

# Improving Content Delivery Using Provider-aided Distance Information

Ingmar Poesse Benjamin Frank Bernhard Ager  
Georgios Smaragdakis Anja Feldmann

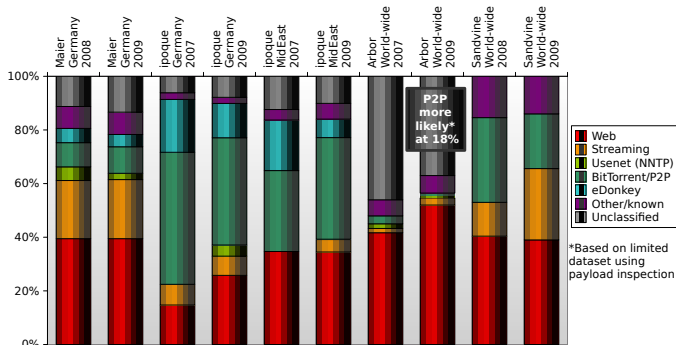
{ingmar|bfrank|bernhard|georgios|anja}  
@net.t-labs.tu-berlin.de

Technische Universität Berlin/Deutsche Telekom Laboratories

November 1 2010

- 1 Background
- 2 Diversity in cache locations
- 3 Leveraging diversity with PaDIS
- 4 Evaluation

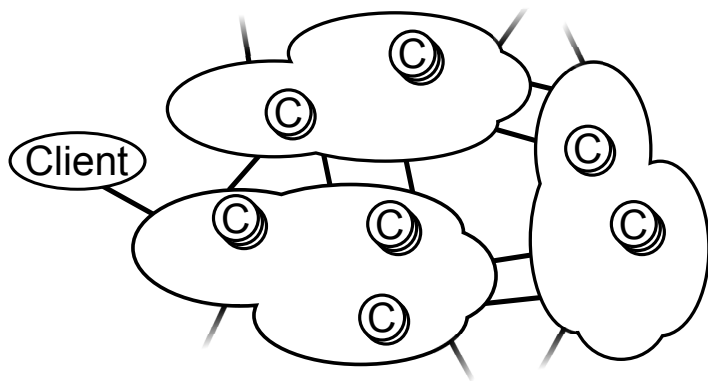
# Content is King



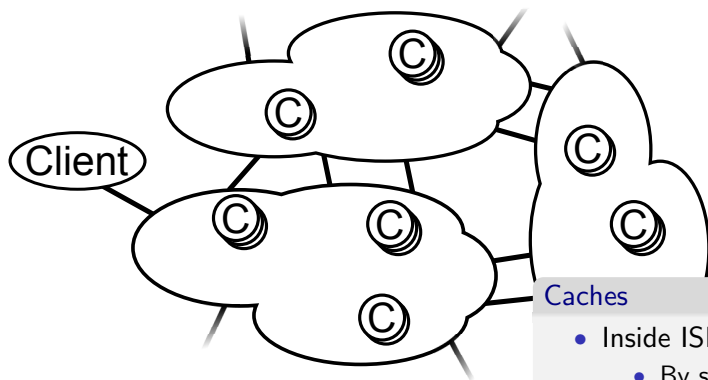
Fabian Schneider: Analysis of New Trends in the Web from a Network Perspective, 2010

- Web and streaming are dominating Internet traffic
  - both run over HTTP
- Contribute up to 60% of the volume

# CDN deployment



# CDN deployment



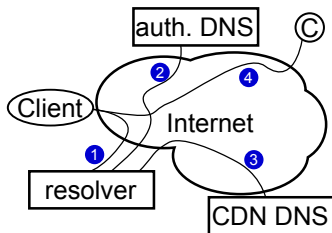
## Caches

- Inside ISPs
  - By subnet
  - By location
- Assignment via DNS
  - By DNS redirection

# CDN cache selection

## DNS based cache selection

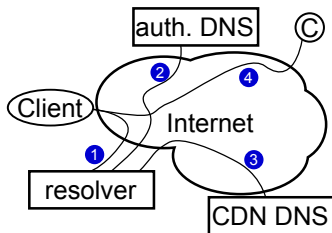
- 1 Client queries resolver
- 2 Redirect to CDN
- 3 CDN chooses cache(s)
  - Return via resolver
- 4 Connect to cache



