The System z Platform

Specialty Engines

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CICS* IBM logo*
zVM* zSeries*
DB2 On Demand Business logo
DB2 Universal Database
Parallel Sysplex*
DRDA* System z
FICON* System z9
GDPS* WebSphere*
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IBM architecture
z/OS*

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Technology Evolution with Mainframe Specialty Engines

- Centralized data sharing across mainframes

Integrated Facility for Linux® (IFL) 2001
Support for new workloads and open standards

System z9 Application Assist Processor (zAAP) 2004
Incorporation of Java™ into existing mainframe solutions

IBM System z9 Integrated Information Processor (IBM zIIP) planned for 2006
Designed to help improve resource optimization for eligible data workloads within the enterprise

Parallel Sysplex

1 to 32 Systems

System z9 continues to meet the requirements for advanced availability and clustering
Technology Evolution with Mainframe Specialty Engines

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Centralized data sharing across mainframes

zSeries Integrated Facility for Linux

- Additional engines dedicated to Linux workloads
  - Supports z/VM V4 and V5
  - Supports Linux for S/390 and Linux for zSeries
  - IFLs on "sub-uni" systems run at full speed!
  - HiperSockets for networks

- Traditional zSeries software charges unaffected
  - IBM zSeries software
  - Independent Software Vendor products

- Linux and z/VM charged only against the IFLs
Industry Applications

- Commercial solutions
  - SAP, PeopleSoft
  - Oracle Applications
  - IBM, BEA

- Advantages:
  - Solution assurance
  - Optimized
  - Reduced implementation time
  - Flexible

Workload Consolidation

- Replace many with few
- Optimize assets

- Advantages:
  - Reduce costs
  - Virtualized servers
  - Share resources
  - Dynamically manage workloads
IBM Communications Server

- Communications Server offers Internet solutions that allow you to take advantage of network advances like information access, electronic commerce, and collaboration
  - Available for Windows, AIX, Linux on Intel, Linux on zSeries and z/OS

- Communications Server for Linux
  - Provides an enterprise quality communications solution for Linux in the Intel environment

- Communications Server for Linux on zSeries
  - Combines the enterprise networking solutions provided by Communications Server with the high performance, reliability, scalability, and security of Linux on zSeries

Technology Evolution with Mainframe Specialty Engines

- Centralized data sharing across mainframes
- Inception of Internal Coupling Facility (ICF) 1997
- Support for new workloads and open standards
- IBM System z9 Integrated Information Processor (IBM zIIP) planned for 2006
- System z9 Application Assist Processor (zAAP) 2004
- Incorporation of Java™ into existing mainframe solutions

- Designed to help improve resource optimization for eligible data workloads within the enterprise
Marketplace Insight

- e-business on demand™ is here
- Strategic Web-based Application exploitation is increasing at exponential rates
  - Much of this technology is driven by Java™
  - Java technology-based applications require more resources than traditional applications (up to 2-3x more)
  - Levels of abstraction, code generation, and reuse result in longer path lengths
- Web-based Applications can be a source of Competitive Advantage
- Web-based Application workloads are often unpredictable
- IT Budgets are not growing exponentially

What’s a zAAP?

- **zSeries Application Assist Processor for Java**
- zAAPs are designed exclusively for z/OS and z/OS.e Java code execution
- z/OS & z/OS.e JVMs assists with the execution of Java code from CP's to zAAPs
- The zAAP assists are designed to reduce the CP time needed to run Java applications (like Websphere), freeing capacity for additional workload
Deployment Options

Objective:

Enable integration of new Java technology-based Web applications on z/OS® for high performance, reliability, availability, security, and lower total cost of ownership

zAAP Concept Overview: A Simplified Example…

Consider a WebSphere Application that is transactional in nature and requires 1000 MIPS today on zSeries.

