

# CONIC: Content-Oriented Network with Indexed Caching

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# Problem Statement

- Trends in the current usage of Internet
  - content-oriented
  - cache-oriented
- Clean-slate content-oriented networks
  - concept: deliver from possible nearest place
  - architecture: lack perspective for deployment
- Existing work to remove redundant traffic
  - web proxies, object caches: partial solution
  - CDN: for the sake of servers

# Our Ideas

- Cache content in clients
  - eliminate extra storage cost in network
  - self-scaling like peer-to-peer
- Redirect by routers
  - indexing local cache in routers
  - make use of routing information
- Designed for incremental deployment
  - do not require all hosts switch to benefit
  - modified hosts do not lose accessibility

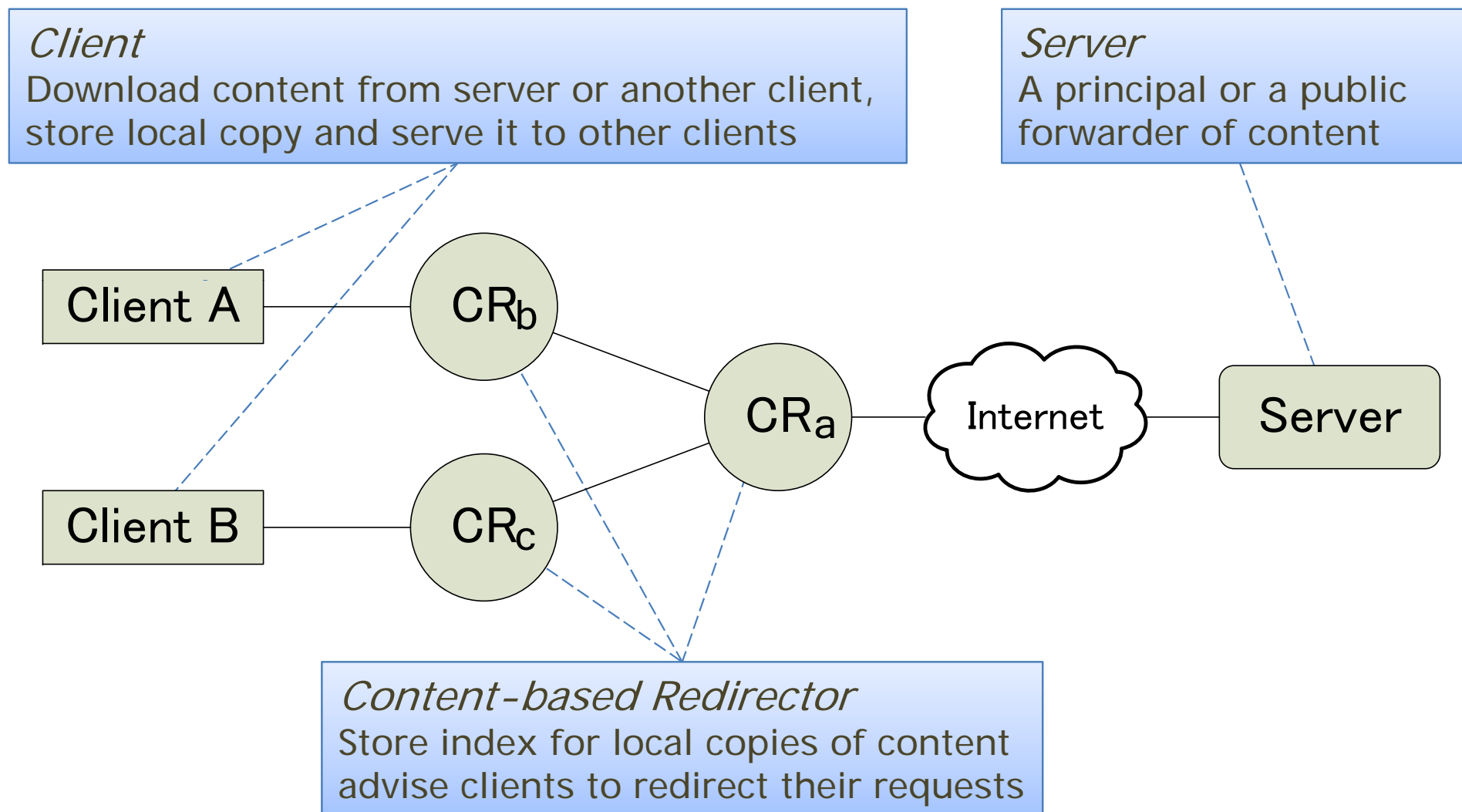
# Our Solution

- CONIC: Content-Oriented Network with Indexed Caching
  - deployable, self-scaling
  - eliminate redundant traffic
  - enable efficient and fast access
  - incrementally implemented and deployed

