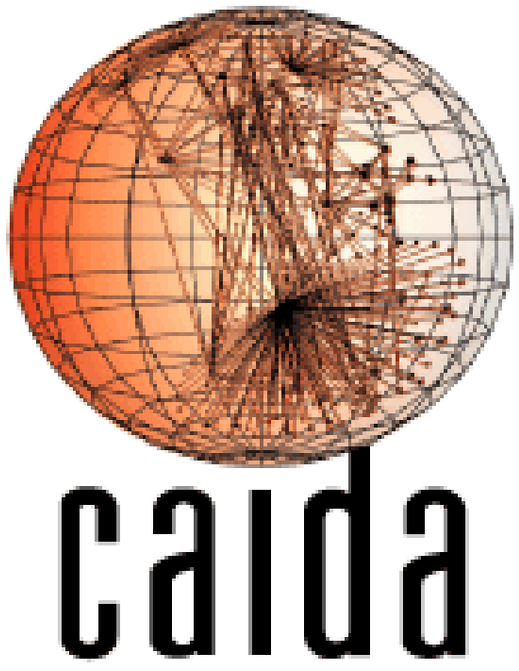

Two days in the life of three DNS root servers

cooperative association for internet data analysis

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3 November 2006

DNS anycast analysis

Using tcpdump from three roots we examined the geographic and toplogical clustering of DNS clients.

Data collected by OARC ISC with COGENT and RIPE NCC.

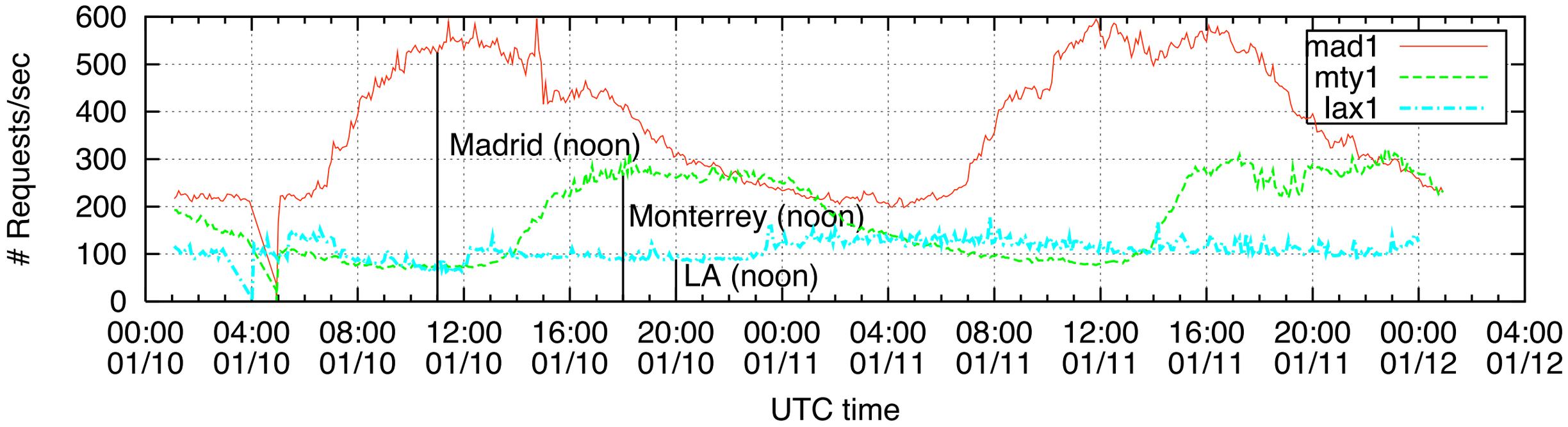
Outline

- data source
- analysis
  - diurnal patterns
  - num. of requests/addresses per instance
  - geographic reltionships / distances
  - coverage topological / geographic
- visualization
  - Influence Map

