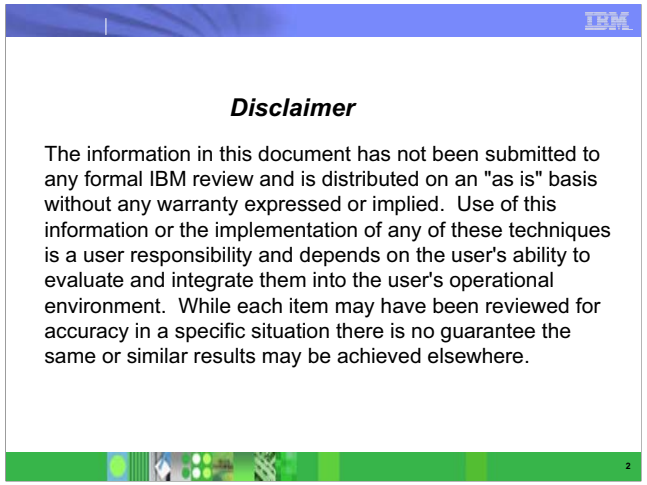
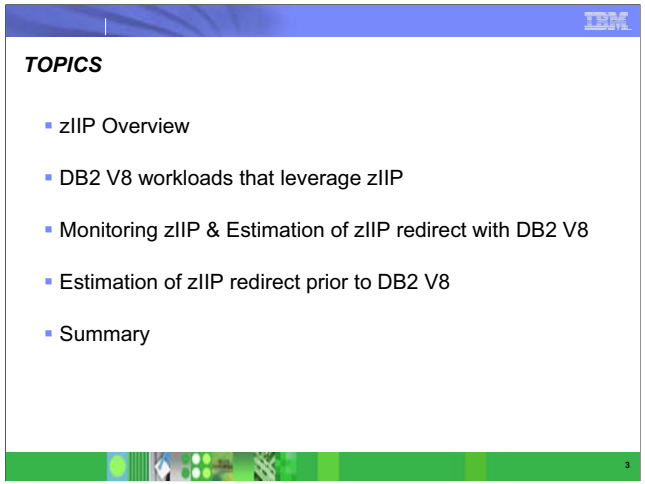
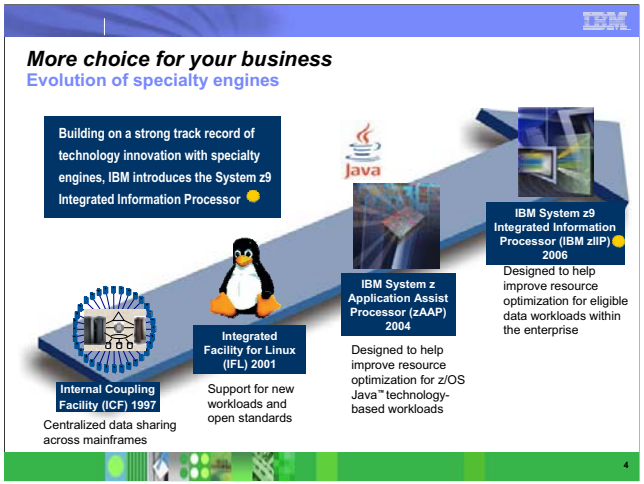
- IBM announced and shipped its zIIP specialty engine offering in 2006 and is making more work eligible in 2007.
- The zIIP is designed to help process certain DB2 related tasks at a reduced software license and processor cost. The workloads which benefit are distributed SQL access, parallel queries, and some utility processing. SAP customers are a good example. In this session, we will explain how you can start making use of the zIIP and which workloads qualify for the zIIP. We will also provide some best practices on how to maximize the usage of the zIIP.
- We'll also include information about the April 2007 and August 2007 announcements for more work which can use the zIIP and a little about the zAAP as well.

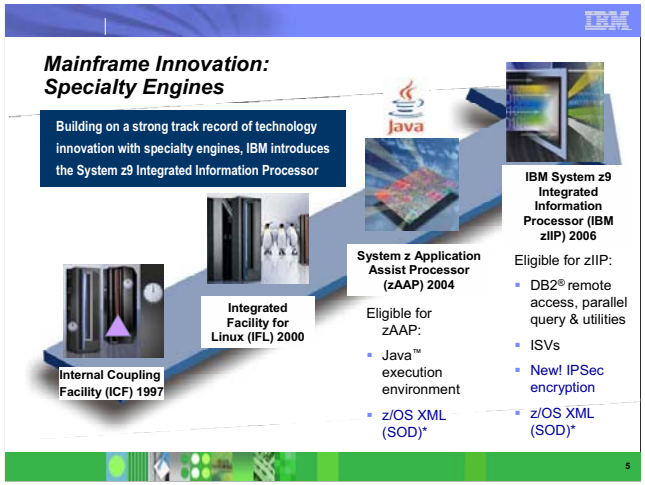




- We'll start with an overview, then explain more about the work loads and what is eligible. Then we can work down to show some of the techniques for measurement and estimation, ending with a summary.