# Outline

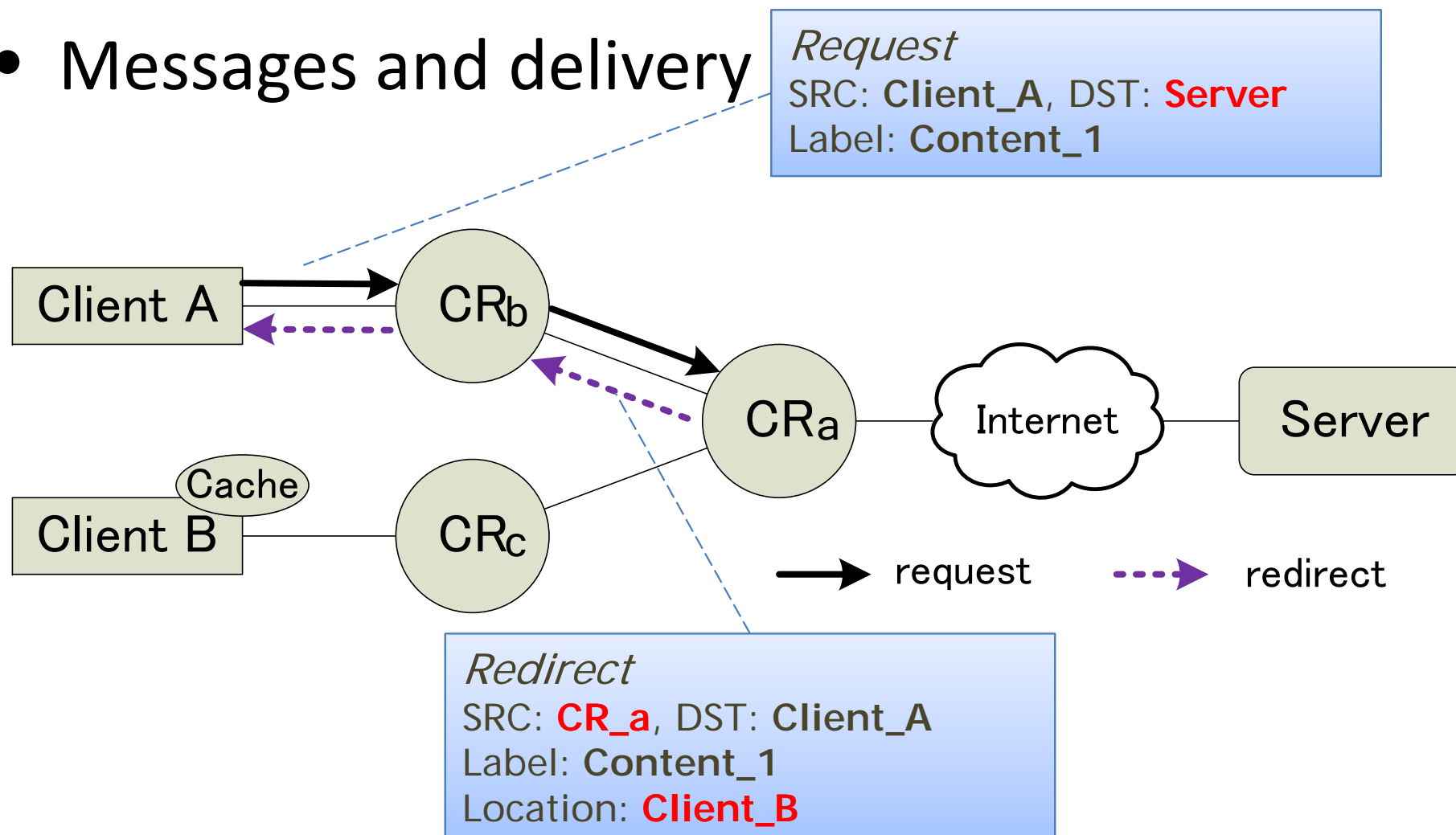
- Introduction
- **Design**
- Evaluation
- Discussion
- Conclusion

