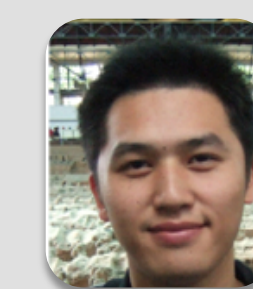




An Analysis of Facebook Photo Caching



Qi Huang



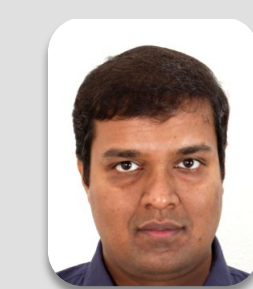
Ken Birman



Robbert van Renesse



Wyatt Lloyd



Sanjeev Kumar



Harry C. Li

Instrumented Stack

Deep and Distributed

1. 4 layers of cache and storage.
2. ~12M user IPs, ~20 Point-of-Presence, 4 Datacenters.

Browser (millions)

- 77.2M user reqs
- 65.5% hit ratio
- 65.5% reqs share

Edge (dozens)

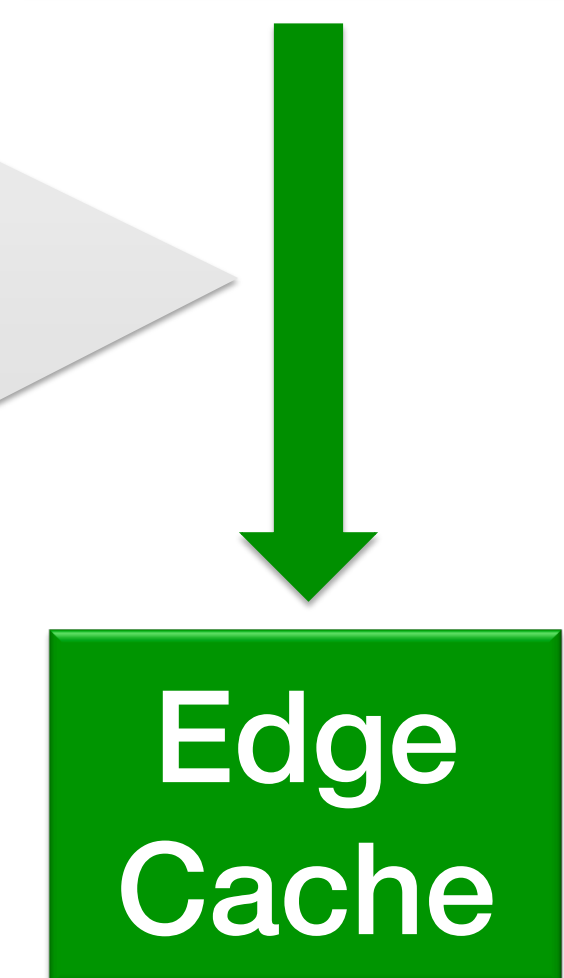
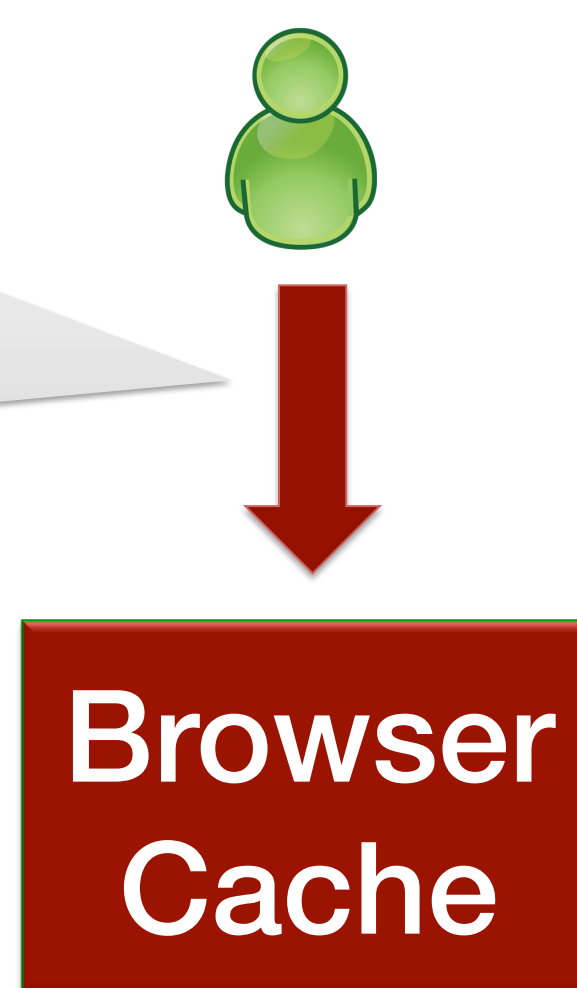
- 26.6M reqs
- 58% hit ratio
- 20% reqs share
- Routing factors:
 - Latency
 - Edge capacity
 - Peering cost

Origin (one)