Java Execution Powered by zAAP

1000 MIPS for WebSphere App

80% utilization

Java
Java
Java
Java
Java

40% utilization

Java
Java
Java
Java
Java

500 MIPS for WebSphere App +

500 MIPS now available for additional workloads
**zAAP Impact on Sub-Capacity Pricing Scheme**

**BEFORE zAAP:**
- Machine Type: 2084-B16
- Rated @ 647 MSUs
- Sub-Capacity Pricing based on:
  - LPAR A rolling 4hr avg @ 233 MSUs
  - LPAR B rolling 4hr avg @ 200 MSUs
  - LPAR C rolling 4hr avg @ 267 MSUs
- Rolling 4hr avg of Machine = 547 MSUs
- Average Prime Shift Machine Utilization = 80%

**AFTER zAAP:**
- Machine Type: 2084-B16
- Rated @ 647 MSUs
- Java cycles executed on zAAPs
- New Sub-Capacity Pricing on reduced rolling 4hr avg
  - LPAR A rolling 4hr avg @ 213 MSUs
  - LPAR B rolling 4hr avg @ 100 MSUs
  - LPAR C rolling 4hr avg @ 167 MSUs
- New Rolling 4hr avg of Machine = 480 MSUs
- Average Prime Shift Machine Utilization = 50%

**zAAP Architecture and Workflow:**
Executing Java under IBM JVM control

- IBM JVM, parts of LE runtime, and z/OS Supervisor needed to support JVM execution can operate on zAAPs
- IBM JVM communicates to z/OS dispatcher when Java code is to be executed
- z/OS dispatcher attempts to dispatch zAAP eligible work on a zAAP (when present)
  - zAAP ineligible work only dispatched on standard processors
- If there is insufficient zAAP capacity available, or standard processors are idle, the dispatcher may dispatch zAAP eligible work on a standard processor
  - There is an installation control to limit the use of standard processors to execute zAAP eligible work (see Java code execution options)
Requirements for zAAP Exploitation

- Available on z990, z890, z9-109 and follow-on models only

- Prerequisites:
  - z/OS 1.6 (or z/OS.e 1.6)
  - IBM SDK for z/OS, Java 2 Technology Edition, V1.4 with PTF

- Subsystems and Apps using SDK 1.4 will exploit zAAPs automatically, for example:
  - WAS 5.1
  - CICS®/TS 2.3
  - DB2 V8
  - IMS™ V8
  - WebSphere WBI for z/OS
  - Java Batch

- zAAPs must be jointly configured with General Purpose processors within z/OS LPARs:
  - Number of zAAPs may not exceed the number of permanently purchased CPs on a given machine model

- zAAPs are transparent to JAVA applications: No application modifications are required
Configuration example: z/OS zAAP Partitions

Logical partition hypervisor only dispatches standard logical processors on standard physical processors & zAAP logical processors on zAAP physical processors

General Purpose physical Processor Pool

*zAAP Physical Processor Pool

z/OS Logical Partition A

z/OS Logical Partition B

zAAP = IFA in PRSM panel

z9-109 Specialty Processor Enhancements

- Flexibility for management of Processor Unit (PU) types
  - All zAPPs, ICFs and IFLs now managed as individual separate types/pools by PR/SM

- Improved weight management
  - Independent PR/SM weight management for both CPs and zAPPs configured to each ESA mode logical partition
  - zAAP extensions to the z/OS WLM diagnose interfaces necessary to allow for dynamic WLM weight reassignment of zAPPs, just as is currently provided for standard processors.

- Enhanced z/OS support for zAPPs
  - WLM goal mode management for zAAP processors
  - WLM dynamic monitoring of work priorities on zAPPs so that goals can be met
  - Both Java technology and non Java technology work may each have individual goals
    - WLM manages each individually and collectively
zAAP Summary

zSeries Application Assist Processors can help enable effective integration of Web applications with mission critical workloads for high performance at an affordable cost.