# Architecture



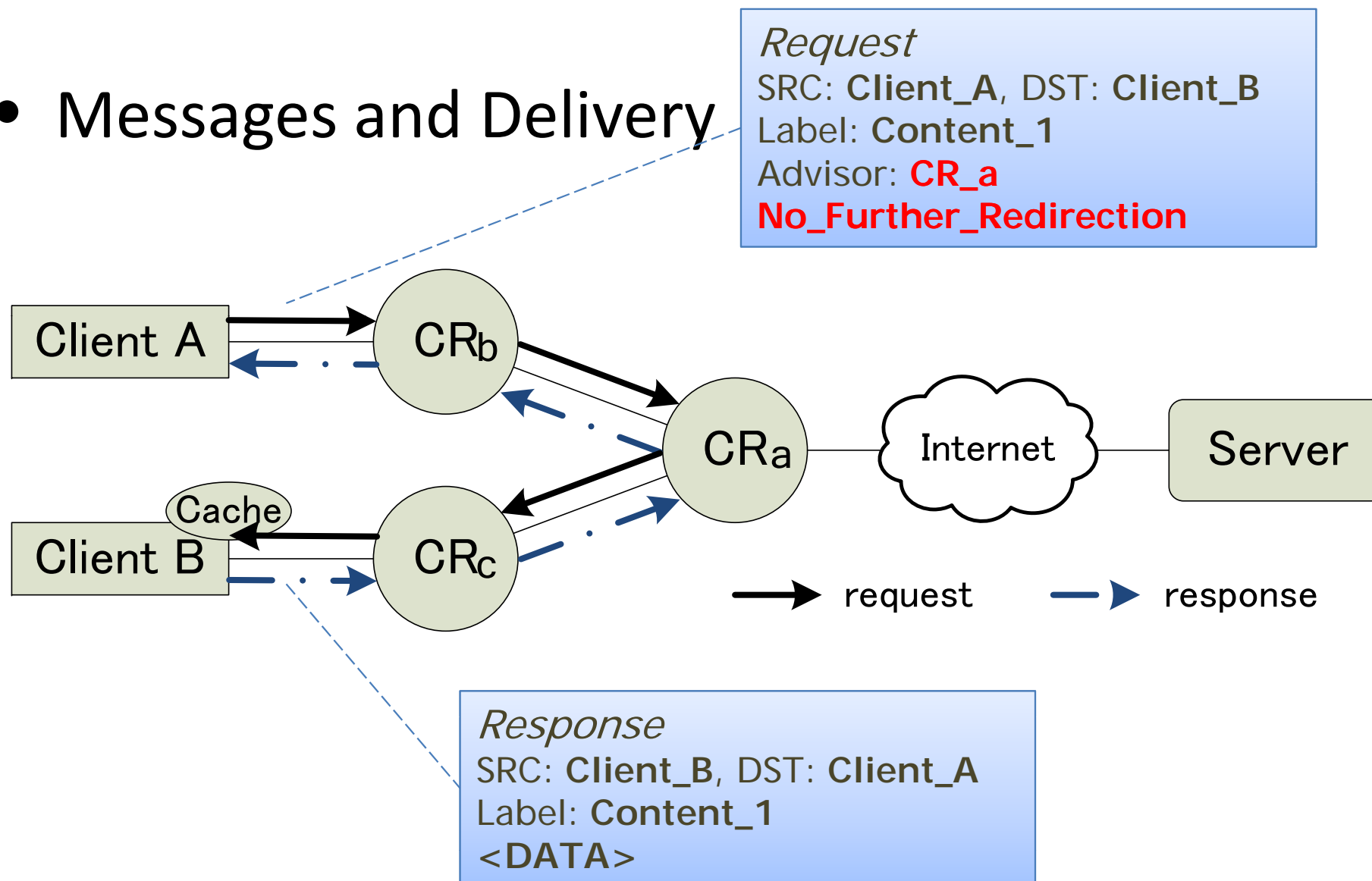
# Architecture

- Messages and delivery



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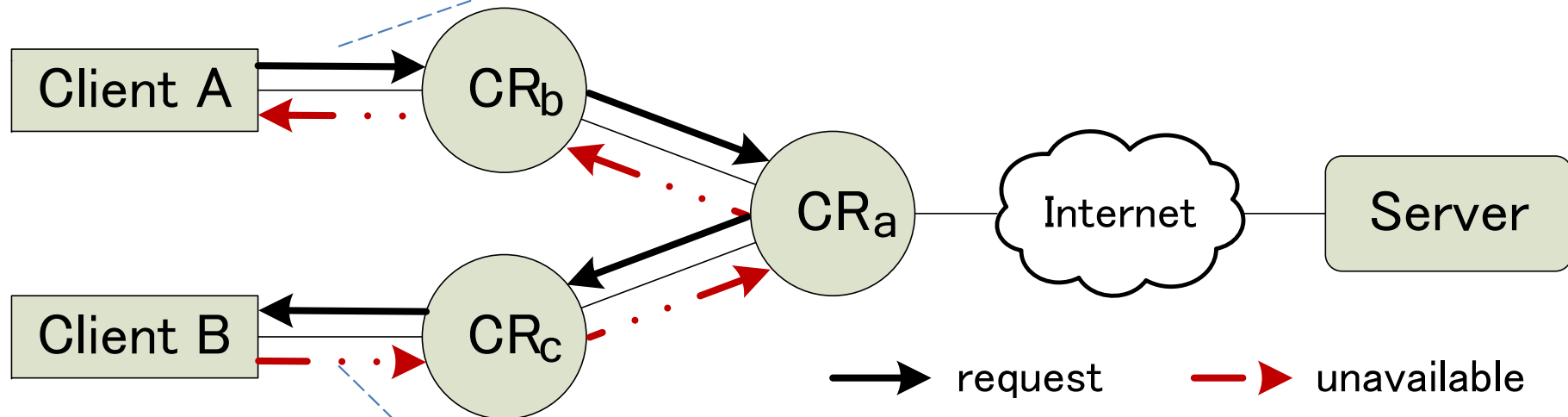
*Request*

