


# Cross-Domain Cooperation for Small Clients



Amy S. Hughes

Joe Touch

USC/ISI



# Overview

- Problem: DNS overhead
- Solution: Web-DNS Cooperation
- Experiment: Squid log analysis
- Conclusions
- Future Work

# DNS Overhead in Web Transactions

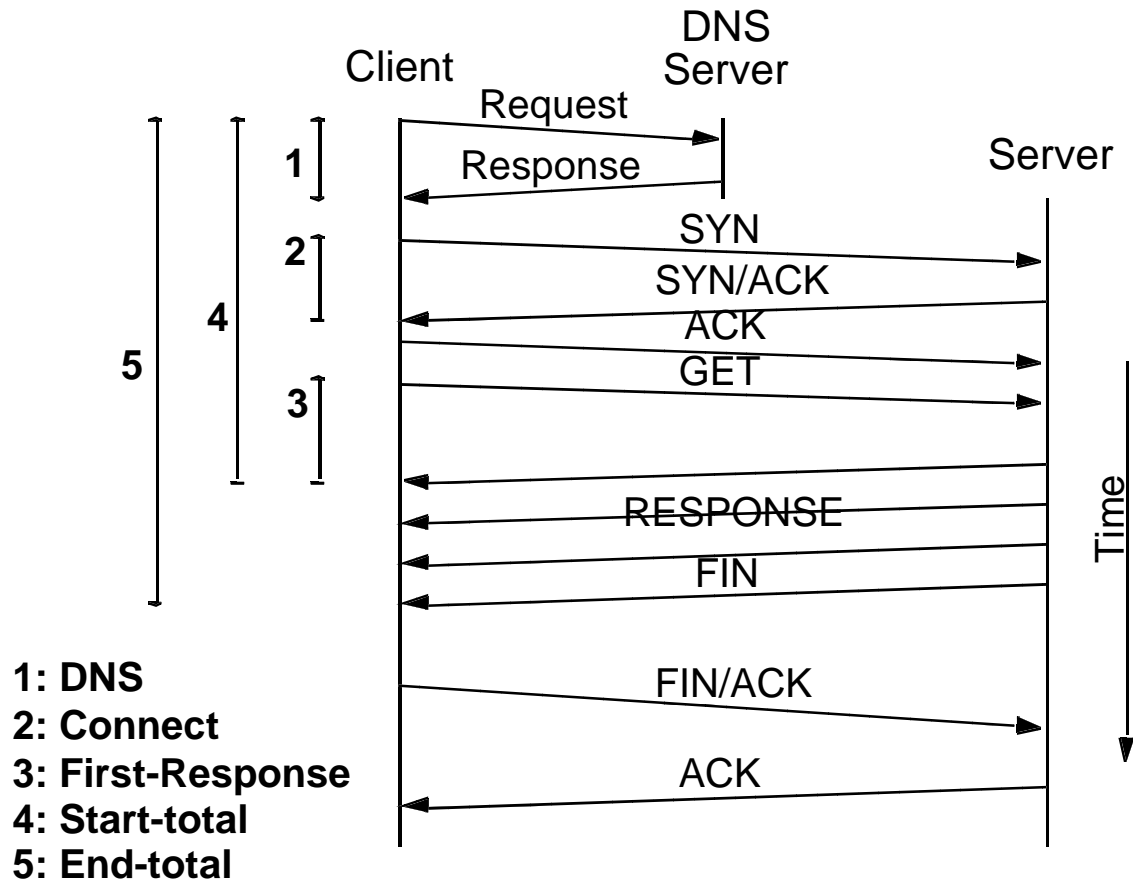
- DNS request is a large part of web transaction
- DNS request dominates as:
  - Bandwidth increases
  - Persistent connections reduce overhead
  - Latency increases

A = Connection Goodput  
B = Connection Establishment  
C = DNS Requests  
A + B + C = Total Connection Time

