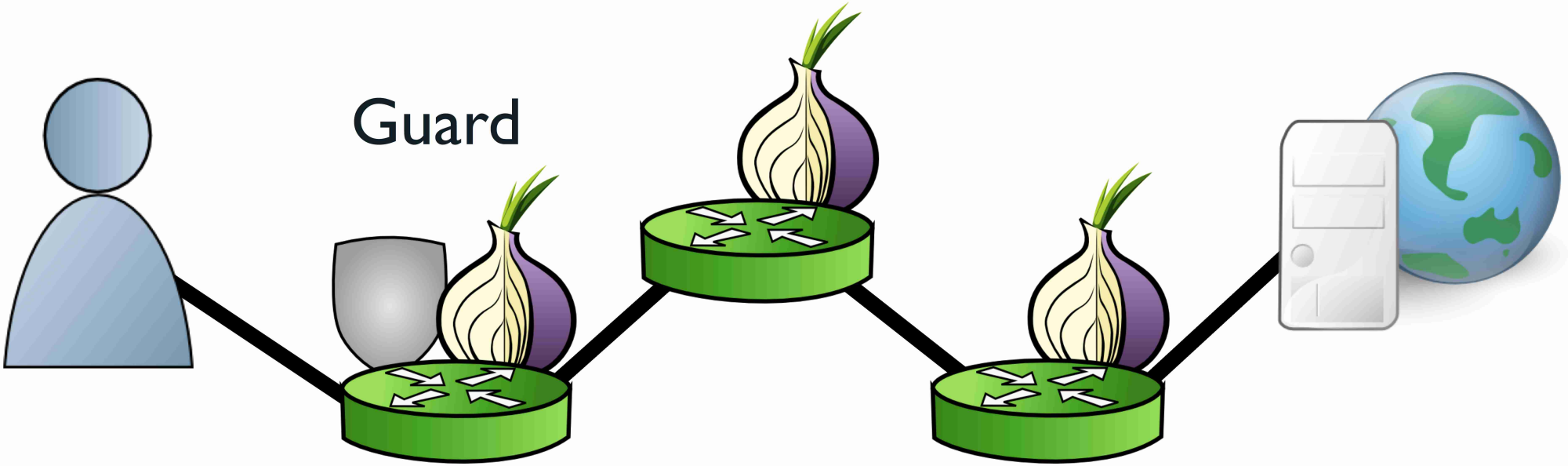
Anonymity with Tor

Anonymity with Tor

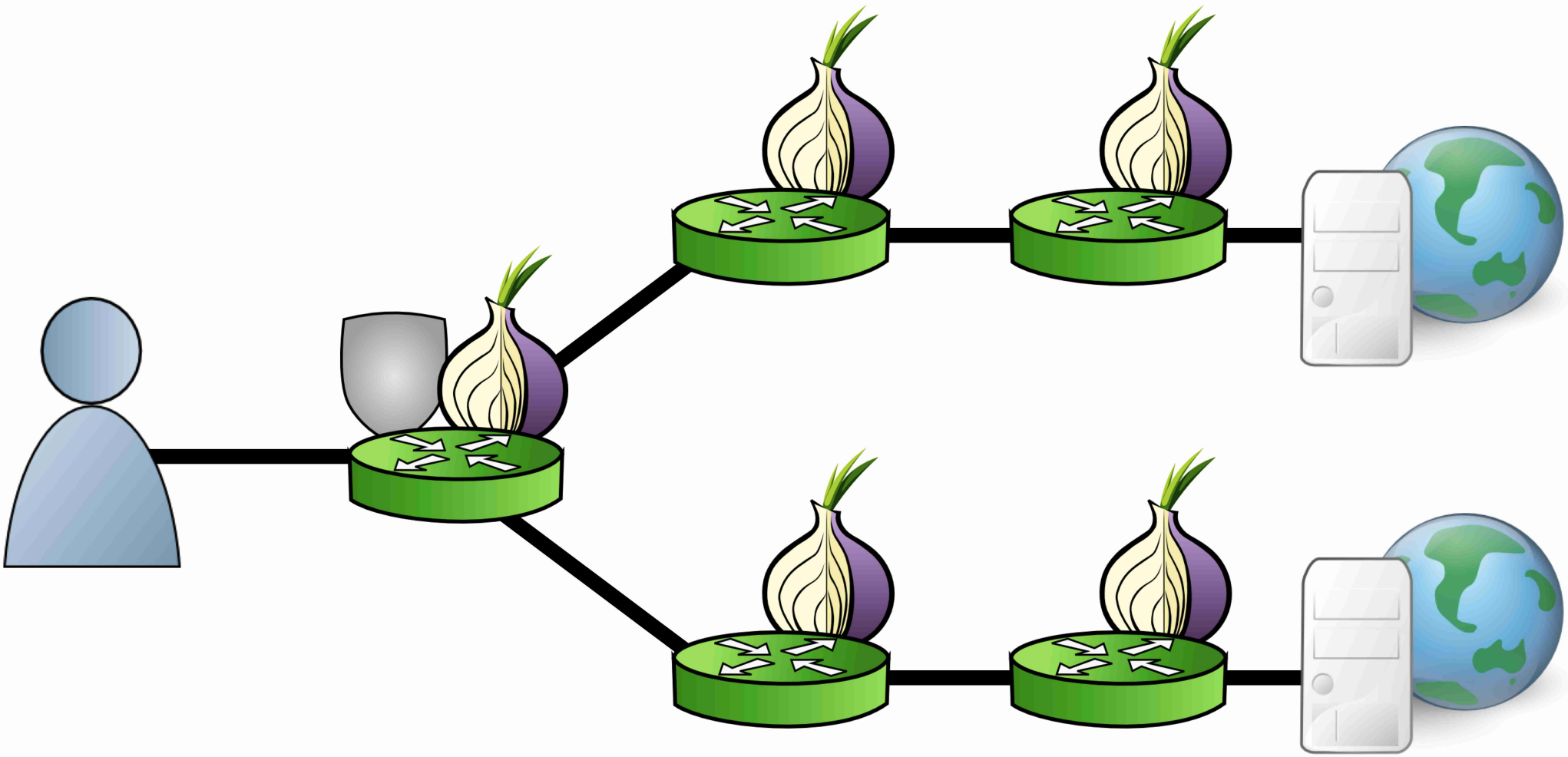


Client Relays Server

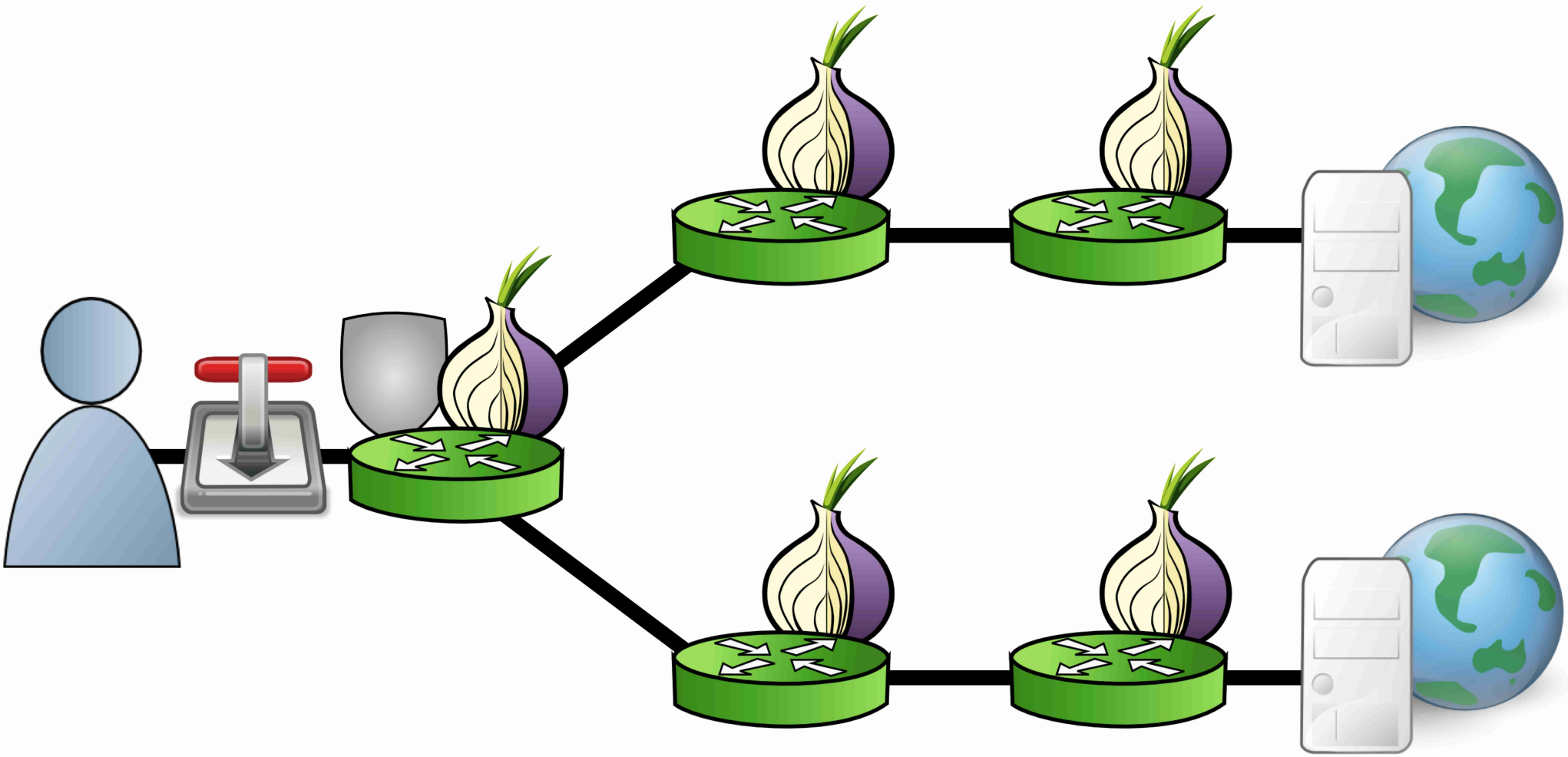
Tor Guard Relays



Multiplexing Circuits



“Statically” Throttling Clients