SRC: Client\_A, DST: Client\_B

Label: **Content\_2**

Advisor: CR\_a

No\_Further\_Redirection



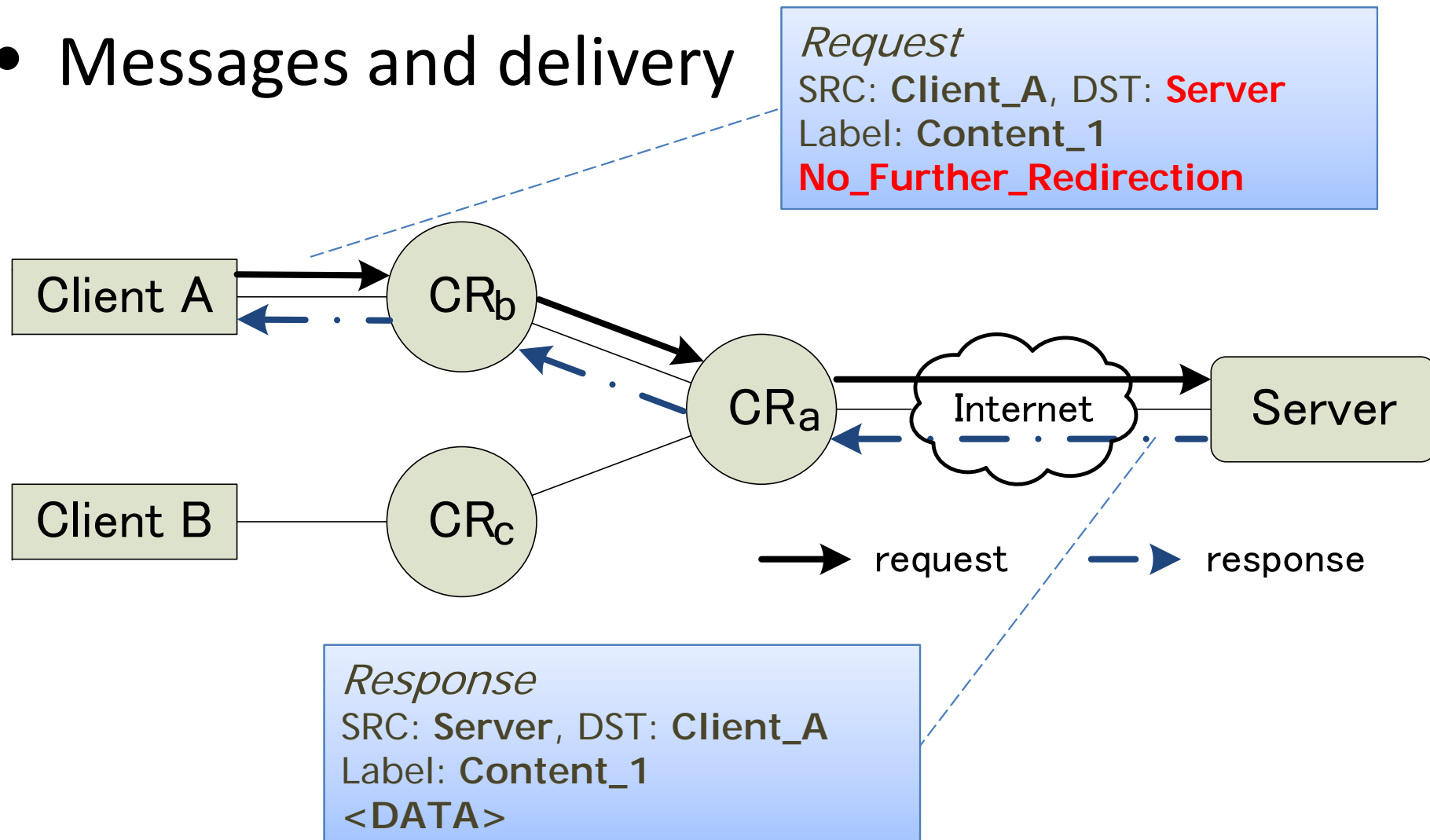
*Unavailable*

SRC: Client\_B, DST: **Client\_A, CR\_a**

Label: **Content\_2**

# Architecture

- Messages and delivery

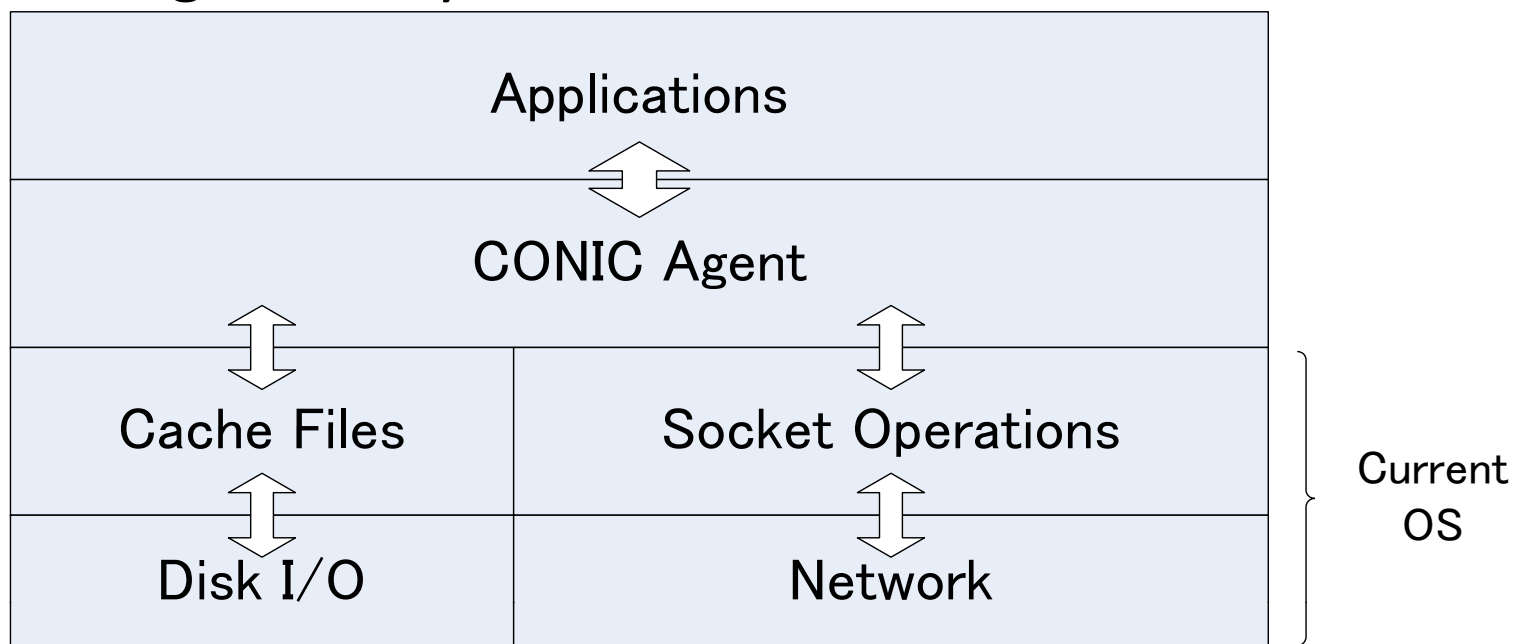


# Content-Based Redirector

- IP router + cache index
  - index manipulation
    - creation: by probability of distance
    - removal: by Least Recently Used (LRU)
  - cache redirection
    - pick up candidate cache according to distance
  - implicit cooperation
    - no computational / network overhead
    - different access pattern / position

# Client Hosts

- CONIC agent
  - manage local files and network communication
    - rapid deployment: middleware
    - integration: system-call

