Oracle Fusion Middleware

The Grid Infrastructure

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Oracle Fusion Middleware

User Interaction
- Web 2.0 Portal, Rich Internet Apps, Mobile, Search, Desktop, Presence, VoIP

Enterprise Performance Management
- Planning, Budgeting, Financial Management & Reporting, Scorecards

Business Intelligence
- Data Integration, Query & Analysis, OLAP, Dashboards, Reports, Alerts, Real-Time

Content Management
- Web Content, Document, Records Mgmt, DAM, Capture and Imaging, Archiving, IRM

SOA & Process Management
- ESB, BPM, Workflow, BAM, Rules, B2B, MDM, Registry, Repository

Application Server
- Java EE, Web Services, TP Monitor, Complex Event Processing, XTP, SIP

Grid Infrastructure
- Application Clusters, In-Memory Data Grid, Metadata Services, JVM, Virtualization

Development Tools
- Unified SOA Development Tool & Framework

Enterprise Management
- SOA Management, Provisioning, Diagnostics, Configuration Management, Tuning

Identity Management
- Provisioning, Access Management, Audit, Directory, Role Management, Fraud Detection
Continuous Availability Relevance

- Infrastructure Availability is becoming more and more critical

<table>
<thead>
<tr>
<th>Industry/Sector</th>
<th>Revenue/Hour</th>
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<tr>
<td>Energy</td>
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<td>Telecommunications</td>
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<tr>
<td>Transportation</td>
<td>$668,586</td>
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</table>

![Downtime Calculator](chart.png)

Approximate Total Cost of Incident: $554,019
Middleware Availability Requirement

- Web Application need 24/7 availability
  - Online Stores, Reservation System, Financials, Telecommunications, Health care etc.

- SOA Applications have unique availability challenges
  - Varied set of consumer like partners, other departments, end users or can be publicly available.
  - Union of Availability Requirements of all it’s consumer
  - Long running processes. Cannot assume human retry

- Content needs to be available for Web as well as SOA applications
  - WebContent, Documents, Records, Images, Archives

- Identity Management is an integral part of any system
  - WebApplications, SOA, Content, Data, and even Systems

- Data MUST be always available! Literally!

- Meeting SLA is often challenging
  - Unpredictable load, Applications depend on other Applications

- Availability of an Application depends on Availability of entire infrastructure
  - WebServers, Application Servers, Databases, LDAP Servers, Security Infrastructure, Content Management, Backend Systems etc…
**OFM Grid**: Scalability, Availability, Automated Management and Real Time Performance

- **Continuous Availability**
  - Zero Planned & Zero Unplanned Downtime, Disaster Protection

- **Extreme Scale-out**
  - Zero Latency, Extreme Throughput, Transaction Integrity

- **Automated Management**
  - Provisioning, Dynamic Clusters Operations, Monitoring, Optimized Quality of Service

- **On-Demand Scalability**
  - Capacity on Demand, Dynamic Workload Management, Clusters
OFM High Availability

UNPLANNED DOWNTIME

Failures & Solutions

- Data Failure
- Human Error
- Site Disaster
- Hardware Failure
- Software Failure

Solutions:
- Backup & Recovery
- Clusters & Load Balancing
- Server Migration
- Clusterware Integration
- Death Detection and restart Clusters & Load Balancing
- Replica aware Stubs

WAN Clusters
Disaster Recovery
Deploy and Re-deploy Applications
Transformations, scalability and topology extensions
Upgrades
Rolling Upgrade Rolling Patching
PLANNED DOWNTIME Operations & Solutions
Hot Deployment Side By Side Deployment
Configuration Changes
• Online configuration Changes
  • Changes and warnings
  • Batching
  • changes/Deferred Activation
• Cluster wide JNDI
• Dynamic Clusters
OFM High Availability
WLS HA Deployment Architecture
Active/Active Clustering

DMZ Firewall

External Users

DMZ Firewall

Internal Users

Network Dispatcher/LBR

Active/Active Cluster

Managed Servers
Node Manager

Oracle HTTP Server
Oracle WebCache

Managed Servers
Node Manager
Admin Server
Active/Active Cluster

Oracle HTTP Server
Oracle WebCache

Oracle HTTP Server
Oracle WebCache

Oracle HTTP Server
Oracle WebCache

DB Servers

Directory Server

Data Tier / Intranet

Client Tier

Web Tier DMZ

App Tier DMZ

S}

wireless & Mobile

Internet

ORACLE
Highly Available Clustering

• **Problem Description**
  • Server infrastructure must be able to automatically handle and recover from process, machine, disk, network and data center failures