- Help Address the Challenges of new Web-based Applications
- Help simplify and reduce server infrastructures and improve operational efficiencies
- zAAPs deliver investment flexibility with significant TCO savings

Additional Resources

- Performance White Paper
- Techdoc WP100431 Installing zAAP Projection tool
- IBM Redbook on zAAP: SG24-6386
- IBM zAAP site
  - ibm.com/zseries/zaap
  - Frequently Asked Questions
  - Customer Brochure
- z990 Latest Enhancements Announcement Letter (104-118).
- z890 Announcement Letter (104-117).
Technology Evolution with Mainframe Specialty Engines

Building on a strong track record of technology innovation with specialty engines, IBM intends to introduce the System z9 Integrated Information Processor

- Internal Coupling Facility (ICF) 1997
- Integrated Facility for Linux® (IFL) 2001
- Support for new workloads and open standards
- System z9 Application Assist Processor (zAAP) 2004
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- IBM System z9 Integrated Information Processor (IBM zIIP) planned for 2006

- Designed to help improve resource optimization for eligible data workloads within the enterprise

Raising the bar for Information on Demand

- Information on demand is essential for driving business strategies.
- Data is at the core of our customers’ businesses, and must be leveraged for competitive advantage.
- For over four decades mainframes have been a leader in data and transaction serving. It’s time to further leverage this asset.
- January 24th, 2006, IBM announced technology innovation for advanced data serving:
  - New DB2® function
  - New specialty engine
  - Planned future directions and roadmap
Companies Face Increasing Information Realities

60%+ of CEOs: Need to do a better job capturing and understanding information rapidly in order to make swift business decisions

79% of companies: have 2+ repositories... 25%: have 15+

85% of information is unstructured

17% of IT Budgets Spent on Storage HW, SW, People

37% CGR Disk Storage Growth '96-'07

122 Terabytes Disk Storage in 2005

Only 1/3 of CFOs believe that the information is easy to use, tailored, cost effective or integrated

48 disparate financial systems and 2.7 ERP systems in the average $1B company

30-50% of design time is copy management

30% of people’s time is spent searching for relevant information

40% of IT budgets may be spent on integration

Sources: IBM & Industry Studies, Customer Interviews
What are the biggest challenges and inhibitors?

- **Volume**: Amount of data and content is growing
- **Variety**: It’s not just the transaction data; it’s e-mails, document libraries, etc.
- **Velocity**: The pace of business and business users who need information now, in real time for their business needs
- **Complexity**:
  - Lack of business process standards
  - Point application buys to support redundant LOB needs
  - Limited architectural policies
  - Infrastructure built with no roadmap
  - Mergers & Acquisitions
  - Disparate information

A vision for System z advanced data serving

**System z Enterprise Hub for Mission Critical Data**

- With a strong foundation for transaction processing, built on 40+ years of technology innovation, System z servers with z/OS and DB2 can provide a premier platform for data serving, today and into the future*
- IBM plans to continue to invest in new solutions to address customers’ strategic information on demand goals*

**Today’s Capabilities**

- Industry-leading data integrity and security
- Data sharing solution for centralized view of data
- Scalability and availability for enterprise class workloads
- Comprehensive systems and data management environments

**Extension of capabilities**

- New specialty engine (zIIP) with DB2 exploitation - for mission critical ERP, CRM, and Data Warehousing workloads *
- Database support improves regulatory compliance and autonomies
- Support of encryption capability (tape subsystem) with z/OS centralized key mgmt
- Data protection to achieve highest levels of security certifications
- Additional zIIP exploitation
- DB2 enhancements to help improve usability and reduce complexity and management costs.
- DB2 table scan acceleration via DS8800
- Support of encryption capability (disk subsystem) with z/OS centralized key mgmt
- Handle larger volumes of data, with improved scalability

*All statements regarding IBM’s future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.
New IBM System z9 Integrated Information Processor (IBM zIIP)

- New specialty engine for the System z9 mainframe (planned for 2006) designed to help:
  - Customers integrate data across the enterprise
  - Improve resource optimization and lower the cost of ownership for eligible data serving workloads

- z/OS manages and directs work between the general purpose processor and the zIIP
  - Number of zIIPs per z9-109 not to exceed number of standard processors
  - No changes anticipated to DB2 for z/OS V8 applications
  - Price for each zIIP is $125k (US) – consistent with other specialty engines.*
  - No IBM software charges on the zIIP – consistent with other specialty engines

- DB2 for z/OS V8 will be first IBM exploiter of the zIIP with
  - System z9 109
  - z/OS 1.6 or later
  - DB2 for z/OS V8