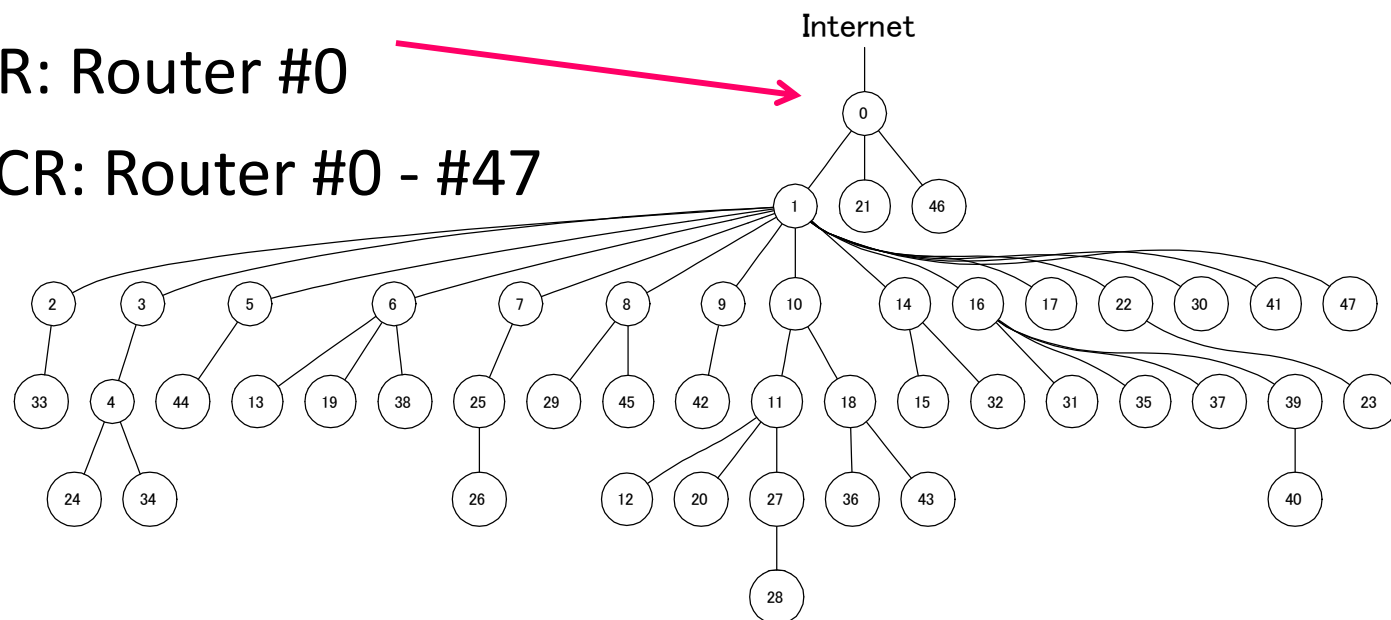


# Outline

- Introduction
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- **Evaluation**
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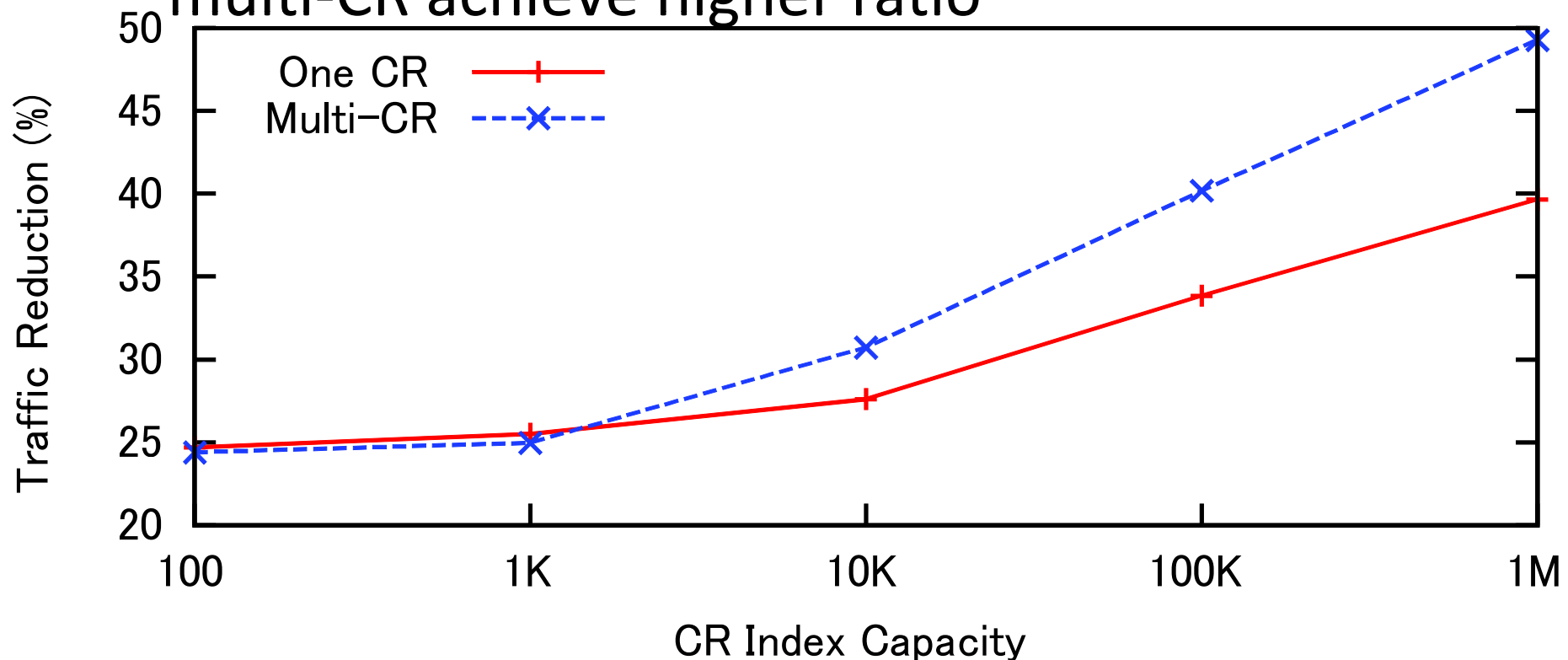
# Experiment Setup

