Specialty engines on System z9 - zAAPs and zIIPs
(and IFLs and ICFs)

Faheem Ashraf
IT specialist
IBM Systems and Technology Group
New workload manager
faheem@dk.ibm.com
+45 2880 3066

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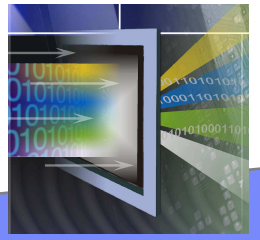
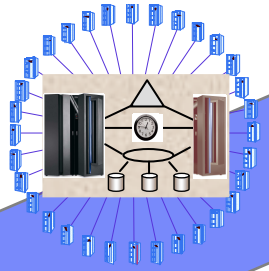
Technology Evolution with Mainframe Specialty Engines

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

IBM System z9 Integrated Information Processor (IBM zIIP) 2006



Centralized data sharing across mainframes



Internal Coupling Facility (ICF) 1997

Integrated Facility for Linux (IFL) 2001

Support for new workloads and open standards

System z Application Assist Processor (zAAP) 2004

Incorporating Java into existing mainframe solutions

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

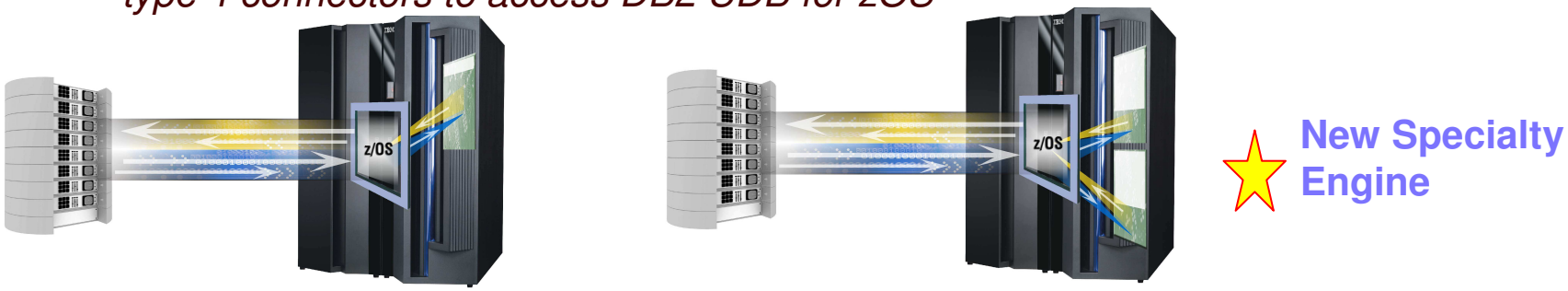
New IBM System z9 Integrated Information Processor (IBM zIIP)

- **New specialty engine for the System z9 mainframe 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 IBM System z9 not to exceed number of standard processors
  - No changes anticipated to DB2 UDB for z/OS V8 applications
  - Price for each zIIP is $125k (US) for the z9 EC and $95k (US) for the z9 BC.*
  - No IBM software charges on the zIIP – consistent with other specialty engines
- **DB2 UDB for z/OS V8 will be first IBM exploiter of the zIIP with**
  - System z9 EC or z9 BC
  - z/OS 1.6 or later (with PTFs)
  - DB2 UDB for z/OS V8 (with PTFs)

* Prices may vary outside of the US

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

- **Portions of the following DB2 UDB 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
     - *Examples could be SAP using DB2Connect, and WebSphere applications that use type 4 connectors to access DB2 UDB for zOS*

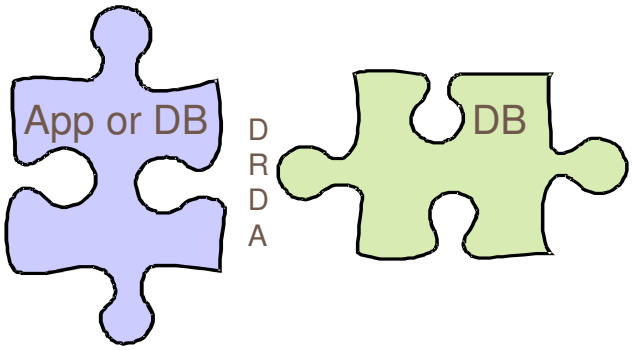


  2. Data warehousing applications*
     - Requests that utilize complex star schema parallel queries
  3. DB2 UDB for z/OS V8 utilities*
     - Internal DB2 utility functions used to maintain index maintenance structures

- **Utilization of the zIIP is expected to be transparent to the application.**
  - ► No anticipated changes to applications that access DB2 UDB for z/OS V8 data

* The zIIP is designed so that a program can work with z/OS to have 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. Stored procedures and user-defined functions do not use SRBs and so are not eligible.

What is DRDA?



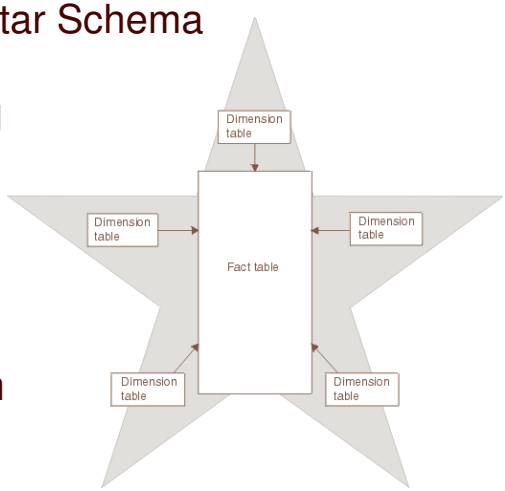
- **DRDA = Distributed Relational Database Architecture™**
  - Developed by IBM
  - Enables relational data to be distributed among multiple platforms – 'any app to any db and any db to any db'
- **DRDA is implemented in DB2 UDB for z/OS V8 and reduces the need for additional gateway products that may 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 server. The universal driver is an example of a DRDA application requester**
- **DRDA is network independent. It can use TCP/IP or SNA as a network protocol to flow DRDA commands. Connections using SNA are not eligible for zIIP.**

- So.... regarding the zIIP: **If DB2 for z/OS V8 work load comes over TCP/IP and is DRDA compliant (and not stored procedures or user-defined functions), a portion of that DB2 workload is eligible to be redirected to the zIIP – you need BOTH TCP/IP and DRDA but not stored procedures or user-defined functions.**

What is Star Schema?

DB2 V8 zIIP redirect enabling APAR :
PK19921 for 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
  - Example: store "facts" of the sale (units sold, price, ..) with product, time, customer, and store keys in a central fact table. Store full descriptive detail for each keys in surrounding dimension tables. This allows you to avoid redundantly storing this information (such as product description) for each individual transaction
- **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 workload uses DB2 UDB for z/OS V8 to join star schemas, then portions of that DB2 workload will be 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.**

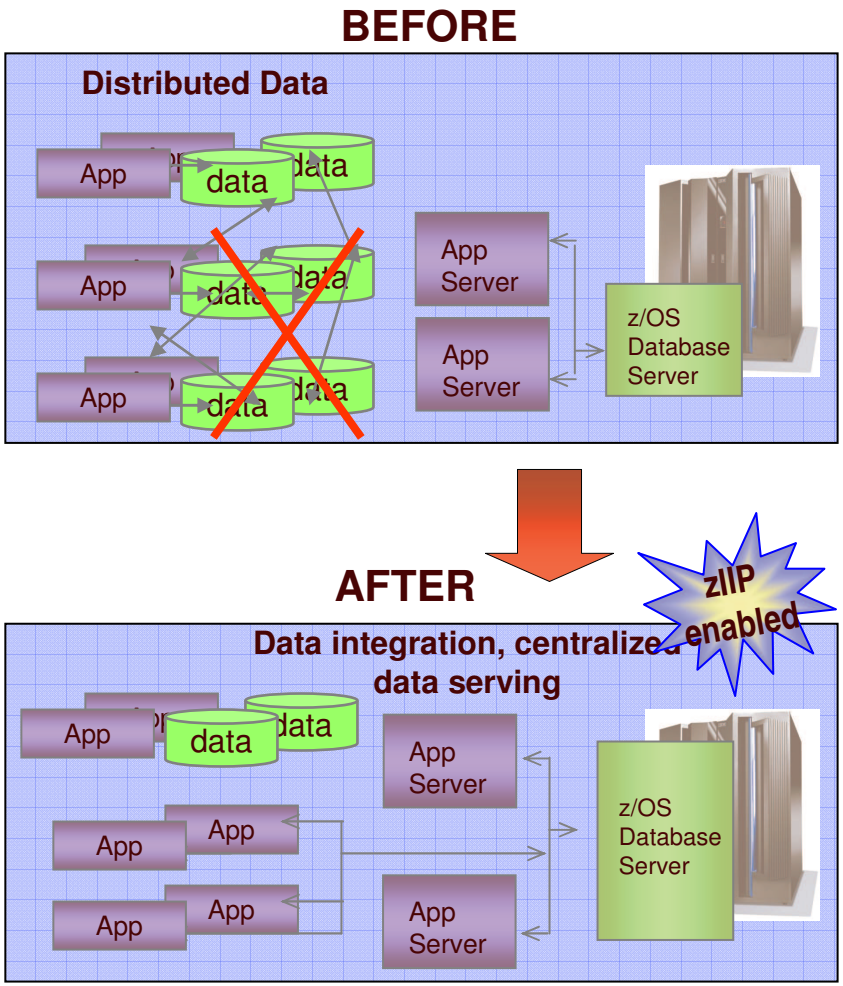
- **Over time, as data in a large database is manipulated indexes can become less efficient. They need to be updated and maintained. This can be a very big task.**
  - LOAD – loads your tables
  - REORG – improves your index performance
  - REBUILD INDEX – creates or rebuilds your indexes