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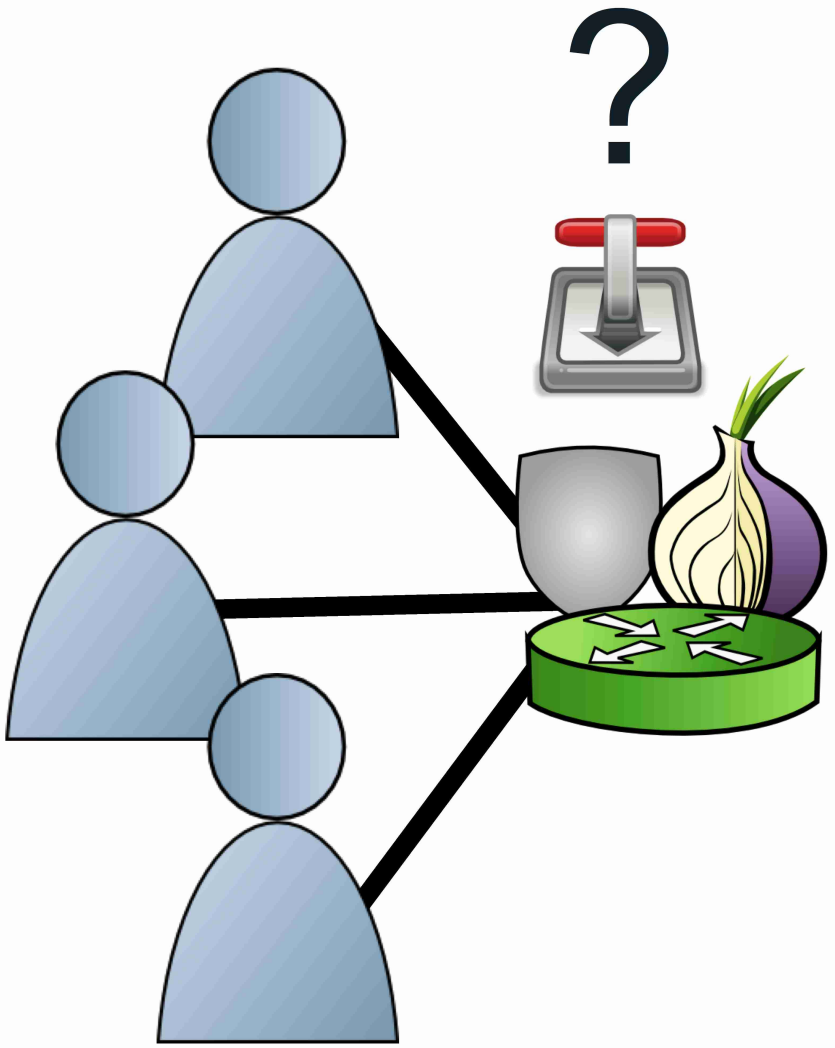
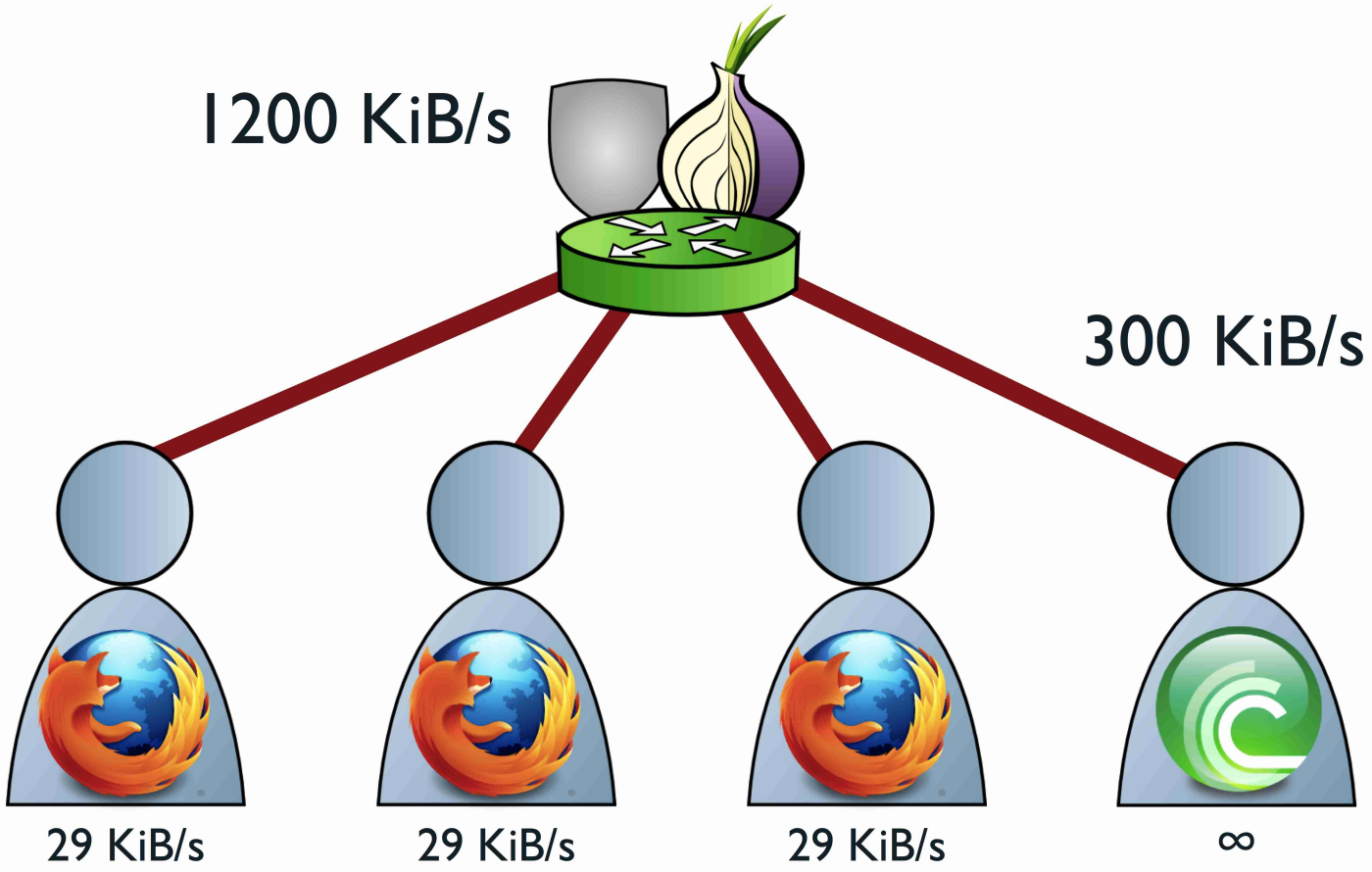
Throttling Algorithms

- Criteria:
  - Which connections?
  - At what rate?
- Constraints:
  - Use only local information
  - Unsupervised