- Trace-based simulation
  - 12-hour traffic from a campus network
  - “traceroute” to infer network topology
  - replay HTTP sessions with simulator
    - One-CR: Router #0
    - Multi-CR: Router #0 - #47



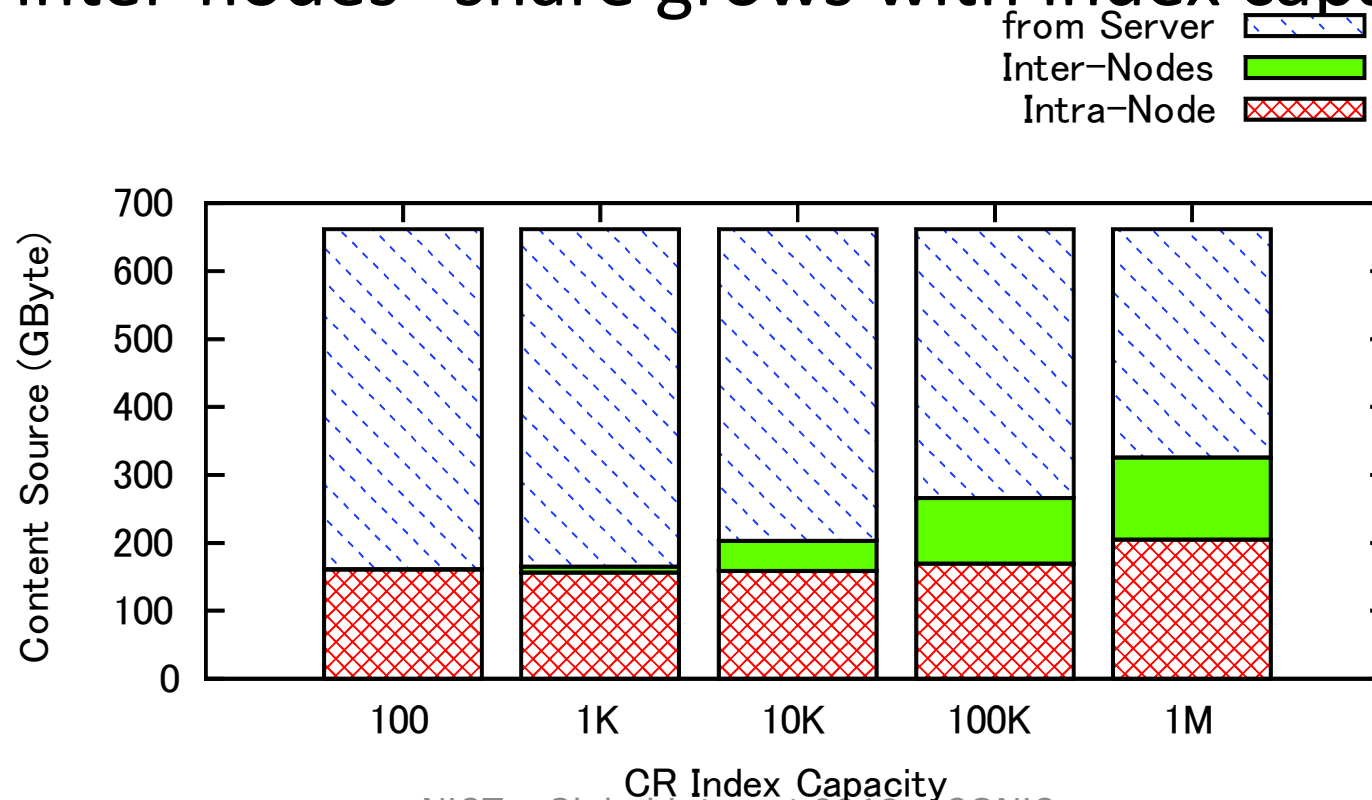
# Results and Analysis

- Traffic reduction: up to 50%
  - index capacity is essential
  - multi-CR achieve higher ratio



