Throttling Tor Bandwidth Parasites

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Anonymity with Tor

Client

TorProject.org

Server
Tor is Efficient: ~65% utilization!
Tor is Slower

Web (320 KiB)

Bulk (5 MiB)
' 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

Client

TorProject.org

Server
Tor Guard Relays
Multiplexing Circuits
“Statically” Throttling Clients
Outline

→ Problem and Motivation
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→ Adaptive Throttling
→ Performance Evaluation
→ Anonymity Evaluation
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

1200 KiB/s

29 KiB/s  29 KiB/s  29 KiB/s  ∞
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

Threshold = 50%

```
29 KiB/s  29 KiB/s  29 KiB/s  ∞
```
Outline

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- Adaptive Throttling
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- Anonymity Evaluation
Performance, Lighter Load

Web (320 KiB)

Bulk (5 MiB)
Performance, Heavier Load

Web (320 KiB)

Bulk (5 MiB)
Outline

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Attacking Anonymity: Learning Circuit Throughput
Attacking Anonymity: Learning Circuit Throughput

Client

Request

Garbage Response

Server

TorProject.org
Attacking Anonymity: Learning Circuit Throughput

Client -> Server

Request

Garbage Response

Re-request

Clock
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

Throughput (KiBps) vs Time (m)

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