# CDN cache selection

## DNS based cache selection

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## Known metrics

- Cache load
- Content availability

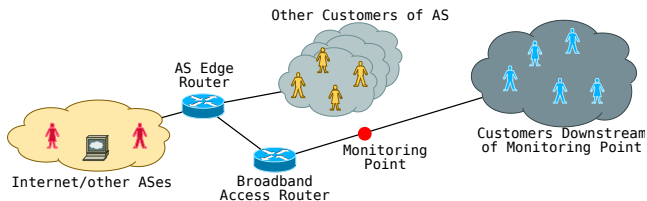
## Unknown metrics

- Exact position
- Path properties

- ① Background
- ② Diversity in cache locations
- ③ Leveraging diversity with PaDIS
- ④ Evaluation



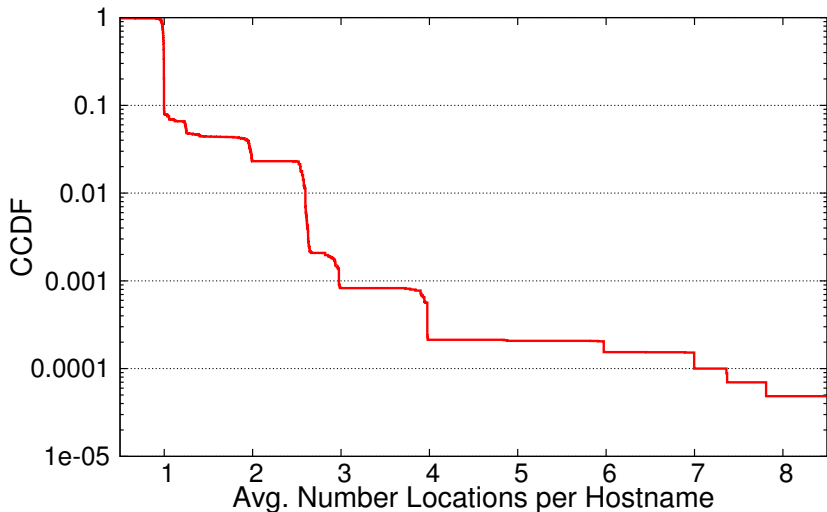
# Data



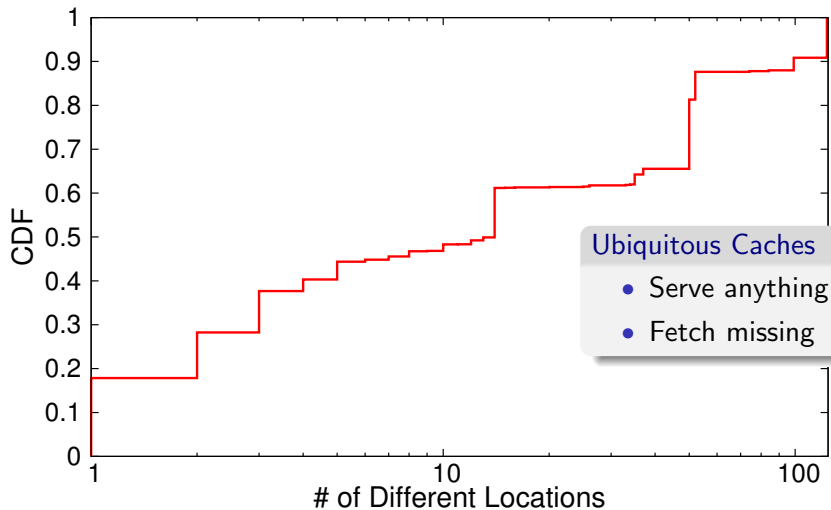
## Click stream data

- Anonymized trace from a POP in a large European ISP.
- Trace spans over 20.000 customers and 14 days
  - total of 1.2 billion requests (89 million/day)
- Examine top 10,000 hostnames
  - Exposed location diversity
  - Potential for content delivery

# Location diversity per hostname



# Location diversity per content provider



# Opportunities for ISPs

## Current situation

- CDNs do not expose location diversity
    - Cache selection without accurate client position
    - Unknown path properties to content consumer
- ⇒ Can content delivery be improved with location diversity ?