- 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.**

DB2 V8 zIIP redirect enabling APAR :
PK19920 for Utilities

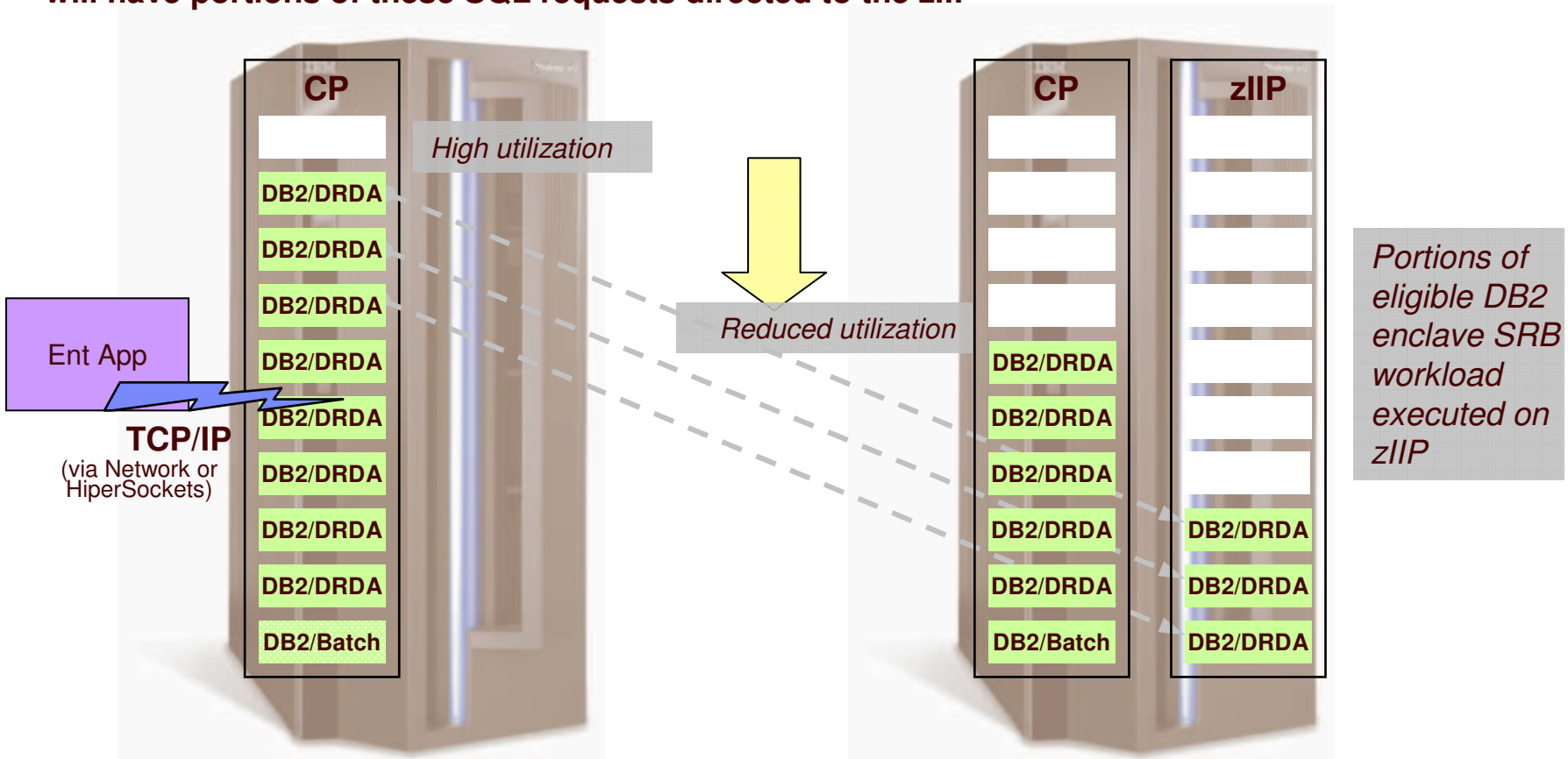
System z9 and DB2 UDB for z/OS V8 are an ideal data serving platform

- **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
- **IBM zIIP specialty engine designed to help:**
  - Customers integrate data across enterprise
  - Improve resource optimization
  - Lower the TCO for data serving workloads



Example 1: Enterprise Applications

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



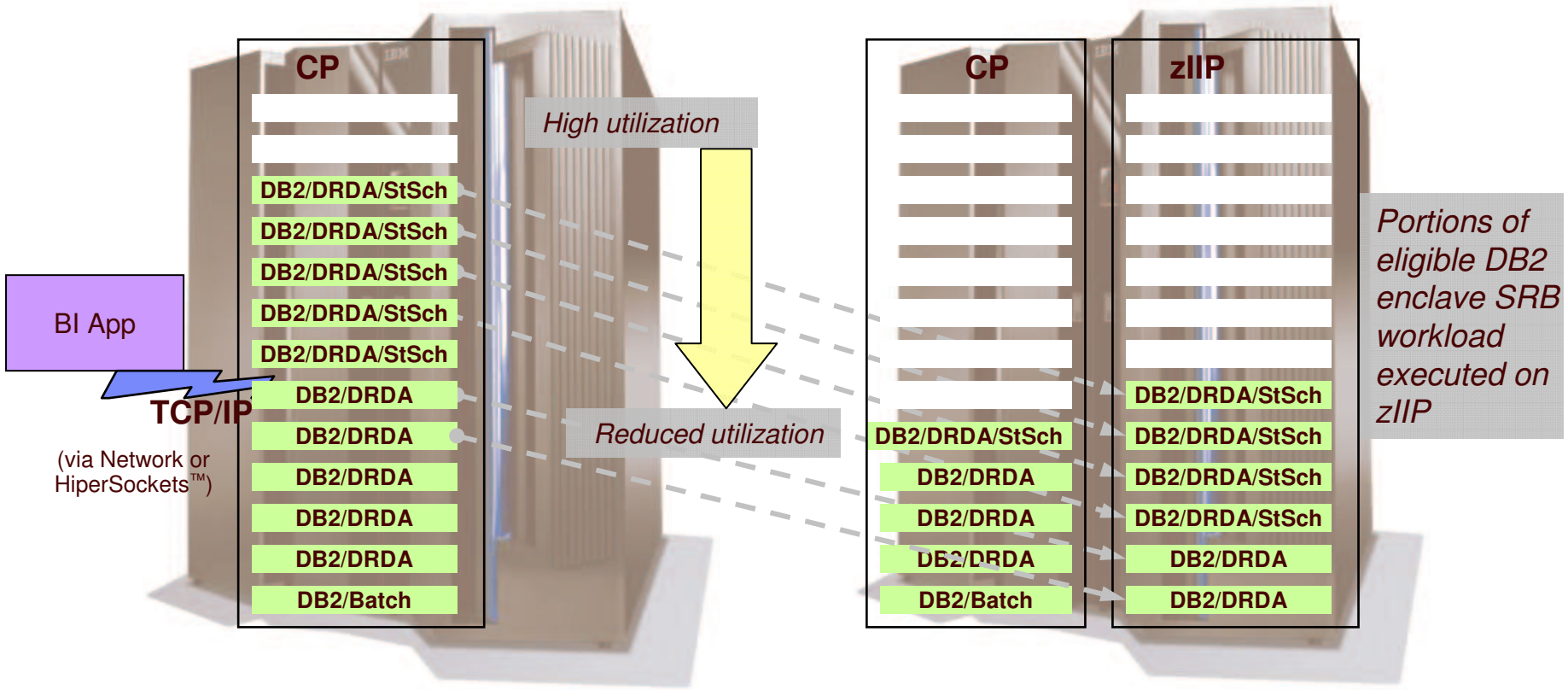
For illustrative purposes only. Single application only.