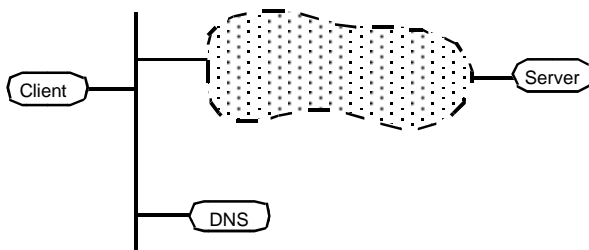
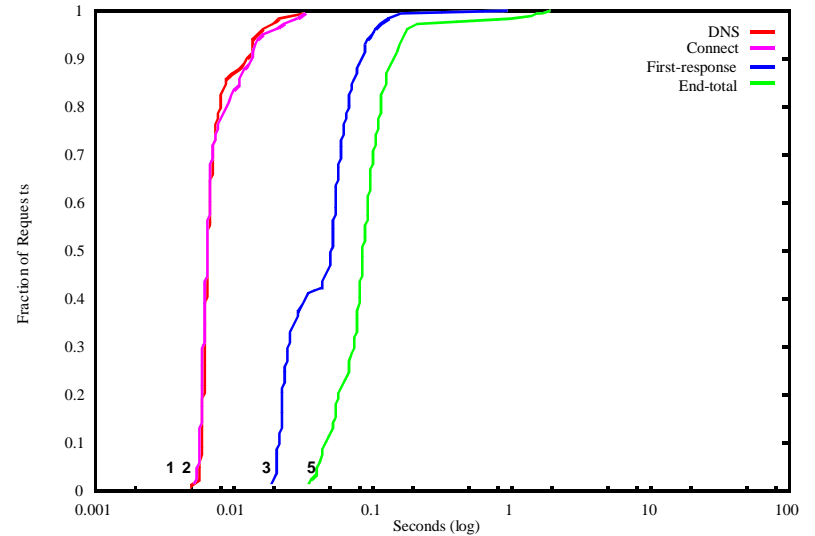
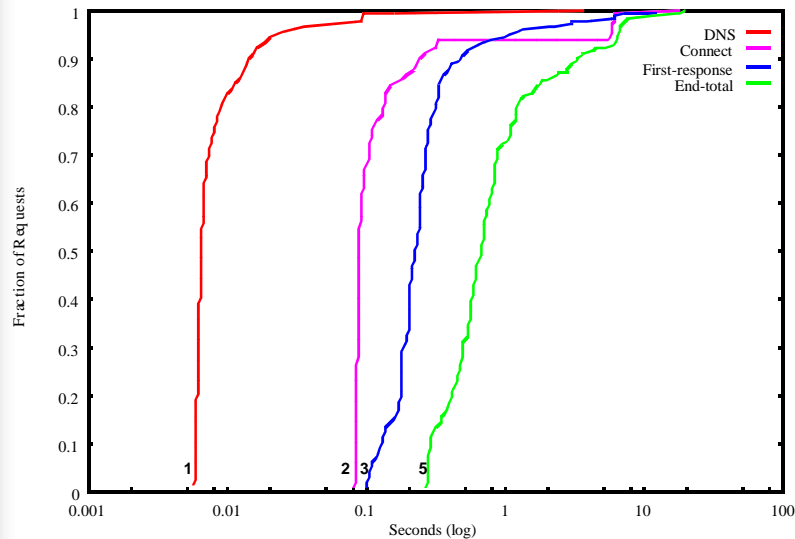
$$\frac{C}{A + B + C} < \frac{C}{A + B + C}$$