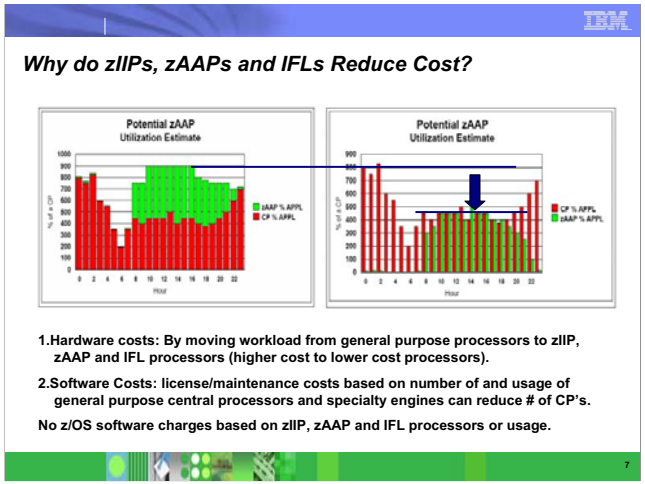


- The IBM family of specialty engines have been delivered over a number of years for the diverse work loads, ranging from a Coupling Facility in 1997 and Linux in 2000 to the Java work loads in 2004 and some database work in 2006.
- System z9 zIIP web site, FAQs, press release
- http://www.ibm.com/systems/z/ziip/
- Link to the white paper, Why Data Serving on the Mainframe: http://www.ibm.com/systems/z/feature012406/whitepaper.html
- Articles in ESJ, ComputerWorld, ADT, NetworkWorld
  http://www.esj.com/news/article.aspx?EditorialsID=1603
  http://www.esj.com/news/article.aspx?EditorialsID=1647
  http://www.computerworld.com/hardwaretopics/hardware/mainframes/story/0,10801,108080,00.html?source=NLT_ERP&nid=108080
  http://www.adtmag.com/article.asp?id=17854
  http://www.networkworld.com/news/2006/020606-ibm-db2.html?nettx=020606netflash&code=nlnetflash21301
- Blog discussion by Willie Favero, an IBMer on the DB2 team: http://blogs.ittoolbox.com/database/db2zos/archives/007533.asp

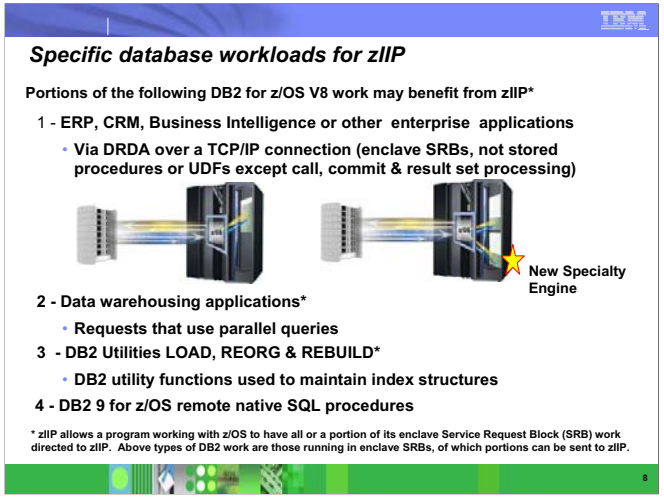


- The latest change to deliver is the ability to use the zIIP for IPSec encryption in 2007. A statement of direction was provided for z/OS XML to be able to use zAAP or zIIP for XML parsing in April and August 2007.

- The value of specialty engines



▪zIIPs and zAAPs do not add functional capabilities, but they do address hardware and software costs. In addition to being lower cost processors for the specialty purposes, they allow you to reduce the license and maintenance cost for software on z/OS, as there is no z/OS software charge for processing running on zIIP, zAAP or IFL processors.