Data Source

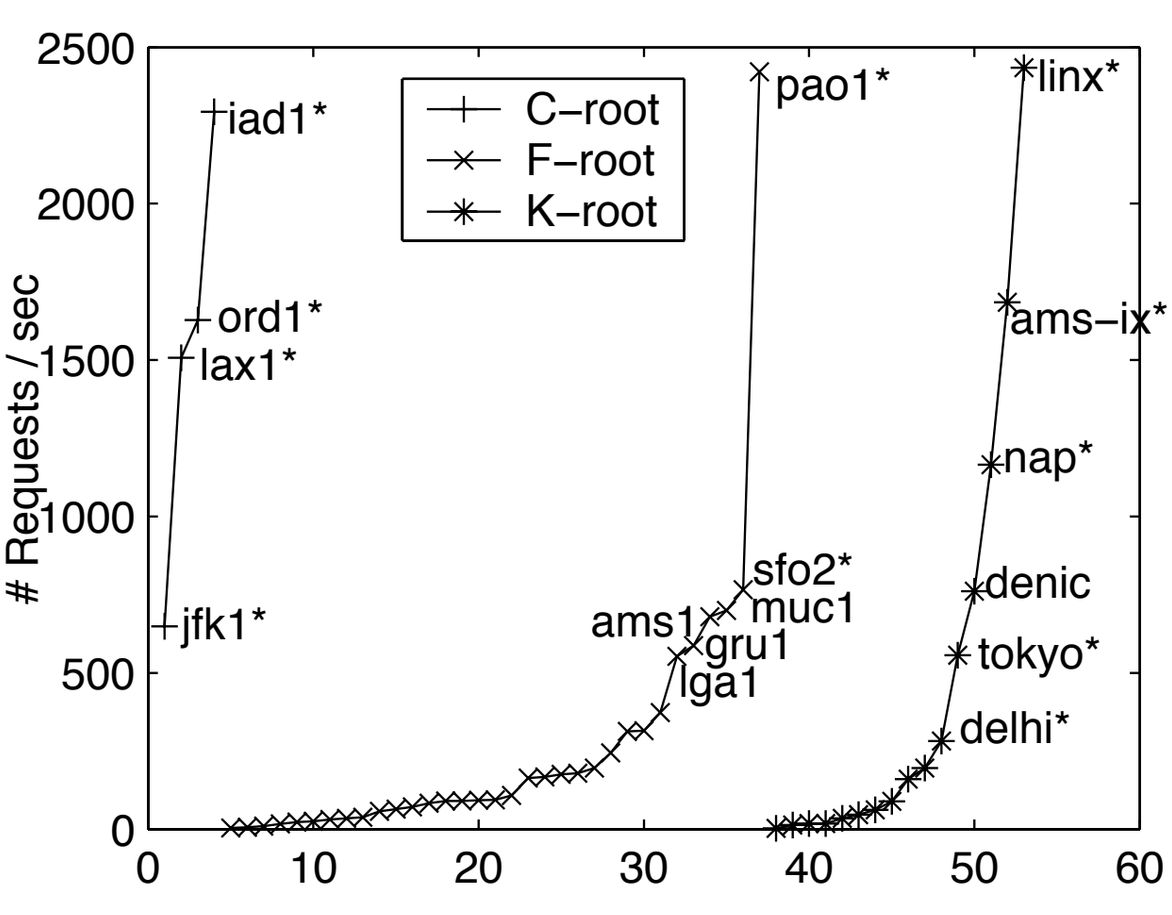
- dates
  - January 10th-11th 2006 (47 hours)
- DNS sources
  - c-root (Cogent) 4 out of 7 instances
  - f-root (ISC) 61 out of 71 instances
  - k-root (RIPE) 24 out of 31 instances
- geographic
  - Netacuity database used for geographic mapping
- topological
  - Route Views used for ASs and prefixes (January 10th)

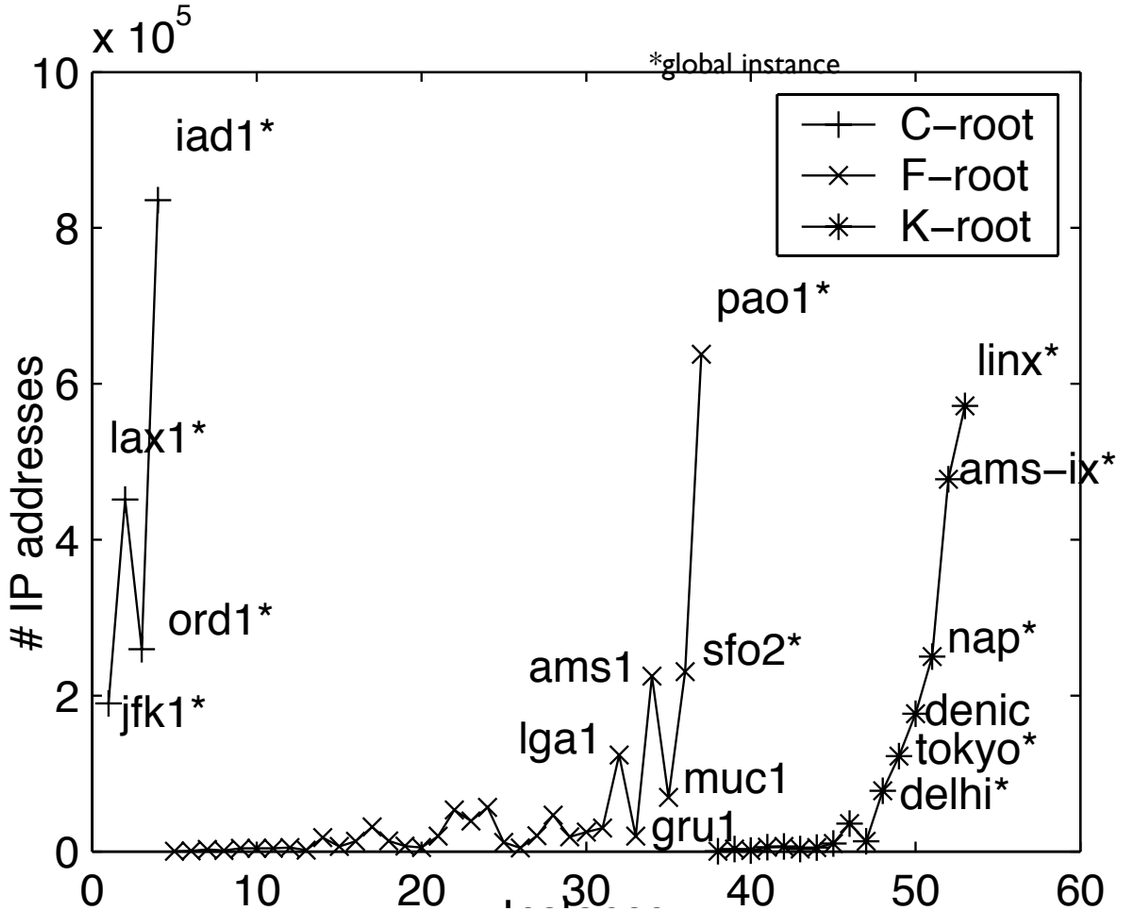
Diurnal Patterns



The local instances mad1 and mty1 show clear diurnal patterns, while lax1, a global instance, does not.

