Cloud4Home — Enhancing Data Services with @Home Clouds

Sudarsun Kannan, Ada Gavrilovska, Karsten Schwan
Center for Experimental Research in Computer Systems
Georgia Institute of Technolog

Presenter: Kai Liu
- Introduction
- Motivation
- VStore++ Architecture
- Experiment
- Future work
Introduction

Mobile devices, like smartphones, tablets, laptops, and powerful home PCs are creating ever-growing computational capacity.

How to make use of it?
Motivation

Use local resources at lower cost
Avoid potential issues:
data privacy or security

Exploit Internet resources
Condition:
when not encumbered by high latency or undue communication overheads.
Why do we need it?

Home surveillance
- Storage cost in the cloud
- Rely on connectivity to public cloud

Media conversion
- Unnecessary delay and operating cost
- Rely on connectivity to public cloud
VStore++

Cloud4Home approach for providing data storage, access, and manipulation services.

- Fungibility
- Augmentation
- Guided active management
- Automation and independence
VStore++ Architecture

- Guest Domain
- Control Domain
- Remote/public Cloud
- Other Home Cloud Nodes
Metadata and resource

GetDecision( Objname, service_id, mechanism) {
    NodeList = getListOfNodesFromLogicalTree()
    getOptimalNode( NodeList, service_id, mechanism)
    /*mechanism denotes strategy to use for finding optimal node (greedy, fair)*/
}

KEY
-- generate by object name

VALUE
-- object location & metadata

GetDecision()
-- determine the most suitable target node

  • get node list
  • choose optimal one (based on what?)
VStore++ Operation

- **Store**
  
  Guest Domain→CreateObject()→
  StoreObject()→Control Domain→Set
  ObjectInfo()→Store object in the same
  node's Mandatory bin

- **Fetch**
VStore++ Operation

Fetch and Process

IF the requesting node S1 can process, pass and process
ELSE IF requested node can process, process and then pass to it
ELSE pass to other nodes to process, then pass to S1
VStore++ Operation

Fetch and Process

IF the requesting node S1 can process, pass to it
ELSE IF requested node S2 can process, process and pass
ELSE pass to other nodes to process, then pass to S1
VStore++ Operation

Fetch and Process
IF the requesting node S1 can process, pass to it
ELSE IF requested node S2 can process, process and pass
ELSE pass to other nodes to process, then pass to S1

Rules of passing to other nodes:
Time to locate the target nodes, movement costs
Experiment(1)

Home vs. remote cloud latency
Experiment(2)

Linear Increase vs Constant time

<table>
<thead>
<tr>
<th>File Size(MB)</th>
<th>Total(ms)</th>
<th>Inter Node(ms)</th>
<th>Inter Domain(ms)</th>
<th>DHT Lookup(ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>228</td>
<td>103</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>454</td>
<td>190</td>
<td>37</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>1160</td>
<td>513</td>
<td>57</td>
<td>13</td>
</tr>
<tr>
<td>10</td>
<td>2522</td>
<td>1042</td>
<td>189</td>
<td>14</td>
</tr>
<tr>
<td>20</td>
<td>2477</td>
<td>2079</td>
<td>386</td>
<td>12</td>
</tr>
<tr>
<td>50</td>
<td>5174</td>
<td>4678</td>
<td>480</td>
<td>16</td>
</tr>
<tr>
<td>100</td>
<td>15180</td>
<td>13577</td>
<td>1603</td>
<td>12</td>
</tr>
</tbody>
</table>

Table I

HOME CLOUD FETCHES: COST ANALYSIS.
Experiment(3)

Determine “optimal size” of file
Experiment(4)

Node Performance
- S1 low
- S2 medium
- S3 high

Image size:
- 0.25 MB
- 0.5 MB
- 1 MB
- 2 MB
Experiment(5)

Media conversion

.avi -> .mp4

When optimal node has better computing performance than owner node
Future work

• Privacy
• Exploit heterogeneity
• Scale to larger number of @home structure
• Adapt to network condition
• Multiple Cloud4Home collaboration (neighborhood security)
Question?
Thank you