# Results and Analysis

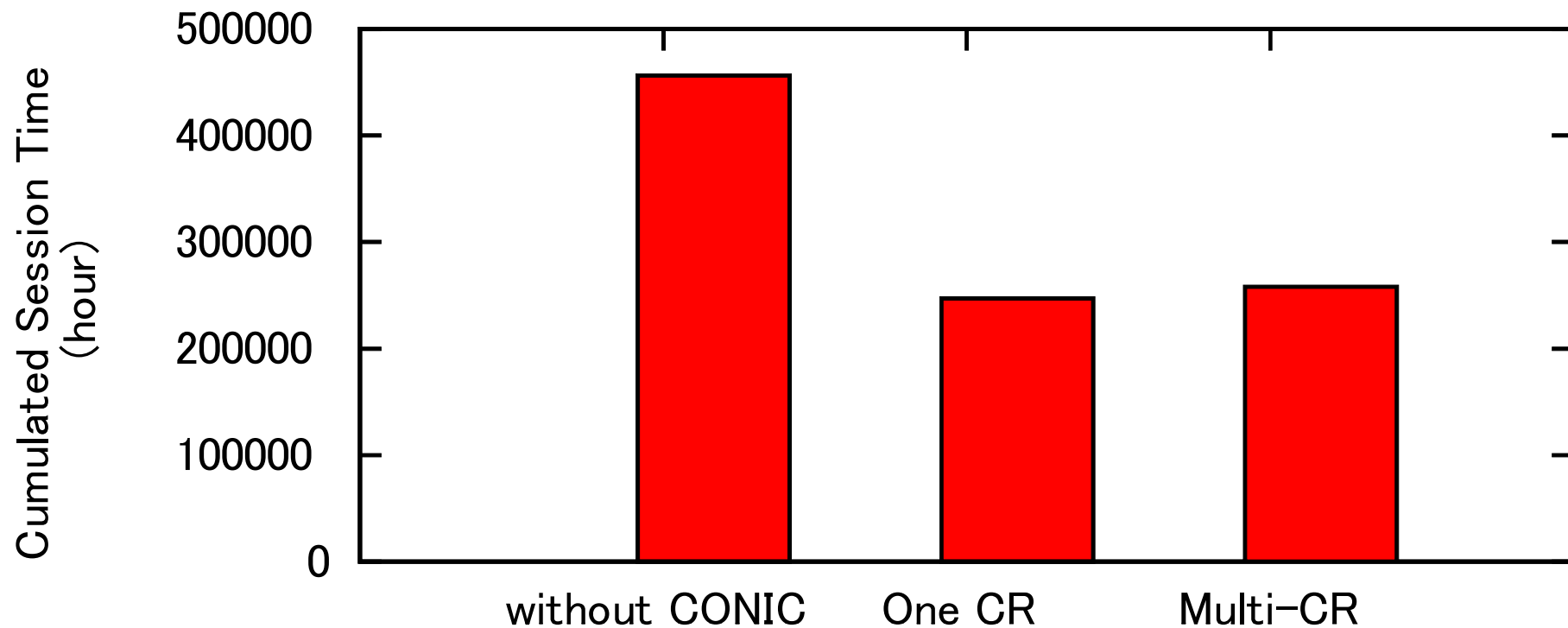
- Distribution of content sources (Multi-CR)
  - “intra-node” share is constant but significant
  - “inter-nodes” share grows with index capacity





# Results and Analysis

- Cumulative session time
  - both One-CR and Multi-CR halve retrieval latency



# Outline

- Introduction
- Design
- Evaluation
- **Discussion**
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# Content Labeling

- Traditional applications
  - URL: host + path
- Content-oriented network
  - new naming system
  - hash-based identification
- CONIC
  - reuse URL as identifier

# Push vs. Pull

- Push-based delivery
  - maximize network utilization
  - require register beforehand
- Pull-based delivery (CONIC adopts)
  - retrieve content after publication
  - cannot maximum optimization

# Selective Caching

- Cache replacement →  
Selective cache creation
  - distance of an entry
  - object size
  - object type

# Outline

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# Concluding Remarks

- Content-Oriented Network with Indexed Caching
  - requires minimal change in routers
    - *increase deployability*
  - exploits storage and bandwidth on end-systems
    - *ensure self-scaling*
  - reduce >25% web traffic & latency
    - *provide fast and efficient access*

# Future Work

- Address open questions discussed
- Conduct more evaluation
  - different networks
  - different applications
- Extend current prototype implementation
  - real network deployment
  - benchmark



Any questions?

**THANK YOU VERY MUCH!**