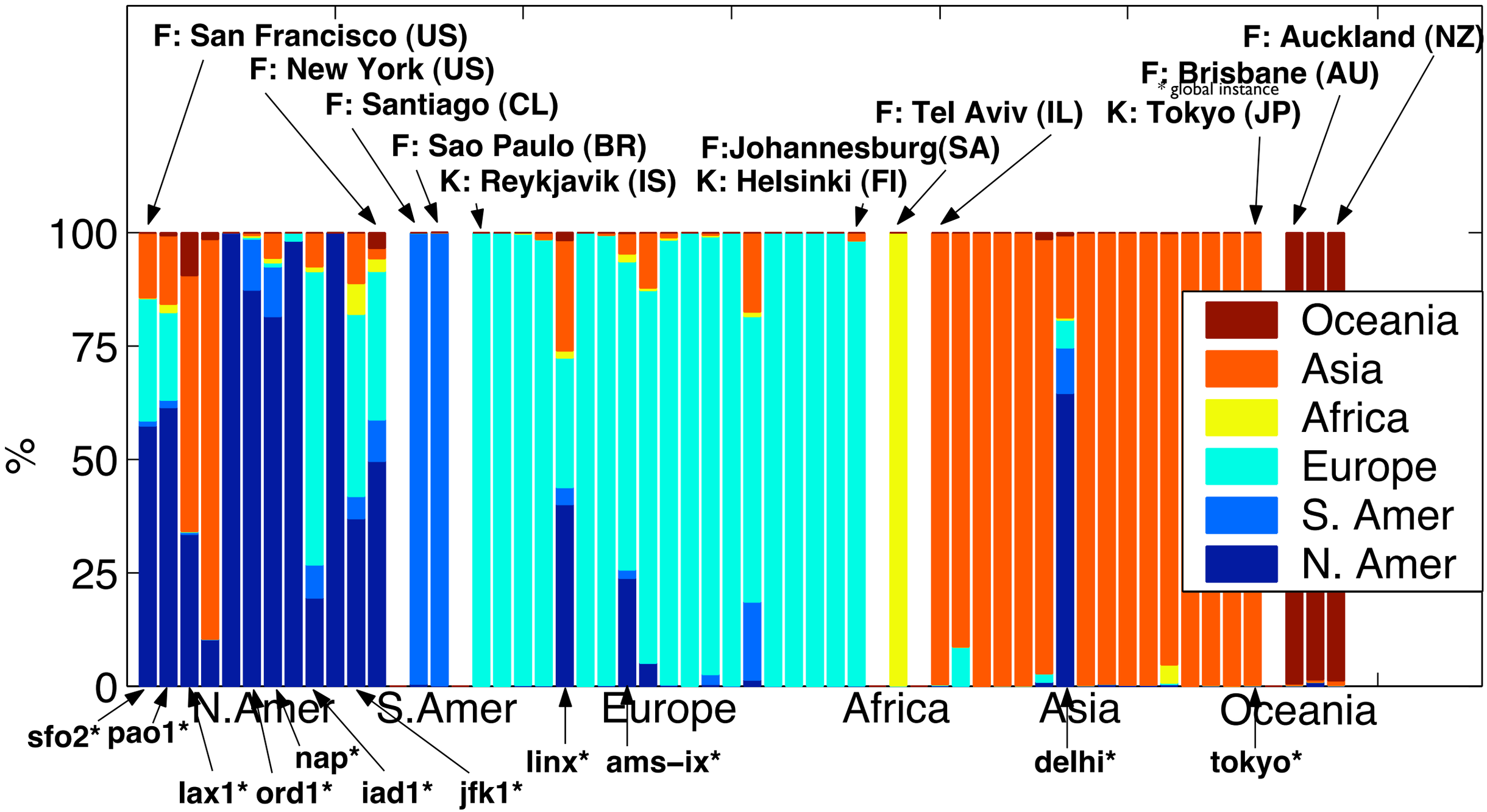
Num. of Requests/Addresses



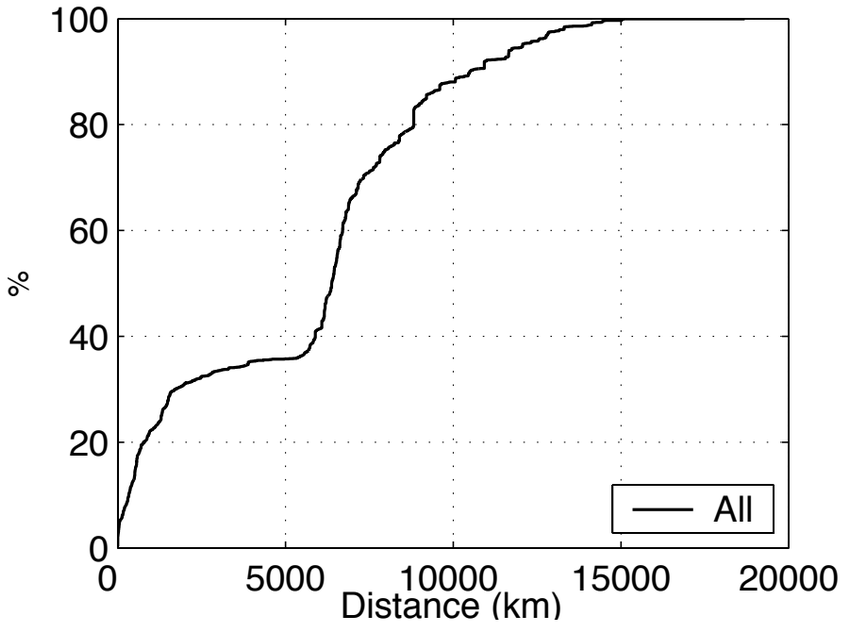


Instances sorted by the number of requests per second.

