Carnegie Mellon

Thesis Presentation

COMPUTER SCIENCE DEPARTMENT

Master of Science in Computer Science

Content Delivery Optimization for the Future Internet Architecture

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Thursday, December 15, 2016
2:30 PM
GHC 6501

This thesis research presents content delivery optimization techniques in the eXpressive Internet Architecture (XIA). First, we propose an intradomain CID routing protocol that achieves performance objectives of reducing request latency for ISP's customers by routing content requests off-path to nearby caches. This is beneficial for ISP since it helps them attract more customer through offering content delivery with lower latency. The challenges for the CID routing design are that 1) scalability of the protocol to a large number of CIDs in the domain and 2) resistance to cache churn. To address the first challenge, we propose 1) scoping the advertisements and 2) advertise the delta of locally cached CIDs. We evaluate the scalability of the protocol by comparing it against traditional link-state and distance vector routing protocol. The metrics we used for comparison are: 1) size and the number of advertisements messages, 2) efficiency of route computations, and 3) space consumptions. For churn resistance, we show that advertising content that would stay in cache longer during the event of high cache churn can reduce the number of failed requests in a domain. We compare this benefit against the performance objective of CID routing and show that advertising popular content can be a good strategy to reduce the number of invalid CID routes during high cache churn.

The second part of the thesis discusses an interdomain cache management scheme. We discuss a cache sharing model that allow regional peering ISPs to collaboratively share their cache space to reduce cost of interdomain data exchange, and the tradeoffs between performance, availability, and bandwidth consumption. Our results show that replicating the top few popular content locally in the domain achieves a good balance between these criteria for coordinating ISPs. Finally, we present a cache sharing algorithm that distributes the request load evenly among coordinating domains without incurring explicit message exchange. We evaluate this approach against the oracle that would require coordination overhead but approximate the optimal solution very closely. The result shows that the caching decision output by our approach differs little from the oracle in terms of the cache hit rate for each domain.

Website: https://www.andrew.cmu.edu/user/zihaol1/thesis.pdf

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