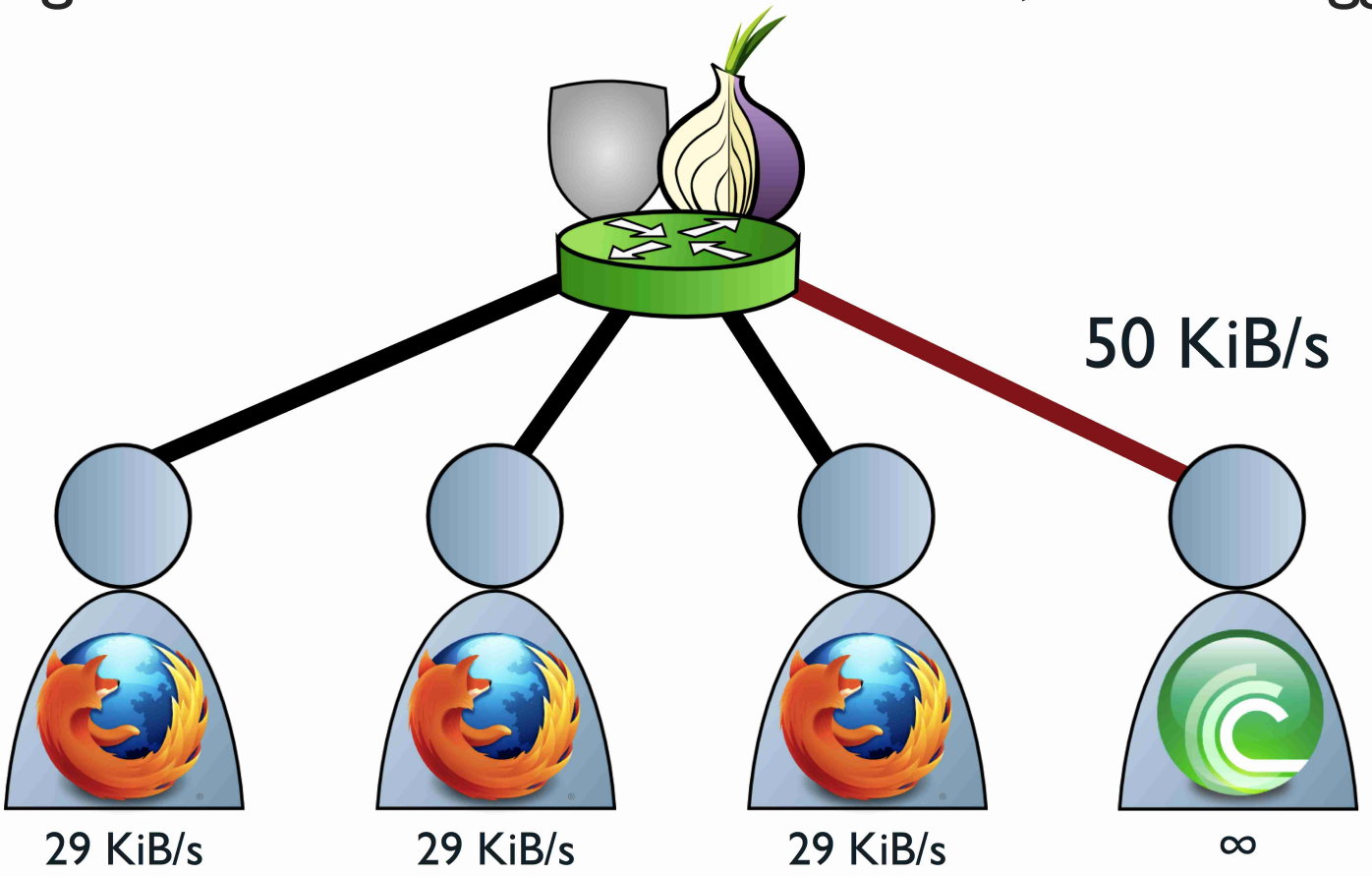
Our Approaches: Bit-splitting

- Adaptively adjust *throttle rate*
  - Each client allocated fair bandwidth share



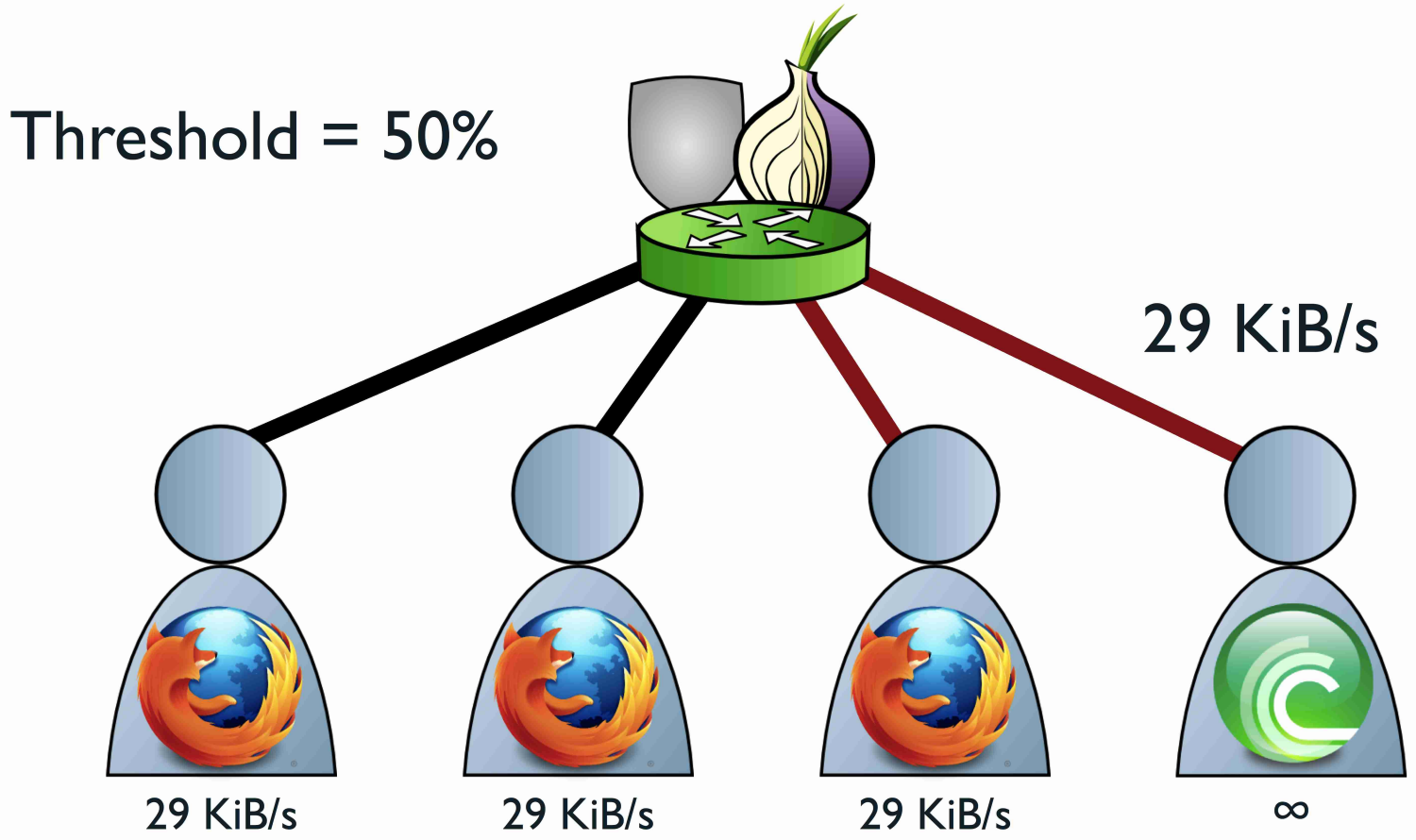
Our Approaches: Flagging

- Adaptively select *connections*
  - Flag connections that use too much, throttle aggressively



Our Approaches: Threshold

- Adjust both *throttle rate* and selected *connections*
  - Threshold: throttle the loudest connections



