iCDN: An NDN-based CDN

♀ Chavoosh Ghasemi (The University of Arizona)
Hamed Yousefi (Aryaka Networks)
Beichuan Zhang (The University of Arizona)
What is **Content Delivery Network (CDN)**?

- An overlay content network on top of the Internet
- Handles requests based on the name of the solicited content (e.g., HTTP requests)
- Employs a third-party module to keep track of cached contents in the network
  - Scalability issues

What if CDNs could *cache, find, and serve* contents without a strong dependency on any controlling module.

- ICN/NDN seems to be able to realize such a network
Can any NDN network serve as a CDN? NO

Consider the NDN Testbed

- It strongly relies on a routing protocol to disseminate content availability information in the network

Issues:

- FIB explosion
- Inefficient use of in-network caches

iCDN is an attempt to address these two issues in a scalable, high-performance fashion
iCDN

A scalable, high-performance NDN-based CDN

FIB explosion:
• Full-mesh overlay network topology
• Caching hierarchy

Inefficient use of in-network caches:
• C-Strategy

Note:
• CDNs are profoundly complex ecosystem
  • Most common feature of CDNs: content retrieval and sharing
Network topology

- Full-mesh overlay topology
  - There is one-hop virtual link between any pair of nodes on an overlay network.

- Logical partitions
  - Nodes can still access the entire network beyond a partition
Consistent Hashing

Announcements

Not an RP or Hot node

Producer of /a/b/c

RPs

Hot Nodes

Cold Nodes

Cache Hierarchy
C-Strategy

• Utilizing off-path and on-path caches in the cache hierarchy

• Always chooses nodes in higher tiers
  • E.g., Upon a cache miss at a hot node, c-strategy probes a group of RPs

• Metrics for our polynomial WMA:
  • Interest-Data Round-Trip Time
  • Number of Nacks
  • Number of Timeouts
  • Estimated Bandwidth

• To be responsive to network changes:
  • After choosing a node, C-Strategy still periodically probes other nodes
Evaluation setup

- Compare iCDN with a routing-based solution (i.e., NDN testbed solution)
- Compare C-Strategy with different forwarding strategies (ASF, Best Route, Flooding)
- ndnSIM for simulations
- Content popularity in the network follows Zipf Dist.
- Consumers are connected to nodes 0, 3, and 5
- The producer is connected to node 10
Content Retrieval Delay

![Graph showing content retrieval delay for different methods: ASF, BR, C-STR, Flooding. The x-axis represents the origin nodes, and the y-axis represents the content retrieval delay in seconds.](image-url)
Responsiveness
Scalability
Conclusion

• Using NDN technology for large-scale content distribution needs an exclusive network design

• iCDN proposes a **cache hierarchy** and a new **forwarding strategy**:
  • iCDN scales as it has no strong dependency on routing/controlling information
  • iCDN addresses FIB explosion and fully utilizes on-path and off-path caches

• A foundation towards a complete NDN-based CDN design and performance evaluation
Thank You