* Prices may vary outside of the US

DB2 V8 exploitation of IBM zIIP can add value to database workloads

- Portions of the following DB2 for z/OS V8 workloads may benefit from zIIP*
  1. ERP, CRM, Business Intelligence or other enterprise applications
     - Via DRDA® over a TCP/IP connection
  2. Data warehousing applications*
     - Requests that utilize complex star schema parallel queries
  3. DB2 for z/OS V8 utilities*
     - Internal DB2 utility functions used to maintain index maintenance structures

* The zIIP is designed so that a program can work with z/OS to have all or a portion of its enclave Service Request Block (SRB) work directed to the zIIP. The above types of DB2 V8 work are those executing in enclave SRBs, of which portions can be sent to the zIIP.
Example 1: Enterprise Applications

Enterprise Applications that access DB2 for z/OS V8 via DRDA over a TCP/IP connection will have portions of these SQL requests directed to the zIIP.

For illustrative purposes only
Actual workload redirects may vary depending on how long the queries run, how much parallelism is used, and the number of zIIPs and CPs employed.

Example 2.0: Business Intelligence Applications

Complex star schema parallel queries via DRDA over a TCP/IP connection will have portions of this work directed to the zIIP.

For illustrative purposes only
Actual workload redirects may vary depending on how long the queries run, how much parallelism is used, and the number of zIIPs and CPs employed.
Example 2.5: Business Intelligence Applications (local - no DRDA)

Complex star schema parallel queries via LOCAL connection will have portions of this work directed to the zIIP.

For illustrative purposes only
Actual workload redirects may vary depending on how long the queries run and how much parallelism is used.

<table>
<thead>
<tr>
<th>BI App</th>
<th>LOCAL</th>
<th>NO DB2</th>
<th>DRDA</th>
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</table>

Example 3: DB2 for z/OS utilities

DB2 for z/OS utilities used to maintain index structures

For illustrative purposes only, actual workload redirects may vary.
Only the portion of the DB2 utilities used to maintain index structures (within LOAD, REORG, and REBUILD) is redirected.

<table>
<thead>
<tr>
<th>CP</th>
<th>High utilization</th>
<th>Reduced utilization</th>
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</thead>
<tbody>
<tr>
<td>BATCH</td>
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</tbody>
</table>
The zIIP is designed so that a program can work with z/OS to have all or a portion of its enclave Service Request Block (SRB) work directed to the zIIP. The types of DB2 V8 work listed below are those executing in enclave SRBs, portions of which can be sent to the zIIP.

Example 1 = Distributed SQL requests (DRDA)
Queries that access DB2 for z/OS V8 via DRDA over a TCP/IP connection are dispatched within z/OS in enclave SRBs. z/OS directs a portion of this work to the zIIP.

Example 2 = Complex parallel query (BI)
Complex star schema parallel queries will now use enclave SRBs. z/OS directs a portion of this work to the zIIP.

Example 3 = DB2 utilities for index maintenance
DB2 utilities LOAD, REORG, and REBUILD will now use enclave SRBs for the portion of the processing that is related to index maintenance. z/OS directs a portion of this work to the zIIP.

Types of DB2 for z/OS workloads that may benefit from zIIP

1. ERP or CRM application serving*
   For applications, running on z/OS, UNIX®, Linux, Intel®, or Linux on System z that access DB2 for z/OS V8 on a System z9 109, via DRDA over a TCP/IP connection. DB2 gives z/OS the necessary information to have portions of these SQL requests directed to the zIIP.

2. Data warehousing applications*
   Requests that utilize DB2 for z/OS V8 complex star schema parallel queries may have portions of these SQL requests directed to the zIIP when DB2 gives z/OS the necessary information.

3. Some DB2 for z/OS V8 utilities*
   A portion of DB2 utility functions used to maintain index maintenance structures (LOAD, REORG, and REBUILD INDEX) typically run during batch, can be redirected to the zIIP.

* The zIIP is designed so that a program can work with z/OS to have all or a portion of its Service Request Block (SRB) enclave work directed to the zIIP. The above types of DB2 V8 work are those executing in SRB enclaves, portions of which can be sent to the zIIP.
What is DRDA?