- 11.2M reqs
- 31.8% hit ratio
- 4.6% reqs share
- Routed by consistent hashing

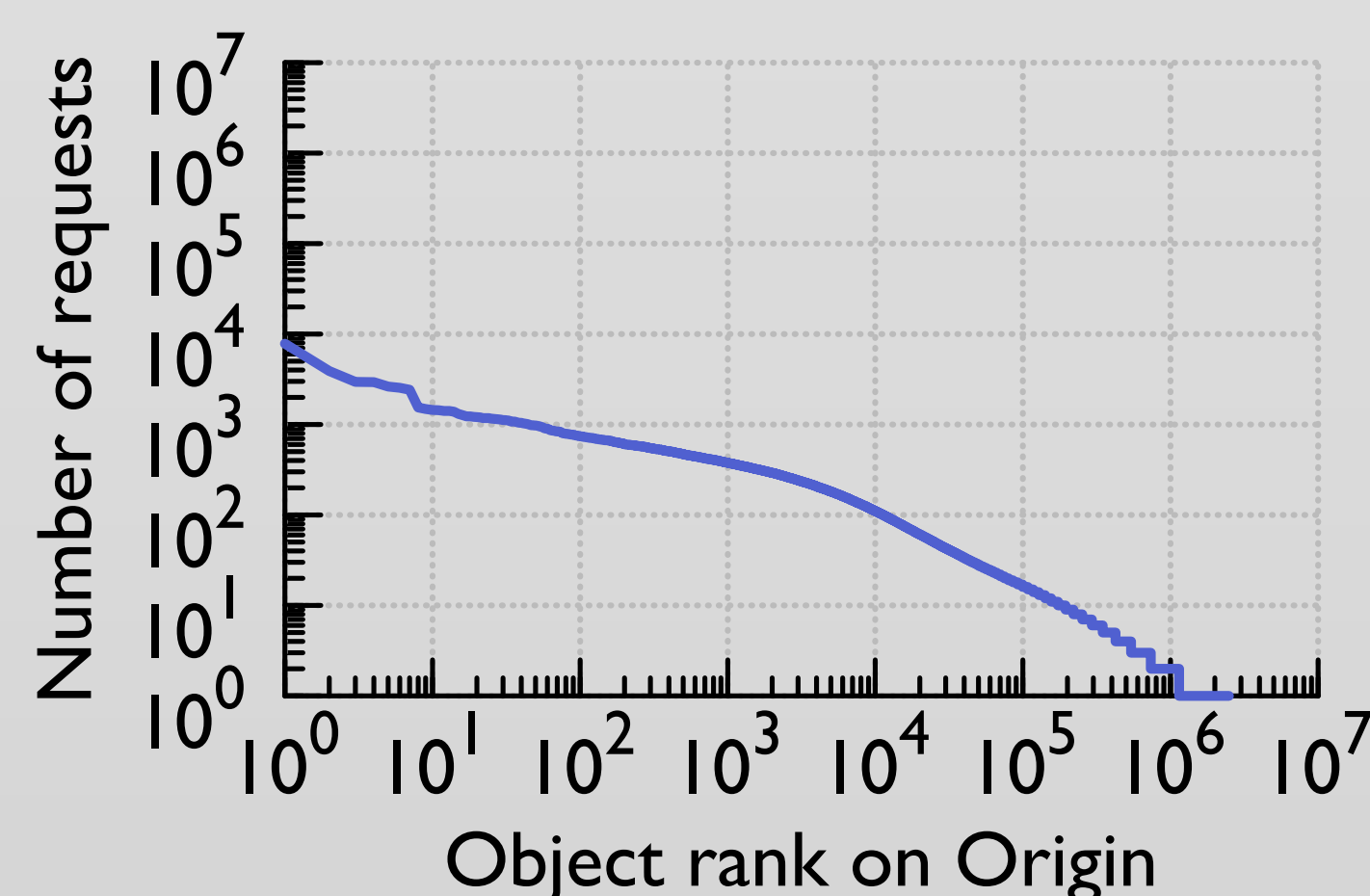
