

Java on HP NonStop Update

for BITUG BIGSIG

Moore Ewing
HP EMEA NonStop PreSales

December 2013

The unique value of HP NonStop

Designed from the ground up for 100% application availability

NonStop Operating System

- Fault-tolerant, scalable, shared-nothing architecture
- Single-system-image clustering up to 255 systems
- Uncompromising data integrity

Security

- Built-in system and application security
- Enterprise security integration
- Software to help with Security audits

System management

- HP Mission-Critical Converged Infrastructure integration
- Industry standard, enterprise class

The HP NonStop Integrated Stack

APPLICATIONS

Modern Application Development

Middleware

Database and Transaction Management

System Management and Control

Security

NonStop Operating System

Hardware

Database and transactions

- Highly scalable, clustered SQL database with transactional integrity
- Mixed workload support – OLTP, queries and batch

Middleware

- Transparent application fault tolerance and scalability through standard middleware
- Service-Oriented Architecture (SOA)
- Java frameworks for fast deployment

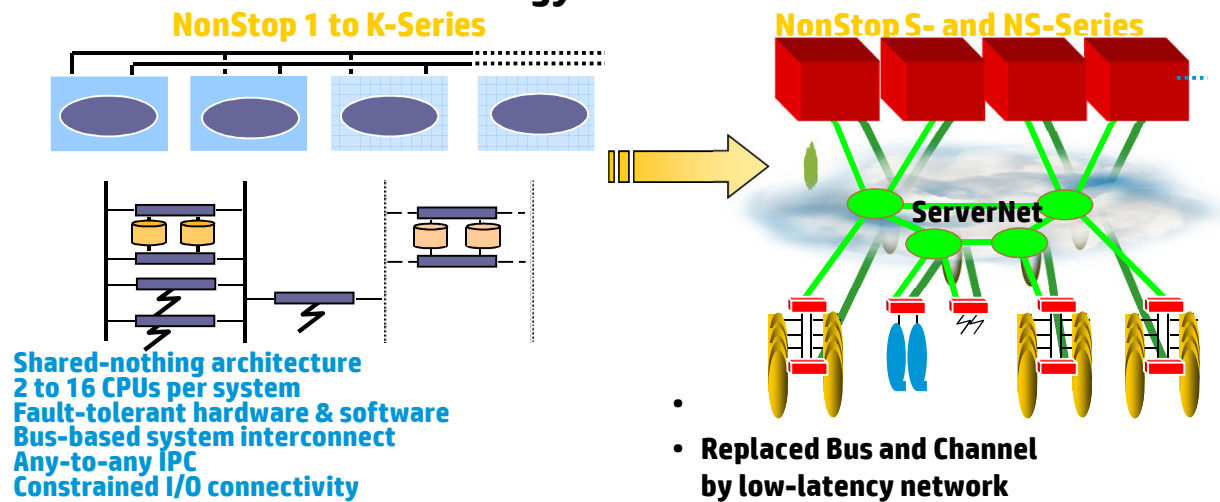
Modern app development

- Java, C/C++, ODBC, JDBC, SOAP, XML
- Eclipse



Architecture evolution (Hardware)

- from Bus&Channel technology to Server-Area-Network

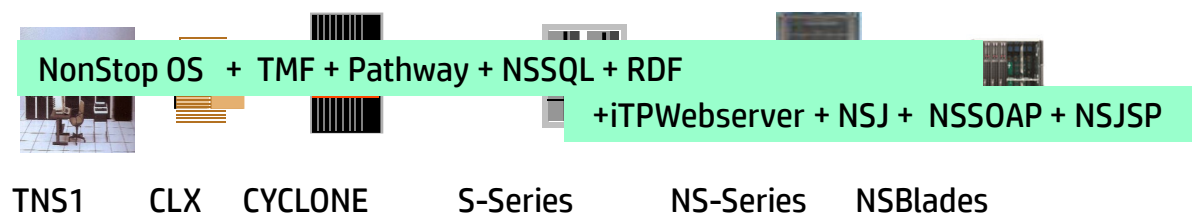


T/16 CISC chips -> MIPS RISC chips -----> Itanium 1-core -> Itanium n-core

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NonStop is primarily a software product



**The hardware has constantly changed to new technology ,
 the architecture of how the software uses it has stayed the same !**

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NonStop Architecture is Scalable and Fault-Tolerant

How does an HP NonStop server do it?

Share-nothing, clustered, single system image architecture

- Creates an Available and Scalable system with online expansion of resources (CPUs, disc, etc.)

Hardware and software fault-tolerance

- Non-redundant duplication of hardware plus stateful takeover by process-pairs

Single system image across network of clusters

- Supports local expansion, distributed applications and disaster recovery

Fail-fast fault containment

- Combines with share-nothing model to prevent propagation of errors

Online management of the system and database

- Avoids application downtime while administration is taking place

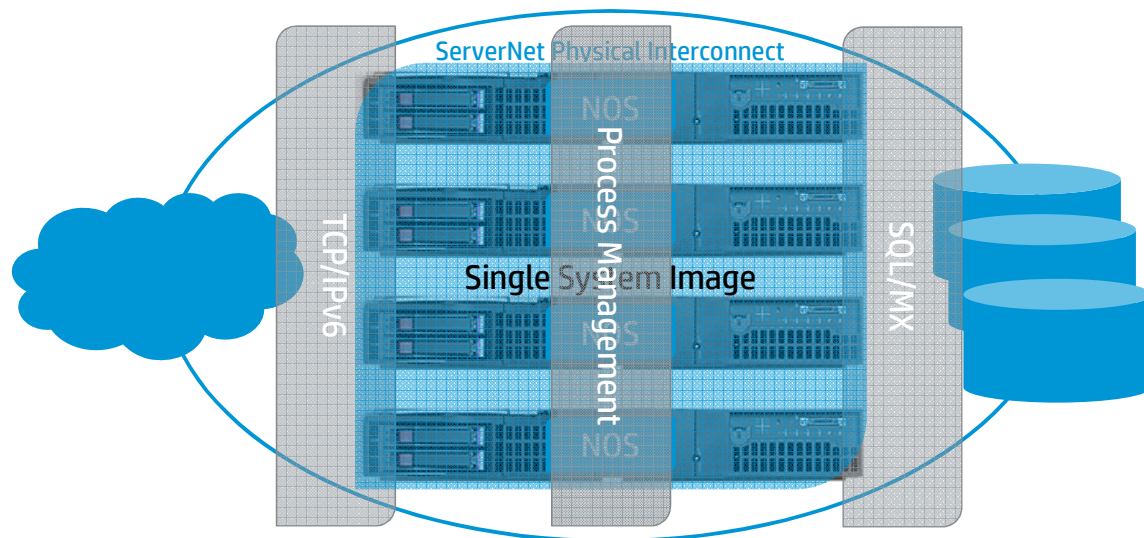
Evolving technology

- Intra-system connectivity: bus/channel – ServerNet (CPU and I/O network)
- Processor chips: Tandem CISC – MIPS RISC – Intel Itanium EPIC