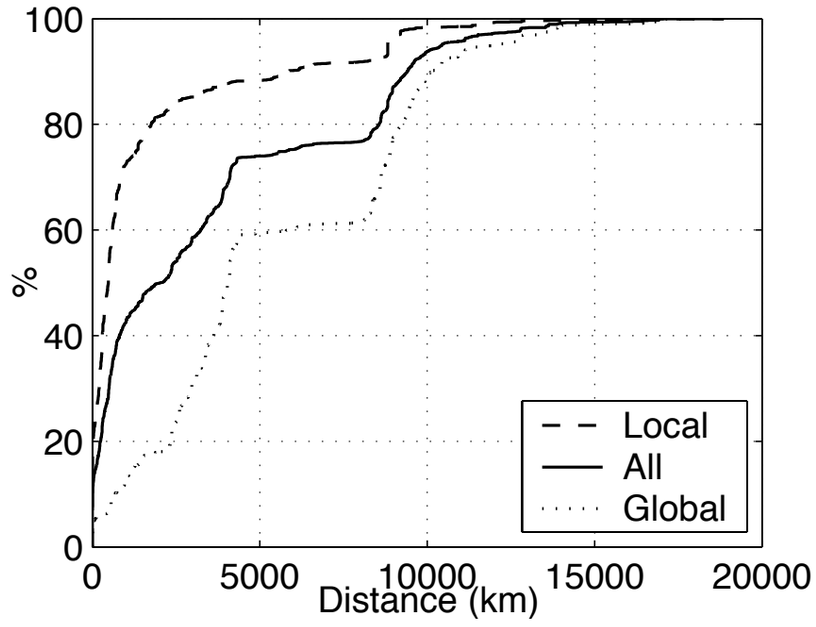
Client Geographic locations



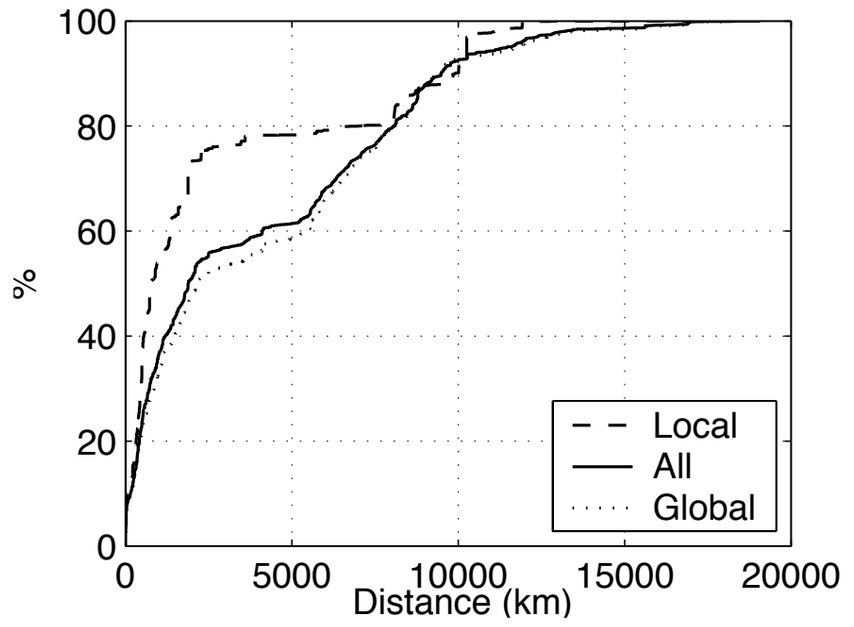
CDF of distance from instance to client



c-root