• **How this feature helps**
  • **Node Manager** monitors health of and automatically restart failed servers
  • **Whole Server Migration** machinery automatically migrates servers off failed machines and restarts them on other physical machines in the data center. Service Migration protects Singletons.
  • WLS Clusters uses TCP-based communication and hence can span multiple data centers across Metropolitan Network (MAN)
  • Replicate **HTTP Session** data to servers in same cluster or to a Secondary server in a different Cluster in a different data center
  • **Cluster-Aware RMI stubs** enable clients to transparently access services from across the Cluster and be load-balanced/failed-over as necessary
  • Cluster wide JNDI service provides location transparency

• **Business Impact**
  • Business can continue to function normally even in the face of major software and hardware infrastructure failures
Production Redeployment

• **Problem Description**
  • Application Upgrade requires downtime or “cluster switch”, neither preserves active client sessions

• **How this feature helps**
  • Newer version of application deployed side-by-side with older version in same JVM
  • Clients already connected continued to be served by older version
  • New clients connect to newer version
  • Test versions before opening up to users
  • Rollback to previous versions
  • Automatic retirement – graceful or timeout

• **Business Impact**
  • Upgrade applications without taking downtime
  • Reduces hardware, software, maintenance, and support costs
Self-Tuning and Work Management

- **Problem Description**
  - Optimally tuning server (handle varying loads, provide different QoS to different applications, gracefully handle overload conditions, etc.) is extremely hard!
  - Administrators tend to overprovision resources to be safe, leading to sub-optimal ROI

- **How this feature helps**
  - Server dynamically and automatically tunes itself for optimal resource (threads) utilization
  - User can define QoS constraints per application, server will allocate resources accordingly
  - Server will reject new work when overloaded (user gets to define what “overloaded” means)

- **Business Impact**
  - “Self Healing” servers reduce administration, maintenance, and support costs
Best-of-Breed Messaging (JMS) Engine

• **Problem Description**
  • Typical Enterprise Applications need a JMS solution with availability & reliability
  • Third-party solution is often deployed which needs a separate infrastructure and skills

• **How this feature helps**
  • High Performance, integrated, OOB, best-of-breed JMS solution
  • Unit of Order/Unit of Work
    • Strict Ordering of Message processing
  • Distributed Destinations
    • Highly Available JMS Destinations across a Cluster
  • Store-and-Forward (SAF)/Client SAF
    • Asynchronous Reliable Messaging across WAN
  • Integrated JTA (XA) Transaction Management
  • Message Processing co-located with Application Server
    • No callout over network to external process (avoids network hop and serialization/deserialization of payload)

• **Business Impact**
  • Out of the box best-of-breed JMS solution reduce administration, maintenance, and support costs
WLS Rolling Upgrade

- **Problem Description**
  - Patching product binaries incurs downtime.

- **How this feature helps**
  - Upgrades a running cluster with a patch, maintenance pack, or minor release without shutting down the entire cluster.
  - During the rolling upgrade of a cluster, each server in the cluster is individually upgraded and restarted while the other servers in the cluster continue to host your application.
  - You can also uninstall a patch, maintenance pack, or minor release in a rolling fashion.

- **Business Impact**
  - Minimize planned down time
WLS Integrated Availability
RAC DB Support with Multi Data Source

• Problem Description
  • Application Servers maintain connection pools to individual RAC DB instance.
  • If a RAC DB instance becomes unavailable, all the connections pointing to it must be cleaned

• How this feature helps
  • Multi Data Source is an abstraction around a group of Data Sources
  • Provides Faster Failover
  • Automatic Failback
  • Load Balancing or High Availability Option available
  • Periodic Health Check
  • Pinned Transactions

• Business Impact
  • No manual intervention required for protection from a RAC DB instance failure
Automated Management
Operations & Management Tools

- **Problem Description**
  - # of Application Server instances deployed in Datacenter is ever increasing, which imposes severe manageability challenges.
  - Application Servers/JVMs tend to be “Black Boxes” in terms of diagnosing and debugging application runtime execution behavior.
  - Many 3rd party Diagnostic Toolkits impose significant performance overhead, so are not usable in Production.