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NonStop system architecture is MPP not SMP



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HP NonStop

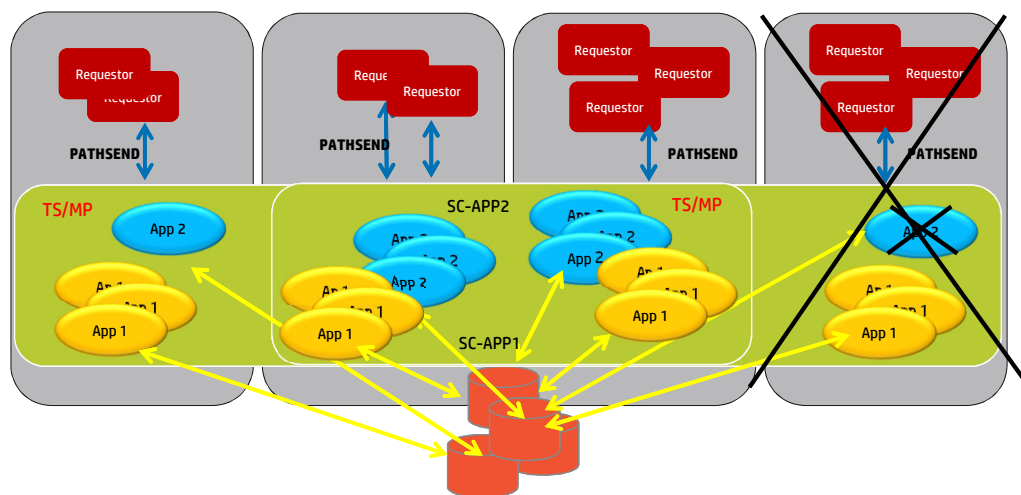
The critical role of “TS/MP”

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NonStop TS/MP

Scalability and availability



TS/MP and Requester-Serverclass structure

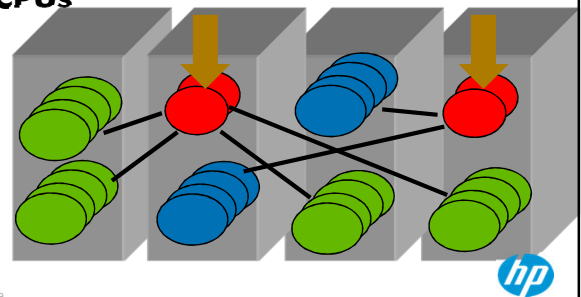
- Application Virtualization in and across NonStop Servers

Application is divided into

- **Requester processes** - Presentation, Navigation, Context Man
- **ServerClasses** - pools of replicated pro

• Application

- Does this require special application coding ?
- Not with standard application containers !!
- Application runs across NonStop Servers
- Server Class balanced across CPUs
- Location of data transparent to application
- On-line upgrade to new version of Server Classes



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Bringing Java to Integrity NonStop

About more than just a language About Enterprise quality transactional applications

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Bringing Java to Integrity NonStop



- Technical challenges in NS system environment
 - a uni-processor system without threading
 - 32-bit addressing with a 2GB user data limit in the process
 - Static binding without DLLs
- “Religious wars” in the JEE world
 - EJB Entity beans very “ugly” and expensive
 - Servlet/JSP + Opensource projects satisfied many (most) applications
- Implemented
 - POSIX User level threading for JVM
 - Opensource Web Container (Tomcat) and popular Frameworks .
 - Have added 64-bit addressing and EJB3 container (JBoss/Wildfly))
- **Had to bridge the SMP-MPP threading gap.....**

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NonStop Server for Java

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NSJ features – summary

NSJ 6 features

- Based on Oracle JDK 1.6.0_24 version
- Supports all headless JDK APIs
- < 1.2 GB Java heap size
- Current version = NSJ 6 Update 3

NSJ 7 features

- Based on Oracle JDK 1.7.0_01 version
- First NSJ release with 64-bit support
- Supports a very large Java heap
 - Size is only limited by the physical memory of the system
- Improved garbage collection
 - Parallel and concurrent mark sweep GC



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Garbage collection and NSJ 7.0

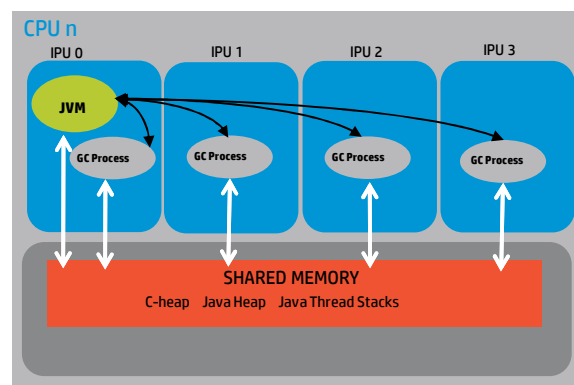
New feature in future release of NSJ

For a JVM running on NSMA (J-series)

- GC Policy Commands now supported
 - -XX:+UseSerialGC
 - -XX:+UseParallelGC
 - -XX:+UseParNewGC
 - -XX:+UseParallelOldGC
 - -XX:+UseConcMarkSweepGC
- Garbage collection processes created in each IPU associated with each JVM
- Essentially working as GC “threads” similar to SMP implementations (e.g. HP-UX)
- Can be used in either 32-bit or 64-bit JVM

For a JVM running on single-core (H-series)

- GC policy remains as **Serial**
- JVM will not start if any other GC Policy Command is used



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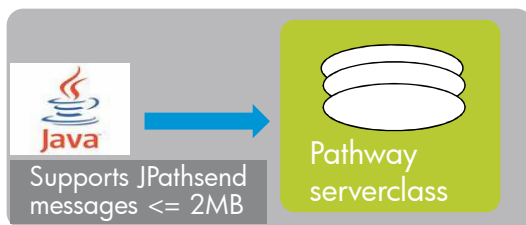
NonStop Extensions for Java

- **JToolkit**
To integrate Java modernisations with other NonStop application environments
- **Jl (Java Infrastructure)**
Allow Java APIs to use TS/MP functionality