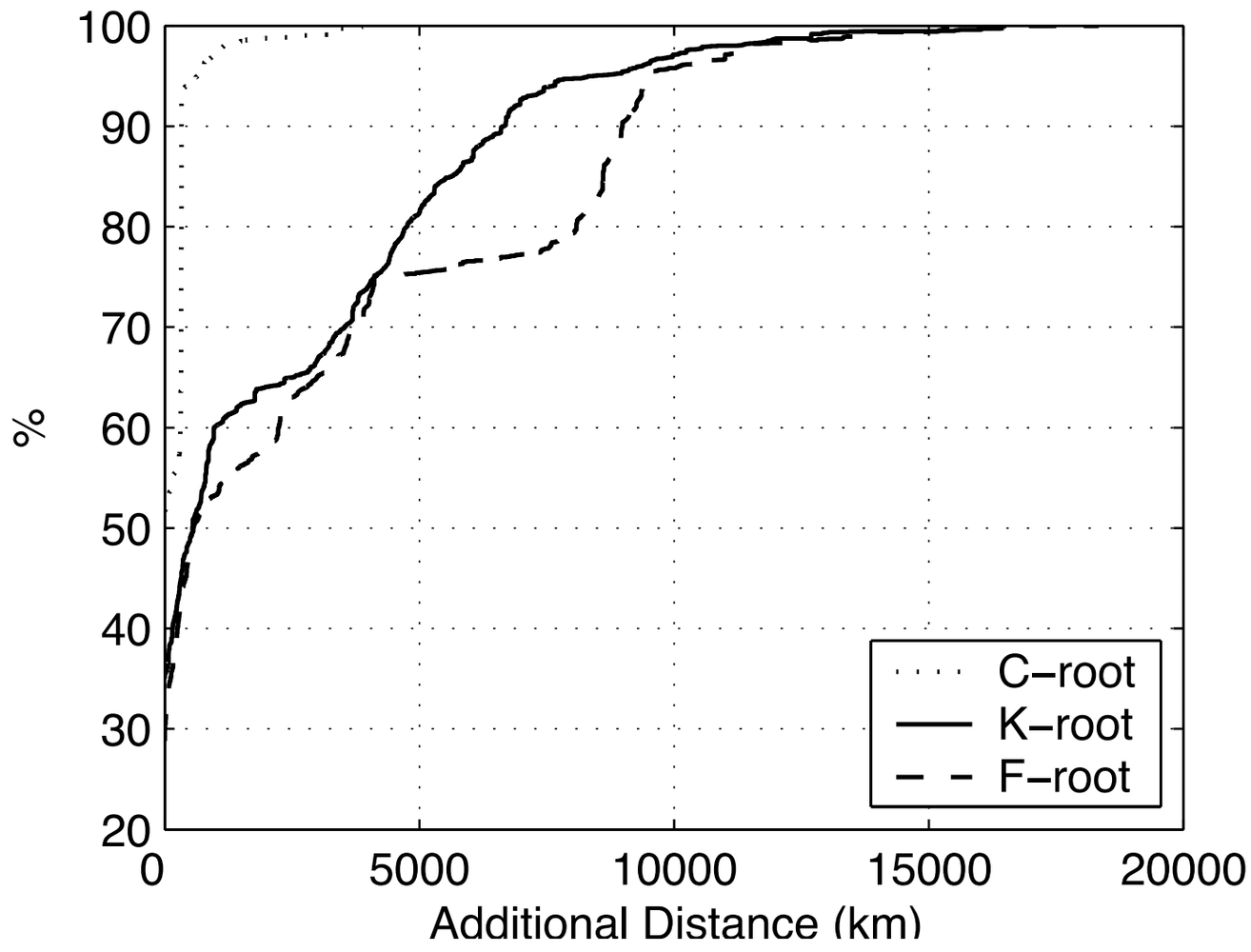
f-root



k-root

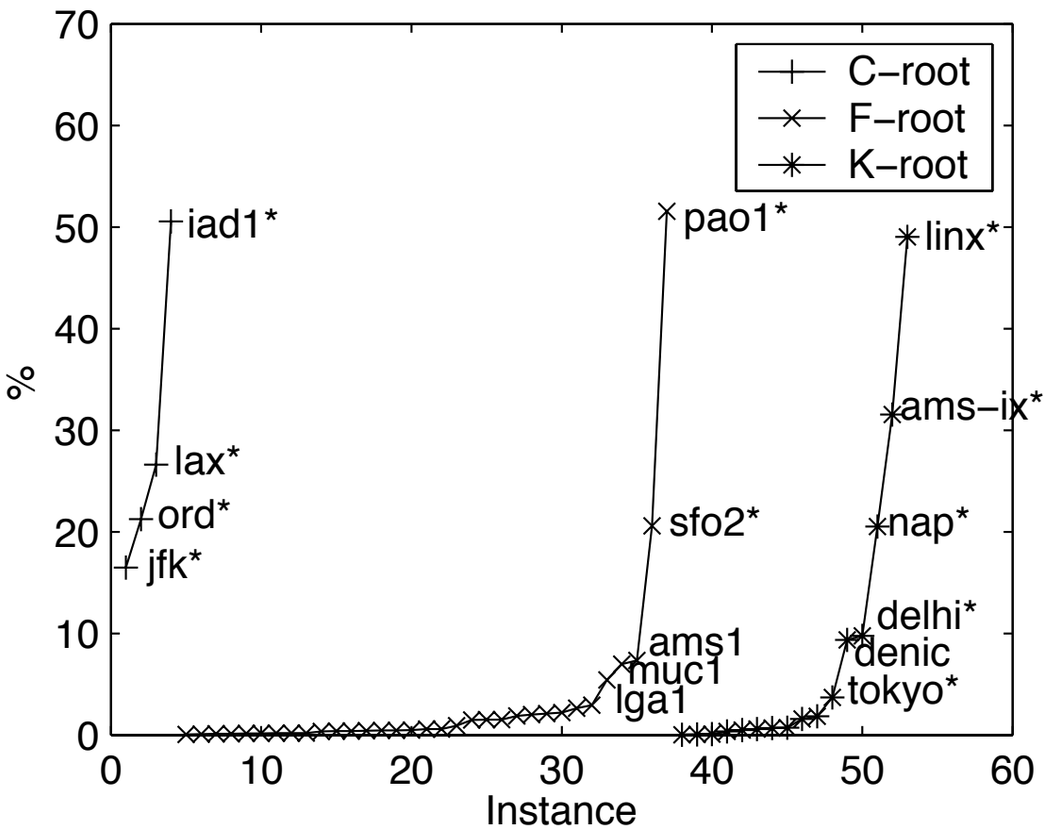
Inflection points between 5000 and 7000 km are the result of clients clustering on continents.