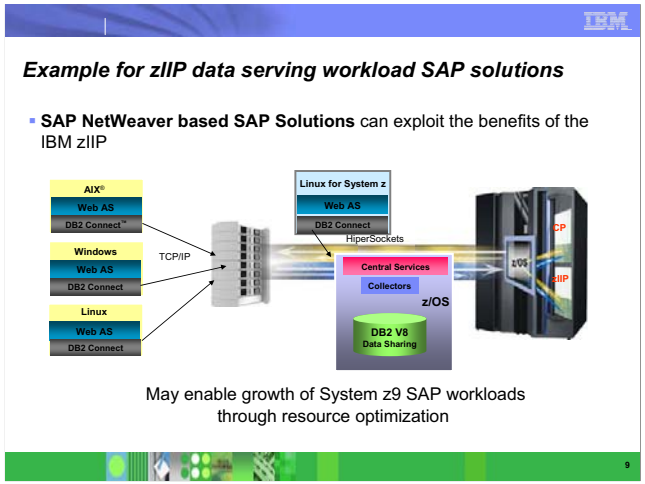
▪The zIIP is designed so that a program can work with z/OS to have all or a portion of its enclave Service Request Block (SRB) work directed to the zIIP. The above types of DB2 V8 work are those executing in enclave SRBs, of which portions can be sent to the zIIP. Not all of this work will be run on zIIP. z/OS will direct the work between the general processor and the zIIP. The zIIP is designed so a software program can work with z/OS to dispatch workloads to the zIIP with no anticipated changes to the application – only changes in z/OS and DB2. IBM DB2 for z/OS version 8 was the first IBM software able to take advantage of the zIIP. Initially, the following workloads can benefit:

▪ SQL processing of DRDA network-connected applications over TCP/IP: These DRDA applications include ERP (e.g. SAP), CRM (Siebel), or business intelligence and are expected to provide the primary benefit to customers. Stored procedures and UDFs run under TCBs, so they are not generally eligible, except for the call, commit and result set processing.

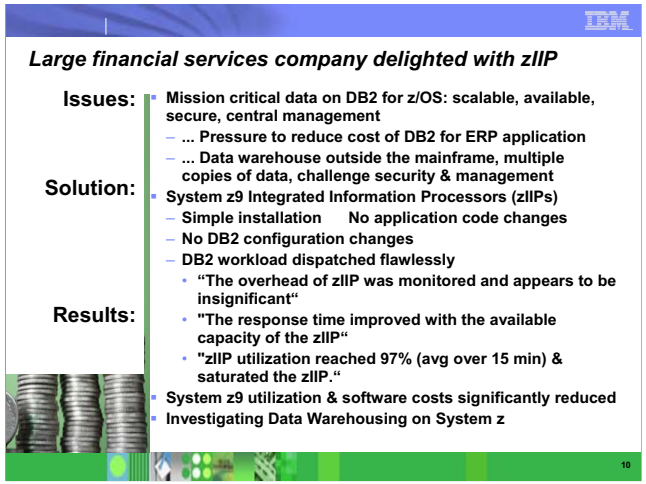
- V9 remote native SQL Procedure Language is eligible for zIIP processing.

▪BI application query processing utilizing DB2 parallel query capabilities; and
▪Functions of DB2 LOAD, REORG and REBUILD utilities that perform index maintenance.

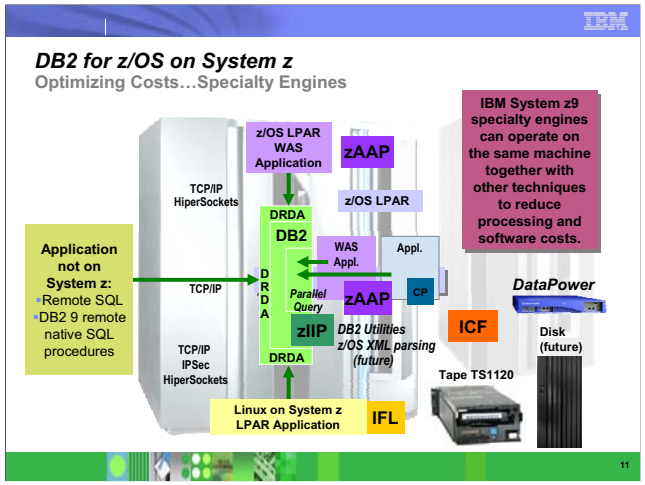
For more, see http://www.ibm.com/systems/z/ziip/



- The zIIP is for customers who are concerned about costs for growth. The big cost reduction is in hardware cost, which is much less than a standard processor. The biggest cost reductions are in software, as IBM does not charge for software running on the specialty processors. The zIIP will fit some customers very well, but will not apply for all. As a specialty processor, not all work can use the zIIP, which will only process work running under an enclave SRB. Most applications cannot run in SRB mode. The specifics of the software charging need to be considered. Customers must be current on hardware (System z9), current on software (z/OS 1.6 or later, DB2 V8 or later) and have a work load peak using the types of work supported by the zIIP:



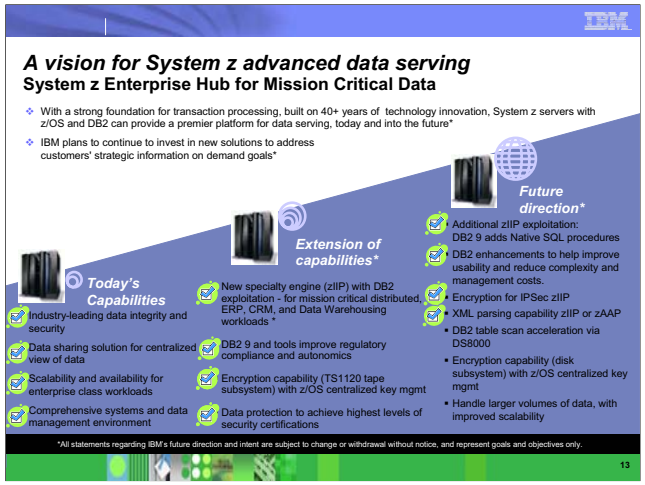
- Mission critical data is on DB2 for z/OS. Data is highly scalable and available, is secure, and has centralized management, backup, and recovery, but there is pressure to reduce the cost of distributed database calls (DRDA).
- An ERP application currently uses DB2 on z/OS for its data store.
- Data warehouse performed outside of the mainframe, causing multiple copies of disparate data, potentially compromising security, management, backup & recovery.
- Five (5) System z9 Integrated Information Processors (zIIPs) were purchased.
  - ➢Simple installation of DB2 and z/OS maintenance
  - ➢No code changes to the application
  - ➢No configuration changes to DB2
  - ➢zIIP activated automatically without any tuning requirements
  - ➢DB2 workload was dispatched flawlessly
  - ➢Customer quotes:
  - ➢"The overhead of zIIP was monitored and appears to be insignificant"
  - ➢"The response time improved with the available capacity of the zIIP"
  - ➢"zIIP utilization reached 97% (avg over 15 min) & saturated the zIIP."
- The System z9 utilization was significantly reduced as workload was redirected to the zIIP. Software [ISV] costs were significantly reduced.
- Investigating Business Intelligence/ Data Warehousing on System z



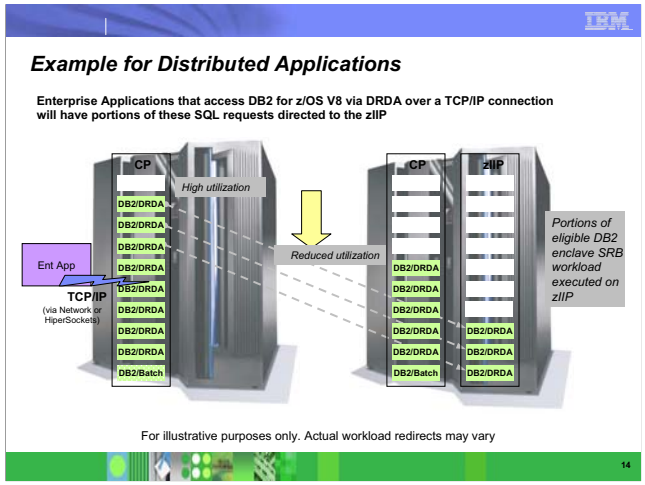
- The specialty engines can be used to improve the cost of ownership, providing a low price for the hardware and not incurring software charges, since they are not general purpose processors. Customers can use all of the engines together with DB2. The ICF provides the Coupling Facility for DB2 data sharing with Parallel Sysplex for availability and scalability. The IFL can run Linux applications using DB2 Connect over a communication link or hipersockets to DB2 for z/OS. The zAAP can run Java applications, while the zIIP runs part of the DB2 work.
- Announcements for zIIP:
- http://www.ibm.com/common/ssi/rep_ca/7/897/ENUS106-287/ENUS106-287.PDF
- http://www.ibm.com/common/ssi/rep_ca/3/897/ENUS106-293/ENUS106-293.PDF