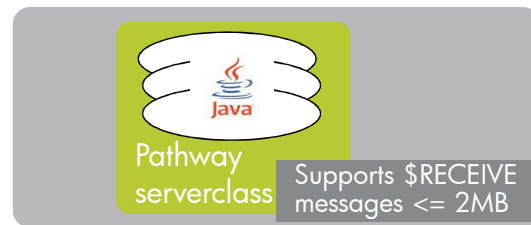
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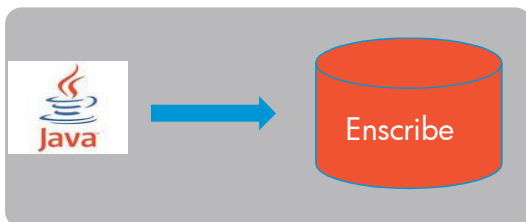
JToolkit – Legacy Integration with Java



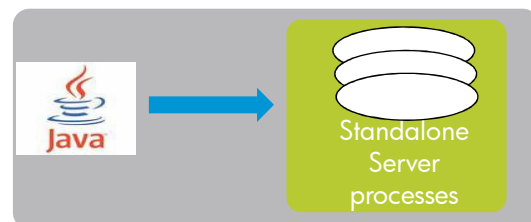
JPathsend API



JPathway API



JEnscribe API



JRequester API

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JI (Java Infrastructure) - Motivation for creating it

WHY LEARN NONSTOP API ?

- Why should a java programmer learn NonStop API while java apps are meant to be platform agnostic

PORTING

- A big chunk of NonStop specific code in NSJSP (port of Apache Tomcat) is interfacing with \$RECEIVE

PROVIDE SOMETHING TO BRIDGE THE Java-NonStop GAP

- Give customers and ISVs something new that will make it easier to exploit NonStop systems

REDUCE EFFORT and COST

- Help more open source products (JBoss etc) to be ported onto NonStop

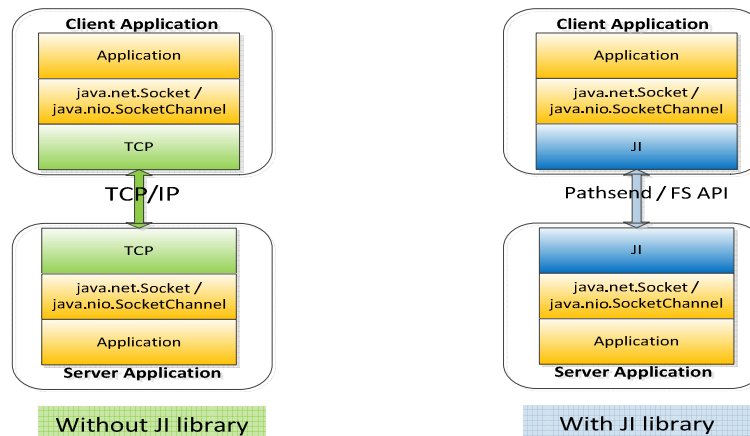


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Product Overview

Standard Interface

- Provides Java standard face to NonStop API for IPC (Pathsend or FS)
- Use `java.net.Socket` and `java.nio.SocketChannel` for Pathsend and FS IPC



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Advantages

Develop on desktop, Deploy on NonStop

DEVELOPMENT

- The application can be developed on desktop using an IDE of developer's choice
- During development no NonStop libraries are needed

TESTING

- The application can be tested on desktop using any of the various testing frameworks
- Testing too does not require any NonStop specific libraries

Desktop

DEPLOYMENT

- The application can be deployed as a TS/MP server class
- The application inherits all the goodness of the platform and TS/MP

NonStop



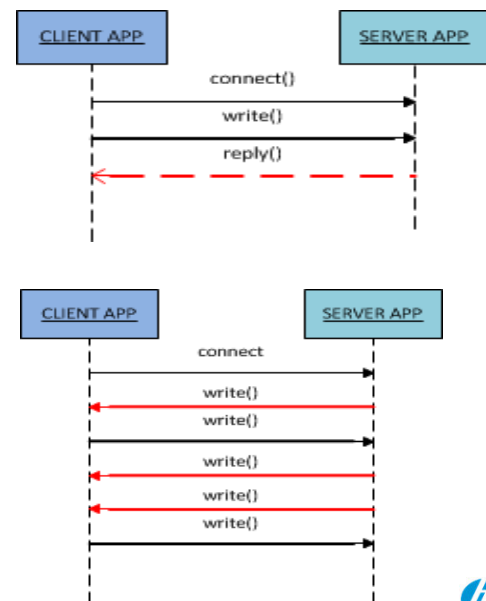
Architecture – Modes of operation

Request-response

- Client initiates data exchange
- Server responds to client request
- Server can ONLY respond to client message

Bi-directional

- Default mode of operation in JI
- Client and Server can each send data independent of the other



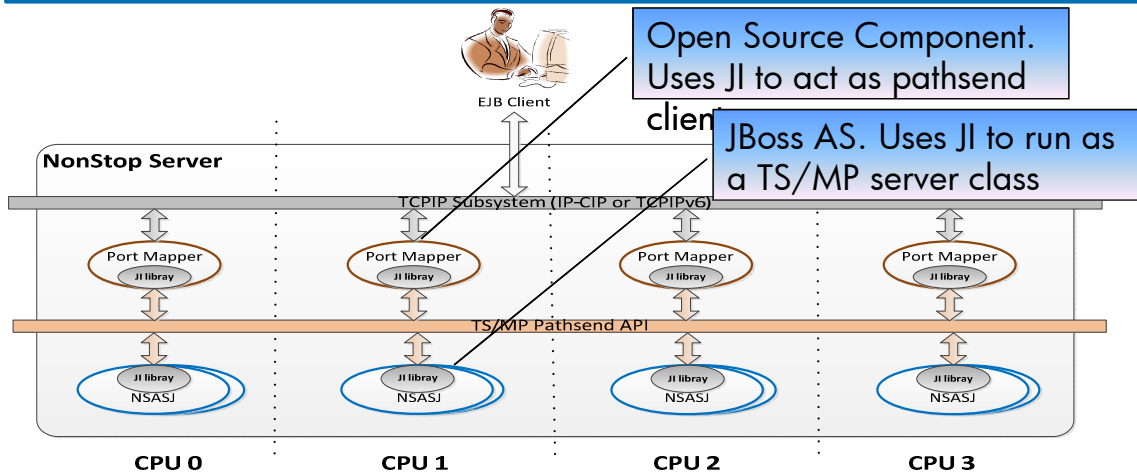
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Use cases – NSASJ (JBoss port on TS/MP)