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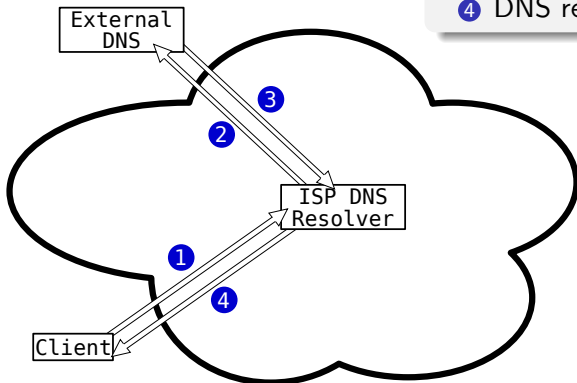
## Provider-aided Distance Information System (PaDIS)

- PaDIS can utilize the diversity in paths to locations
  - Improves application performance and Quality of experience
    - Reduce page load delay
    - Reduce download time for large files
  - Removes the need for in-accurate active measurement
  - ISPs gain influence on the path selection to locations

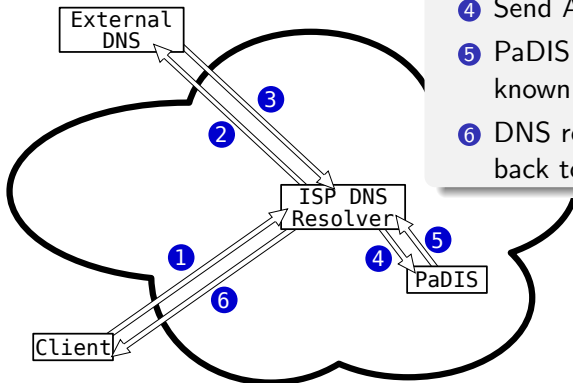
# Status Quo

## Steps

- 1 DNS Query
- 2 Find auth. DNS server
- 3 Receive auth. DNS answer
- 4 DNS resolver forwards reply



# PaDIS usage example



## Steps

- 1 DNS Query
- 2 Find auth. DNS server
- 3 Receive auth. DNS answer
- 4 Send Answer to PaDIS
- 5 PaDIS aggregates and reorders known IPs
- 6 DNS resolver sends top ranked IPs back to client

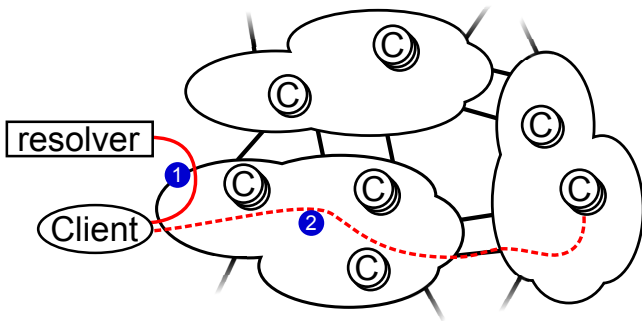
# PaDIS usage example

## PaDIS Properties

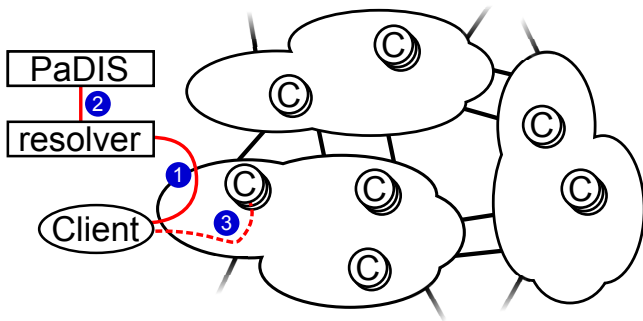
- Operated by the ISP
- Up-to-date network information
- Knowledge of CDN caches
- No architecture change needed
- Transparent to consumer and CDN