- http://www.ibm.com/systems/z/ziip/

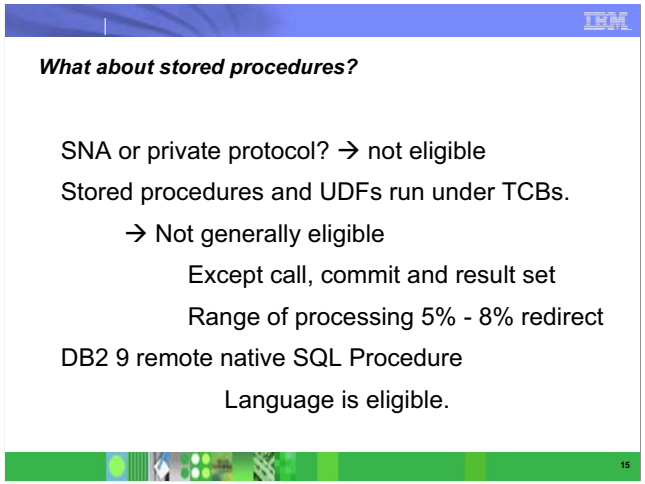
- Statement of Direction: To address customers' growing concern with data security, IBM is announcing a statement of direction for the development, enhancement and support of encryption capabilities within storage environments such that the capability does not require the use of host server resources.
- This includes the intent to offer, among other things, capabilities for products within the IBM TotalStorage® portfolio to support outboard encryption and to leverage the centralized key management functions planned for z/OS ICSF.
- The first change comes in the TS1120 tape drive, but the rest is beyond currently announced products, including DB2 V9.



- We have been working on specialty processors for a long time, and have just delivered new capabilities with the zIIP. The improved cost of ownership can help a lot for some customers, but not at all for others. There have been several big recent changes:
- The z9 Business Class and Enterprise Class extend zIIP capabilities to many more customers. Only the largest customers needed the z9-109 processors, and the upgrade steps were very large ones. The new z9 Business Class and Enterprise Class processors have a much greater range of processing power with more granular upgrade options. The entry level z9 processor now starts at under $100,000.
- Query work was broadened beyond just star joins to all large parallel queries. If you have a warehouse that uses parallel processing and significant CPU time, then the zIIP may provide a benefit.
- The TS1120 tape subsystem has added encryption capability with several options for centralized key management.
- DB2 9 for z/OS adds three check marks. Another comes in August 2007, and some delivers with z/OS 1.9, but statements of direction note other improvements to come.
- The Data Serving Roadmap provides more information about this slide: http://www.ibm.com/systems/z/ziip/data.html



- Remote SQL processing of DRDA network-connected applications over TCP/IP: These DRDA applications include ERP (e.g. SAP or PeopleSoft), CRM (Siebel), and business intelligence running on other platforms. Remote SQL is expected to provide the primary benefits to customers, as it is commonly part of the peak load. Stored procedures and UDFs run under TCBs, so they are not generally eligible for zIIP, except for the call, commit and result set processing. V9 remote native SQL Procedure Language is eligible for zIIP processing.



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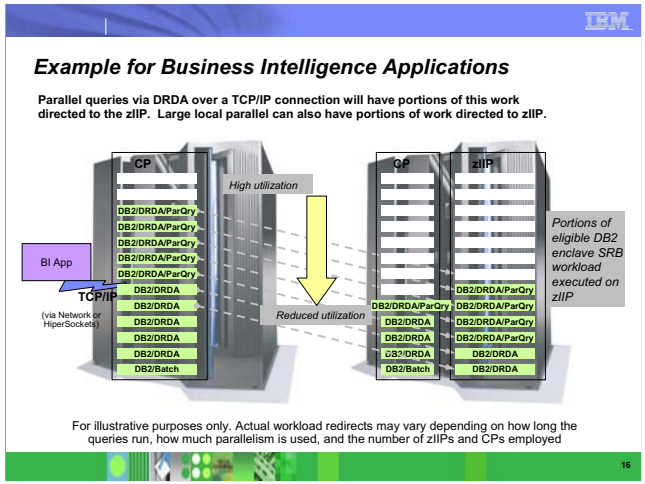
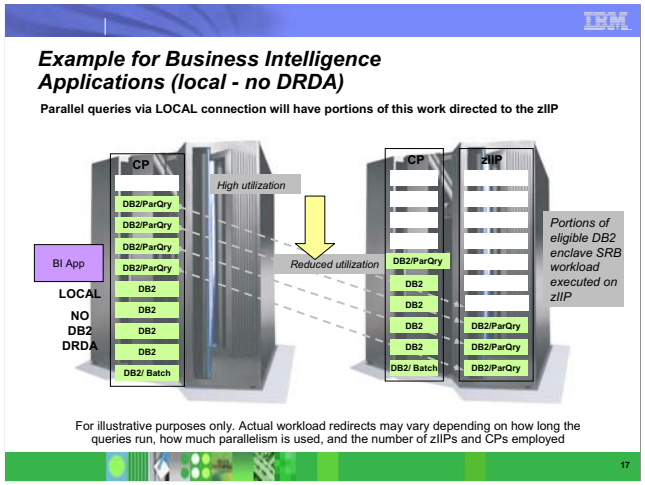


- Parallel queries: If the work comes in remotely over DRDA using TCP/IP, then the initial work is eligible as remote work. After the initial time, the parallel processing threads are eligible and can use more processing on the zIIP.