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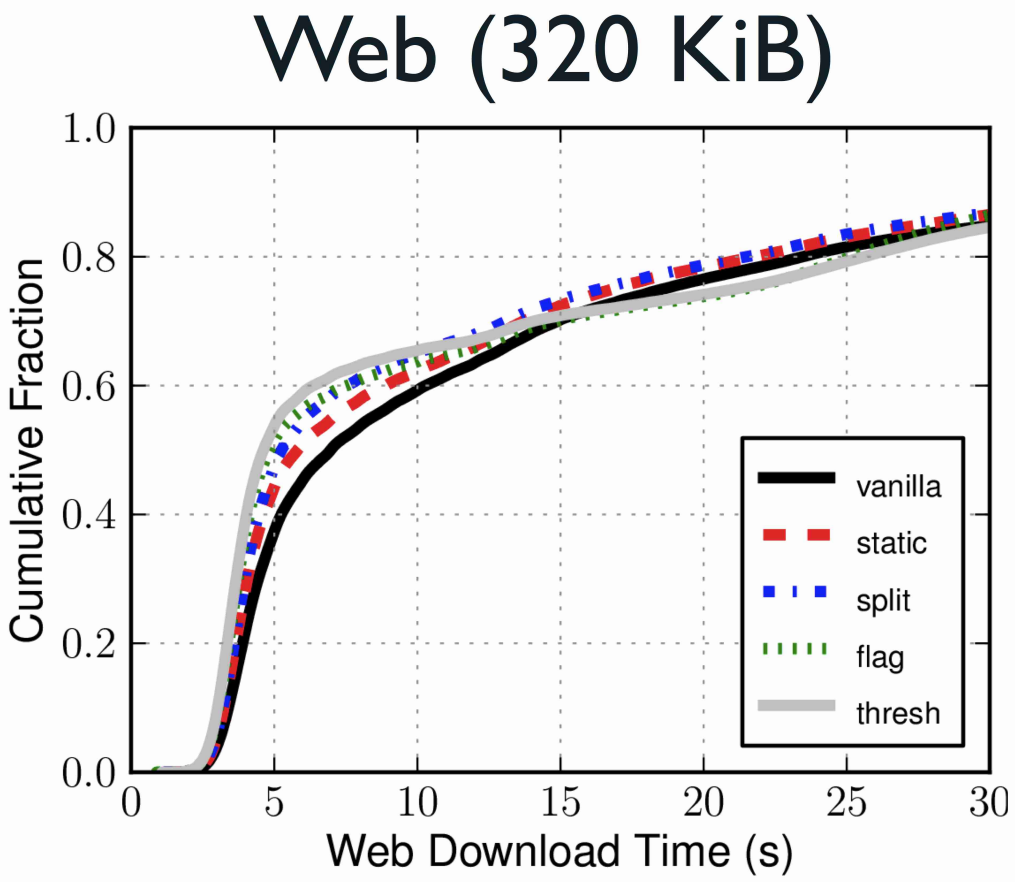
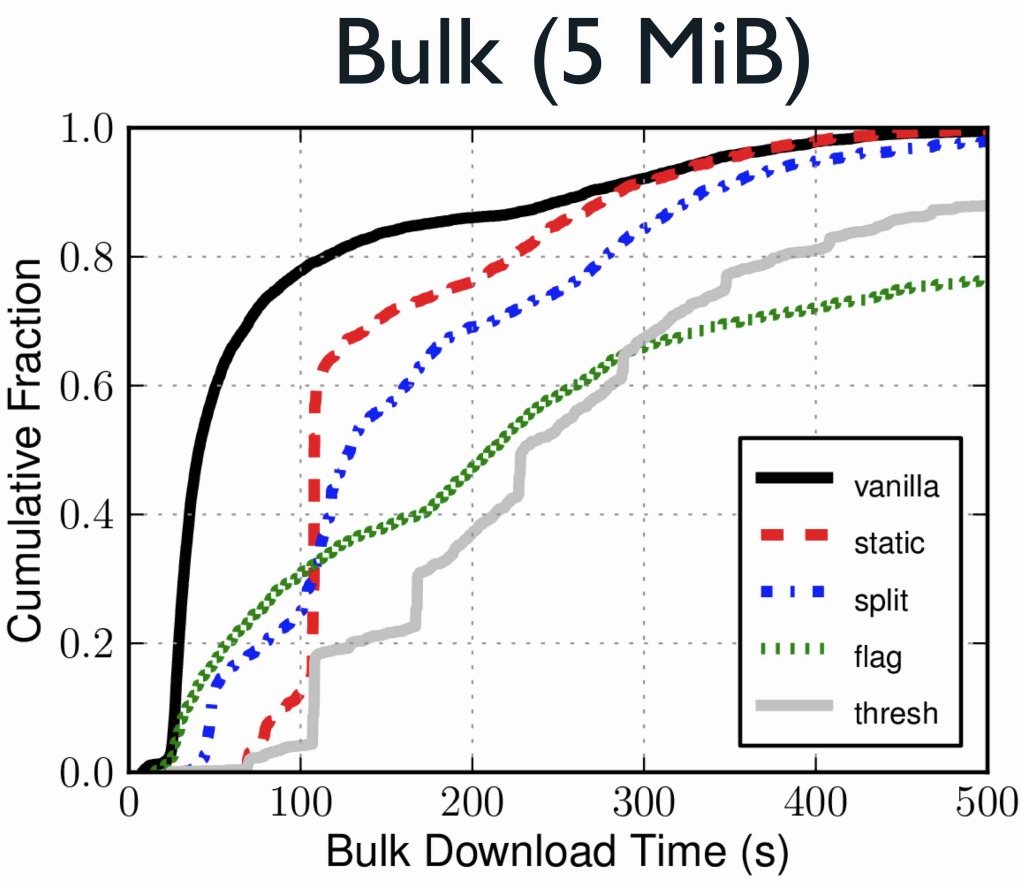
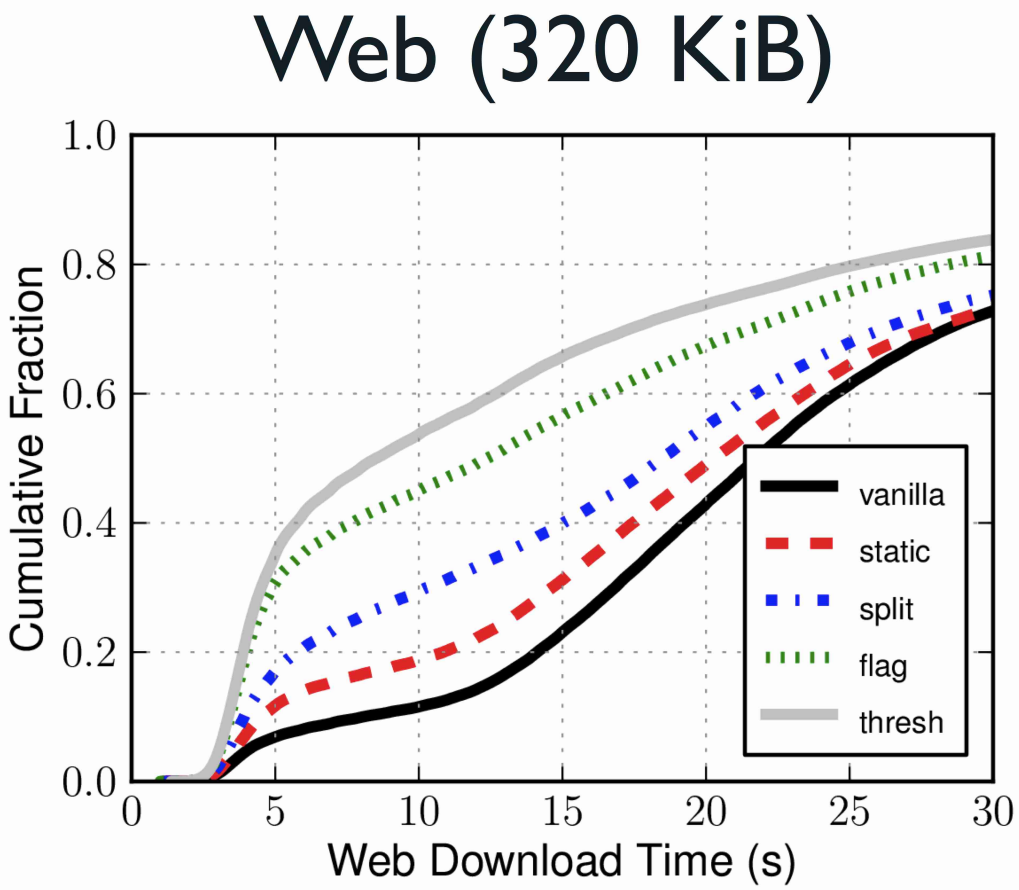
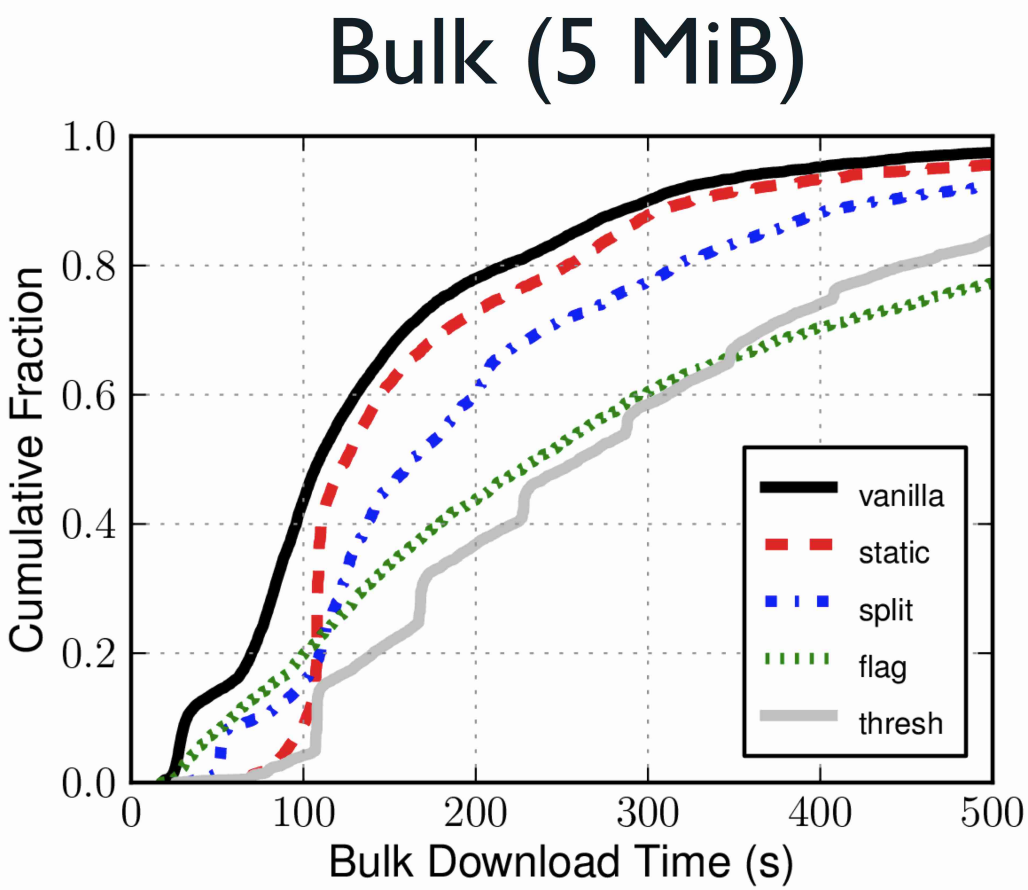
Performance, Lighter Load





