MPC: Popularity-based Caching Strategy for Content Centric Networks

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Schedule

1. Information Centric Networks
   - Content Centric Networks

2. CCN Cache Management

3. MPC: Most Popular Content Caching strategy

4. Results

5. Conclusions & Future Work
Internet is mostly used to access content

- Forecast: 2016, 86% of global consumer traffic (CISCO VNI ’12)

- Internet: host-to-host communication

- New Information Centric Networks
  - Content Centric Networks
  - PURSUIT
  - NetInf
Motivation

- Internet is mostly used to access content
  - Forecast: 2016, 86% of global consumer traffic (CISCO VNI ’12)
- Internet: host-to-host communication
- New Information Centric Networks
  - Content Centric Networks
  - PURSUIT
  - NetInf

Users are interested in content, not its location
### Host-to-Host Communication
- Host remain FIXED
- Path determined on the fly
  - Find Host (DNS Resolution)
  - Send TCP/IP request
- TCP/IP packets **can not** be reused

### Host-to-Content Communication
- Host and Content FIXED
- Content located at the Fly
  - Ask for content
  - ICN protocol found it
- Content **can** be reused/reemployed
ICN: New Paradigm

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Caching of Content becomes a central key of the Architecture
ICN: Content Centric Networks (CCN)

Based on two primitities

- Interest: user requests content issuing a named Interest
- Data: every user having the answer, issue a response

Features

- Every node has in-caching network support
- Multicast, Encryption, Signatures features
- Strongly accepted by the Community
Host 1 wants /content/abc.flv
Host 1 issues an interest message
**CCN: Caching: HIT**

- **CCN Node** has content `/content/abc.flv` in the cache
- **CCN Node** issues a Data message with the answer
CCN: Caching: MISS

- **CCN Node** has NOT content `/content/abc.flv` in the cache
- **CCN Node** retransmit the message to the rest of the network
/content/abc.flv content is found
A Data message is received with /content/abc.flv
CCN Node make room by evicting some content
CCN Node sends the Data with /content/abc.flv
Host 1 receives the content
# CCN Cache Management

## Content Management

- Content Management is the master piece on ICN networks
- Replacement Policies
  - LRU, FIFO, MFU, Rand, etc.
  - Well-studied into OS, web-servers, etc.
- Caching Strategy
  - Decide which content to cache

## Problem

- Design of CCN caching management policy
  - MPC: Most Popular Content Caching Strategy
CCN Cache Management

CCN Overview

- CCN in-network caching
- Overloading nodes and network resources.
  - *Impact of traffic mix on caching performance in a content-centric network* - Fricker et al.
  - *Cache Less for More in Information Centric Networks* - Chai et al.

MPC: Most Popular Content Caching Strategy

- Cache **only** popular content
- Cache less and smartly
MPC: Most Popular Content

How-To

- Count locally number of access counts for every content name
- Information stored in a Popularity Table
- Content requested $\geq$ Popularity Threshold $=$ Popular
- Popular content is pro-actively cached 1-hop away
MPC: Case Study

CCN Node X

/abc.flv - 0
/def.flv - 0
MPC: Case Study
MPC: Case Study

/abc.flv is POPULAR

/abc.flv - 2
/def.flv - 1

CCN Node X

/abc.flv

/abc.flv

/def.flv is NOT POPULAR (not distributed)
Simulation

ccnSim

- Scalable chunk-level simulator of CCN
- Support for Large Catalog ($10^8$ files)
- Support for large CCN Content Stores ($10^6$ chunks)

Simulation Scenario

- ZIPf probability distribution for the popularity of content
- Several topologies
- Evaluated against common used strategies (LRU, RAND, FIFO)
Simulation: Topologies

Tree  Abilene  Tiger

Geant  DTelcom  Level3
MPC: Results

The graph shows the cache hit ratio for different network topologies under two schemes: CCN (LRU+Always) and MPC. The topologies tested include Tree, Abilene, Tiger2, Geant, DTelekom, and Level 3. The CCN scheme consistently has a higher cache hit ratio compared to MPC for all topologies.
MPC: Results

![Graph showing the ratio of eviction operations for different topologies: CCN (LRU+Always), MPC, Tree, Abilene, Tiger2, Geant, DTelekom, and Level3.]
Conclusions

- MPC caches only popular content
- MPC improves Cache Hit Radio
- MPC reduces consumption of resources

Future Work

- Organize content in communities
- Focus on social information
Questions

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