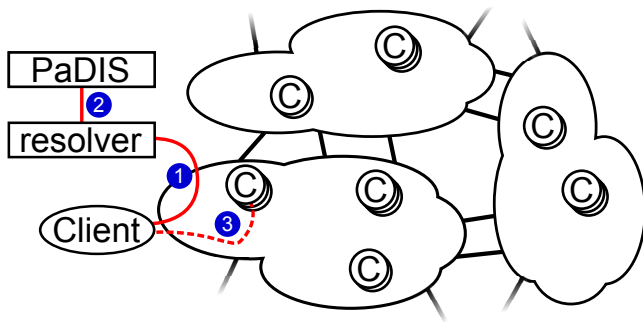
# Experiment setup for CDN



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## Statistics

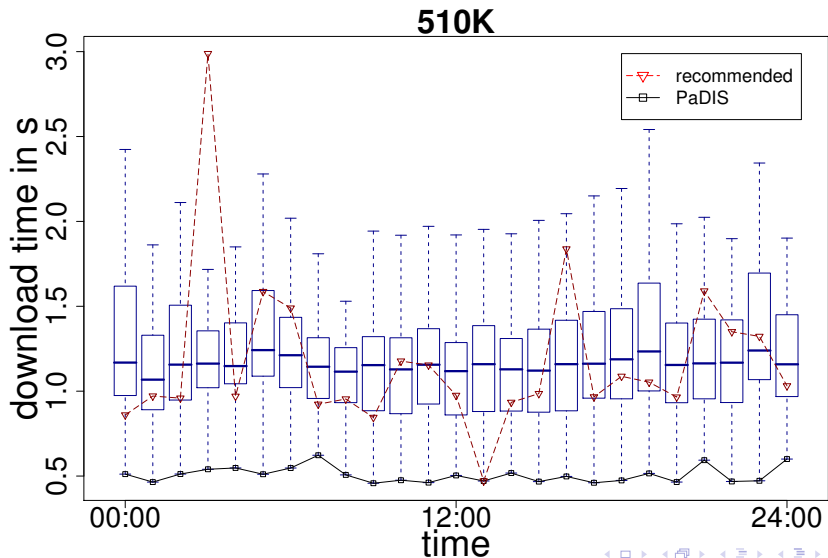
- 124 locations
- 11 files

## Algorithm

- Download file from all locations
- Compare CDN selection with PaDIS

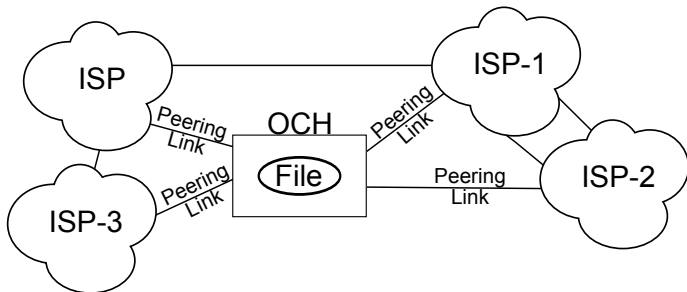
# Selected result for CDN

Downloading a 510K file from 124 locations every hour



# Expanding the scope

Using PaDIS on a One-Click-Hoster (OCH)

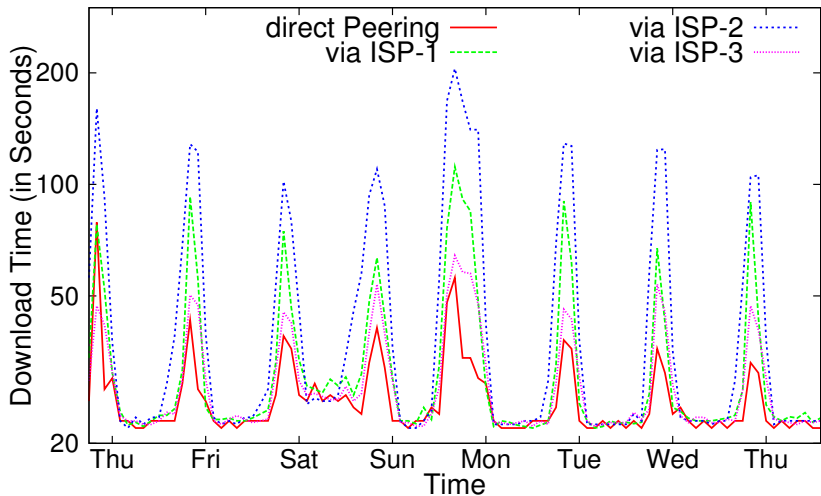


## Repeat experiment setup with an OCH

- Select peering link instead of cache location
  - Repeatedly download a (60 Mbyte) File via all peerings
  - Evaluate link selection
  - Compare download times

# Download time Evaluation

Downloading a 60MByte file every two hours via all peering links



# Summary

## Summary

- CDNs do not expose location diversity consumers
- PaDIS can expose and utilize the diversity
  - Localize traffic
  - Decrease delay and download times
  - Give power back to the ISP
- The experiments (CDN + OCH) show a significant reduction in download time

## Future work

- Quantify traffic reduction for ISPs when using PaDIS
- Can PaDIS be used for traffic engineering by ISPs ?