Distributed Overlay Anycast Table using Space Filling Curves

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Multi Service Networks, Abingdon, July 2009
• Project
• Anycast
• Distributed Anycast
• Space filling curves
• Routing
• Evaluation
• Conclusions and future work
Near real-time P2P video distribution

Areas of research

• Peer discovery
• Incentive mechanisms
• Delay optimised swarming

More information, publications and talks at: www.peerlive.org
• Large number of Anycast groups
• Popular (lots of member nodes), and unpopular groups
• High membership churn, high arrival/departure churn
• Find the closest member quickly and accurately

brown, purple, turquoise, magenta
group member hosts

querying host
searching for a brown group member host

oracle

✗
• Large number of Anycast groups
• Popular (lots of member nodes), and unpopular groups
• High membership churn, high arrival/departure churn
• Find the closest member quickly and accurately
Space Filling Curves

DOAT one-dimensional wrapping space

multi-dimensional proximity space

H-curve value
Bloom Filters and routing

E(0.71)  F(0.95)  D(0.19)

A(0.43)  B(0.40)  C(0.50)
Bloom Filters and routing

host M1 member of group BBC.News
host M2 member of group BBC.News
host M3 member of group Fox.News

(hash value #D880)  (hash value #D880)
(hash value #3AB1)

local registry

local Bloom Filter

#FAB1

F(0.95)
Bloom Filters and routing

<table>
<thead>
<tr>
<th>Distance</th>
<th>Coordinate</th>
<th>Next-Hop Bloom Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.43</td>
<td>A BF.local</td>
</tr>
<tr>
<td>0.03</td>
<td>0.40</td>
<td>B</td>
</tr>
<tr>
<td>0.07</td>
<td>0.50</td>
<td>C</td>
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<tr>
<td>0.24</td>
<td>0.19</td>
<td>D</td>
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<tr>
<td>0.28</td>
<td>0.71</td>
<td>E</td>
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Evaluation, synchronous updates

- **Group Members over DOAT Nodes (%):**
  - 500 artificial nodes
  - 1000 artificial nodes
  - 3000 artificial nodes
  - 1740 King data nodes

- **Query Delay (ms):**
  - Plotted with different line styles for each node count.

- **Query Hops:**
  - Plotted with different line styles for each node count.

- **Accuracy Error (probability):**
  - Plotted with different line styles for each node count.

- **Update Messages per Member per Node:**
  - Plotted with different line styles for each node count.

- **Group Members over DOAT Nodes (%):**
  - Plotted with different line styles for each node count.
Evaluation, asynchronous updates

- 10% members/nodes
- 20% members/nodes
- 40% members/nodes
- 60% members/nodes
- 80% members/nodes

Accuracy Error (probability)

Update Messages per Member per Node

Update / New Member Arrival
Conclusions and Future Work

✓ Scalable Application-Layer Anycast, supporting any number of small and very large groups

✓ Minimum querying delays, highly accurate results subject to proximity coordinates accuracy, low sensitivity to coordinates drift

▪ Investigate false positive impact on performance

▪ Prototype evaluation
Thank you!

For more information about the Peerlive project, of which DOAT is a core technology of please visit www.peerlive.org