- **How this feature helps**
  - **WLS offers best-of-breed Operations & Management tooling that significantly lowers TCO of application development and deployment/maintenance**
  - Best-of-breed browser-based Administration Console GUI
  - Best-of-breed single unified command-line WebLogic Scripting Tool (WLST) to perform any/all administration actions to a WLS Domain
  - OOTB WebLogic Diagnostic Framework (WLDF) diagnostic toolkit to perform common developer and administrator monitoring & diagnostics functions
  - JRockit Mission Control (JRMC) and AD4J provides unique and best-of-breed JVM tooling to diagnose Java runtime execution
  - All of these tools impose a very small (2-3%) performance overhead and are **usable in Production**

- **Business Impact**
  - Lower TCO of building and maintaining IT applications
Enterprise Manager Packs

• Problem Description
  • Ability to manage, monitor and analyze WebLogic domains and clusters using Enterprise Manager along with other entities in data centers like Databases, OAS, Oracle Applications, Load Balancers, Storage, Firewalls etc.

• How this Feature Helps
  • Diagnostic Pack
    • Multi-domain management and monitoring from a single console
    • 24x7 monitoring of availability, performance, load, and usage metrics of WebLogic Server and the host monitoring
  • Configuration Pack
    • Configuration Management and Tracking for WLS domains and clusters
  • Provisioning Pack for WLS(Planned with 11g)
  • Business Impact
    • Single unified tool to manage, monitor and analyze entire data center results in significant lower TCO
    • Real Time SLA views for Business Users
WebLogic Server Dynamic Updates

- **Problem Description**
  - Making configuration changes often result in down time

- **How this feature helps**
  - Batch Updates
    - User obtains a configuration lock
    - Makes multiple config changes and deployments
    - Activates or rolls back changes
    - Previous configurations archived
  - Configuration Deployment
    - Configuration changes ‘deployed’ to managed servers
    - Managed servers listen for dynamic settings
    - Static settings reflected on server restart
  - Dynamic configuration settings
    - Take effect when changes activated
    - Approximately 1,400 dynamic configuration settings
    - Supports common tunables, channels, scalability, performance settings

- **Business Impact**
  - Minimize planned down time
Extreme Scale-out
# JRockit Product Family

## JROCKIT MISSION CONTROL
- Complete insight into application & JVM behavior
- Zero performance overhead in production environments
- No application modification or configuration required

## JROCKIT REAL TIME
- High-performance real-time solution for standard Java
- Industry leading **Deterministic Garbage Collector**
- Millisecond response times with “five nines” guarantee
  - **Improve application performance & latency** with unique tooling

## JROCKIT VIRTUAL EDITION
- Fly-weight Java container for virtualized environments
- Improve datacenter efficiency - do more with less
- Simpler and more powerful VM management
- Scheduled for release in 2009*

## JROCKIT JVM
- World-class performance
- Powerful diagnostics
- Full support from Oracle

* Forward-looking statement, see disclaimer on earlier slide
JRockit Real Time

- Java SE engine with ‘soft’ real-time performance
  - Deterministic GC provides max pause time guarantees
    - “no pause should be longer than 5 ms”
    - Max latency = time to process transaction + max pause time
  - Decreases frequency and severity of latency spikes
    - Snap-in replacement for existing JVM, no code rewrite required!
  - Unique RT tooling helps customer identify & remedy latency issues
Benefits of Deterministic GC

Traditional Java

During Low Load: GC spikes and occasional timeouts visible

During High Load: GC pauses can result in unacceptable response times

JRockit Real Time

JRRT Makes garbage collection deterministic. Allowing for the guarantee of SLAs.
JRockit Real Time Tooling
Built on JRockit Mission Control

- Monitor health & performance in production
- Visualize application & JVM events per thread
  - Nanosecond granularity (subject to OS limitations)
- Identify and remedy latency issues with the Latency Analyzer
Data Grid
What is Coherence?