Actual workload redirects may vary

DB2 V8 zIIP redirect enabling APAR: PK18454 for DRDA

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

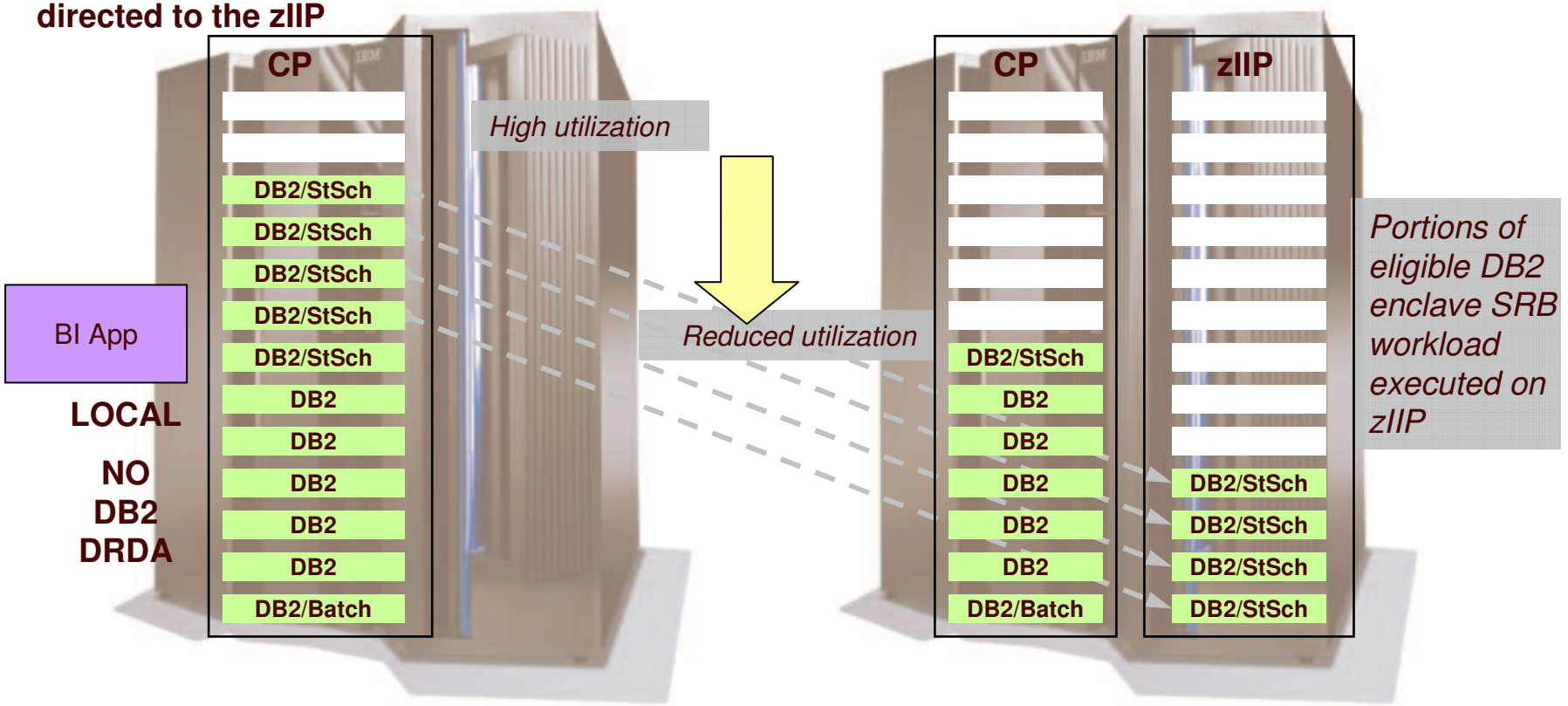


For illustrative purposes only. Single application only.

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

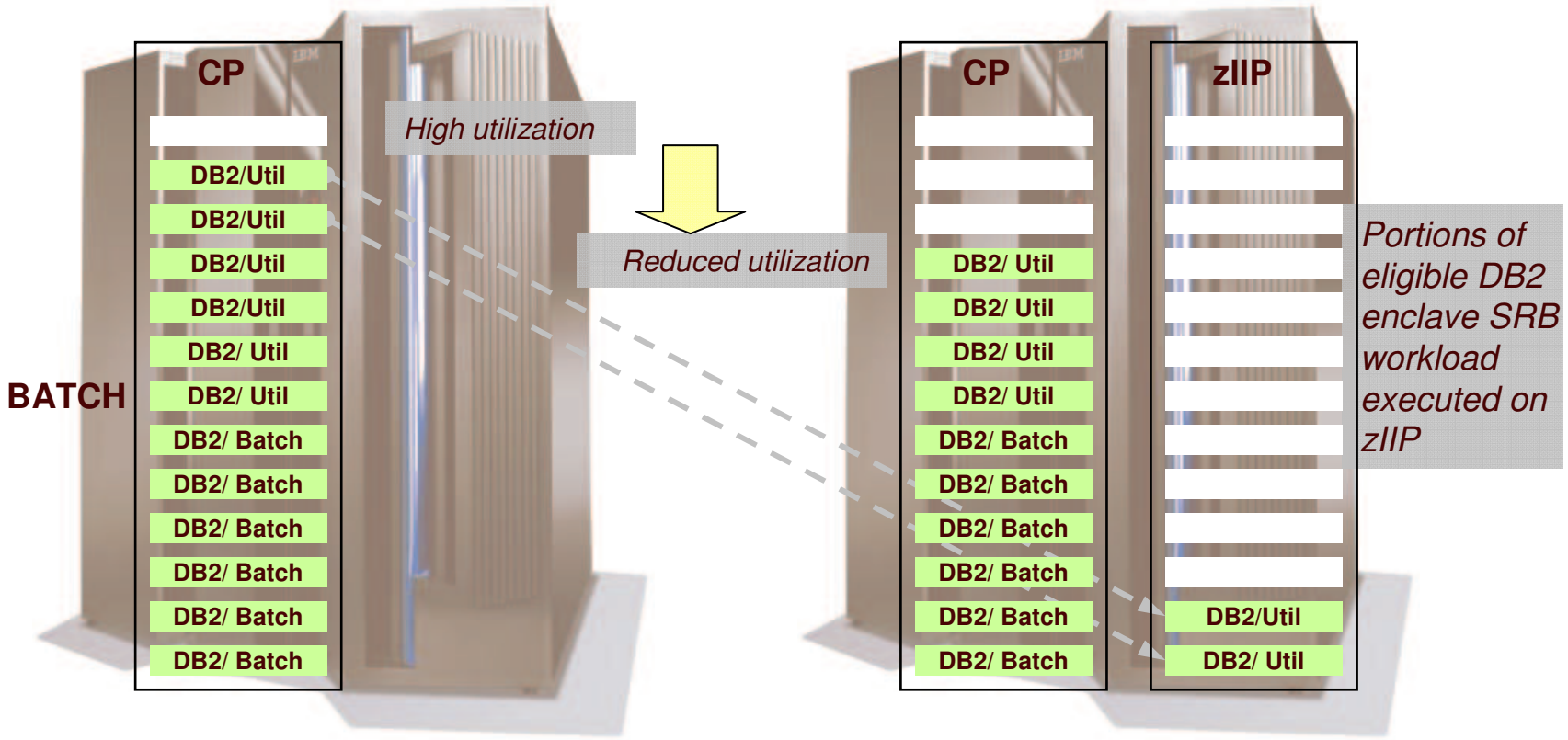


For illustrative purposes only. Single application only.

Actual workload redirects may vary depending on how long the queries run and how much parallelism is used

Example 3: DB2 UDB for z/OS V8 utilities

DB2 UDB for z/OS V8 utilities used to maintain index structures



For illustrative purposes only, single application 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.

How to Estimate the Redirect Potential of DRDA (M #1)

- Two Methodologies (M) are currently available:
  - Method #1: Analyze RMF type 70 and 72 records
    - First cut to determine total amount of DRDA work running in a partition
    - Minimal amount of data
    - Requires good granularity of DRDA work in WLM service classes or report classes
    - Can provide complete analysis if customer is NOT using stored procedures or UDF (User Defined Function) or SNA
    - This method should be used for all scenarios

How do I Estimate the redirect Potential of DRDA (M #2)

- Method #2: Analyze SMF 101 (DB2 accounting) records
  - Required if customer makes extensive use of Stored Procedures or UDF
  - Can use a significant amount of data
  - IBM provides a tool which can be run on the customer machine to process the data and create a small file to be sent to IBM for further analysis
    - DB2 for z/OS DRDA zIIP Redirect Data Collector
    - Available from Techline
  - Results of this tool are integrated with the EDF Model in zCP3000.
  - Can process DB2 V7 or V8 data
    - Results can provide more accurate estimates with V8 data