- DNS is multiple RTTs

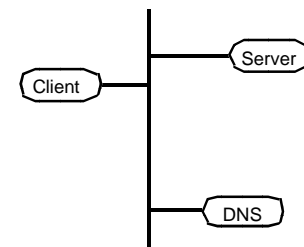
# Web Connection Components



# DNS overhead with low latency

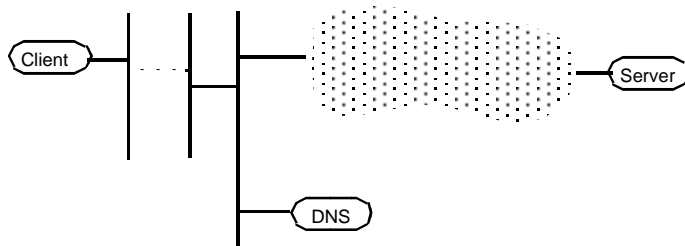
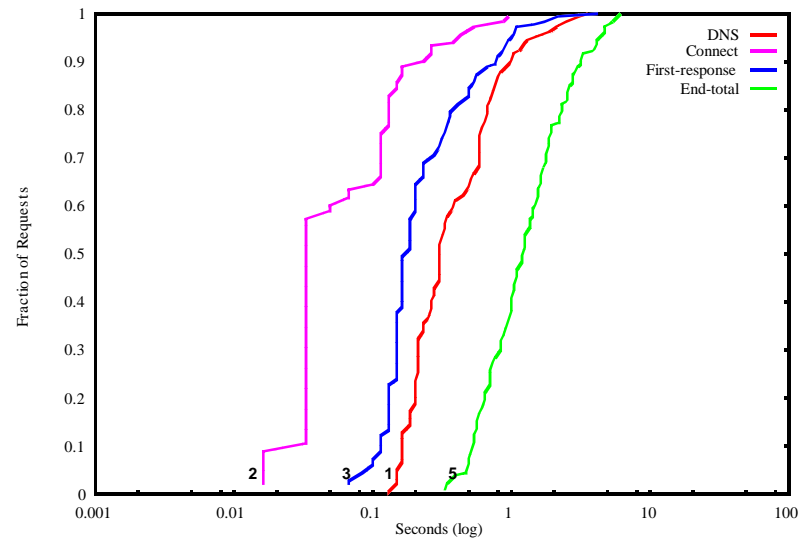
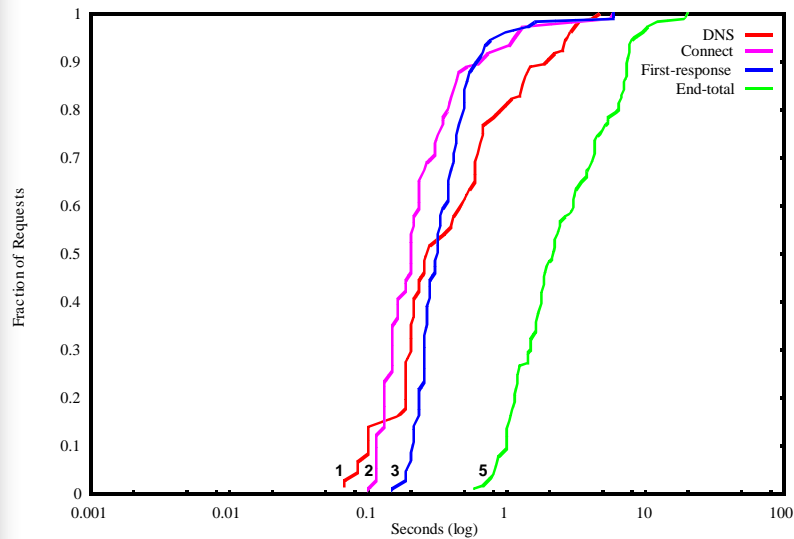