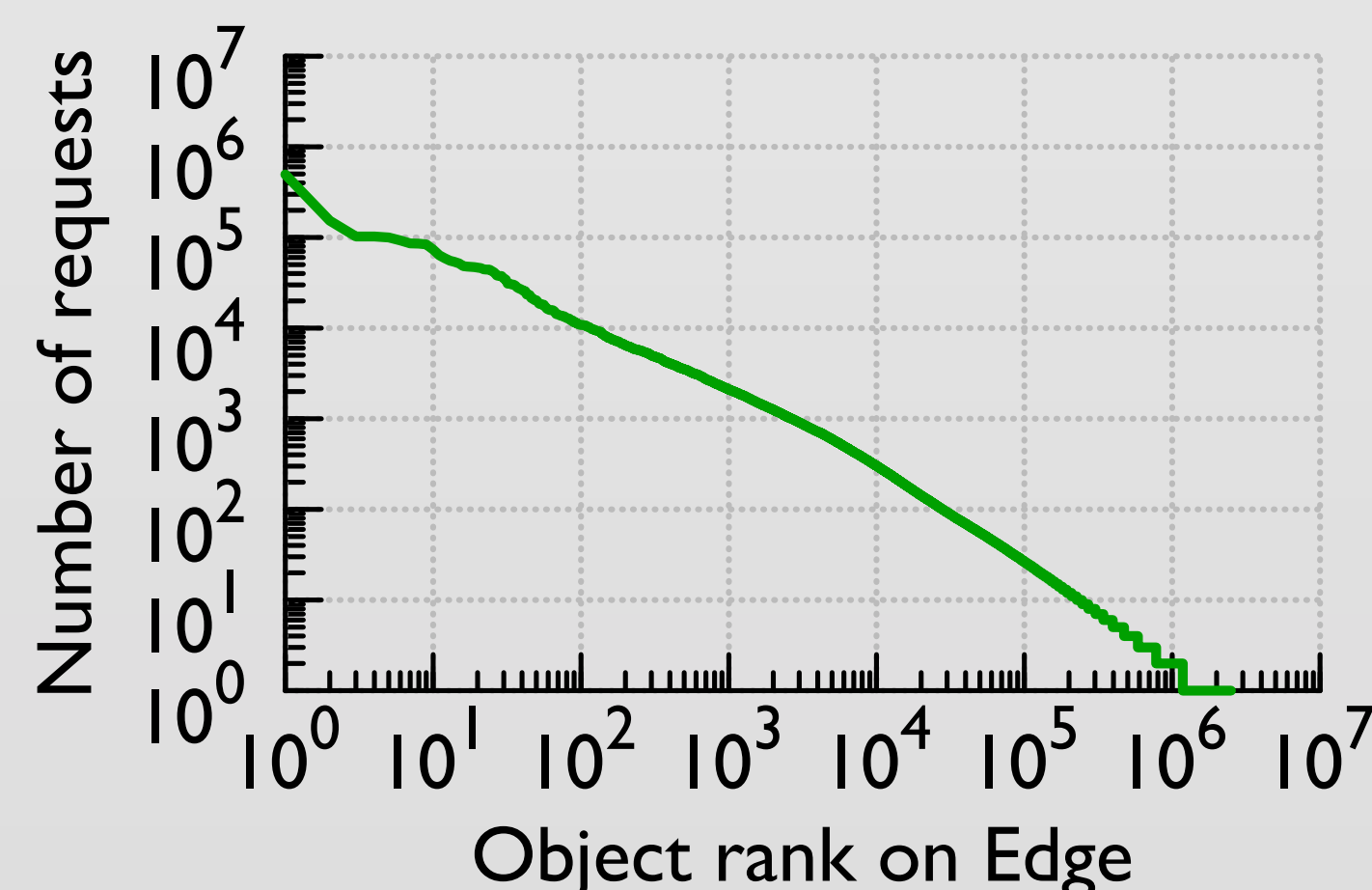
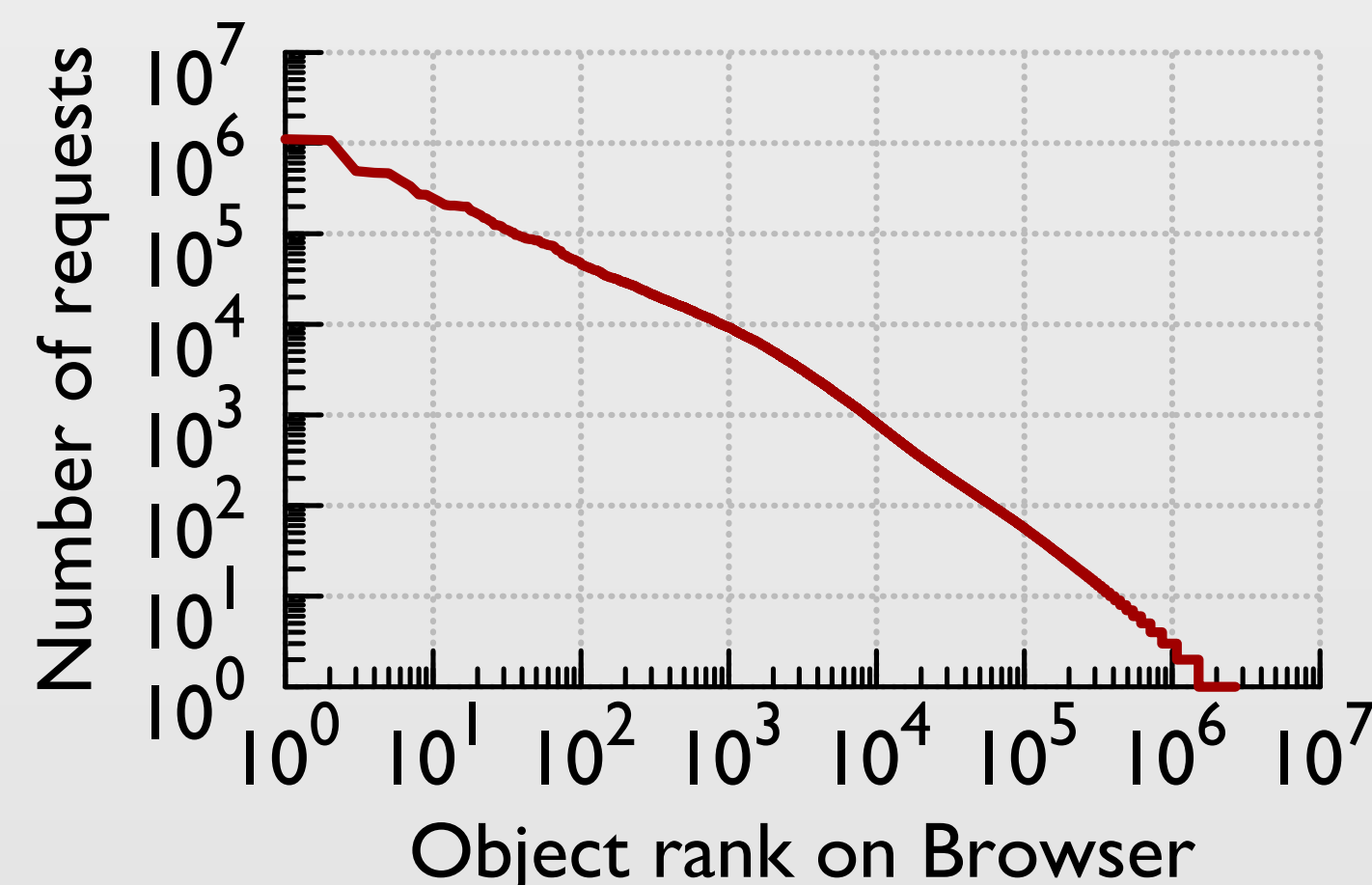
Haystack