- DRDA = Distributed Relational Database Architecture
  - Developed by IBM
  - Enables relational data to be distributed among multiple platforms – ‘any app to any db and any db to any db’. Applications and APIs accomplish the actual implementation

- DRDA is native to DB2 for z/OS. It reduces the need for additional gateway products that may affect performance and availability

- The Open Group adopted DRDA in 1998 as the open standard for database access interoperability

- An application uses DRDA application requestor or server to access a remote database (DB2 Connect is an example of a DRDA application requestor)

- Uses TCP/IP or SNA as a network protocol to flow DRDA commands

  **So.... regarding the zIIP:** if DB2 for z/OS V8 work load comes over TCP/IP and is DRDA compliant, a portion of that DB2 workload is eligible to be redirected to the zIIP – you need BOTH TCP/IP and DRDA.

What is Star Schema?

- Star schema = a relational database schema for representing multidimensional data.

- Sometimes graphically represented as a ‘star’
  - Data stored in a central fact table
  - Surrounded by additional dimension tables holding information on each perspective of the data

- Complex star schema parallel queries include the acts of joining several dimensions of a star schema data set (like promotion vs product).

  **So.... regarding zIIP:** if the work load uses DB2 for z/OS V8 to join star schemas, then a significant portion of that DB2 workload is eligible to be redirected to the zIIP
What is index maintenance?

- An index allows quick access to the rows in a table. Indexes are created using one or more columns of a table.
- Over time, as data in a large database is manipulated indexes can become less efficient. They need to be updated and maintained. This can be a very big task.
  - LOAD—loads your tables
  - REORG—improves your index performance
  - REBUILD INDEX-- creates or rebuilds your indexes

So.... regarding the zIIP: The BUILD phase of LOAD, REORG, and REBUILD utilities performs index maintenance. Most of the BUILD phase is eligible to be redirected to the zIIP.

What are enclave SRBs?

- z/OS dispatches DB2 work in either TCB (Task Control Block) mode if request is local or SRB (Service Request Block) mode if request is distributed. Under these modes of operation the parallel tasks are assigned the same importance as the originating address space.
- Pre-emptable enclaves are used to do the work on behalf of the originating TCB or SRB address space. Enclaves are grouped by common characteristics and service requests and since they are pre-emptable, the z/OS dispatcher (and WLM) can interrupt these tasks for more important ones (ie manage a transaction end-to-end). There are two types of pre-emptable SRBs: client SRBs and enclave SRBs.
- If the DB2 for z/OS V8 request is coming in over distributed (ie DRDA over TCP/IP) then that work is executed in enclave SRBs.
- If the request is coming over local/ native connection, then that work is dispatched between TCBs, client SRBs, and enclave SRBs (star schema queries and index maintenance now use enclave SRBs)

So...... regarding the zIIP, only the enclave SRB work (not the client SRB work) is eligible to be redirected to the zIIP.
- DB2 V8 knows how its work is dispatched and directs z/OS 1.6 to dispatch (redirect) a portion of the eligible work to the zIIP.
Important technical notes

- Utilization of the zIIP is expected to be transparent to the application.
  - No anticipated changes to applications that use DB2 for z/OS V8

- The enclave SRB interface is available upon request to non-IBM vendors as well.
  - ISVs are interested

Specialty engines

The IBM System z9 specialty engines can operate on the same machine together
(shown at left, instances where zIIP can be employed)
Some instances where zIIP would not be exploited

WAS applications may access with a local Type2 JDBC access. For performance reasons, this is the recommended scenario as the WAS code was optimized for this configuration. No zIIP would be needed here.