Performance, Heavier Load





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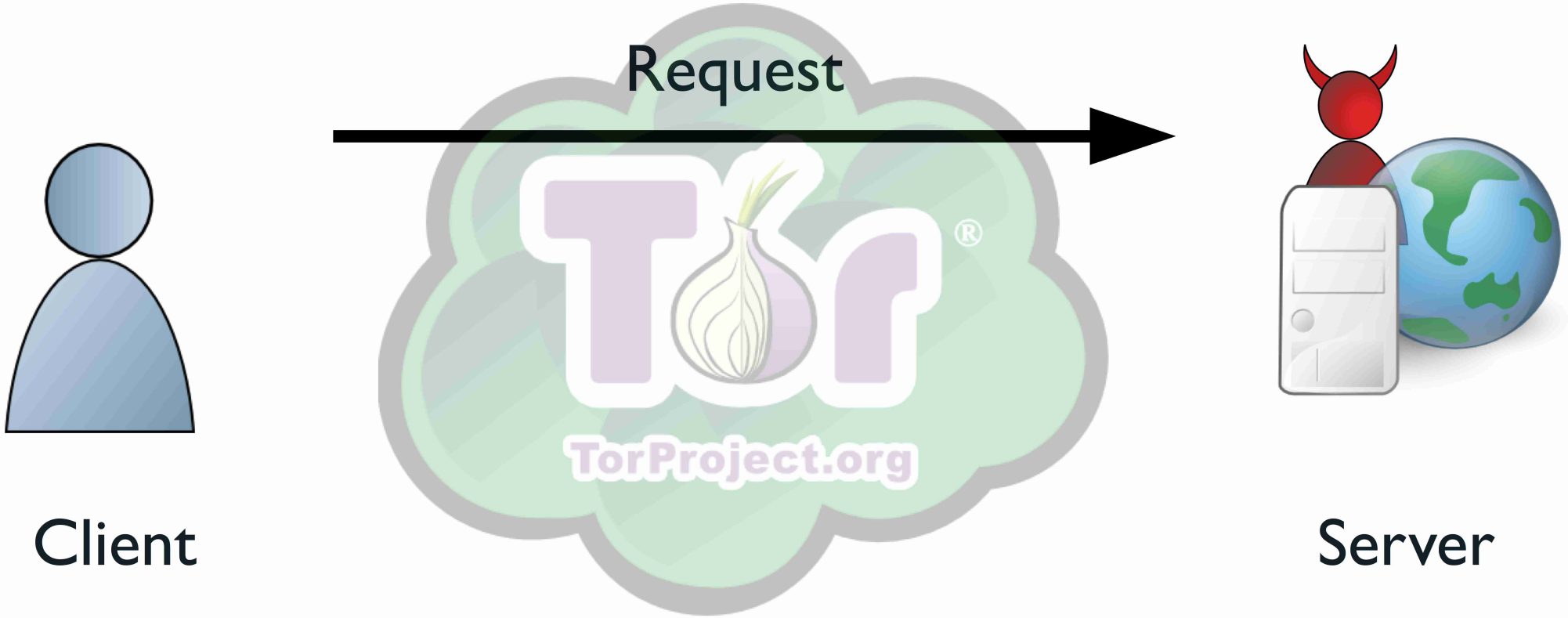
Attacking Anonymity:
Learning Circuit Throughput



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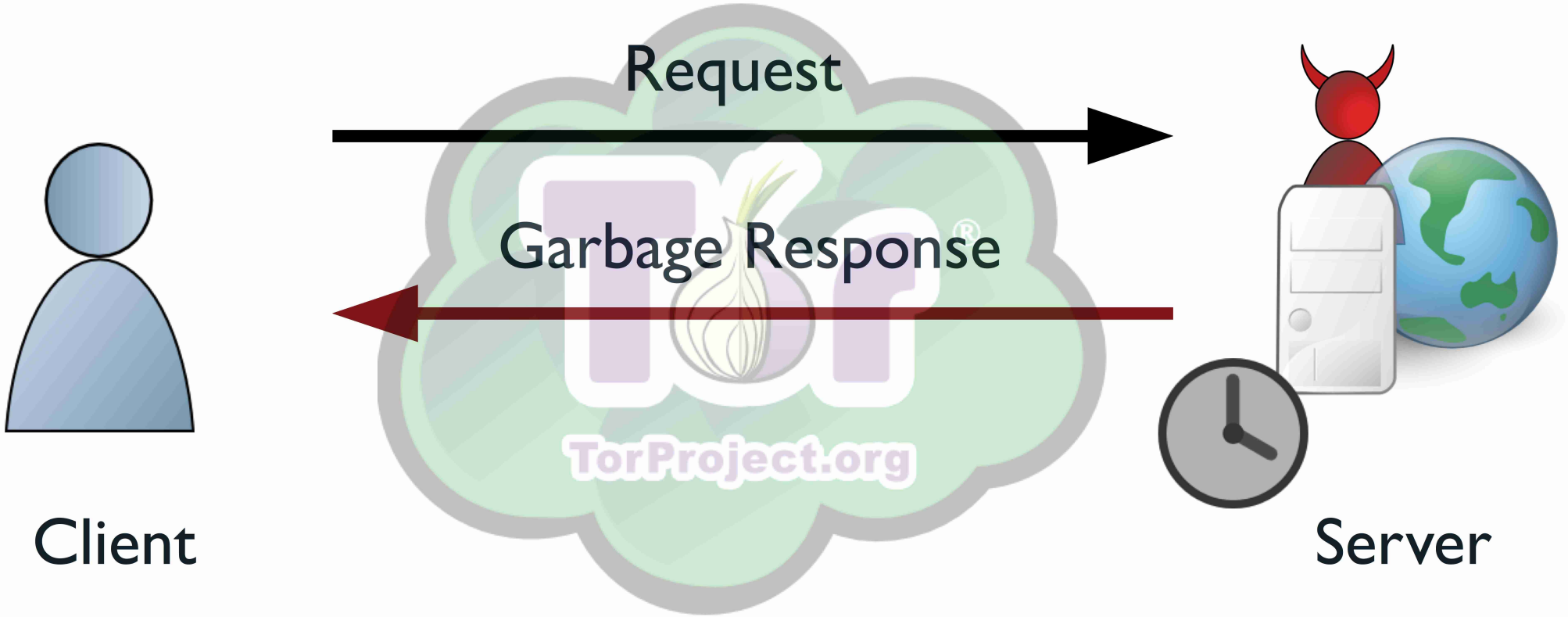

