SPEC Enterprise Java Benchmarks
State of the Art and Future Directions

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Agenda

I. Overview of enterprise Java benchmarks
II. SPECjAppServer2004 after 3 years
III. Towards SPECjAppServer2007
IV. SPECjms2007
V. Summary
## SPEC Enterprise Java Benchmarks

<table>
<thead>
<tr>
<th>Category</th>
<th>Name</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Under Development</strong></td>
<td>SPECjAppServer2007</td>
<td>Java EE 5.0</td>
<td>??? 2007</td>
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<td></td>
<td>SPECjms2007</td>
<td>First messaging server benchmark</td>
<td>Jun 2005</td>
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<tr>
<td></td>
<td>SPECjbb2005</td>
<td>Server-side Java benchmark (J2SE)</td>
<td>Apr 2004</td>
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<td></td>
<td>SPECjAppServer2004</td>
<td>J2EE 1.3/1.4</td>
<td>Nov 2002</td>
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<tr>
<td><strong>Retired</strong></td>
<td>SPECjAppServer2002</td>
<td>Port to J2EE 1.3 / EJB 2.0</td>
<td>Sep 2002</td>
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<td>SPECjAppServer2001</td>
<td>Based on ECperf</td>
<td>Jun 2000</td>
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<td>SPECjbb2000</td>
<td>Server-side Java benchmark (J2SE)</td>
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## Workload Requirements for Enterprise Java Benchmarks

- **Representativeness**
  - Should be representative of real-life applications

- **Comprehensiveness**
  - Should exercise all platform services typically used

- **Focus**
  - Should be focused on the middle-tier

- **Scalability**
  - Must not have any inherent scalability limitations

- **Configurability**
  - Should be customizable/configurable
SPEC OSG Java Subcommittee

SPECjAppServer2004 Business Model

- Dealers
- Customer Domain
- Corporate Domain

- Suppliers
- Supplier Domain
- Manufacturing Domain
Exercised Components / Services

- **Software**
  - J2EE application server
    - The Web container (servlets and JSPs)
    - The EJB container (session beans and entity beans)
    - Container-managed persistence
    - JMS and message driven beans
    - Transaction management
    - Database connectivity
  - DBMS software
  - OS, JVM software, JDBC drivers

- **Hardware**
  - Server systems
  - Storage systems
  - Network components
  - Load-balancers

SPECjAppServer2004

- 45 published results as of June 16, 2007
- **Software platforms tested:**
  - BEA WebLogic Server 9.0, 9.1, 9.2
  - Oracle Application Server 10g
  - IBM WebSphere Application Server 5.1, 6.0, 6.1
  - Sun Java System Application Server Platform Edition 8.1, 8.2, 9.0
  - Sybase EAServer
  - DBMS: Oracle Database 10g, IBM DB2 Universal Database, MySQL 5.0
- **Hardware platforms tested:**
  - IBM xSeries 335/365, OpenPower 720, p5 550, xSeries Blade Center
  - HP DL380, ProLiant BL685c G1, HP-UX rx2660, rx4640, rx3600, rx6600
  - Sun Fire T2000, X4100, X4600, E2900, V20z; Sun Blade 8000
  - Fujitsu SPARC Enterprise T2000
  - Inspur NF380D System
BEA WebLogic Server 9.2 on HP Integrity rx6600 Cluster

IBM WebSphere 6.1 Application Server on xSeries Blade Center
Oracle Application Server 10g Release 10.1.3.2 on HP Integrity rx3600 Cluster

BEA WebLogic Server 9.2 on Sun Blade 8000 Modular System
**SPECjAppServer2007 Goals**

- Simplify the deployment and running of the benchmark
- Improve driver
  - Simplify configuration and result collection
  - Reduce driver CPU consumption by 50%
- Migrate workload to Java EE 5.0 APIs
- Introduce new Java EE 5.0 features
  - Web services in manufacturing and supplier domains
- Improve run repeatability & predictability
- Reduce database contention

**SPECjms2007**

- **World’s 1st industry standard benchmark for MOM**
- Developed by the SPECjms Working Group with the participation of:
  - IBM
  - TU Darmstadt
  - Sun
  - BEA
  - Oracle
  - Sybase
  - Apache
  - JBoss
Supermarket Supply Chain Scenario

Participants:
- Headquarters (HQ)
- Supermarkets (SM)
- Distribution Centers (DC)
- Suppliers (SP)

Modeled Interactions

The following interactions are part of the scenario:

1. Order / shipment handling btw. SM and DC
2. Order / shipment handling btw. DC and SP
3. Price updates
4. SM inventory management
5. Sales statistics collection
6. New product announcements
7. Credit card hot lists
Back to Workload Requirements

- **Representativeness**
  - Based on a realistic workload scenario
  - Features stressed weighted according to their usage in real-life systems
  
  **Goal**
  - Allow users to relate the observed behavior to their own applications and environments

- **Focus** on the middle-tier
  - Messaging server (software and hardware components)
  - Minimize the impact of other components

Comprehensiveness

- Workload should consider the following dimensions:
  - Transactional vs. non-transactional messages.
  - Persistent vs. non-persistent messages.
  - Different message types, e.g. TextMessages, ObjectMessages, StreamMessages or MapMessages.
  - Messages of different sizes (small, medium, large).
  - Point-to-point vs. pub/sub communication.
  - One-to-one, one-to-many and many-to-many interactions.
  - Durable vs. non-durable subscriptions.
  - Ratio of message producers to message consumers.
Scalability

- The workload can be scaled along two dimensions:
  - **Horizontal scaling / topology**
    - Increase the number of destinations (queues and topics)
    - Keep the traffic per destination fixed
  - **Vertical scaling / topology**
    - Increase traffic per destination
    - Keep the number of destinations fixed

- Additionally: Support for **freeform scaling / topology**
  - user defines number of destinations and traffic per destination

- Scaling factor used as metric
  - SPECjms2007@Horizontal
  - SPECjms2007@Vertical

Configurability

- **Goals**
  - Provide a flexible framework for performance analysis of MOM
  - Allow user to customize the workload to stress specific aspects
  - Use interactions as building blocks

- Interactions must be decoupled
  - Standard mode: Ensures that dependencies between interactions are preserved as defined in the application scenario
  - Freeform mode: Run interactions in different combinations depending on the desired transaction mix

- Over 150 configuration parameters available to customize the workload
SPECjms2007 Status

- Project started in Sept. 2005
- 18 releases
- Currently tested on the following platforms
  - IBM WebSphere AS
  - IBM WebSphere MQ
  - Sun Java System MQ
  - Sun JMS Grid
  - BEA WebLogic Server
  - Oracle Application Server
  - Apache Active MQ
  - Sybase EAServer

Summary & Conclusions

- Main challenges in enterprise Java benchmarking
  - Ensuring benchmark scalability
  - Providing maximum
    - ease-of-use
    - flexibility
    - configurability
  - Defining representative metrics

- SPECjAppServer2004
  - 45 results published since April 2004
  - Results exhibit linear scalability
  - 75+ copies sold to non-members
Summary & Conclusions (cont.)

- Increasing use of benchmarks for “in-house” performance analysis and research in academic environments
- Validation of product performance and scalability
- Performance tuning and optimization
- In-depth performance analysis
- Research in performance engineering

- SPECjms2007 about to become the world’s 1st industry standard benchmark for messaging platforms
- In addition to standard metrics and workload, provides a full-blown performance analysis framework for messaging platforms

Thank You For Your Attention!

QUESTIONS

For copy of the slides go to
http://www.dvs1.informatik.tu-darmstadt.de/~skounev