LAN/remote requests

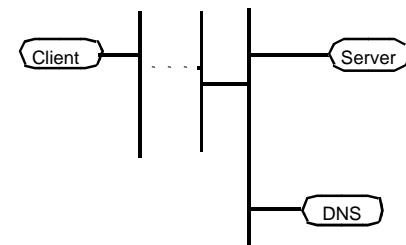


LAN/local requests

# DNS overhead with high latency



ISDN/remote requests



ISDN/local requests



# DNS Reuse and Costs

- Squid logs: 10-15% DNS misses
- 2MB cache upper bound



# Cache Anticipation

## ■ Web Cache

- Request stream related to item content
- Anticipation possible

## ■ DNS Cache

- No item relation to request stream
- No anticipation opportunity





# Web-DNS Cooperation

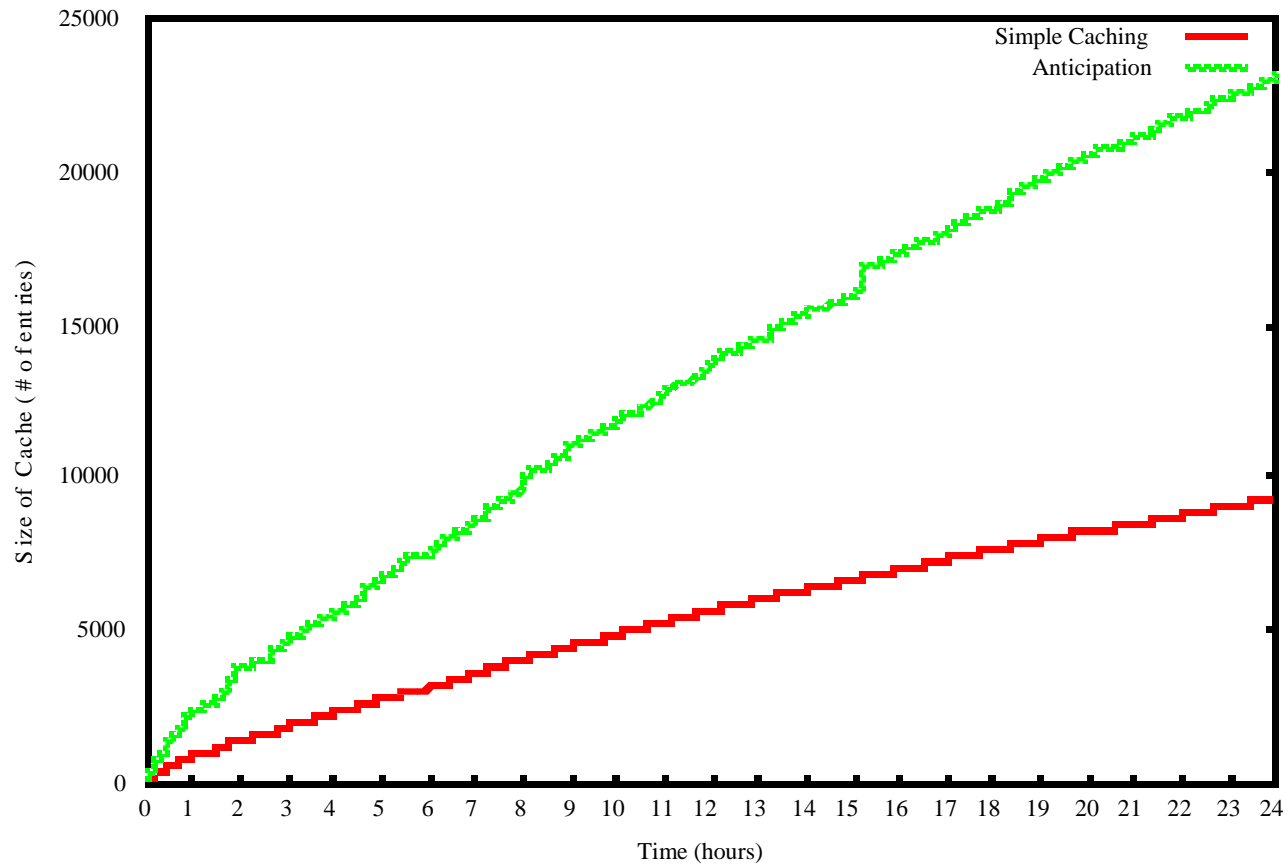
## ■ Opportunity

- Web request requires DNS information
- Cooperation possible

## ■ Solution

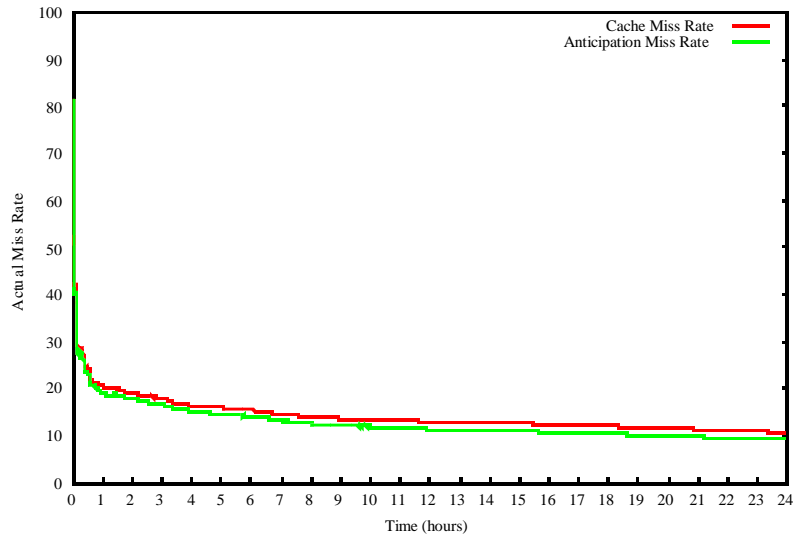
- DNS cache on local client
- Web lookahead to anticipate DNS requests