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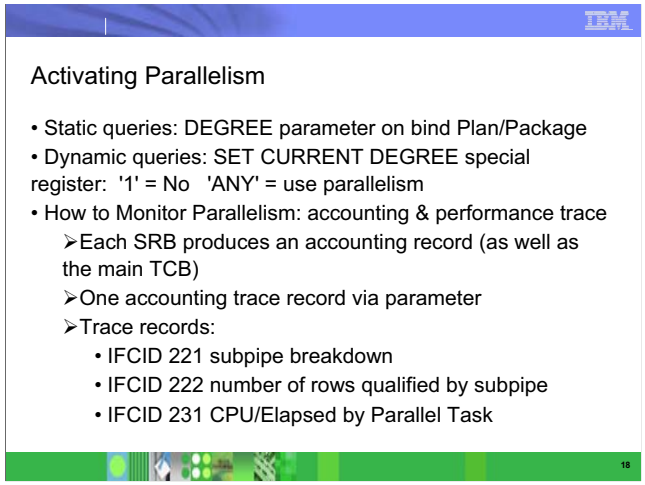
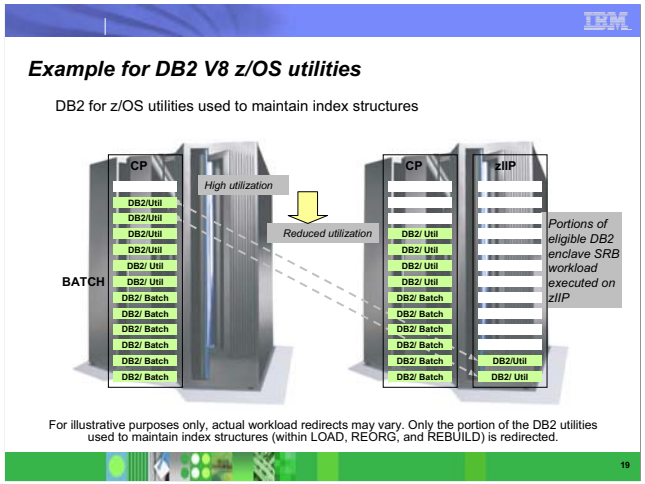


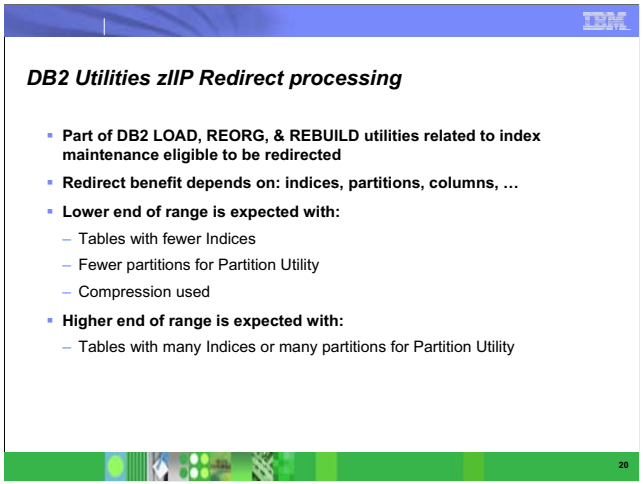
How to Activate Parallelism
• Static queries: DEGREE parameter on bind Plan/Package
• Dynamic queries: SET CURRENT DEGREE special register
– '1' -- DB2 will not consider parallelism for queries
– 'ANY' - DB2 will use parallelism for queries where possible
• DSNZPARMS
– DEFAULT CURRENT DEGREE in INSTALL panel DSNTIP4 (CDSSRDEF = ANY)
– Default CURRENT DEGREE for dynamic queries (no effect on static queries)
• To avoid query regression:
– Parallelism can be controlled with 2 ZPARMs
– PARMMDEG for the maximum degree of parallelism in DSNTIP4 (not often needed)
– Ensures single query does not consume all parallel tasks
– Minimizes runtime regression if large number of resources are not available
• SPRMPTH: Threshold to disable parallelism for short running queries

How to Monitor Parallelism

• Each SRB produces an accounting record (as well as the main TCB)
• You can tell DB2 to roll-up information into one accounting trace record via ZPARM: PTASKROL=YES
• IFCID 221 gives subpipe breakdown
• IFCID 222 gives # rows qualified by subpipe
• IFCID 231 gives CPU/Elapsed by Parallel Task



- DB2 utility index processing: Functions of the LOAD, REORG and REBUILD DB2 utilities that perform index maintenance are eligible for zIIP. This is not a common peak capacity constraint, but could be useful in reducing CPU charges.