- 7.6M reqs
- 9.9% reqs share
- Prefers local Haystack

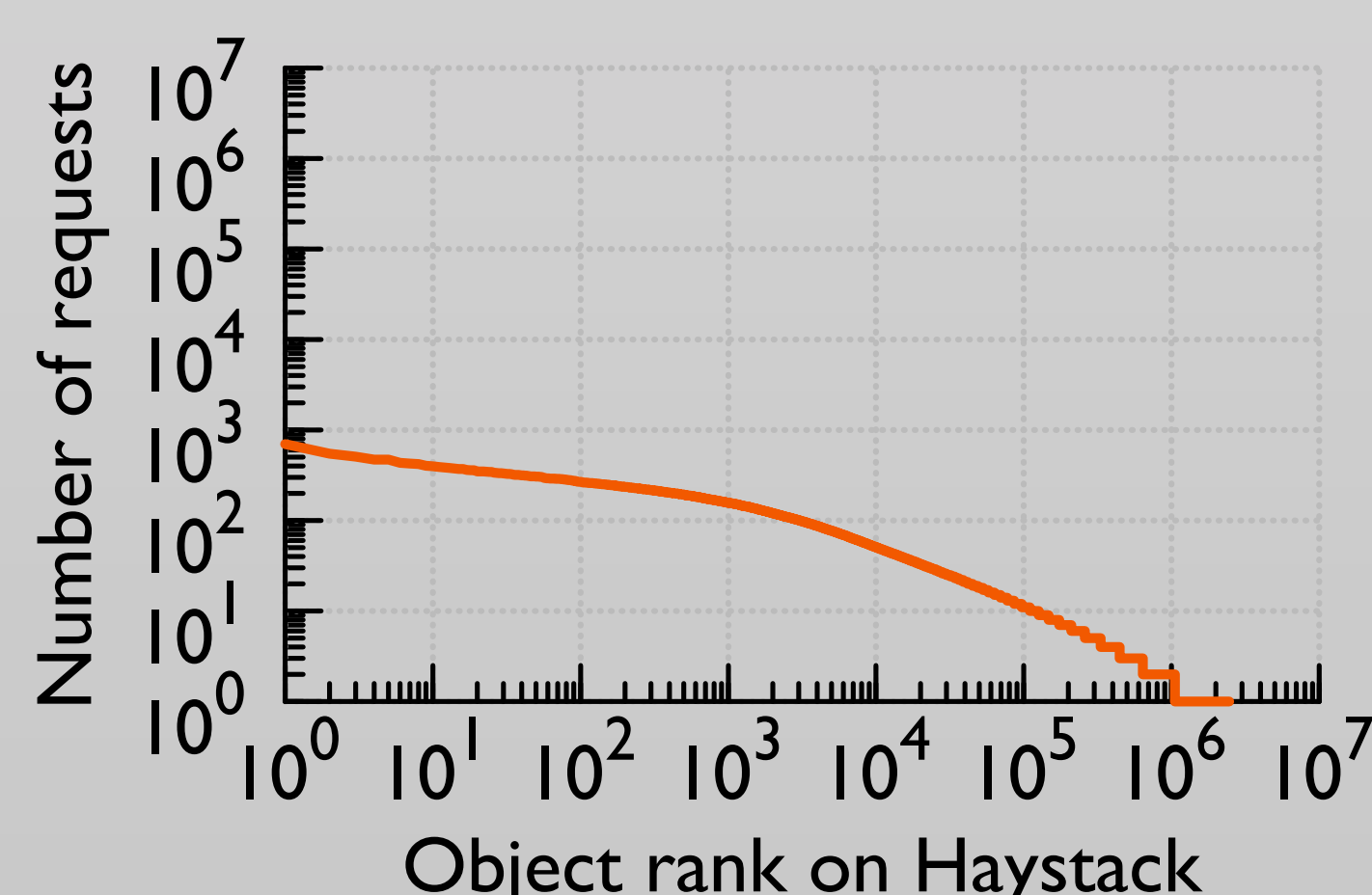


Workload

At top layers, req popularity follows a power-law dist., but curve flattens as reqs tunnels deeper.



Haystack sees a Stretched Exponential dist.