Attacking Anonymity:
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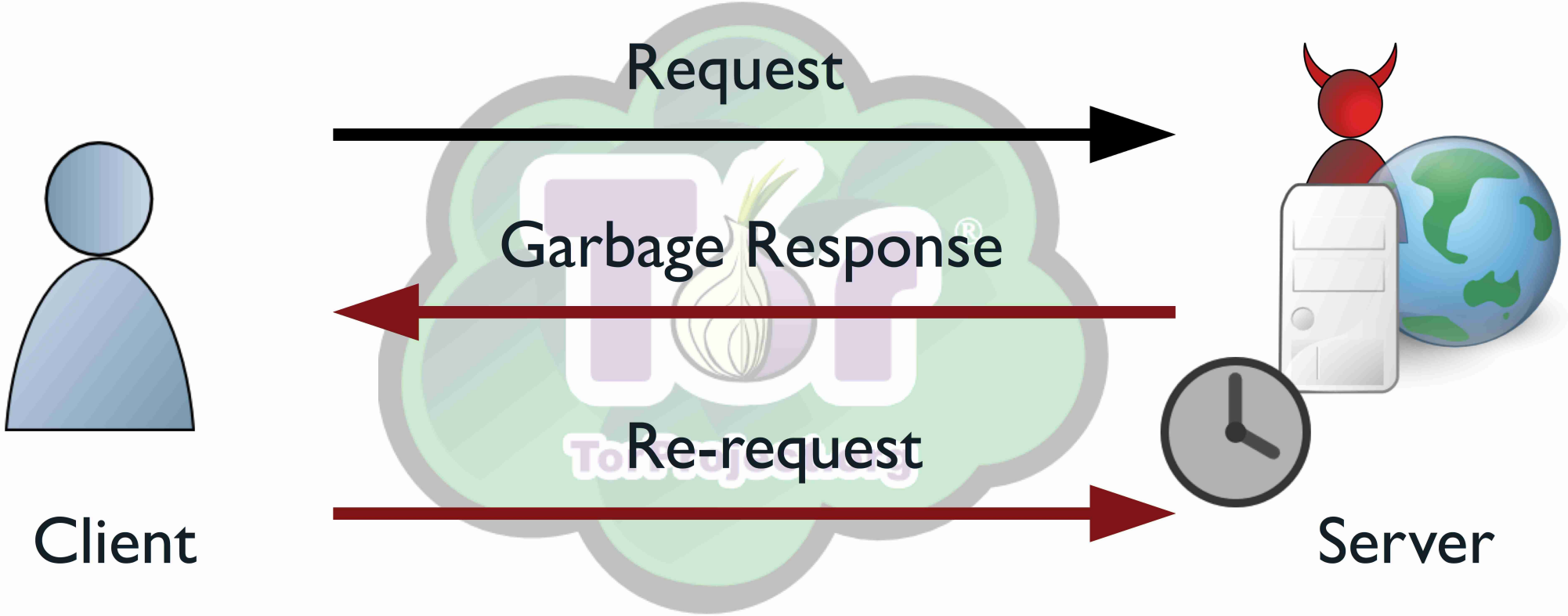
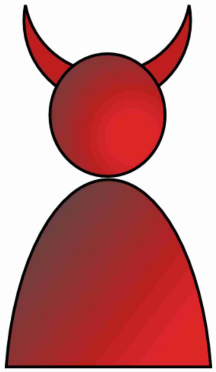
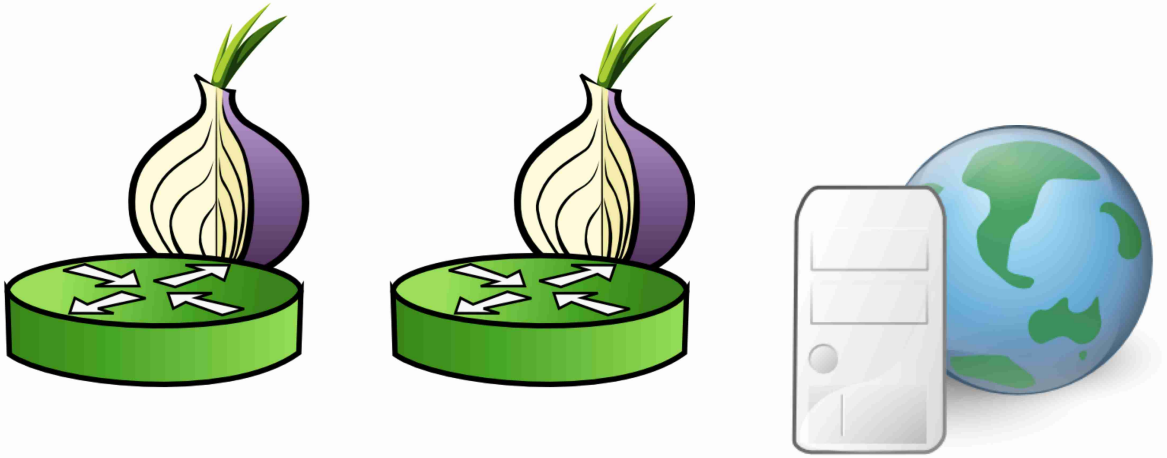


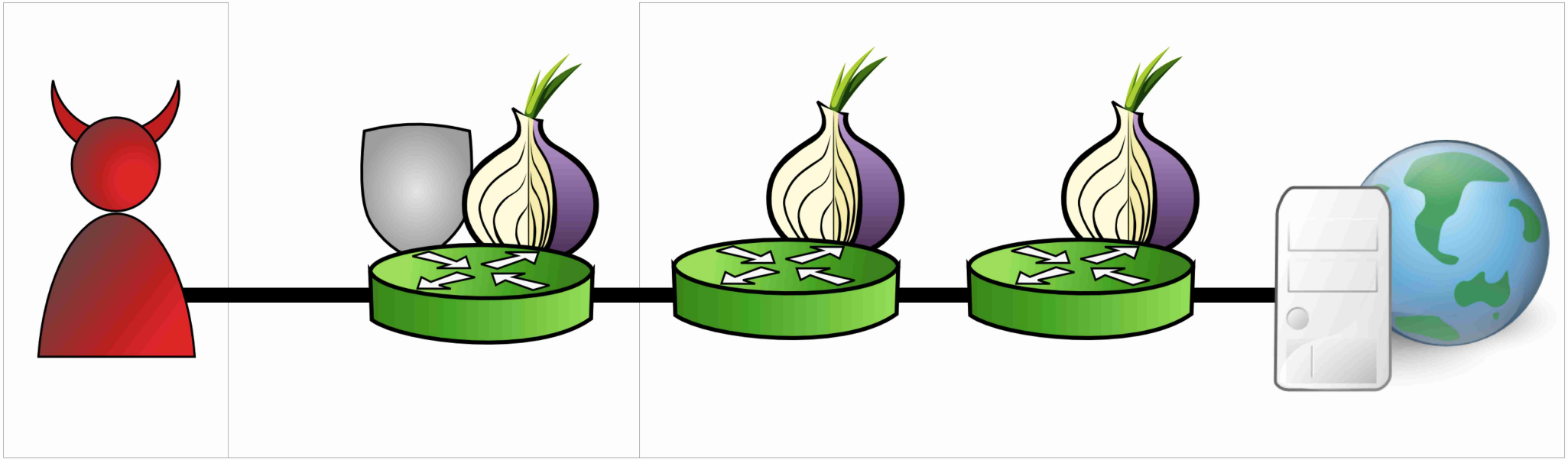
Attacking Anonymity:
Learning Throttle Rate