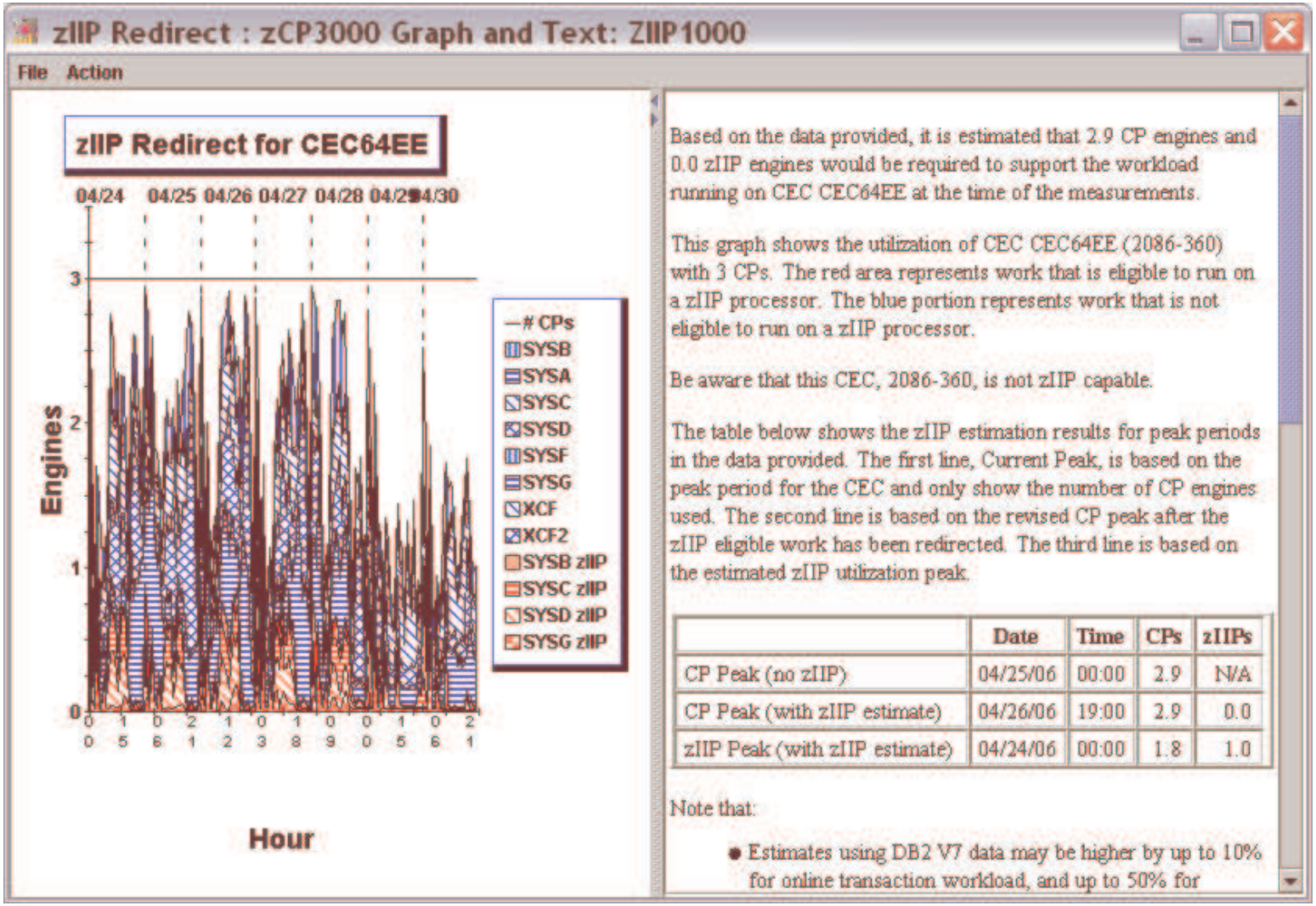
Measuring zIIP activity

- **Once a zIIP is installed (with z/OS R6 or R7 (w/ PTF) and DB2 V8 (w/ PTFs)), monitoring zIIP activity will be similar to monitoring zAAP activity**
  - Set up WLM policy with Service Class(es) for SUBSYSTEM TYPE=DDF
  - RMF Monitor 1 Type 70 Record will monitor overall zIIP activity:
    - Logical processor busy as seen by z/OS is reported
    - Physical processor busy as seen by LPAR is reported
  - RMF Monitor 1 Type 72 Record will show more detail:
    - The amount of time spent executing on zIIP processors is reported
    - Usage and Delay sample counts for zIIP eligible work is reported
  - In addition, DB2 accounting trace records can provide information on the zIIP. IBM Tivoli® OMEGAMON® XE for DB2 Performance Expert on z/OS, DB2 Performance Expert or IBM Tivoli OMEGAMON XE for DB2 Performance Monitor on z/OS can be used to monitor the zIIP information.

What is needed to esimate zIIP usage… (without the zIIP installed)

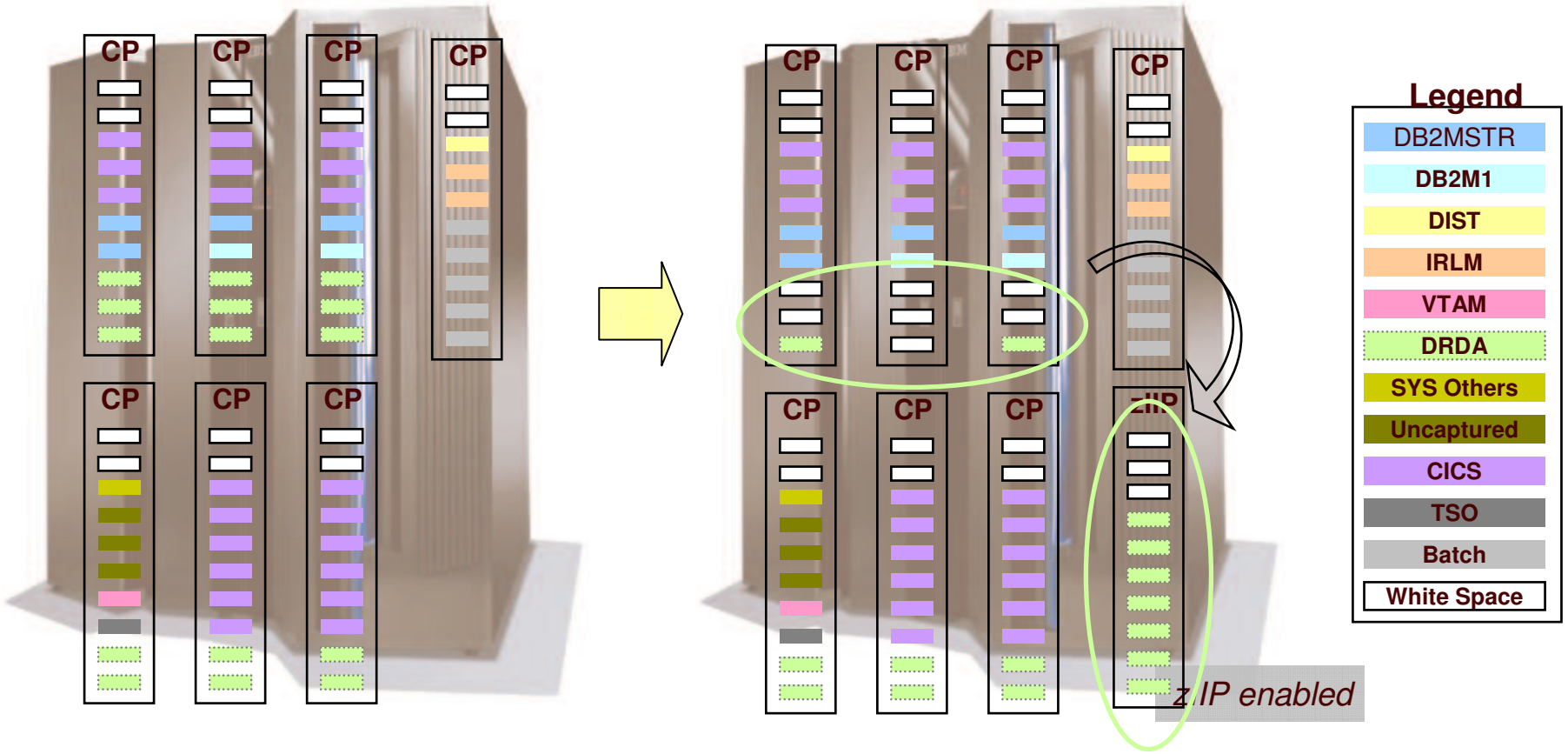
- For all LPARs whose workload has zIIP potential, RMF and DB2 traces need to be collected for certain time intervals. Afterwards, reports need to be generated from this data.
- Time intervals:
  - Data needs to be collected over time intervals of approx. 30 min. In general, there should be at least an interval representative for online and batch peak times, respectively.
- When SAP is running on System z...
  - ...and application servers on z/OS are used besides external ones, the address spaces used for the internal application servers and the DRDA- (or ICLI-) address spaces should be defined in different report classes in WLM
- What data to collect?
  - RMF I data for CPU-activity report and workload activity report
    - SMF-records 70,72
  - DB2 Traces (SMF-records 101):
    - DB2 Accounting Class(1,2)

zIIP Analysis using zCP3000 (M #1 & #2)