JBoss code modification to run it as TS/MP server class

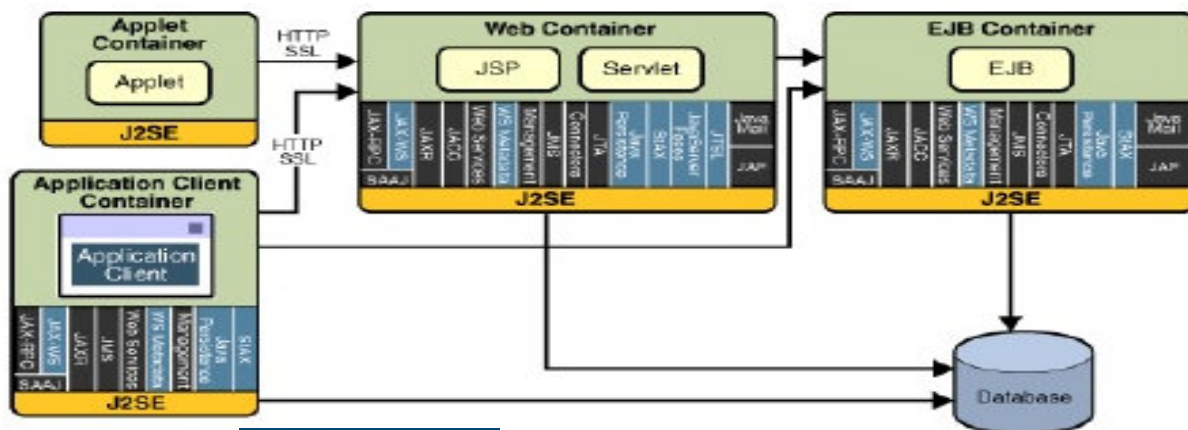
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JEE functionalities



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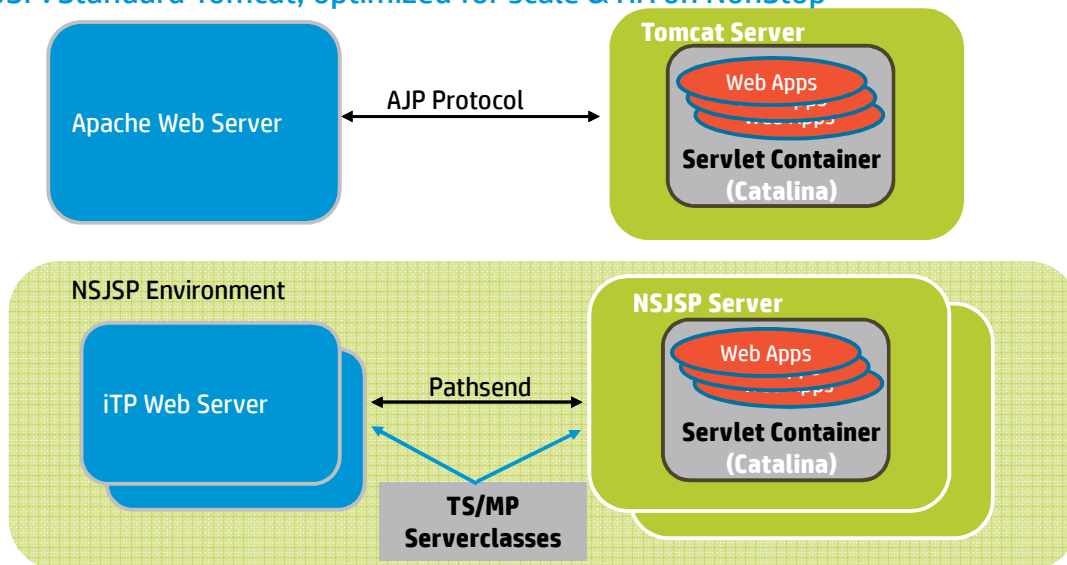
NonStop iTP WebServer and NonStop Servlets for JavaServer Pages

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Tomcat vs NSJSP

NSJSP: Standard Tomcat, optimized for scale & HA on NonStop



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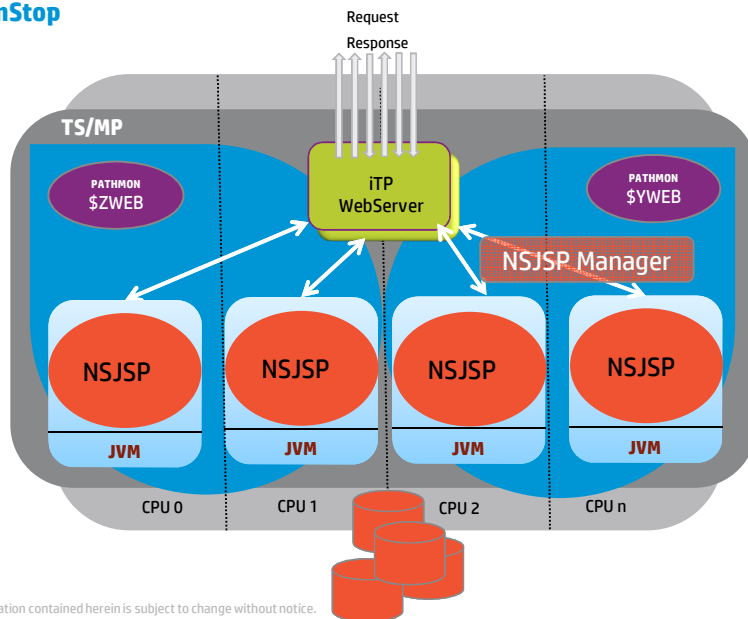


NonStop Servlets for JavaServer Pages (NSJSP)