# DNS Anticipated Cache Size

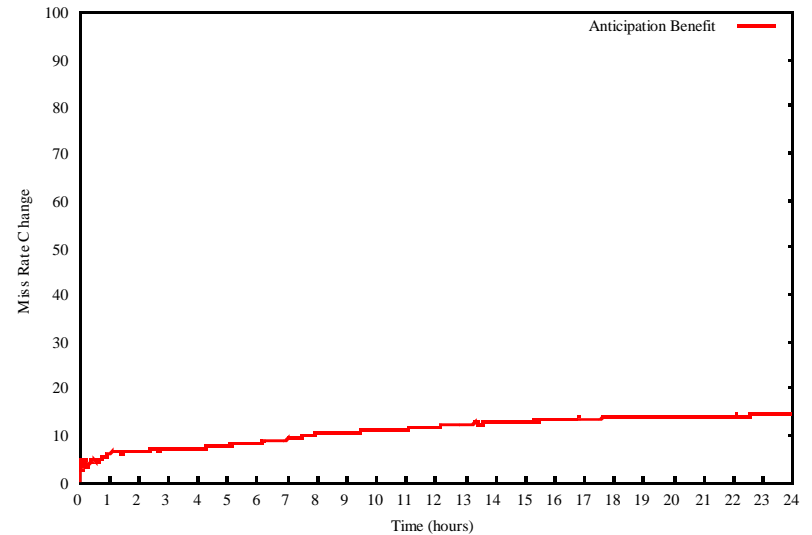


DNS Cache Size / Time

# DNS Misses and Reduction

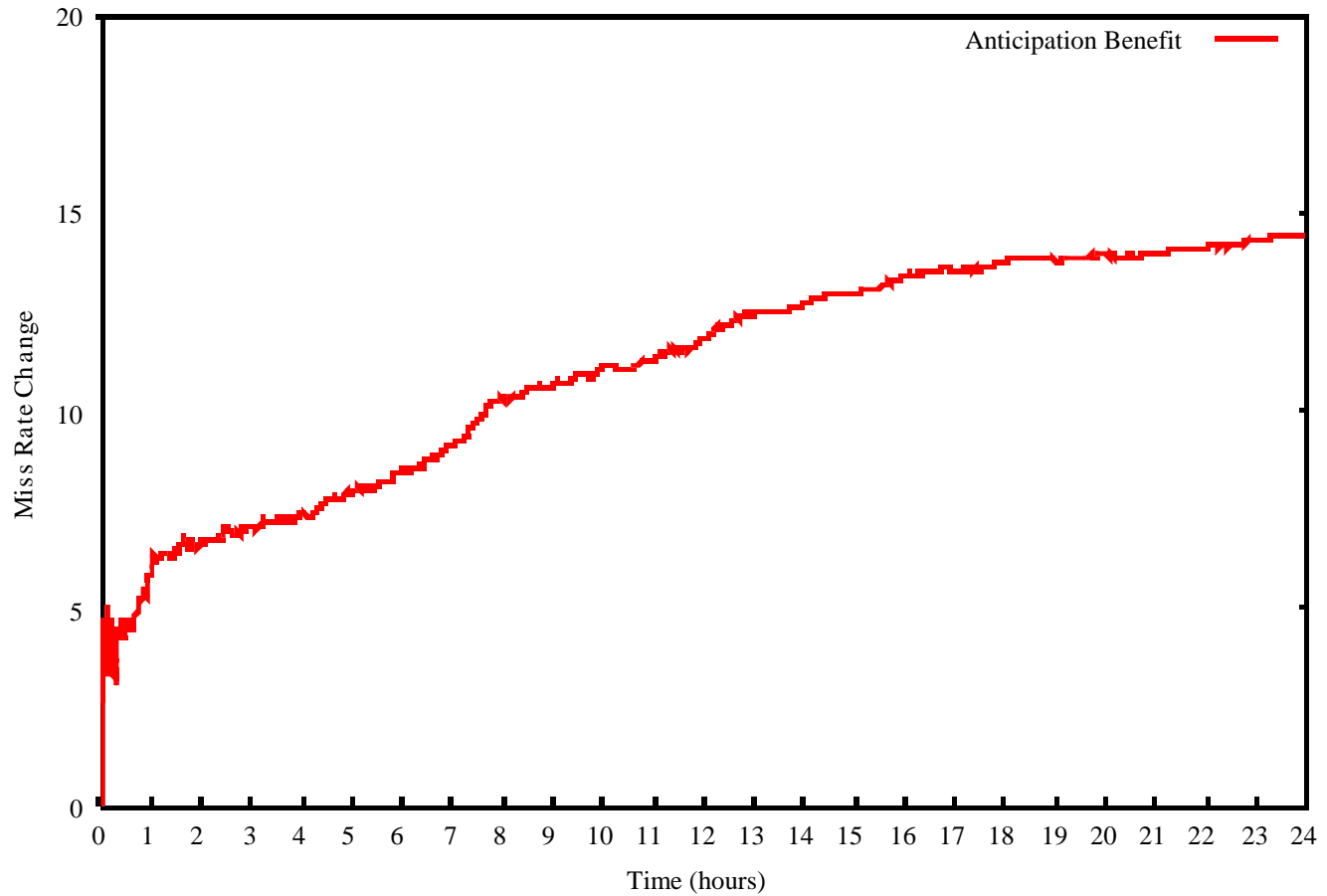


DNS Miss Rate



Miss Rate Change

# DNS Miss Reduction



Magnification of MISS Rate Change



# Prior and Related Work

- Web Log Analysis
- Web Anticipation
- Web Cooperation
  - Squid
  - LSAM
  - Adaptive Web Caching



# Conclusions

- DNS caches must be local on client machines to be useful
  - 90% benefit
  - esp on ISDN connections
- DNS-Web cooperation needs more exploration
  - 15% reduced misses
  - 3x space increase (<6MB total)



# Future Work

- **Analyze real-time client traces**
  - Squid logs wrong place in cache hierarchy
  - Real-time tracing allows examination of time components
- **Define DNS hits and misses**
  - Some DNS misses are partial hits due to multiple RTTs
- **Implementation of Cross-Domain system**
  - Measure real benefits
  - Examine DNS aggregation