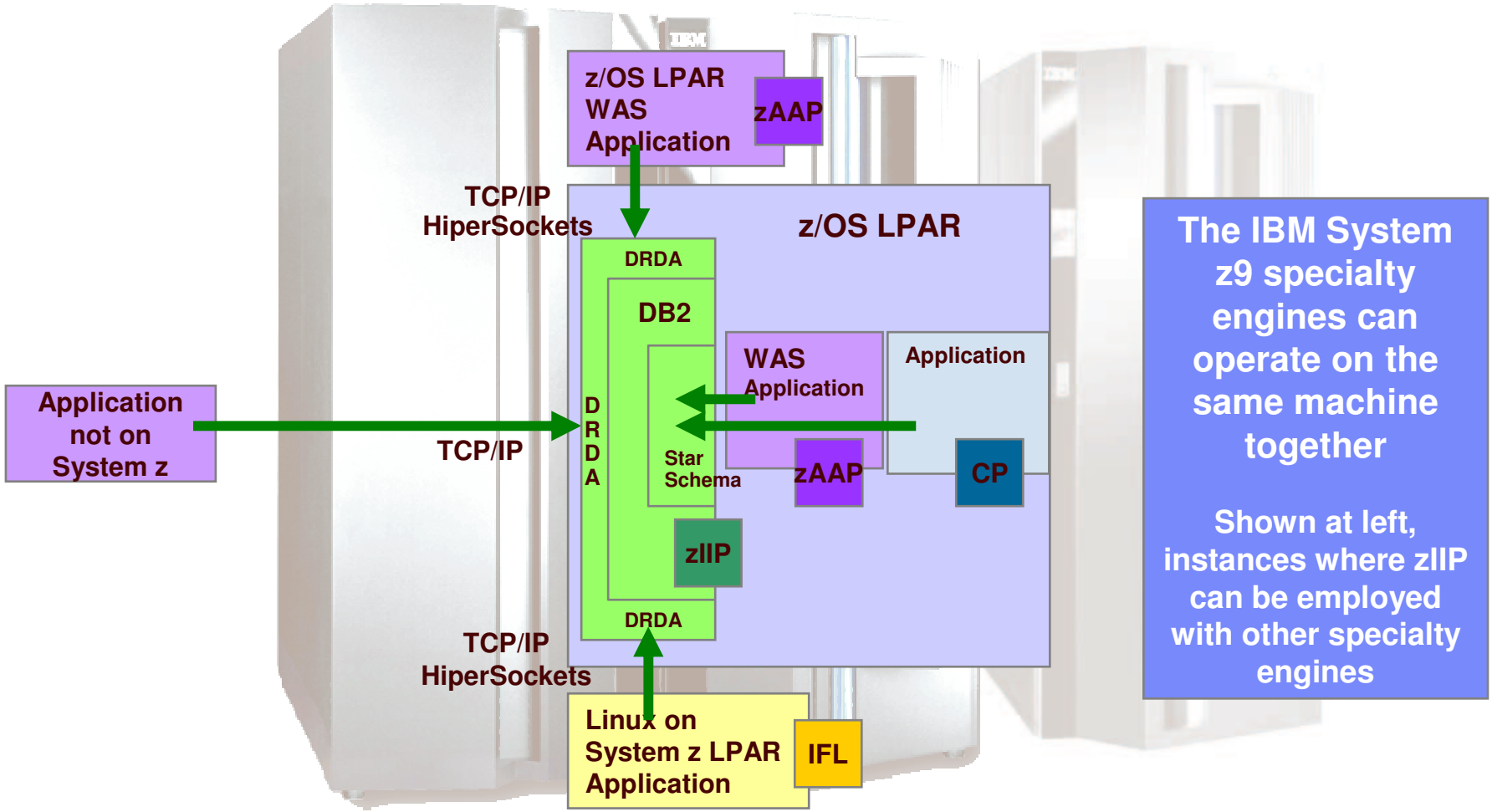
zIIP and overall machine utilization

The overall impact the zIIP will make on your LPAR or machine or sysplex will depend on your workloads



For illustrative purposes only. Your machine utilization will vary

Specialty engines



The IBM System z9 specialty engines can operate on the same machine together

Shown at left, instances where zIIP can be employed with other specialty engines

IT analysts agree, the IBM zIIP represents good value:

"… the introduction of the zIIP is a highly significant milestone that will further accelerate the continuing resurgence of the mainframe platform. It will make it easier, and considerably more cost effective, for customers to support many more of the qualifying DB2 dataserving workloads on the rock-solid "gold standard" enterprise System z9-z/OS-DB2 dataserving platform.

Ian Bramley, Managing Director, Software Strategies,
Information as a Service and the System z9 Mainframe, January 2006

"IBM's new zIIP processor makes z9 more enticing; the mainframe keeps getting better by delivering more benefits while doing so at a lower cost per unit of incremental processing power. It's not just about adding more processors to a resource pool. It is, more importantly, about the ability to get more complicated, interrelated business processing done, when it needs to be done and at an incrementally lower cost. This is what zIIP does for DB2 workloads."

Mike Kahn, Managing Director, The Clipper Group, Inc., January 2006.

To ensure appropriate levels of data security, reduce complexity and manage performance effectively, we need to recentralize the management of corporate data resources. For many businesses, the best way to do this is on the mainframe. In the past, this has been a relatively time consuming process because of technical inconsistencies between platforms. However, DB2 version 9 has made it far easier to consolidate distributed databases onto a centralized system, while establishing the mainframe as a very attractive data server for new workloads in an SOA environment. Moreover, the zIIP co-processor for the z9 promises to provide a very substantial improvement in the cost of managing z/OS-based DB2 data an improvement that makes distributed data management increasingly difficult to cost justify.

Mark Lillycrop, CEO, Arcati, Ltd, January 2006

"Enterprise IT shops are constantly under pressure to find new ways to drive better efficiency for the business. Anything that can be done to increase the workload existing processing units will be embraced as a significant opportunity. IBM's zIIP architecture will allow DB2 processing to be done on idle mainframe processors, thus allowing new workloads to be driven on the mainframe. This will clearly maximize the efficiency of DB2 on the mainframe."

Jerald Murphy, Senior Vice President, Robert Frances Group, January 2006.

The offloading engines are priced significantly lower than the usual z/OS engines. The computing power (MSUs) of these engines is excluded from the software charges. Users who skillfully use these engines can off-load the z/OS MIPS, stem the growth requirements and thus lower the TCO costs. In addition, like in the case of the IFL, users can extend the overall end-to-end application resilience and security also to the front end Linux applications.

Josh Krischer, CEO, Josh Krischer & Associates, January 2006

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 environment

*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 autonomics
- Support of encryption capability (tape subsystem) with z/OS centralized key mgmt
- Data protection to achieve highest levels of security certifications

*Future direction**

- Additional zIIP exploitation
- DB2 enhancements to help improve usability and reduce complexity and management costs.
- DB2 table scan acceleration via DS8000
- 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.

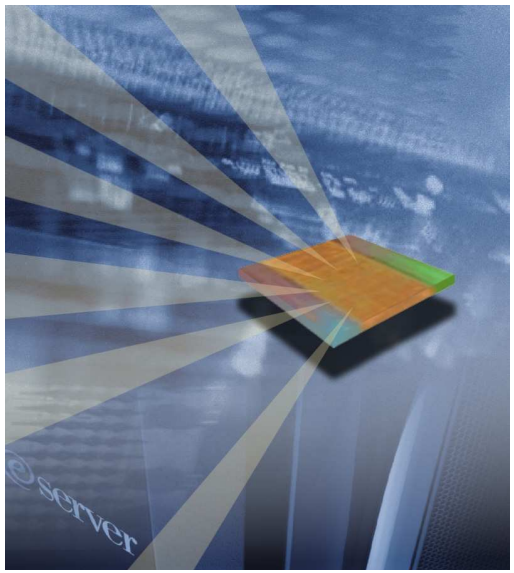
Specialty engines

- **IBM System z9 Integrated Information Processor (IBM zIIP)**
  - Designed to improve resource optimization
  - Can help lower cost of computing for eligible workloads
  - Requires z/OS 1.6
    - First IBM exploiter will be DB2 UDB for z/OS V8
- **System z Application Assist Processor (zAAP)**
  - zAAPs support Java code execution
    - z/OS Java Virtual Machines (JVMs) assist with the execution of code from standard processors to zAAPs
    - JVM executes the Java code on the zAAP
  - Designed to provide a Single Tier integrated application and database serving environment
  - Requires z/OS 1.6
- **Integrated Facility for Linux (IFL)**
  - Provides additional processing capacity exclusively for Linux workloads
  - Runs Linux native or as a guest of z/VM® V4 and V5
- **Internal Coupling Facility (ICF)**
  - Provides additional processing capacity used for coupling to other processors

Introducing the New System z9 Application Assist Processor (or zAAP)

New specialty assist processor dedicated exclusively to execution of Java workloads under z/OS® – e.g. WebSphere®

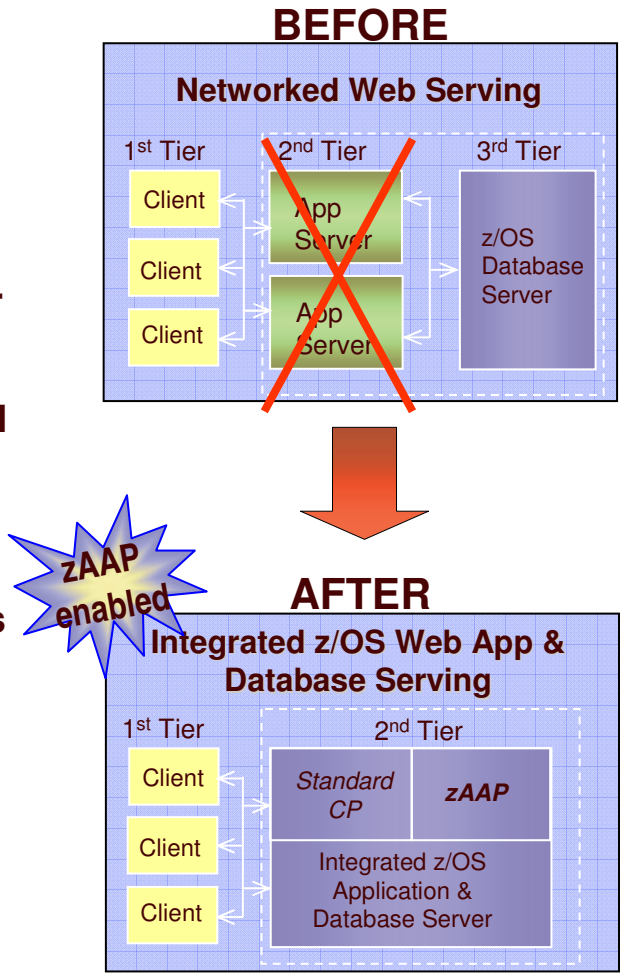
- **Available on IBM System z9 – EC & BC**
  - **Also Server™ zSeries® 990 (z990) and zSeries 890 (z890)**
- **Leveraged by workloads with Java cycles, e.g. WebSphere, DB2®**
- **Up to 1 zAAP per general purpose processor in an LPAR**
- **Executes Java Code with no changes to applications**
- **Traditional IBM zSeries software charges unaffected**