Value-add port of Apache Tomcat to NonStop

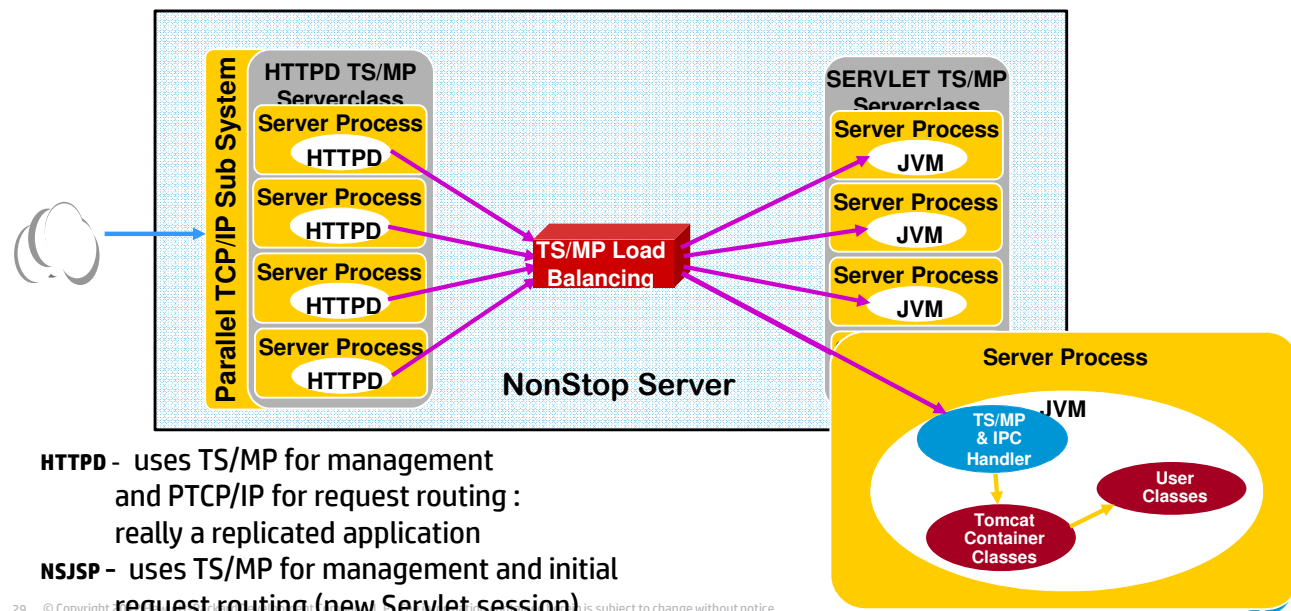
Implemented to leverage **scalability** and **fault-tolerance** provided by TS/MP

Can leverage Pathway Domains feature of TS/MP 2.4 and later releases to implement an “**On-line Upgrade**” configuration of NSJSP.



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iTP WebServer and NonStop JSP



HTTPD - uses TS/MP for management and PTCIP/IP for request routing : really a replicated application

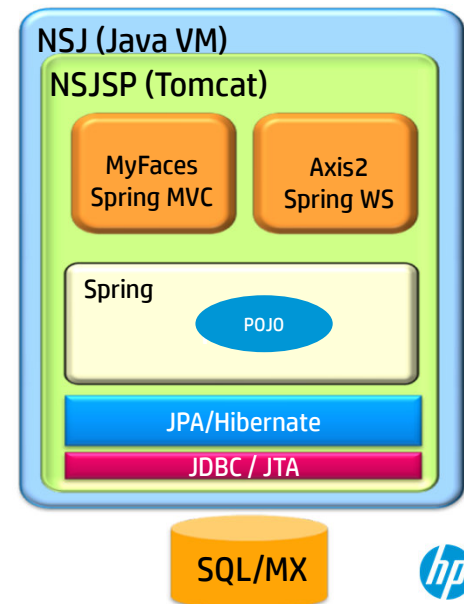
NSJSP - uses TS/MP for management and initial request routing (new Servlet session)

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Open Source Java Frameworks on NonStop

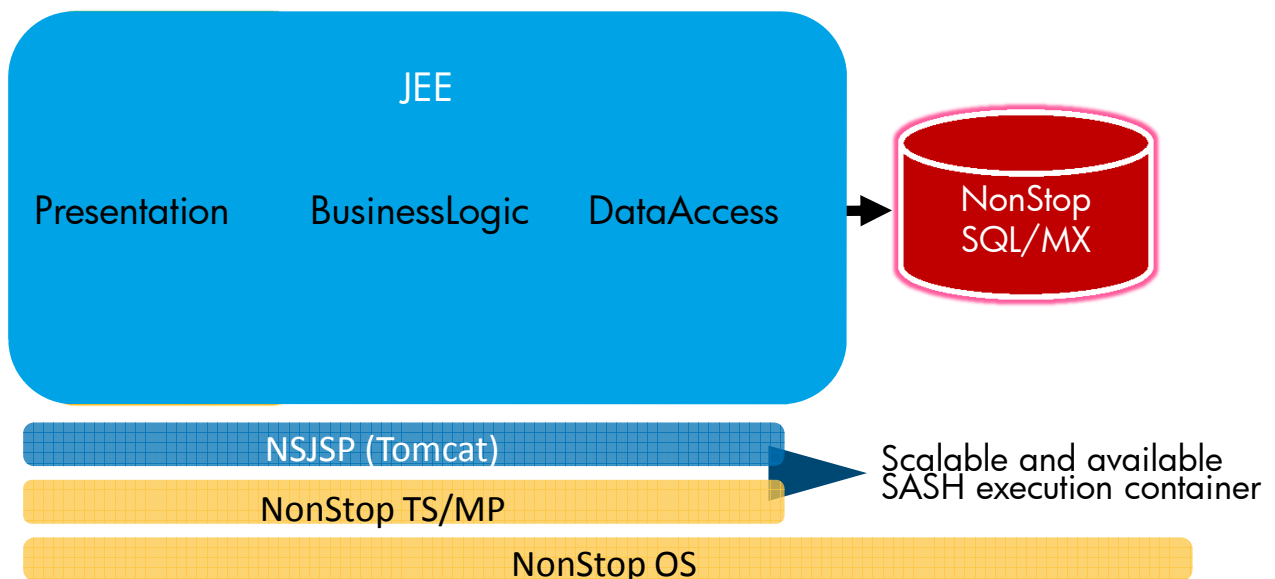
– Enterprise Java on NonStop

- No changes were required except...
 - Special “dialect” file for Hibernate
- Executes in NSJSP container
- Inherits NonStop fundamentals with NSJSP
- Integrate existing NonStop Apps via JToolkit (Java)
- Fully integrated and tested by HP
- End user documentation provided
- Fully supported by HP



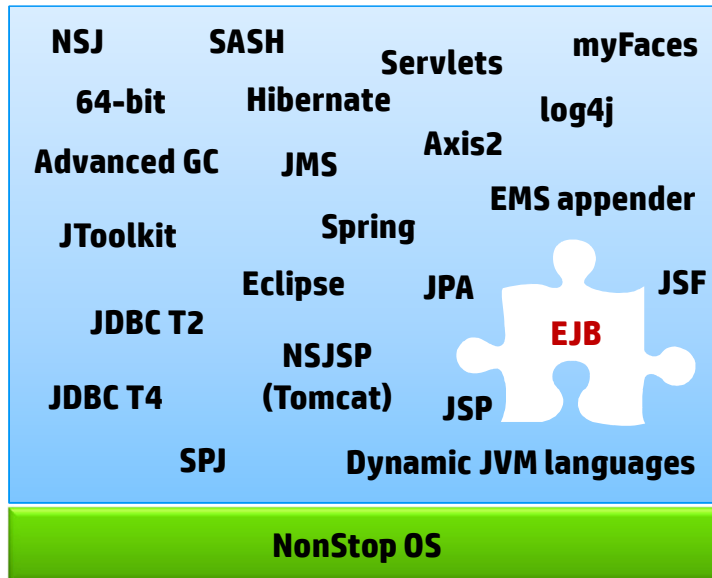
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Where do SASH frameworks fit?