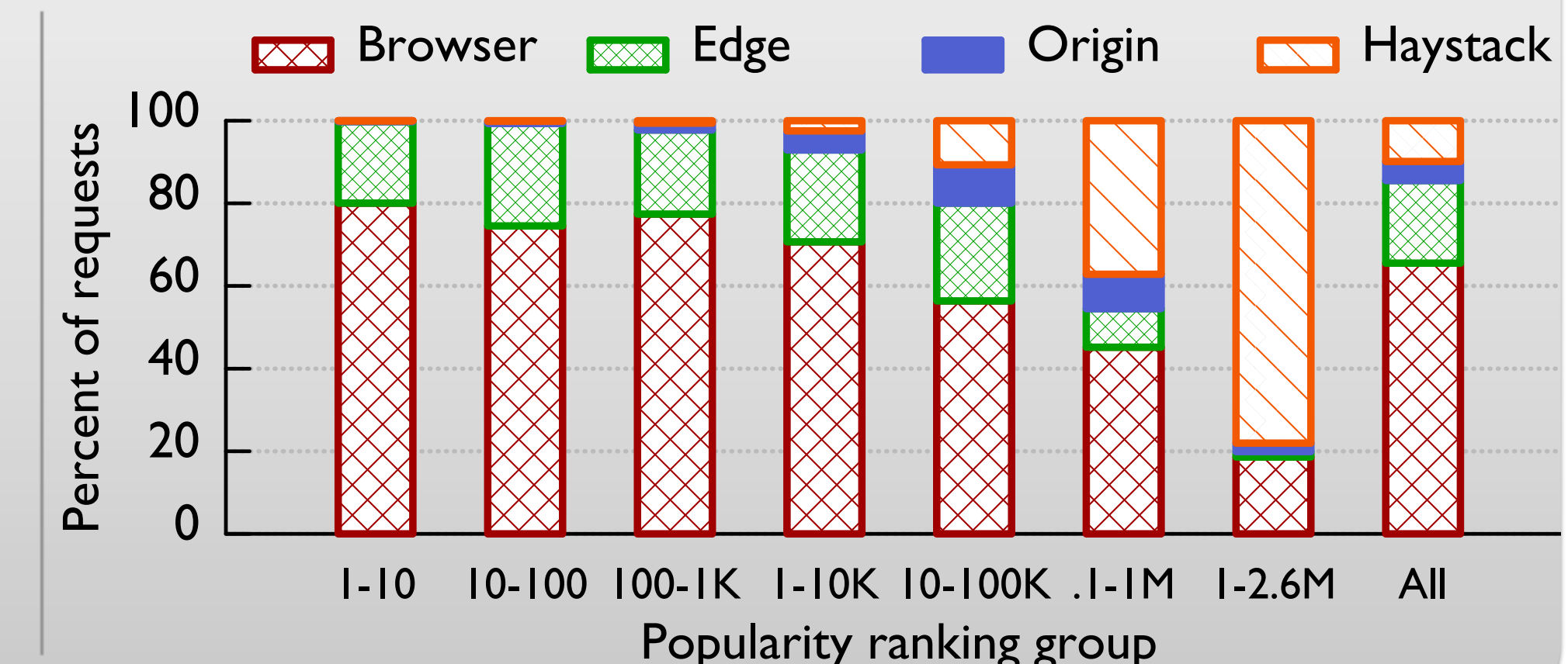


Cache Performance

Traffic Share by Photo Popularity

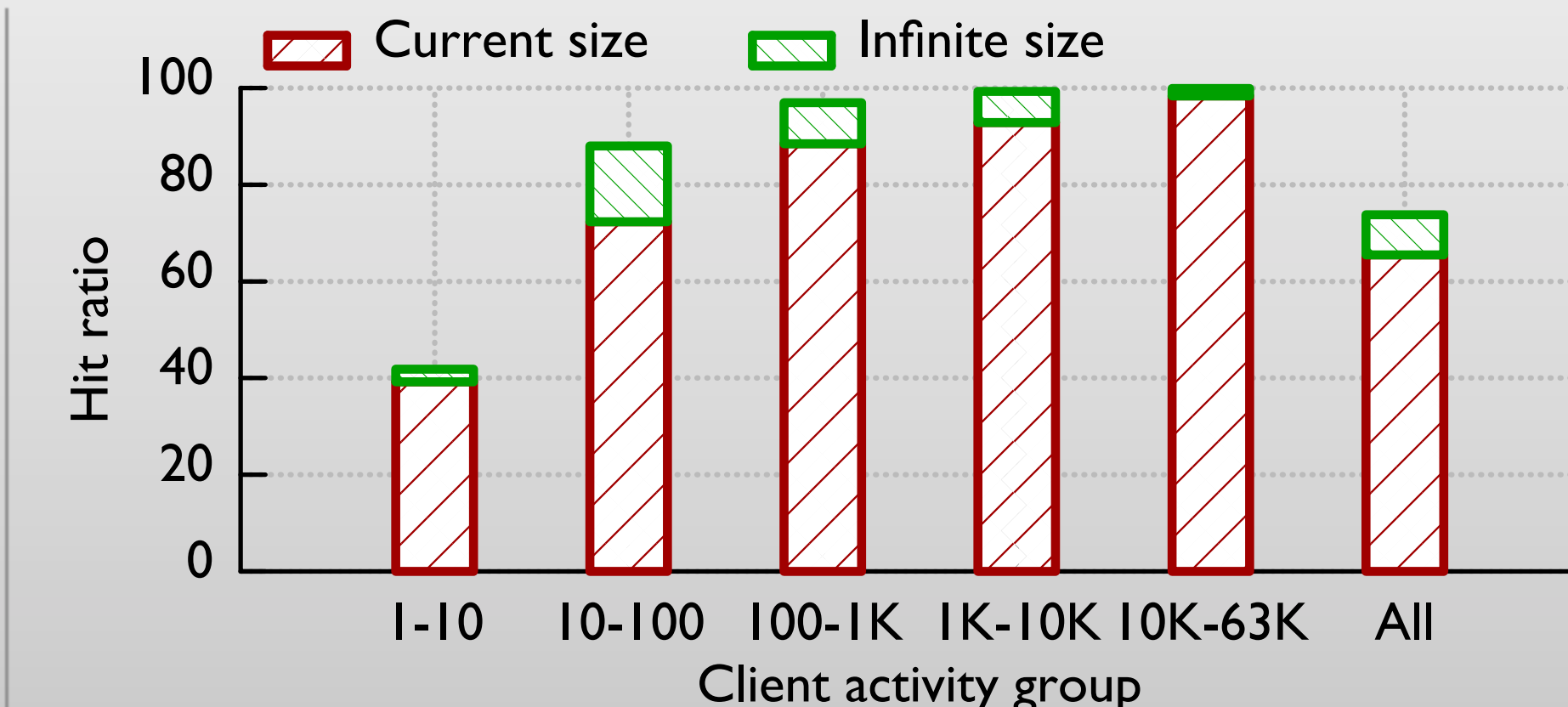
Cache traffic share drop for less popular items.