High Bandwidth Nodes

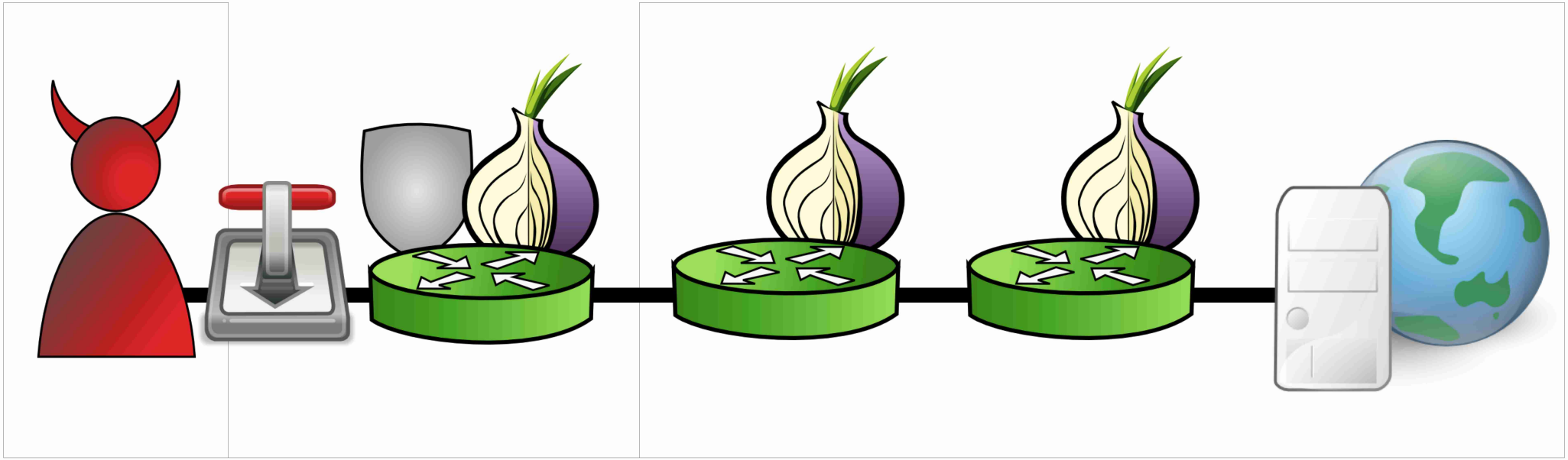
Attacking Anonymity:
Learning Throttle Rate



High Bandwidth Nodes

Attacking Anonymity:
Learning Throttle Rate

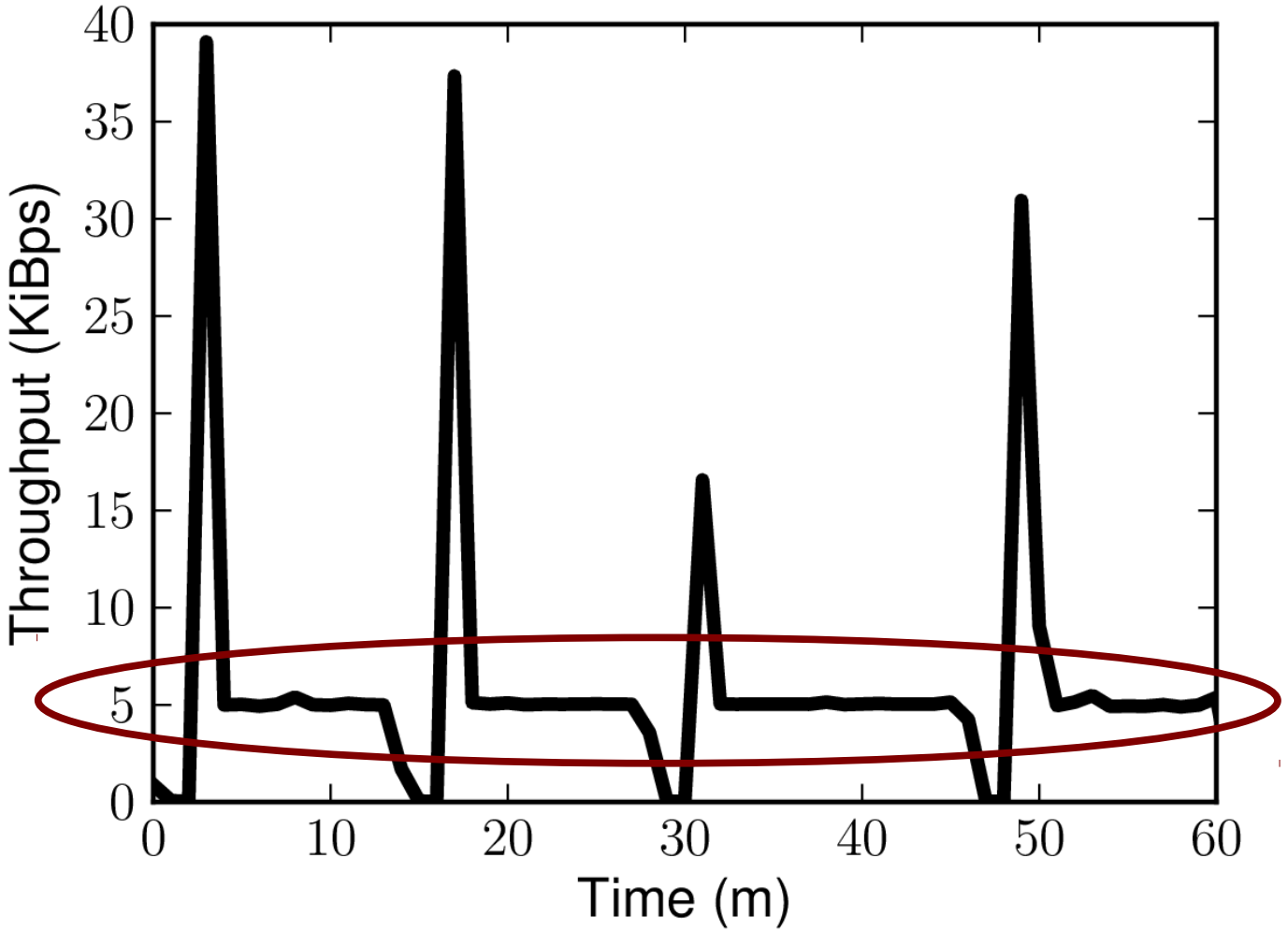
Measure the Rate



High Bandwidth Nodes

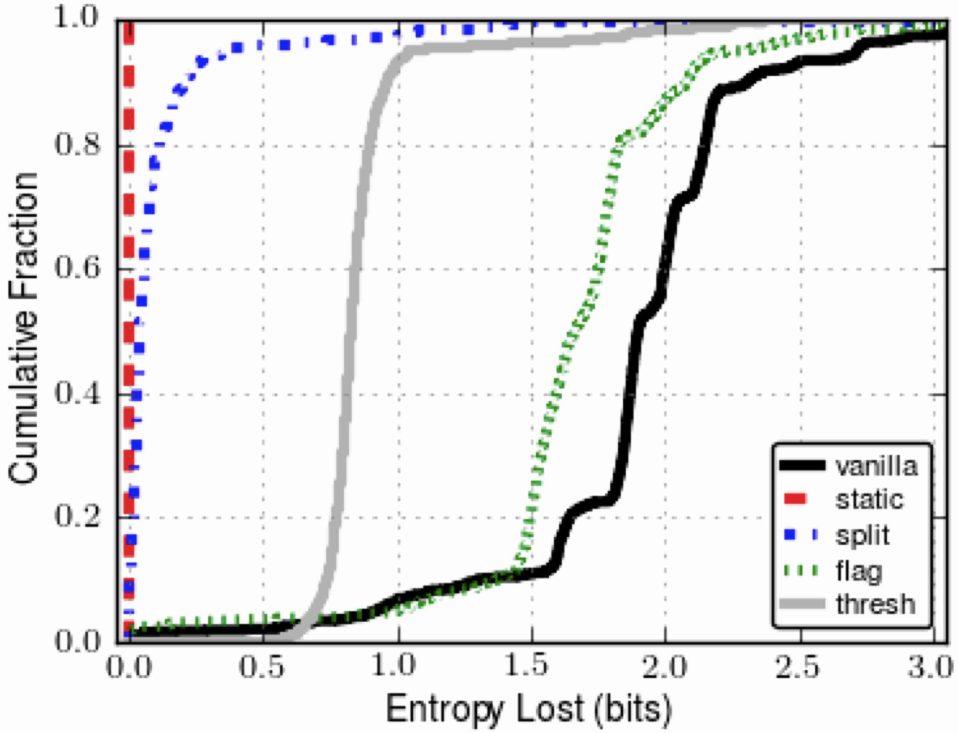
Attacking Anonymity:
Learning Throttle Rate