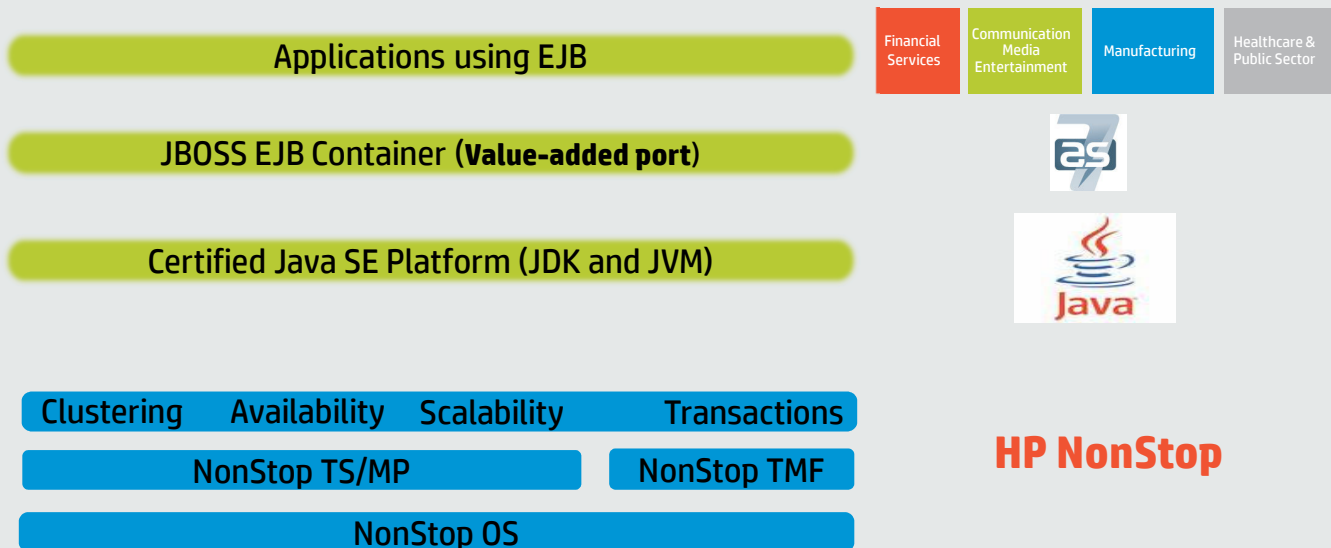
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Java Ecosystem on HP NonStop



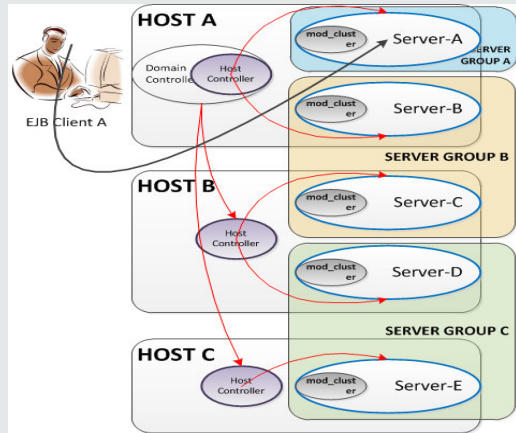
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NSASJ 1.0 = JBOSS EJB Container + Enterprise RAS

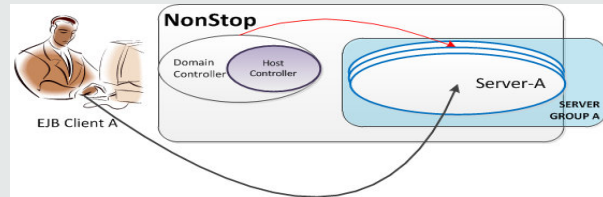
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Wildfly(Jboss) and NSASJ Deployments



JBoss AS Domain Deployment

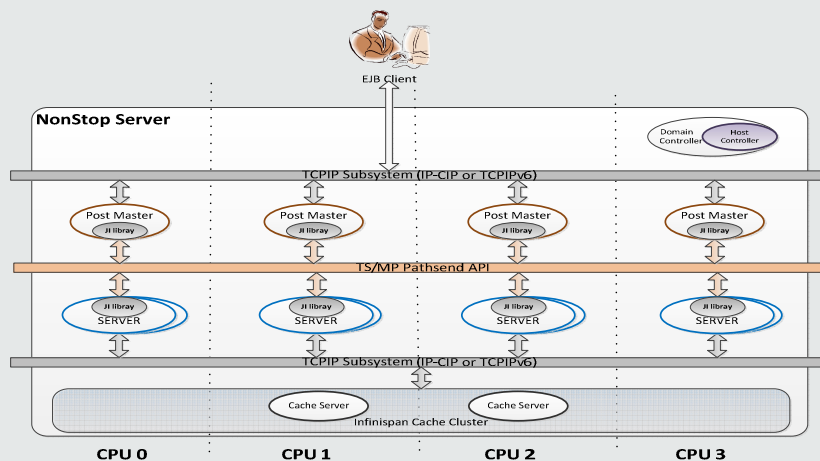


NSASJ derived from JBoss AS

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Architecture & Components



SERVER

- JEE container and TS/MP serverclass

Post Master

- Transfer data from remote client to SERVER
- A pathsend client to SERVER

Host Controller

- Management Component

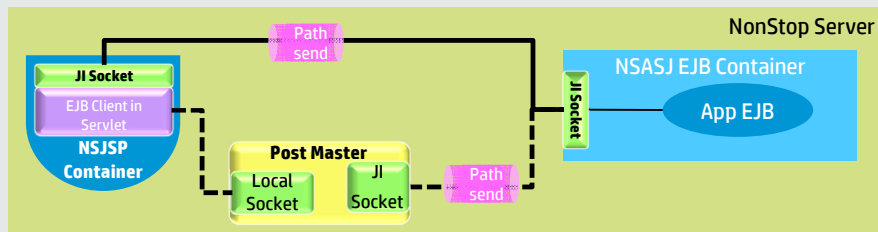
Cache server

- Stores state information (example stateful beans)