1. Top 1K photos attract 25% traffic.
2. Cache serves 99.93% reqs for them.
3. Haystack handles the tail.



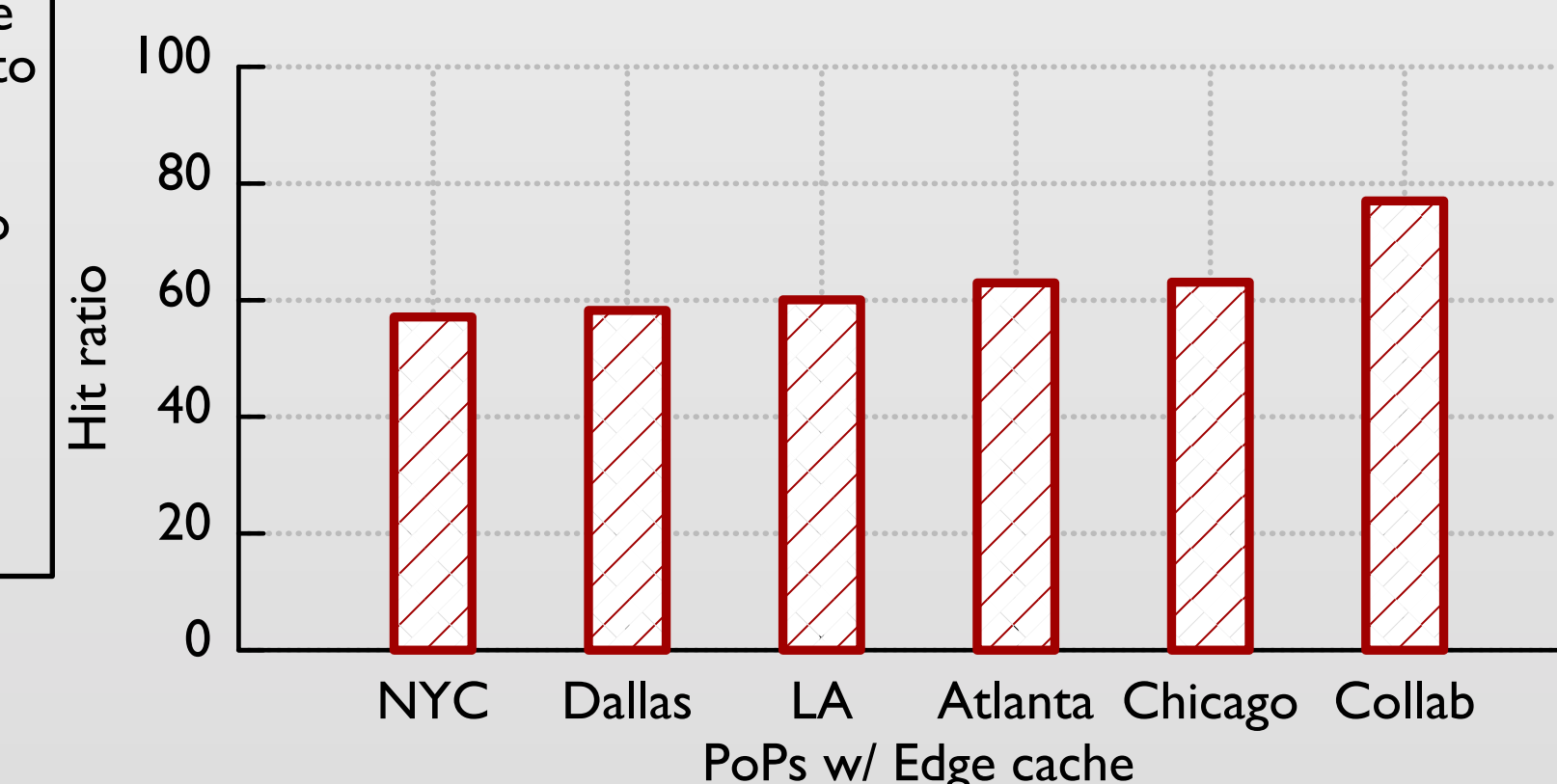
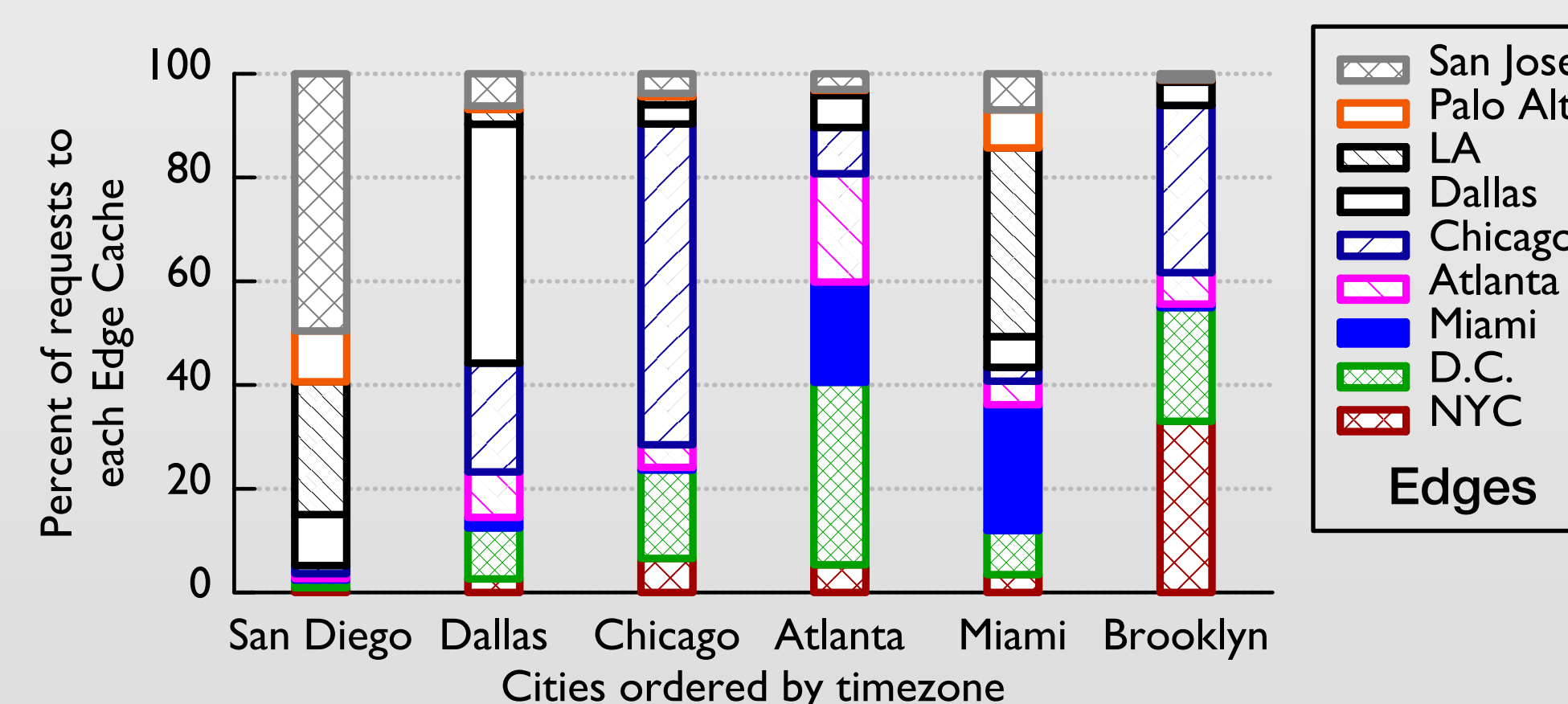
Browser Caching