5 KiB/s

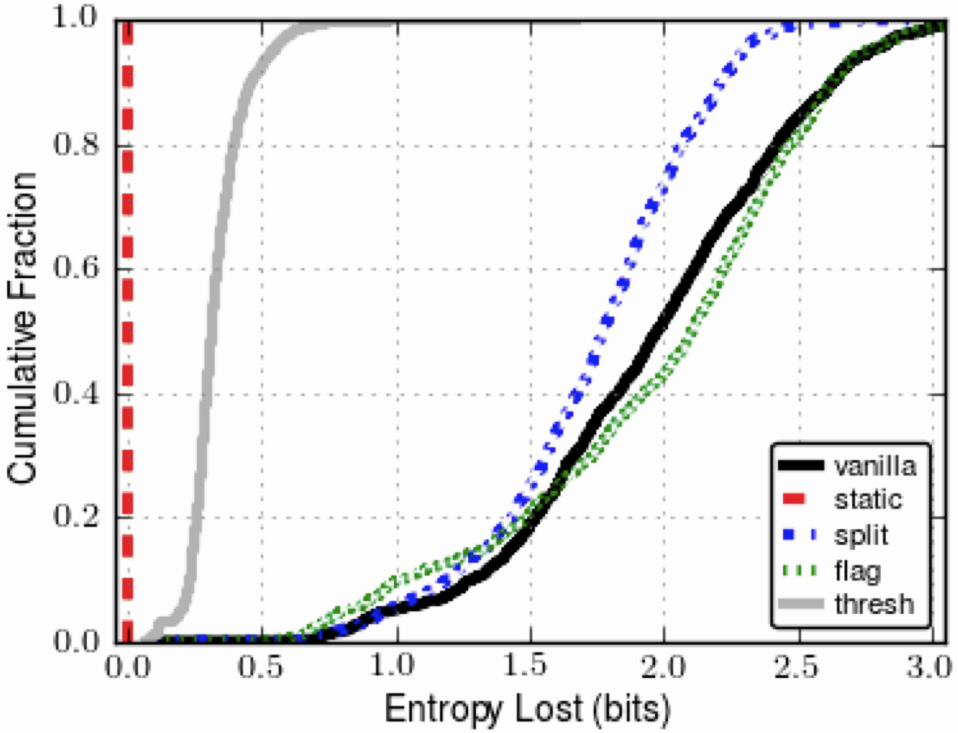


Anonymity Results

Learn Circuit Throughput



Learn Throttle Rate



Conclusions

- Goal: throttle bandwidth parasites
  - Throttling improves web client performance, anonymity
  - Tor patches publicly available

- Open question:
  - How to deal with 'cheaters'?

Questions?

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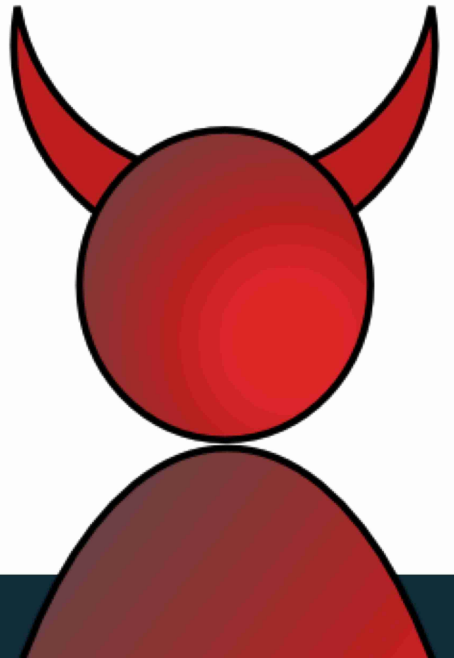
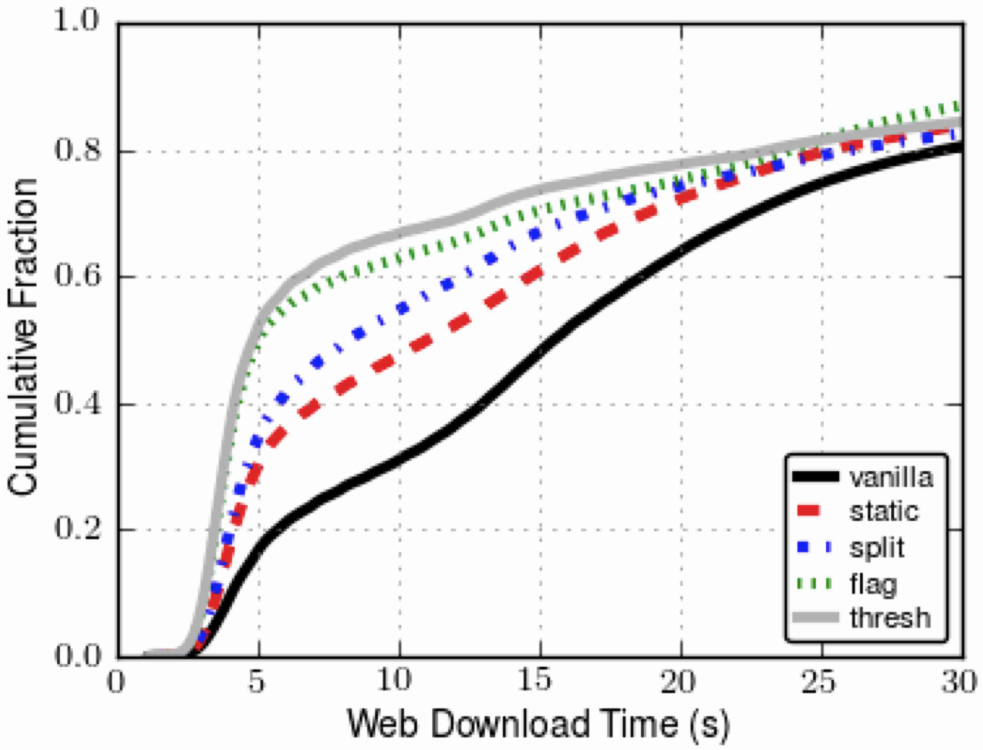
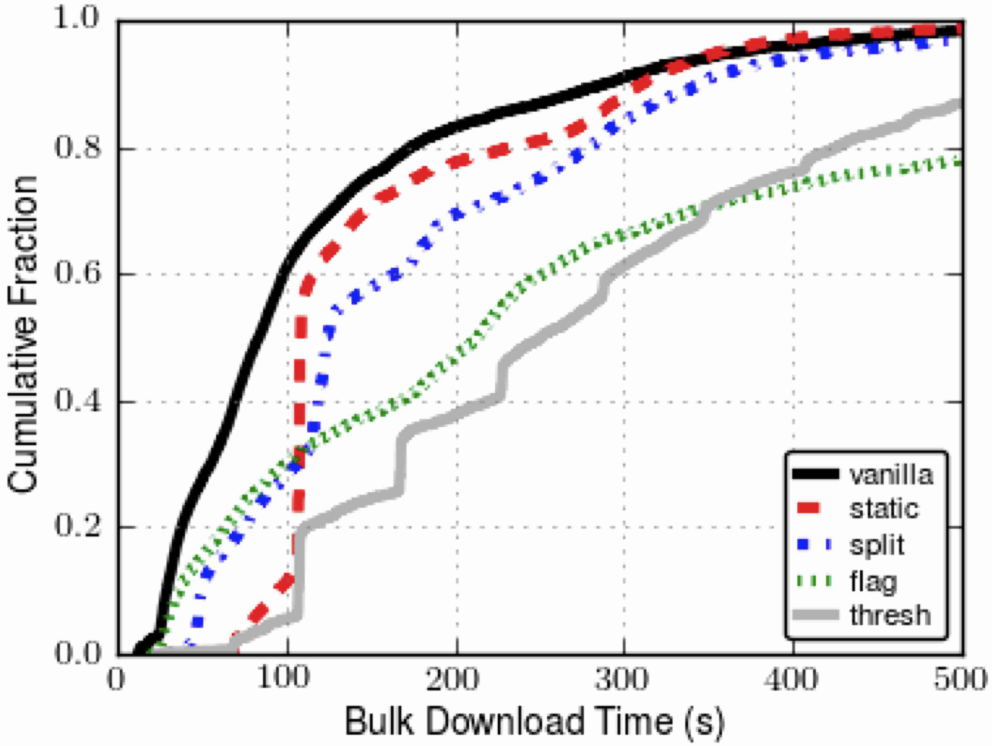
github.com/robgjansen
github.com/shadow
shadow.cs.umn.edu



Performance, Medium Load

Web-client Performance



Bulk-client Performance