- Portions of DB2 Utilities (LOAD, REORG, & REBUILD) processing related to Index maintenance are eligible to be redirected.
- Redirect benefit depends on:
  - How many Indices are defined on the Table
  - How many Partitions are in the Table for Partition Utility
  - Number of Columns, Column data type etc.
  - Use of data compression
- Lower end of range is expected with:
  - Tables with fewer Indices
  - Fewer partitions for Partition Utility
  - Compression used (more CPU overall, lower percentage redirect)
- Higher end of range is expected with:
  - Tables with many Indices or many partitions for Partition Utility

zIIP Redirect Software Maintenance

- DB2 V8 zIIP support :
  - II14219 Info Apar with additional information, later updates
  - PK18454 DRDA
  - PK19920, PK27712, PK30087 Utilities
  - PK19921, PK27578, PK30548 Parallel Queries
- Support for zIIP related instrumentation changes in IFCIDs 1,3,124,147,148,231,239,316 for zIIP usage reporting, monitoring and projection:
  - IBM Tivoli OMEGAMON XE for DB2 Performance Expert on z/OS V3 : PK25395, PK32787, OA15898, OA15899, OA15900
  - DB2 Performance Expert V210 : PK29966, PK32782
  - DB2 Performance Monitor V810 : PK29967, PK32782
- zIIP support maintenance info for z/OS, SDSF,RMF,WLM,BCP
  - FMIDs : z/OS 1.6 JBB77S9, z/OS 1.7 JBB772S
  - Included in the base for z/OS 1.8
  - http://www.ibm.com/systems/z/ziip/gettingstarted/prereqs.html
- RETAIN search keyword zIIP/K for zIIP related Apar/PTF information.

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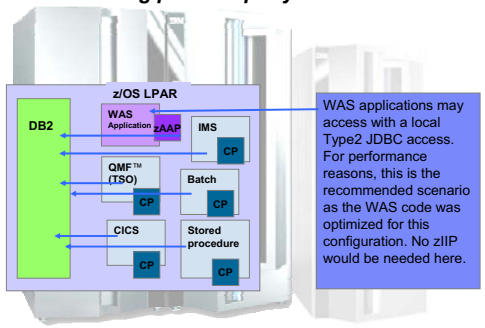
- There are quite a few APARs for zIIP support, with some for z/OS, DB2 and also for many products which report on performance. Be sure that all of the applicable service in in place.

Some instances where zIIP would not be used – local application not running parallel query



To use zIIP more, run SQL parallel, Change to DEGREE(ANY)

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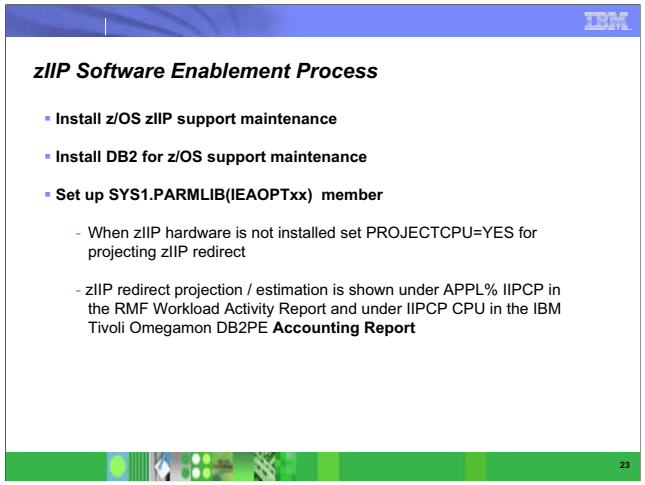
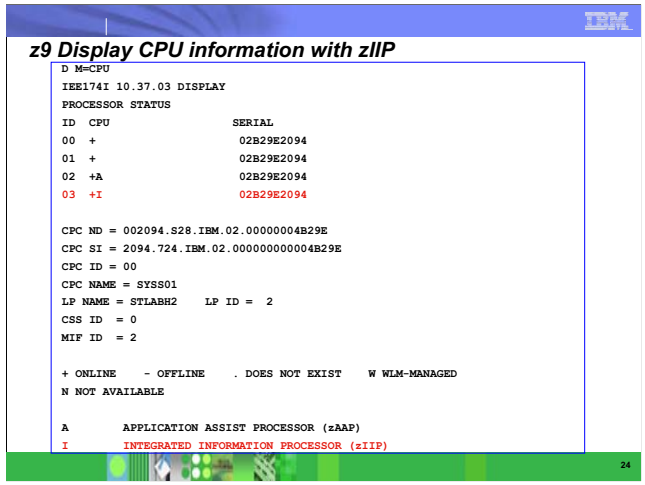
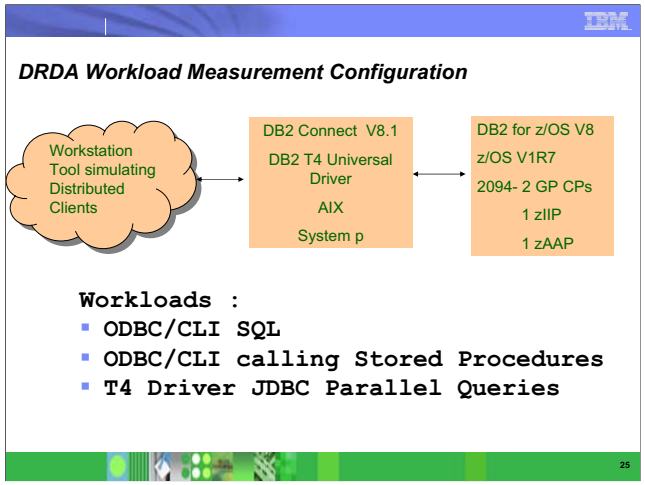
- If the work is local and running under a TCB, as normal applications do, then the zIIP would not be used. This is the case for a local WAS application, which could use a zAAP for the Java processing. Local QMF (TSO or CICS applications), batch programs, CICS, IMS, Stored procedures and User-Defined Functions (UDFs) do not use zIIP, unless they are running parallel queries or LOAD, REORG or REBUILD utilities.