Objective: Enable integration of new Java based Web applications with core z/OS backend database environment for high performance, reliability, availability, security, and lower total cost of ownership

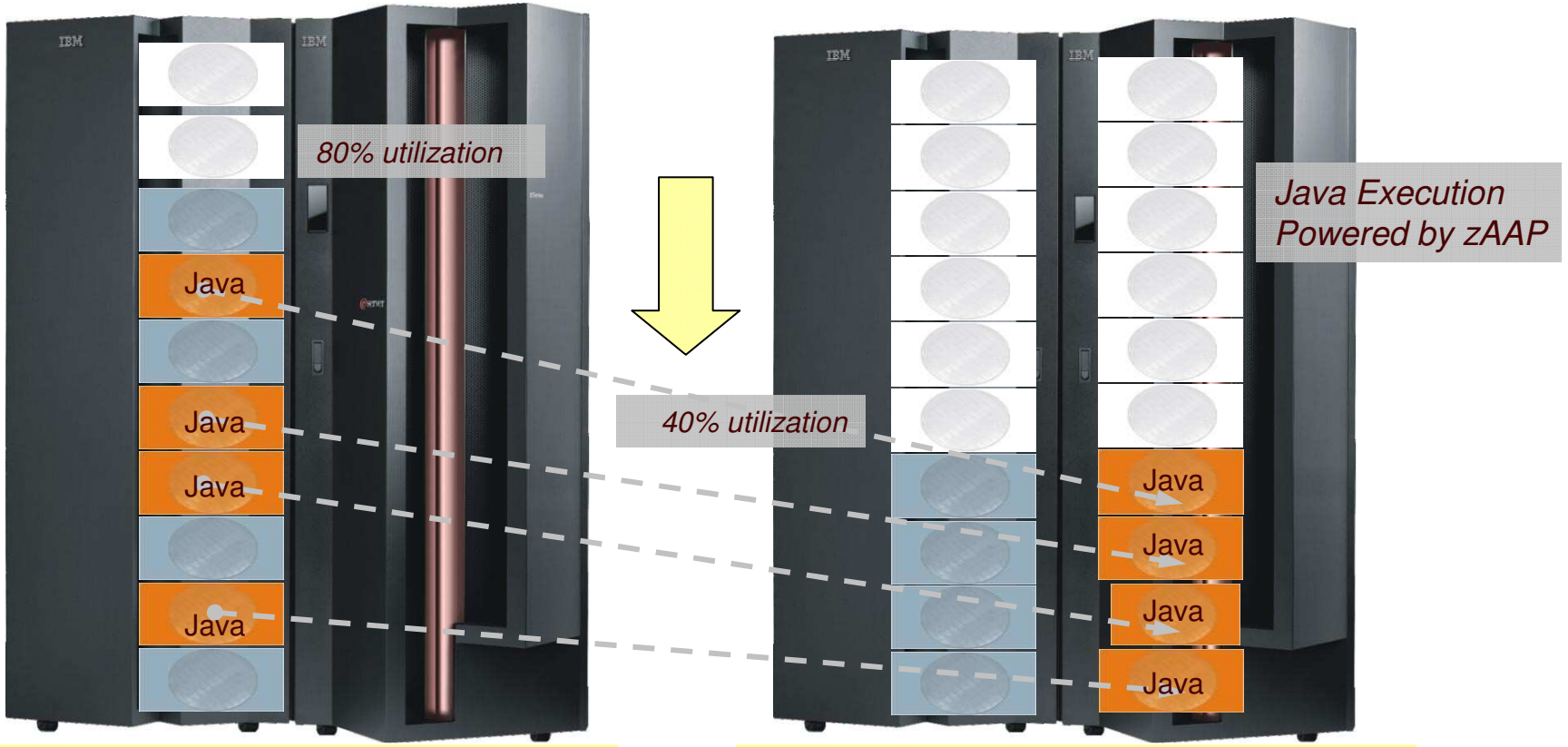
Leveraging zAAPs for e-business Integration and Infrastructure Simplification

- zAAPs can help consolidate, simplify and reduce server infrastructure and improve operational efficiencies.
  - Enables strategic integration of e-business applications with mission-critical database workloads
  - Potential operational advantages over distributed multi-tier solutions
- Eliminates separate tier to handle application server workload
  - Remove one hardware tier
  - Remove one TCP/IP link
- Leverage core zSeries strengths and manage Java Workloads automatically with z/OS
  - zSeries Security
  - zSeries Workload Manager (WLM)
  - zSeries Availability
  - zSeries Scalability
  - zSeries Flexibility



zAAP Concept Overview: A Simplified Example…

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



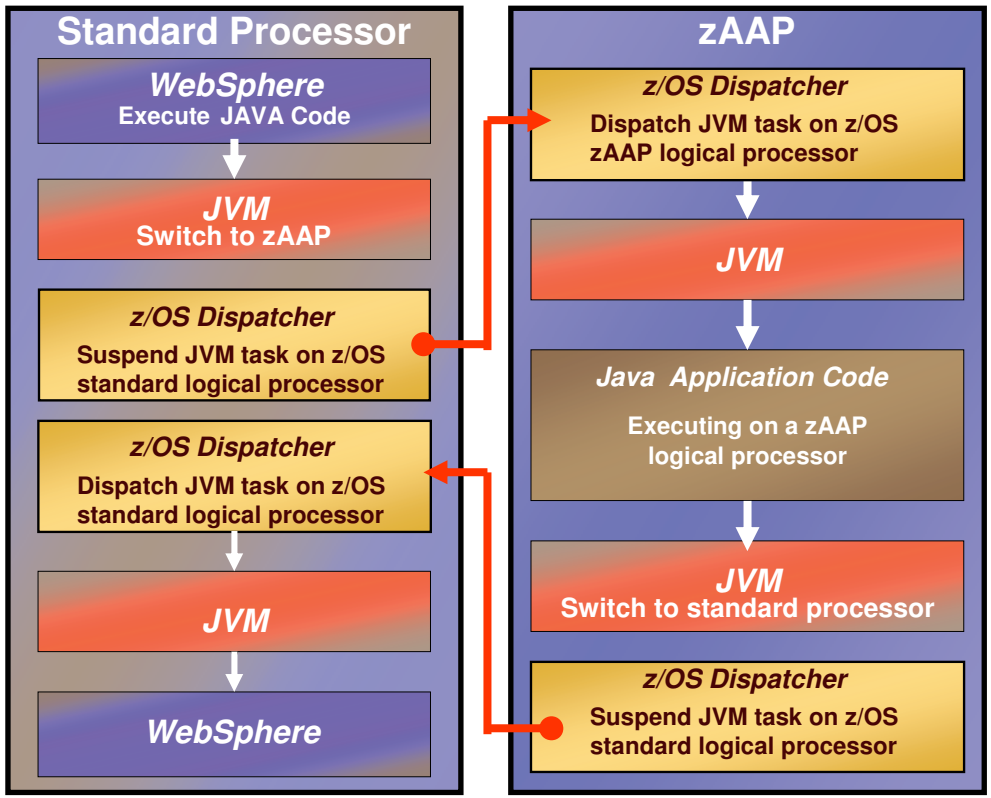
1000 MIPS for WebSphere App

500 MIPS for WebSphere App +
500 MIPS now available for additional workloads

In this example, with zAAP, we can reduce the standard CP capacity requirement for the Application to 500 MIPS or a 50% reduction. ** For illustrative purposes only*

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
  - When Java is to be executed, the work unit is "eligible" to be dispatched on a zAAP
- 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 System z9 – EC & BC**

- **Prerequisites:**
  - **z/OS 1.6 (or z/OS.e 1.6)**
  - **IBM SDK for z/OS, Java 2 Technology Edition, V1.4 with PTF for APAR PQ86689**
  - **Processor Resource/Systems Manager™ (PR/SM) must be enabled.**

Subsystems and Apps using SDK 1.4 will exploit zAAPs automatically:

- **WAS 5.1**
- **CICS® /TS 2.3**
- **DB2 V8**
- **IMS™ V8**
- **WebSphere WBI for z/OS**