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Integration with NSJSP

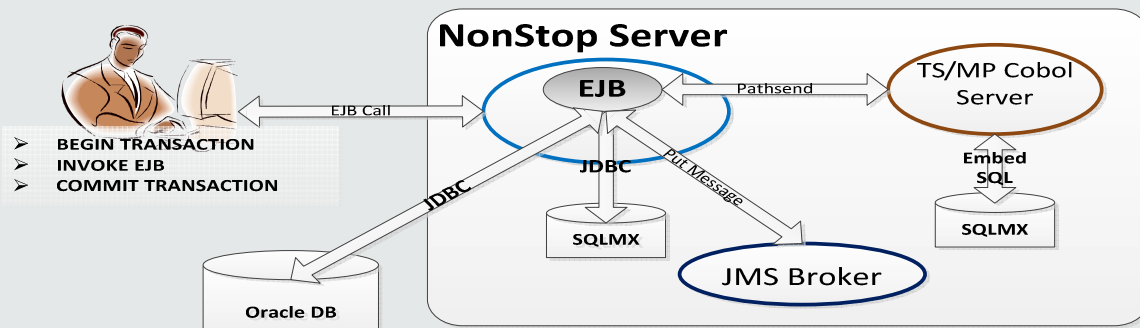


- Two connectivity options shown in figure
 - Using JI and without JI
- NSJSP servlet can use the NSASJ provided client library to invoke the EJBs
- Servlet can also integrate with the JTA library provided by NSASJ
 - EJB invocations by the servlet are within a transaction context
 - If JI used then TMF context too can be propagated to the EJBs

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JTA and TMF Integration



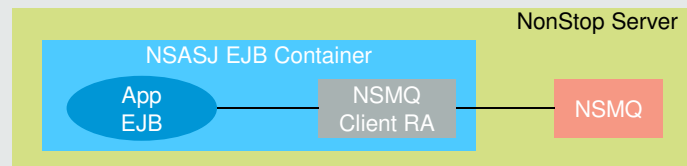
JTA Library

- Integrated with TMF using XARM library
- Seamless integration with TMF

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Integration with NSMQ

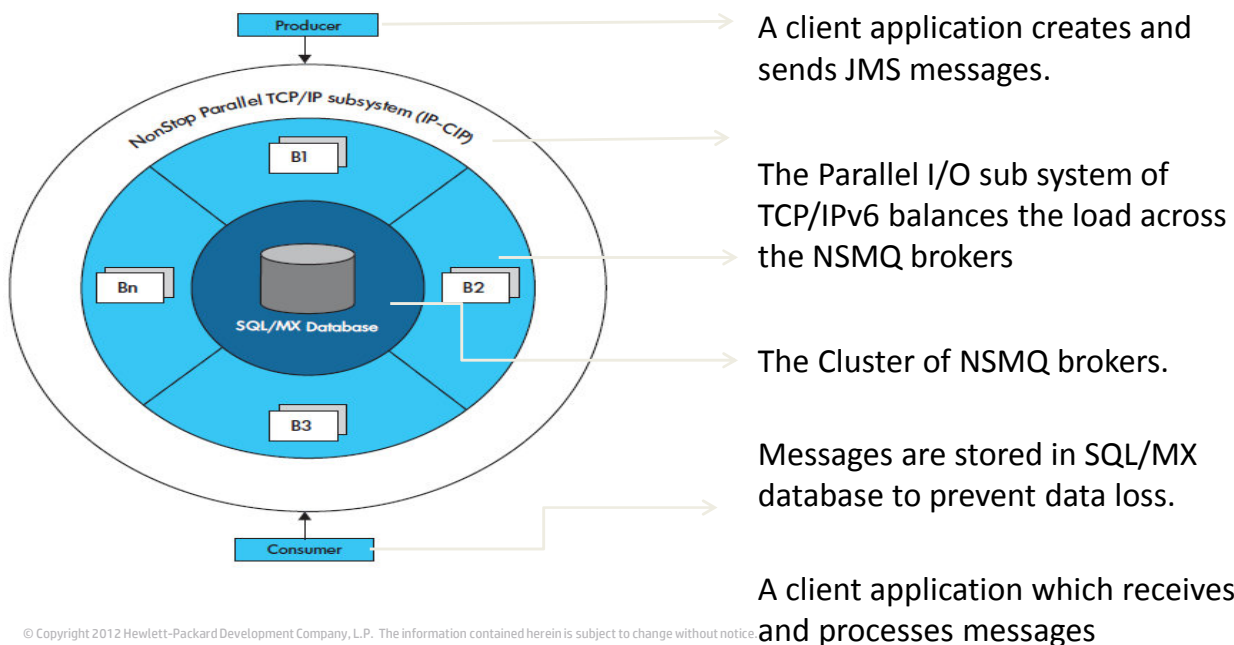


- NSMQ provides a resource adaptor which can be deployed & configured in NSASJ
- NSASJ instances can be configured to register with NSMQ either as consumer or producer
 - Consumers will be Message Driven Beans (MDB)
 - SLSB & SFSB will be the producers
- NSMQ parameters can be configured such that inbound messages are evenly distributed across the consumer NSASJ instances
- Similarly for outbound messages, the NSMQ cluster manager will handle the even distribution
- NSASJ transactions involving NSMQ interactions are part of the global TMF transaction

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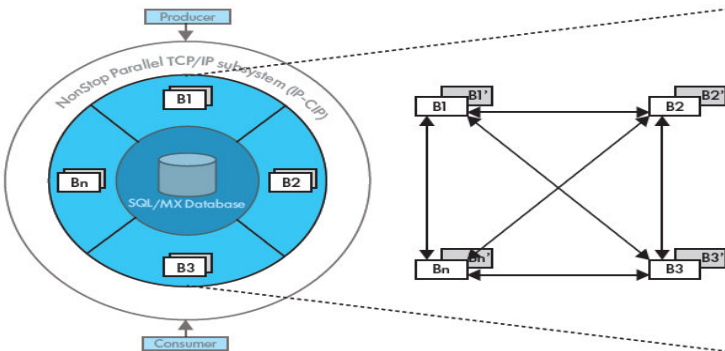
NSMQ Architecture and Components



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Scalability



NSMQ brokers are interconnected to handle additional load

All the brokers establish a duplex connection with other brokers

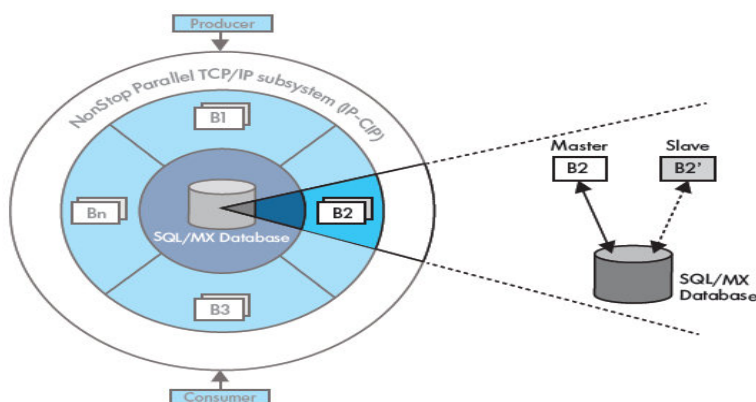
Messages are exchanged between brokers dynamically

Consumers connected to any of the broker has access to the messages residing in any broker



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Fault Tolerance and High Availability



Every NSMQ broker is run as a master and slave processes.