System z9 and DB2 for z/OS are an ideal data serving platform

- **Data consolidation helps reduce:**
  - Multiple copies, disparate data
  - Cost and complexity of back up and recovery
  - Network traffic
  - Amount of storage
  - DB administration and management
  - Risk associated with distributed privacy, security, and audit policies

- **Leverage System z technology**
  - Parallel Sysplex clustering for scalability AND availability AND performance
  - Data sharing = single view of the data
  - Data compression for TCO
  - Centralized backup, recovery, privacy, security and audit policies

- **New System z9 specialty engine (planned for 2006) designed to help:**
  - Customers integrate data across enterprise
  - Improve resource optimization
  - Lower the TCO for data serving workloads

System z9 and DB2 for z/OS are an ideal data serving platform
## System z Data Serving Roadmap

<table>
<thead>
<tr>
<th>Today...</th>
<th>Tomorrow...</th>
<th>Future...</th>
</tr>
</thead>
<tbody>
<tr>
<td>System z mainframes &amp; z/OS combine for Industry Leading Performance, Scalability, Security, Availability and Virtual Partitioning capabilities with a focus on TCO improvements</td>
<td>DB2 Universal Database™ (UDB) for z/OS provides the premier high performance DBMS for high volume transaction workloads based on relational technology</td>
<td>DB2 V8 Exploitation of a new specialty processor zIIP – System z9 Integrated Information Processor(IBM) types of eligible DB2 for z/OS V8 work, portions of which can be sent to the zIIP include: - Network Connected Application processing using DRDA over a TCP/IP connection - Data Warehouse Query processing that utilizes star scheme parallel queries - Select index maintenance in the DB2 Utilities (LOAD, REORG, REBUILD)</td>
</tr>
<tr>
<td>Security for z/OS and DB2 is designed to provide protection and advanced encryption capabilities with focus on recognized industry certifications</td>
<td>DB2 for z/OS Enhancements - Unmatched infrastructure for supporting customer needs for regulatory compliance and auditing - Continue to improve people resources efficiency - Integrated XML - DB2 Spatial Data Support - OmniFind Search in DB2</td>
<td>Further exploitation of zIIP Additional DB2 for z/OS Enhancements - Improve usability and reduce complexity - Java Language Integrated Query - DB2 Table Scan acceleration via DS8000 processing</td>
</tr>
<tr>
<td>DB2 Content Manager for z/OS provides a foundation for managing, accessing, and integrating critical business information on demand</td>
<td>Security for z/OS and DB2 Enhancements - Common Criteria EAL4 Certification for DB2 - Support of encryption capability (disk subsystem) with z/OS centralized key mgmt</td>
<td>Ongoing Security Enhancements - Common Criteria EAL4 Certification for DB2 - Support of encryption capability (disk subsystem) with z/OS centralized key mgmt</td>
</tr>
<tr>
<td>WebSphere Information Integration Platform for z/OS can help you readily access your pertinent information to support strategic business initiatives</td>
<td>DB2 Business Intelligence Solutions for z/OS provides cost-effective, rapid access to your core business data for warehousing and analytics</td>
<td>System z server and z/OS Futures - Continued FICON Enhancements - Continued focus on Storage capability &amp; capacity - Heterogeneous File Sharing Support - NFS V4 Client - Continuous data protection - Dynamic storage provisioning</td>
</tr>
<tr>
<td>IMS &amp; DB2 for z/OS Tools &amp; Utilities provide integrated and intelligent management &amp; monitoring of your IMS &amp; DB2 applications and performance</td>
<td>IMS &amp; DB2 for z/OS Tools &amp; Utilities provide enhanced tools for recovery and performance IMS Version 9 extends and enhances your Industry Leading IMS environment with increased connection &amp; integration capabilities</td>
<td>DB2 CM for z/OS Advancements - XML API and Web Services WebSphere Information Integration Platform - Expanded integration and process automation across and between platform components</td>
</tr>
</tbody>
</table>

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### Information .... Insight ..... System z servers

- **Increased speed and accuracy of business decisions**
  - Single view of the data
- **Better understand customers and operations**
  - Information on demand
- **Real-time Information**
  - Integrated security features
  - Streamline compliance
- **Data**
  - WLM based on business priorities
- **Concurrent maintenance and upgrades**
- **Data compression**
- **Centralized privacy, security and audit policies**
- **Clustering for scalability AND availability AND performance**
Remember:
When it comes to Data Serving, WE KNOW zIIP!

zEND

THANK YOU! – Questions?
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