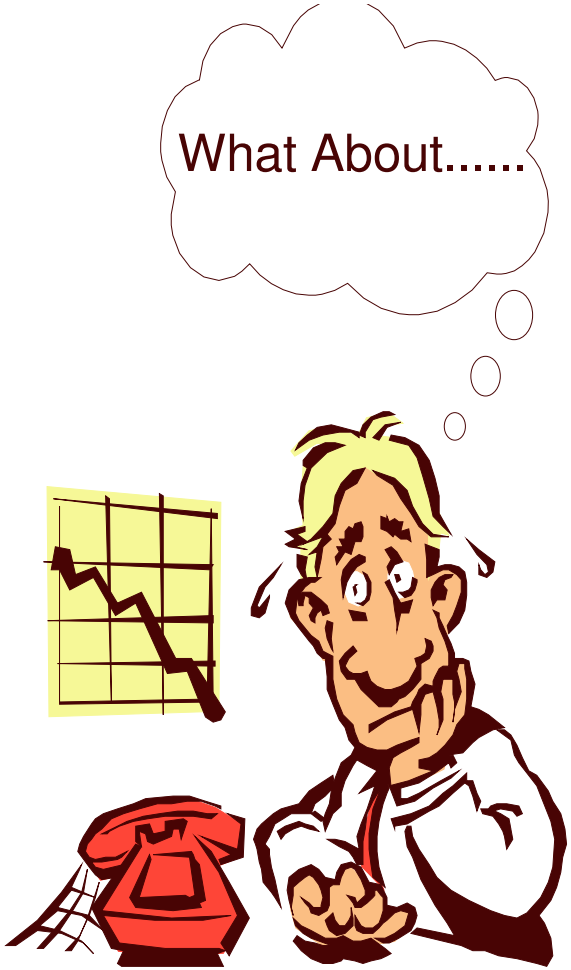
zAAPs must be jointly configured with general purpose processors within z/OS LPARs

- **Number of zAAPs may not exceed the number of permanently purchased CPs**

For more information

- **zIIPs**
  - http://www-03.ibm.com/systems/z/about/
    - **Click on data serving**
    - **FAQ, Whitepapers**
- **zAAPs**
  - http://www-03.ibm.com/systems/z/zaap/
    - **FAQ, Getting started, sizing information, whitepapers**
- **IFLs**
  - http://www-03.ibm.com/servers/eserver/zseries/os/linux/
    - **FAQ, Whitepapers, Tuning hints and tips**

Questions



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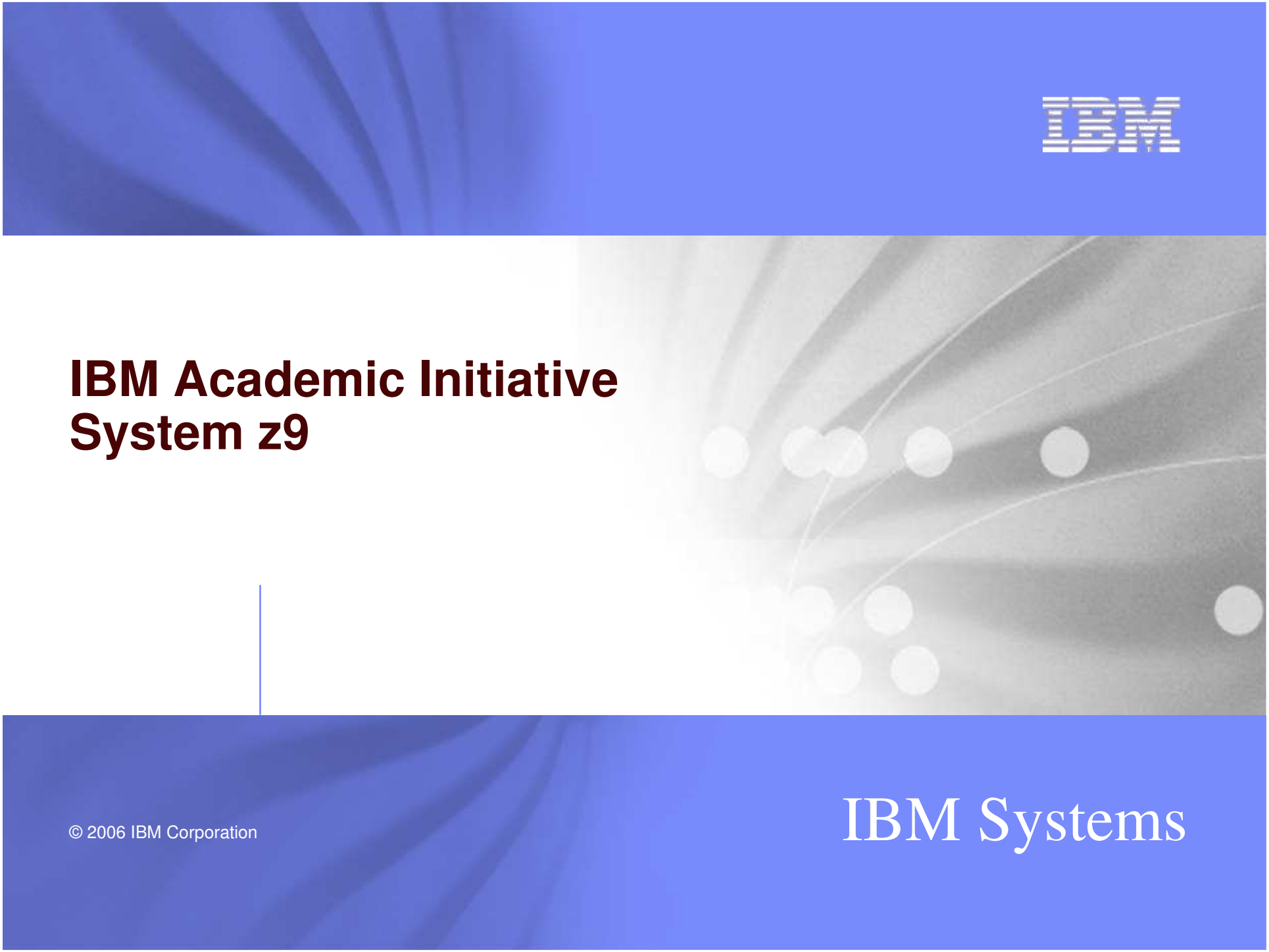
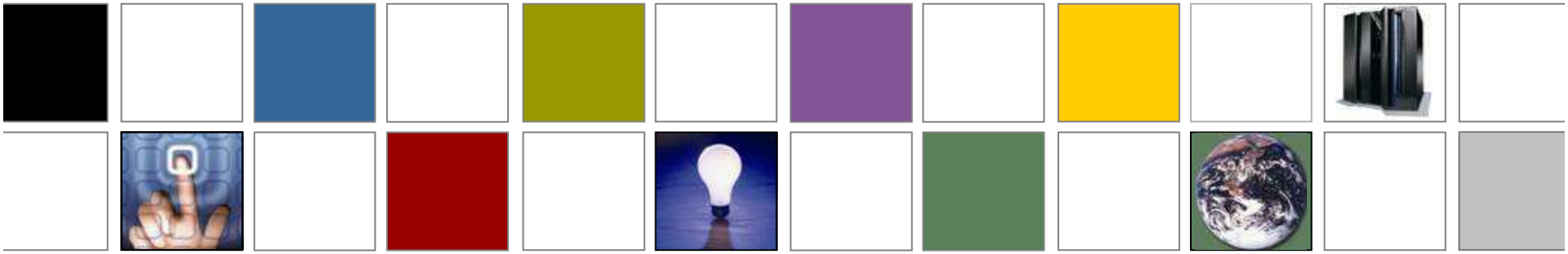


IBM Academic Initiative
System z9

IBM Systems

The Mainframe Charter – Providing a Strategic Framework

It is our intention to…



Innovation

- Provide leadership in innovation to enhance the use of the IBM mainframe to support increasingly integrated and flexible business processes for the on demand business.*

Value

- Enhance the value proposition and lower the cost of computing of mainframe solutions in a way that is compelling, clear, and consistent.*

Community

- Support programs designed to foster vitality in the IBM mainframe community, helping to promote a strong application portfolio and world-class support services.*

* Excerpted from the Mainframe Charter – August 2003

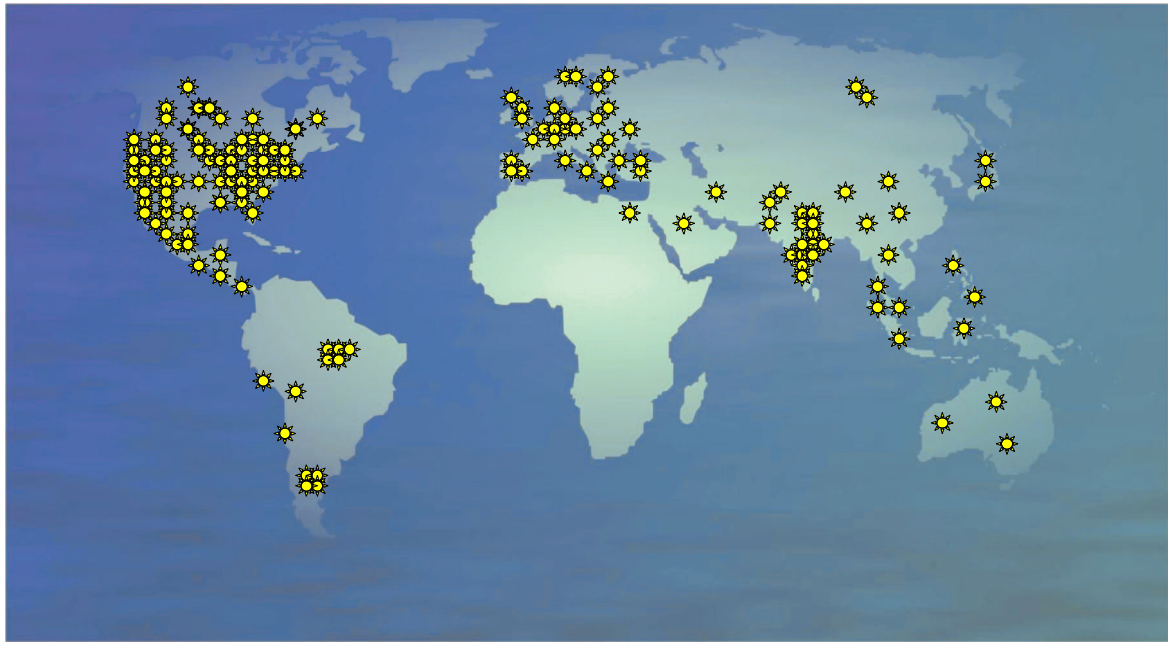
The vibrant mainframe community ecosystem