The master process caters to the requests of the clients.

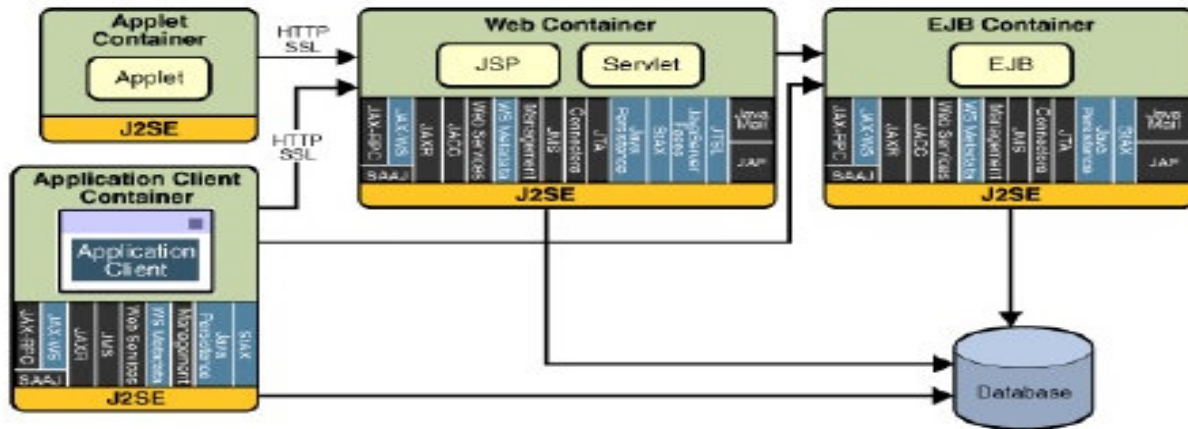
In the event of master failure, the client takes over the responsibilities of the master.

The messages are stored in the SQL/MX database before dispatch.



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JEE functionality on NonStop



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Questions Raised (by Customer Newbies to NonStop)

- Scaling OLTP for cpus/cores?
- The File Loader problem?
- Cost of Java compared to COBOL?
- Need to learn TS/MP and JToolkit?

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Questions Answered

- Scaling OLTP for cpus/cores?

JEE

*iTPWS/NSJSP NSASJ NSMQ all scale by configuration
without programmer code*

RYO (Custom)

*Use Farm/Cluster distributed model
Map to TS/MP if possible*

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Questions Answered

- The File Loader design problem?

*HP accept that for Utility/Batch type programs MPP requires
more design effort due to lack of Globally shared memory.*

*A trade-off for the benefits of NonStop Architecture with
Continuously Available production OLTP applications.*

Techniques such as disc-based context would be recommended.

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Questions Answered

- Cost of Java compared to COBOL?

Good analysis by them of their test case

Small Benchmarks = OK

Full Applications

- *dynamic managed environment vs static data language = NOK*
- *extensive use of libraries = ?/NOK*

JDBC

- *should use Prepare/Execute*
- *MFC helps reduce compilation and start-up costs*
- *cost of parameter/results marshalling*

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Questions Answered

- Cost of Java compared to COBOL?

(Good analysis of test case)

With TS/MP

- *JPathway marshalling can be expensive*
(They identified this)
- *JI should be less expensive*
(but Java clients only)
- *Java /COBOL/C++ = not technical, a user trade-off*
(what they recognised)

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Questions Answered

- Need to learn TS/MP and JToolkit?

Jl (again)

But only supports Java Clients !

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Using Java on Integrity NonStop

- *Architecture is the Key -----→*
 - *exploit Clustered IP and TS/MP*
- *JVM Startup hints*
 - *Class Loading and .war unpacking (WLS could be very bad)*
 - *JDBC preparation, use pools and MFC*
 - *artificial warm-up to prime JIT*
- *NSJSP Sessions, avoid if possible, keep small*
 - *MyFaces can be expensive , consider GWT*
- *Review use of libraries*
- *Manage object lifecycles for gc , very short or very long*

The application should be capable of being deployed on a farm/cluster of systems, by either replication of instances or by distribution of the components of a single instance. All components of the application should be replicable within or across instances to ensure availability and scalability of the application. There should be no reliance upon global shared memory between processor units nor upon sequenced serialization such as allocation of strictly sequential identifiers or rigid time-ordered processing.

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Modern NonStop middleware stack

Financial
Services

Communication
Media
Entertainment

Manufacturing

Healthcare &
Public Sector

Jtoolkit

NSDEE
(Eclipse)

NSJSP
(Tomcat Servlets)

NSASJ
(EJB of JBoss)

NSMQ
(ActiveMQ)

SASH
(Open Source Java)

Cache*

SOAP

All Modern

JI

Certified Java SE Platform (JDK and JVM) (NSJ)

iTP Web Server

All Standard

Clustering

Availability

Scalability

Transactions

NonStop TS/MP

NonStop TMF

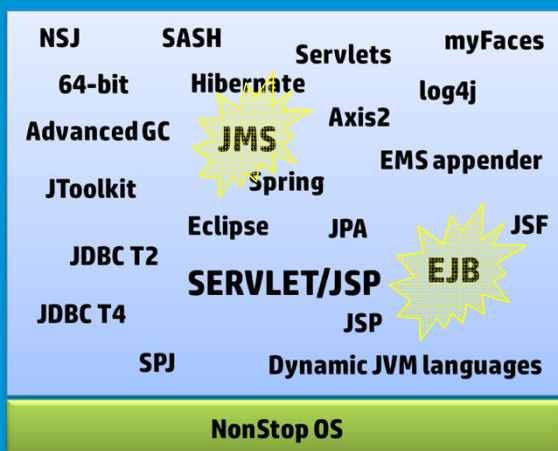
All NonStop

NonStop OS



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The Full Java Ecosystem now on HP NonStop



Java Infrastructure
the new key to TS/MP for Java

Thank you

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