CDF of additional distance from optimal

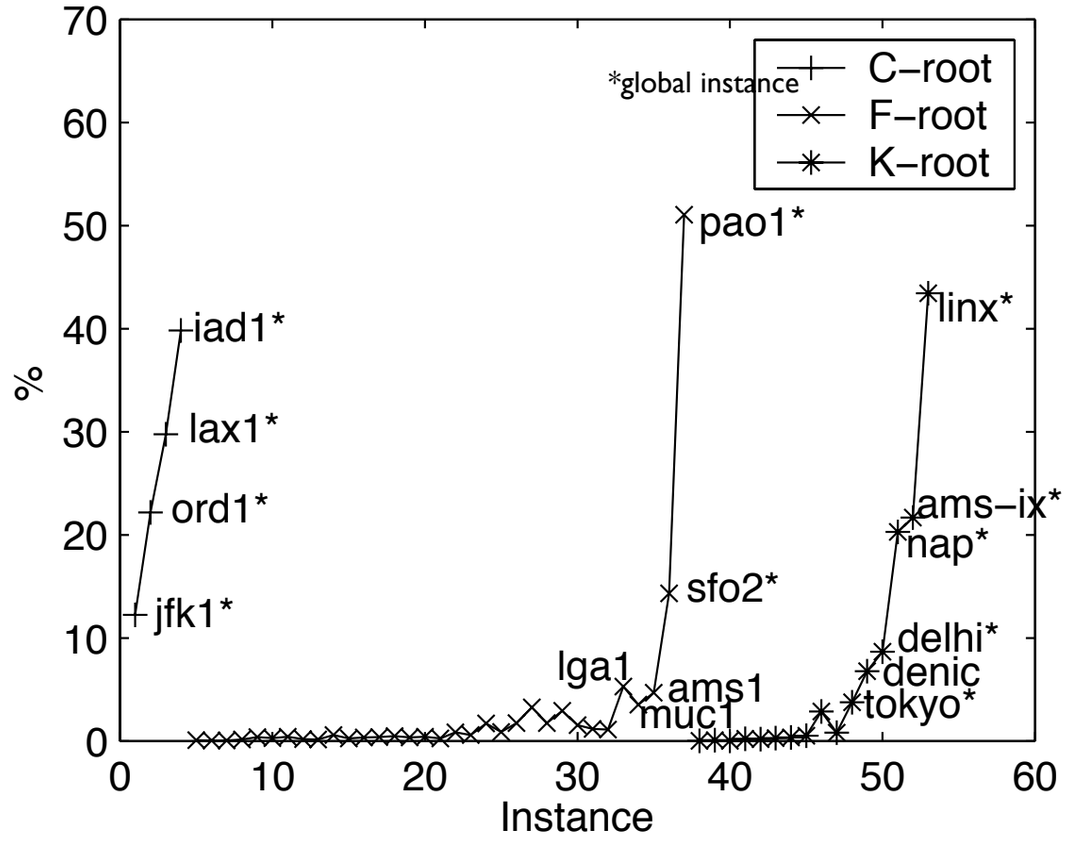


The additional distance a client's requests were routed from its geographically closest router.

