The Costs of Using JXTA

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Outline

- JXTA Overview
- Need for Performance Evaluation
- Related Work
- JXTA Performance Model
- Results and Analysis
- Summary and Future Work
JXTA Overview

- A peer-to-peer (p2p) infrastructure
- Set of protocols for peer discovery, identification, communication etc...
- Virtual structured overlay network
  - Edge, rendezvous, relay peers
  - Advertisements
  - Messaging through pipes
- Java reference implementation
Need for Performance Evaluation

Performance and scalability of JXTA networks are not well understood

Some open questions:

- Search, discovery, connectivity latency
- Message round-trip time and throughput
- Overhead of intermediate peers (relays)
- Impact of XML message size and composition

Essential for system designers and simulation-based research
Related Work

- JXTA as a research tool
  - In the context of a specific application
- JXTA Bench Project
  - Pipe and rendezvous tests in a controlled environment - for platform developers
- Complexity of JXTA makes it hard to encompass all relevant aspects
JXTA Performance Study

A research project at the U of Saskatchewan

Goals
- Develop a JXTA Performance Model
- Evaluate and characterize JXTA performance

Methods
- Develop standard benchmarks
- Measure protocol implementation in Java
JXTA Performance Model

Peer-centric view of the JXTA network performance:

- Latency of typical peer operations
- Message round-trip time (RTT)
- Message and data throughput
- Rendezvous query-response throughput
- Relay message throughput
Results and Analysis

- Benchmark Suite for measuring performance of JXTA components
- Measurements from a small JXTA network on a campus LAN (one test uses outside relay peer)
Results: Typical Operations

- Typical peer operations
  - Startup is costly and strongly affected by local cache size (v1.0) and distance to the rendezvous
  - Advertisement cache saves discovery time
  - Group and pipe creation costly

<table>
<thead>
<tr>
<th>Peer Configuration</th>
<th>Start JXTA</th>
<th>Get group</th>
<th>Join group</th>
<th>Get cached pipes</th>
<th>Get remote pipes</th>
<th>Open out-pipe</th>
<th>Sequence Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>JXTA 1.0 (rel. 092402)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Rdv</td>
<td>4465.8</td>
<td>1257.5</td>
<td>6.0</td>
<td>25.4</td>
<td>221.2</td>
<td>159.0</td>
<td>6695.0</td>
</tr>
<tr>
<td>No Rdv [with 40 ads]</td>
<td>8218.7</td>
<td>1337.2</td>
<td>6.0</td>
<td>28.4</td>
<td>236.1</td>
<td>173.5</td>
<td>10557.1</td>
</tr>
<tr>
<td>Rdv on same LAN</td>
<td>5858.3</td>
<td>968.7</td>
<td>6.0</td>
<td>47.6</td>
<td>414.7</td>
<td>248.8</td>
<td>8467.4</td>
</tr>
<tr>
<td>Rdv 6 hops away</td>
<td>6074.1</td>
<td>1190.1</td>
<td>6.6</td>
<td>29.8</td>
<td>1173.4</td>
<td>693.2</td>
<td>11012.1</td>
</tr>
<tr>
<td>JXTA 2.0 (rel. 030301)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rdv on same LAN</td>
<td>6203.9</td>
<td>963.6</td>
<td>9.8</td>
<td>3.5</td>
<td>86.2</td>
<td>436.1</td>
<td>7986.2</td>
</tr>
</tbody>
</table>
Results: Peer Startup

- Rendezvous peer startup

<table>
<thead>
<tr>
<th>JXTA version and cache location</th>
<th>Startup time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JXTA 1.0 Local</td>
<td>10</td>
</tr>
<tr>
<td>JXTA 1.0 NFS</td>
<td>100</td>
</tr>
<tr>
<td>JXTA 2.0 Local</td>
<td>10</td>
</tr>
<tr>
<td>JXTA 2.0 NFS</td>
<td>100</td>
</tr>
</tbody>
</table>
Results: Pipe Throughput

- JXTA 1.0
- JXTA 2.0

Sending rate (msg/sec)

Message size and traffic type

1 KB

Smooth | Bursty | Smooth | Bursty

10 KB

Unicast | Secure | Propagate

Sending rate (msg/s)

Message size and traffic type

1 KB

Smooth | Bursty | Smooth | Bursty

10 KB

Unicast | Secure | Propagate
Results: Control Overhead

- Overhead of control information in JXTA messages
  - 1 KB message
    - 20-60%
  - 10 KB message
    - 3-12%
Conclusions

- Benchmarking reveals
  - Relative cost of JXTA operations
  - Pipe throughput limits
  - Message control overhead ➔ Exchange larger messages with fewer elements and less frequently
  - Reuse advertisements and open pipe handlers

- Results can be translated into simulation parameters
Summary and Future Work

- JXTA performance model through benchmarking
- Performance results provide insight in issues and trade-offs
- Future work
  - Performance in large peer groups
  - Performance in wide-area networks
  - Performance over slow links
- More info at http://bosna.usask.ca