Mainframe Community Web Portal . . .

ibm.com/systems/z/about/charter/community.html

Advancing toward goal of 20,000 additional mainframe professionals by 2010

- **Mainframe education delivered to 10,000 students to date via Academic Initiative**
  - Over 230 schools enrolled (up from 20+ in early '04)
    - Over half of the schools are outside the U.S.
  - Over 300 professors registered
- **Over 200 IBM mainframe ambassadors reaching out to schools worldwide**
- **Developing mainframe and enterprise computing specializations and certificate programs**
- **Customers working with IBM to reach out to schools**
- **12 existing school courses and more planned (Networking, Security, eBusiness with Java™, large scale commercial computing)**
- **Increased remote access to mainframe hubs**
- **2nd Student Mainframe contest planned in Europe and other locations – Fall 2006**
  - Completed first contest: 700+ students from 85 schools participated in US / Canada



More information: http://www-304.**ibm.com**/jct09002c/university/scholars/products/zseries/

Checklist to educate 20,000 students about the mainframe

- ✓ Develop academic courses
- ✓ Provide access to mainframes
- ✓ Provide education for professors
- ✓ Generate students interest in the mainframe
- ✓ Create awareness in the schools
- ✓ Recruit others to help
- ✓ Validate and involve customers, ISVs, BPs, and IBMers
- ✓ Market the program
- ✓ Continue with a long term commitment

Courses and recruiting materials

Twelve System z courses

- Introduction to the New Mainframe: z/OS Basics
- Linux on System z
- Introduction to z/VM®
- *UNIX*® System Services (Module)
- Basic Interfaces: ISPF (Self-study module)
- JCL
- Assembler Language Coding
- VSAM (Module)
- z/OS Transaction Management with CICS (Module)
- z/OS Data Management with DB2
- An Introduction to IMS (Textbook)
- e-business with WebSphere Application Server for z/OS

Courses under development (in 2006)

- Networking with z/OS
- Security with z/OS
- e-business with Java on z/OS
- Large scale commercial computing

Recruiting materials

- PowerPoint Presentation*: Recruiting Schools to Teach Large Systems Thinking*
- Flash Demo for professors and students*: Learn about your future in Large Systems*
- Interactive e-Learning module*: IBM Mainframes: Big opportunities come in big boxes*!

Increased remote access to university hubs

- Classes in Scandinavia
- Norway
  - 3. year ongoing classes
    - Oslo University College,
- Sweden
  - 2. year on going classes
    - At Royal Institute of Technology, Sweden
- Denmark
  - 1. year completed
    - At The Technical University of Denmark
- ALL HOSTED AT MONTPELLIER, FRANCE

WW Hubs:

- Marist College, NY – 1684 users in 2005
- Colorado State – >500 Linux images avail
- University of Arkansas – new in 2005
- Montpellier, France – IBM site
- China – 5 systems, serving 8 schools

Details on the DTU class – spring 2006

- **Introduction to the New Mainframe: z/OS Basics**
- **30 enrolled students**
  - 13 weeks – 4 hours a week.
  - 50 applied for the class
  - 19 graduated in May 2006 oral exam
  - Both presentation and hands-on education
- **Comments from the students**
  - “It is a exiting subject and it is nice to hear what businesses use and why”
  - “Good split between the exercises and lectures – even though more exercises would have been good too.”
  - “Good and engaged lectures/speakers”
  - “Cool to work on mainframe”
  - “In general good and interesting course with a lot of ”wow” factor”

Press quotes….

"In the coming years companies are experiencing increasing difficulties in getting new qualified personal!

bitconomy.dk April 21, 2006

"First Mainframe class in 20 years"
"Mainframe systems lives on"

COMPUTERWORLD, April 26, 2006

"Experienced mainframe people are retiring"
"Serious bottle neck problems within 10 years"

COMPUTERWORLD, April 28, 2006

Curriculum (not complete)

Emne	Pensum
• Introduction to the mainframe	Kapitel 1 – Introduktion til mainframen - historie - arkitektur - Karakteristika
Characteristics of a mainframe	Kap 19 – Hardware karakteristik - Design - Processor typer - IO – LPARs
What is z/OS	Kap 2 og Kap 3 - z/OS - virtual storage - TSO Øvelser – TSO logon, SDSF
Why mainframe ?	Gues speaker - Why / how do they use the mainframe ? - How does the future looks like for the mainframe ?
z/OS cont..	Kap 3 : -TSO/E -ISPF -UNIX Kap 4 : Håndtering af dataset -Data set typer - DFSMS Øvelser : Unix og Ishell øvelser.
z/OS : data organisering	Kap 4 : Håndtering af dataset Øvelser : håndtering af dataset (4.16)
z/OS	Kap 5 og Kap 6 -Batch processing -JCL -SDSF Øvelser : batch og utility håndtering 6.14
Programming languages	Kap 8 og kap 9 : -Assembler -Cobol - PL/1 – REXX – C - Java Øvelser : KV, java
Business applications	Kap 10 og 11 : -Transactional managers and database managers -DB2 CICS

END

Focus on DRDA

- **A portion of DB2 SQL processing coming in through DRDA via TCP/IP can be eligible for zIIPs**
- **One objective with the zIIP is to help bring the costs of network access to DB2 more closely in line with the costs of running similar workloads under CICS®, IMS™, or Batch on the mainframe.**
- **Why focus on DRDA?**
  - Database workloads such as CICS, IMS, stored procedures and Batch have become increasingly efficient and cost effective on the mainframe. Today, customers are looking to further leverage their data on the mainframe, and are turning to the mainframe more and more frequently for new application workloads. These application workloads, such as Enterprise Resource Planning, Customer Relationship Management and Business Intelligence often use DB2 as a database server.
  - Added system costs for network access to DB2 results in hardware and software charges that are substantially higher for remote applications, when compared to the same workload running as a local batch application. The zIIP is aimed at helping customers more cost effectively run these database serving applications on the mainframe.

Focus on Star Schema

- **Star schema workloads may benefit from two redirected tasks**
  1. 'Main' task = the DRDA request
     - If the request is coming in via DRDA via TCP/IP it can take advantage of the DRDA use of zIIP, just like any other network attached Enterprise Application.
  2. 'Child' task = the star schema parallel queries
     - If the business intelligence and data warehousing application uses star schemas, then a significant amount of this task (star schema) processing is eligible to be redirected to the zip.
- **The child (star schema) & main tasks (coming in through DRDA via TCP/IP) are additive.**
  - Combining the child and the main tasks is expected to yield a larger amount of redirect than that of just DRDA via TCP/IP alone.
- **Longer running queries see higher benefit.**
- **Benefits to a data warehousing application may vary significantly depending on the details of that application.**

Focus on DB2 for z/OS utilities

- **Only the portions of DB2 utility processing related to index maintenance are redirected.**
  - Only the BUILD portion of LOAD, REORG, and REBUILD
- **Amount of workload eligible for zIIP will depend on:**
  - How many indexes are defined on the table
  - How many partitions are in the table
  - If data compression is being used
  - Possibly other factors
- **Lower amount eligible is expected with:**
  - Tables with fewer indexes
  - Fewer partitions
  - Compression used
- **Higher amount eligible is expected with:**
  - LOAD and REORG with many indexes or many partitions

What are enclave SRBs?

- z/OS dispatches work in either TCB (Task Control Block) mode or SRB (Service Request Block) mode. DB2 parallel tasks use SRB mode and are assigned the same importance as the originating address space.
- Preemptible 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 preemptible, the z/OS dispatcher (and WLM) can interrupt these tasks for more important ones (i.e. manage a transaction end-to-end). There are two types of preemptible SRBs: client SRBs and enclave SRBs.
- If the DB2 for z/OS V8 request is coming in over distributed (i.e. DRDA over TCP/IP) then most of that work (other than stored procedures and user-defined functions) 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 parallel queries and some utility index maintenance now use enclave SRBs)

- As for the zIIP, only the enclave SRB work (not the client SRB work or non-preemptible SRB work or TCB work) is eligible to be redirected to the zIIP
- DB2 V8 knows how its work is dispatched and directs z/OS 1.6 or later to dispatch (redirect) a portion of the eligible work to the zIIP

How does the zIIP work .....

The zIIP is designed so that a program can work with z/OS to have 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 UDB 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. Stored Procedures and user-defined functions run under TCBs, not SRBs, so they are not generally eligible for zIIP. The call, commit and result set processing for procedures are eligible. DB2 V9.1 for z/OS remote native SQL Procedure Language are eligible for 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.