Topological Coverage



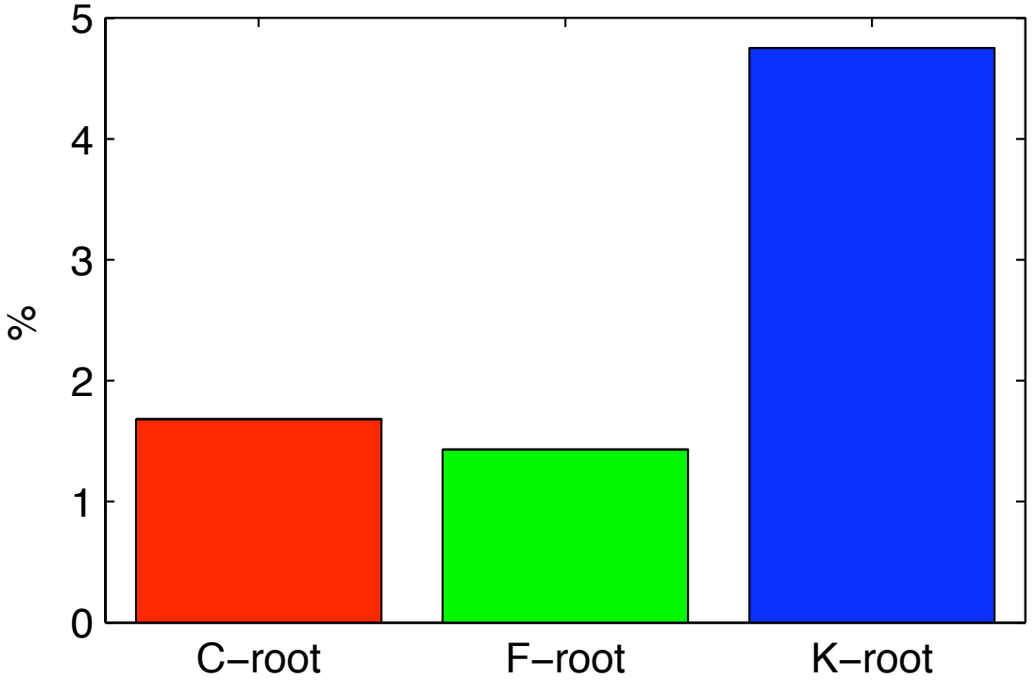
AS coverage



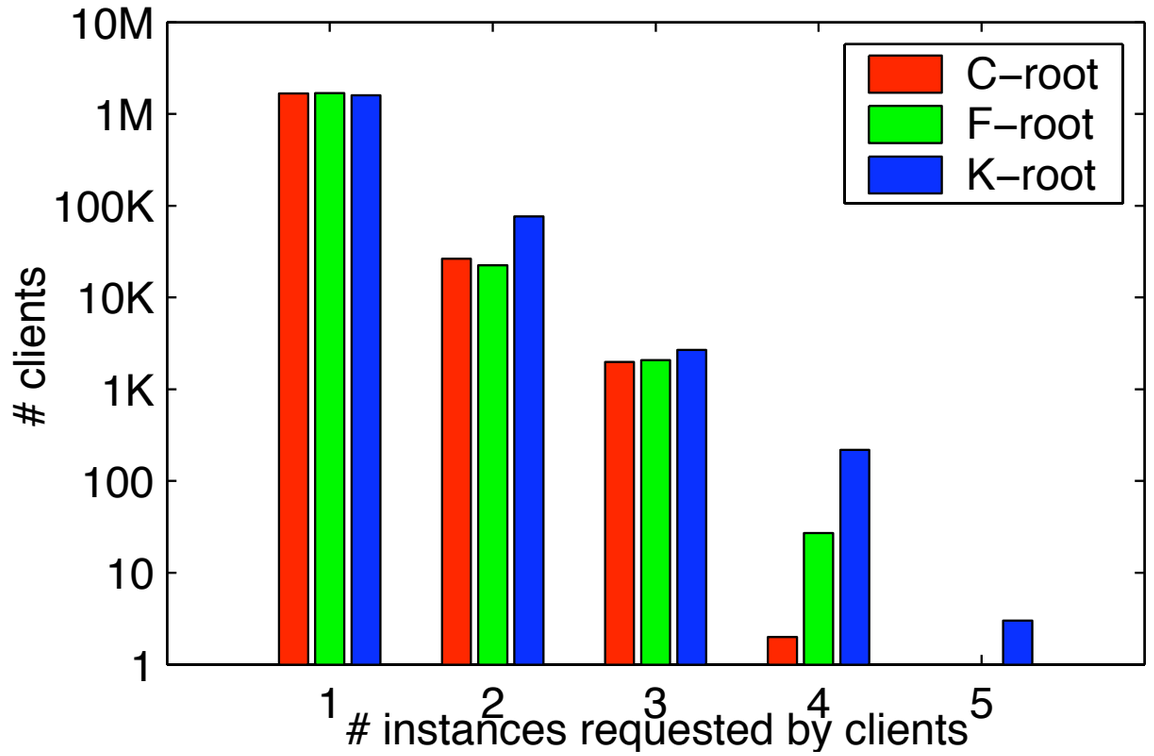
prefix coverage

Instances sorted by AS coverage.

Client Stability



the percentage of clients seen by multiple servers



the number of instances queried by clients

Influence Map Breakdown

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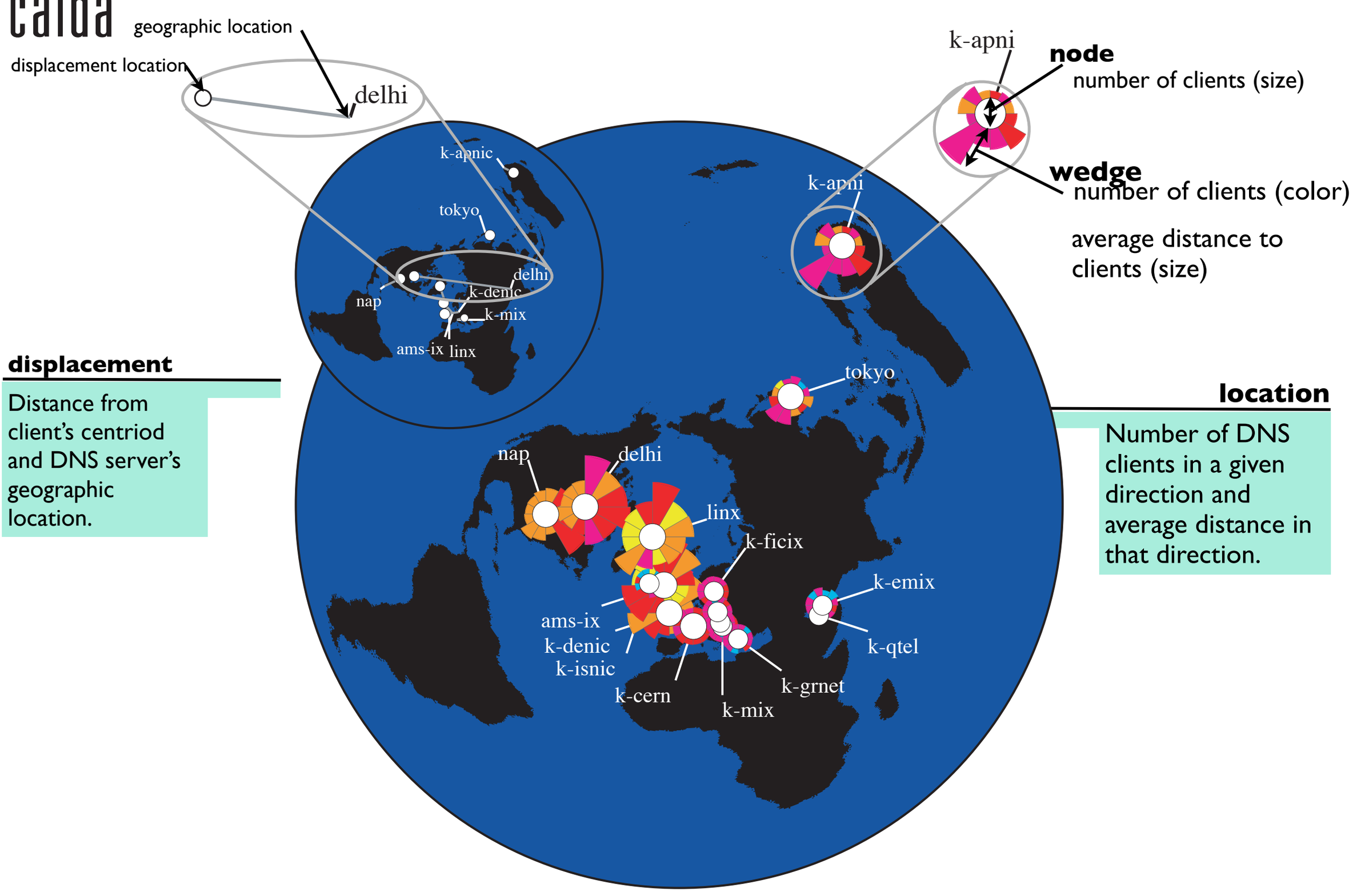