1. Clients with <10 reqs send 37% traffic.
2. Active clients have higher hit ratio.
3. Increasing cache size helps.

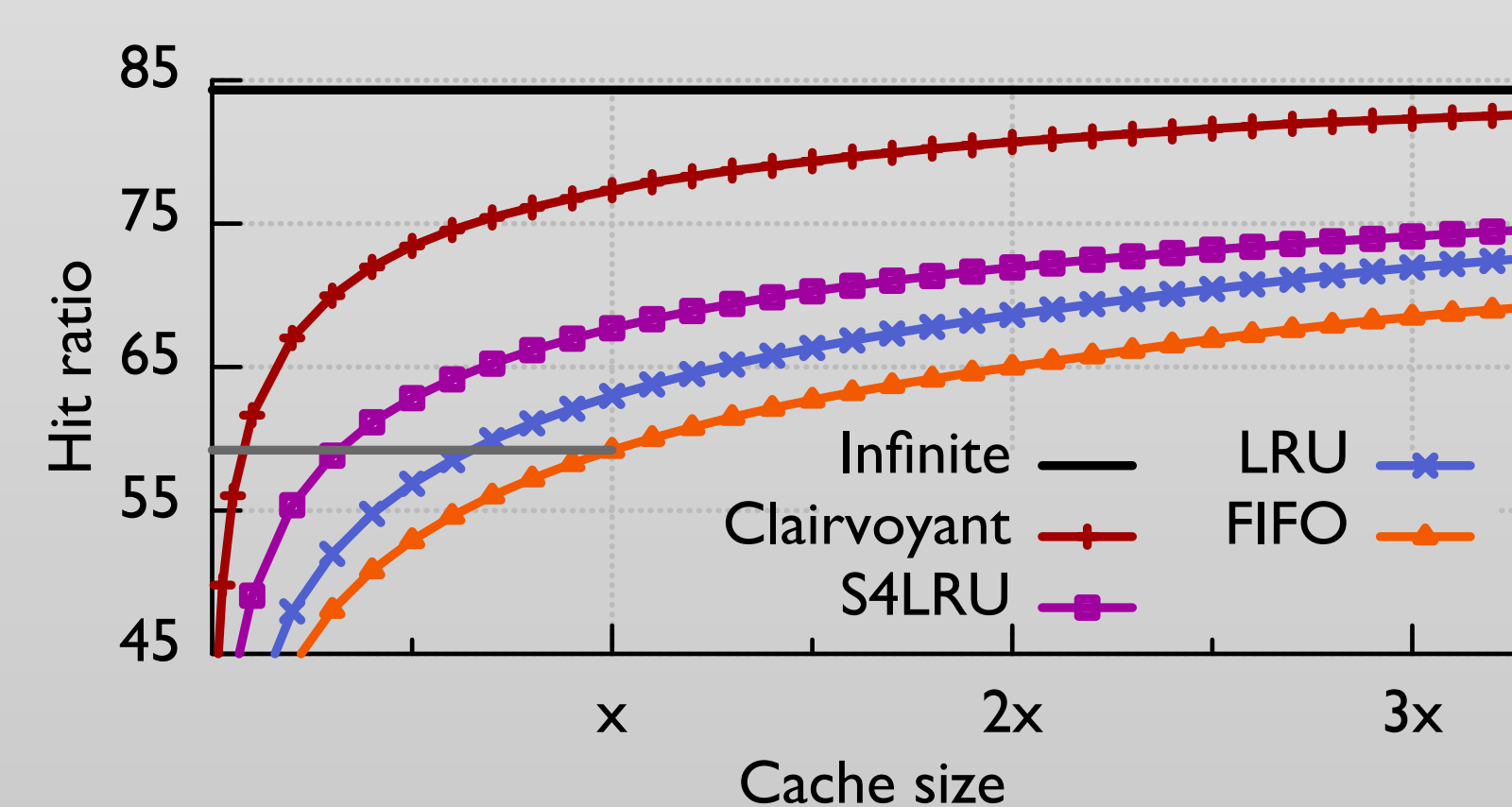


Edge Caching & Origin Caching

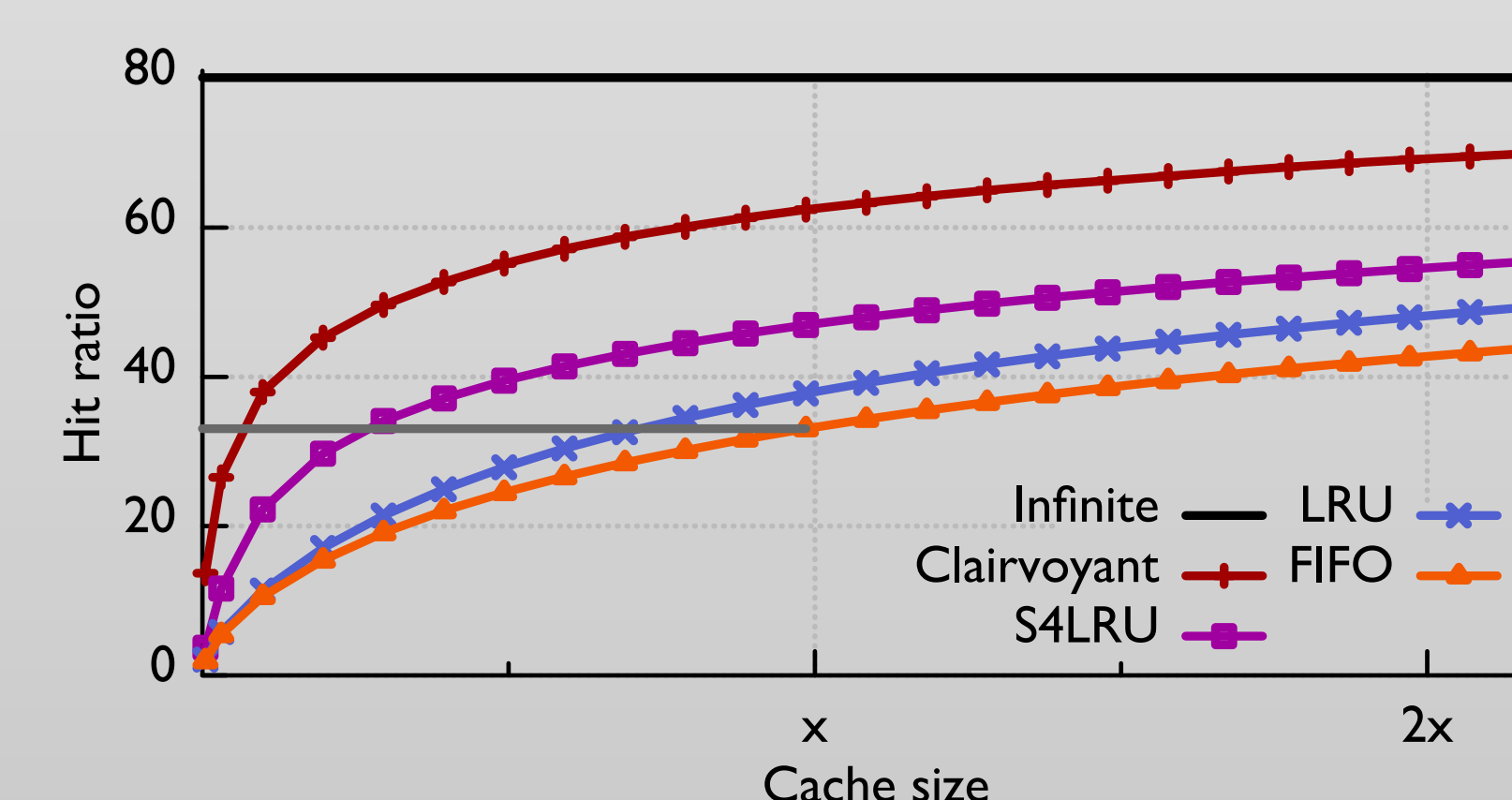
1. Request from clients are often routed to remote Edges.
2. Collaborative Edges (collab bar) increases hit ratio by 17%.



3. S4LRU increases hit ratio significantly both at Edge and Origin.



San Jose Edge



Origin