- Cluster-based Data Management Solution for Applications aka: Data Grid
- Cluster-based parallel processing solution for Applications aka: Application Grid (like Proactive)
Coherence in the Application-Tier: Middleware

- Development Library
  - Pure Java 1.4.2+
  - Pure .Net 1.1 and 2.0 (client)
  - C++ client (3.4)
  - No Third-Party Dependencies
  - Proprietary Network Stack (Peer-To-Peer model)

- Other Libraries Support...
  - Database and File System Integration
  - TopLink and Hibernate
  - Http Session Management
  - Spring, Groovy*
Distributed Data Management (access)

The Partitioned Topology
(one of many)

In-Process Data Management
Distributed Data Management (update)
Distributed Data Management (failover)
Standard Compute Grid

- Client Application 1
- Client Application 2
- Client Application 3
- ... 
- Client Application N

- Job Requests
- Job Results

- Grid Manager
- Job Scheduler
- Task Broker
- Agent Manager
- Service Registry

- Task Requests
- Task Results & Server Status

- Grid Server 1
  - Task 1
  - Grid Agent
  - Task 2
  - Task 3

- Grid Server 2
  - Task 4
  - Grid Agent
  - Task 5
  - Task 6

- Grid Server N
  - Task m-2
  - Grid Agent
  - Task m-1
  - Task m

- N > 100

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Embedded Data Grid
OFM HA Road Map
OFM 11g SOA Unified Service Service Platform

One single runtime to install, cluster, manage
OFM 11g Service Oriented Architecture
Composite Applications

SCA Composite

Policy Management
Optimized Service & Eventing Infrastructure
Common Connectivity Infrastructure

Rules
BPEL
Human Task

Policy Manager
Service Infrastructure

Pluggable Service Engines

SOAP
B2B
ETL
JCA
## OFM 11g SOA HA Considerations

<table>
<thead>
<tr>
<th>SOA Component Characteristic</th>
<th>HA Feature Used</th>
</tr>
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<tbody>
<tr>
<td>Mostly stateless, JavaEE Applications</td>
<td>WLS ilities like clustering, loadbalancing, failover etc.</td>
</tr>
<tr>
<td>• Composites stored in MDS</td>
<td>• RAC based DB</td>
</tr>
<tr>
<td>• DB : Additional Persistence Store</td>
<td>• WLS Multi Data Source</td>
</tr>
<tr>
<td>JMS : B2B, UMS, Adapters BAM etc.</td>
<td>WLS Service/Server Migration</td>
</tr>
<tr>
<td>XA : Most SOA components are XA compliant</td>
<td>WLS JTA Service Migration</td>
</tr>
<tr>
<td>SOA Clustering</td>
<td>Coherence</td>
</tr>
<tr>
<td>No special dependency on hostnames, IP Address etc.</td>
<td>• File System based Backup and Recovery</td>
</tr>
<tr>
<td></td>
<td>• Storage Replication for Disaster Recovery</td>
</tr>
<tr>
<td>Singletons : Components (File, FTP Adapters, BAM Server)</td>
<td>Automated Failover</td>
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</tbody>
</table>
OFM SOA 11g HA Architecture

- External Load Balancer used to front-end WebServers
- WebServer cluster is a run time cluster and does not support cluster wide management
- All WLS instances in cluster WLS Cluster
- At least two MW_HOMEs used to support HA Patching (on local or shared storage)
- RAC DB
- CFC for Admin Server protection (optional)
- TLogs on Shared Storage
- JMS Persistence Store on Shared Storage (Optional)
- Coherence for SOA cluster
OFM 11g Maximum Availability Architecture
Asymmetric Active/Passive

Production Site

Standby Site

Web Tier

Global Router

DR Protection

Average Latency and Bandwidth WAN

Coherence Data Grid Service

Firewall

Firewall

Proactive
SCA
J2EE

IDM

RAC

Firewall

Firewall

Proactive
SCA
J2EE

IDM

RAC

OFM 11g Maximum Availability Architecture
Asymmetric Active/Passive

Production Site

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DR Protection

Average Latency and Bandwidth WAN

Coherence Data Grid Service

Firewall

Firewall

Proactive
SCA
J2EE

IDM

RAC

Firewall

Firewall

Proactive
SCA
J2EE

IDM

RAC

ORACLE
OFM 11g Maximum Availability Architecture
Active/Active

Active Data Center 1
- Global Router
- Firewall
- Web Tier
- Proactive
- SCA
- J2EE
- Low Latency High Bandwidth WAN
- Coherence Data Grid Service
- IDM
- RAC
- Oracle DataGuard
- Stbdy DB

Active Data Center 2
- Firewall
- Web Tier
- Proactive
- SCA
- J2EE
- IDM
- RAC
- Firewall