displacement

Distance from client's centriod and DNS server's geographic location.

location

Number of DNS clients in a given direction and average distance in that direction.

Influence Maps

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f-root

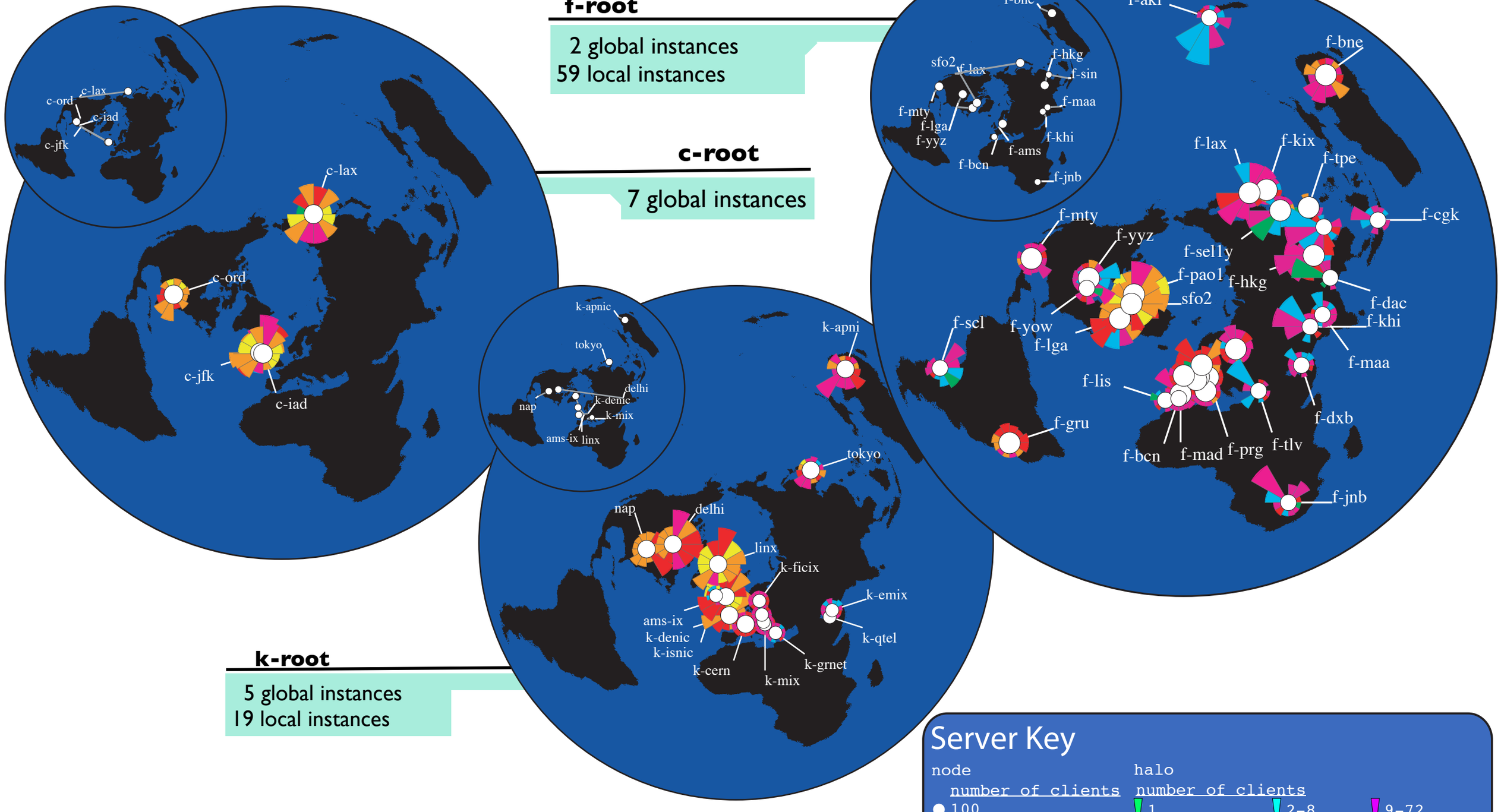
2 global instances
59 local instances

c-root

7 global instances

k-root

5 global instances
19 local instances



Server Key

node
number of clients
100
10,000
1,000,000

halo
number of clients
1
2-8
9-72
73-619
620-5289
5290-45117
45118-384790

conclusion

- Geographic clustering of clients to local instances is high.
  - 60% of clients experience small distance penalties between selected and optimal instances
  - local instances have strong diurnal patterns of use
- Small minority of clients experience a change in instance.
- ASes/IP addresses unevenly spread across instances, especially for f-root
- Propose second data colletion 9th-10th, January 2007