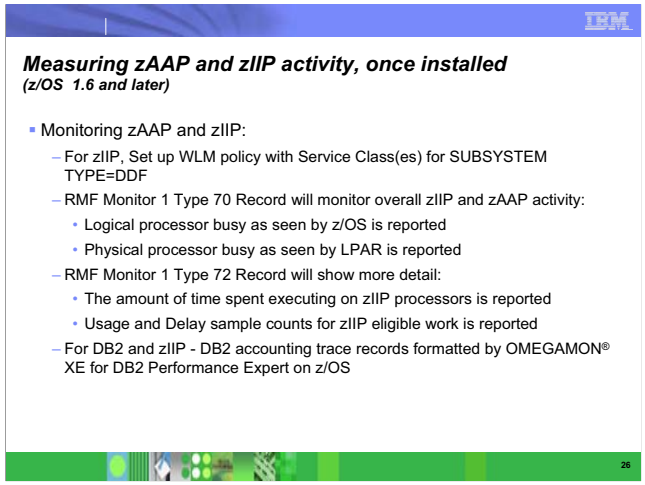
- The PROJECTCPU=YES option (also available on z/OS V1R6 and z/OS V1R7 as part of the zIIP FMIDs) now also allows zAAP projection to occur, without requiring any per JVM configuration changes. Previously, each impacted JVM had to be individually configured to cause zAAP statistics to be collected in RMFand SMF.
- To aid in determining the number of zIIP engines required to satisfy a specific customers usage, this new parmlib option is available once all the software updates have been applied. The PROJECTCPU=YES parameter enables z/OS to collect zIIP usage as if there was one configured, when the target workload is being run. This projection capability can be run at any time, on a production environment if desired. RMF, SMF and IBM Tivoli Omegamon DB2 Performance Expert now show this calculated zIIP time so that an accurate zIIP projection can be made.



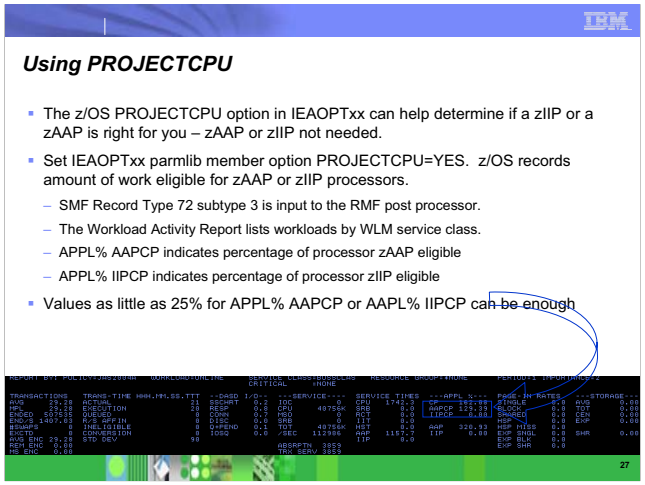
- This chart shows the CPU configuration display on the z/OS console with the D M=CPU command.
- This display shows a configuration with 2 CPs, 1 zAAP and 1 zIIP processor. + sign indicates that the processor is online.



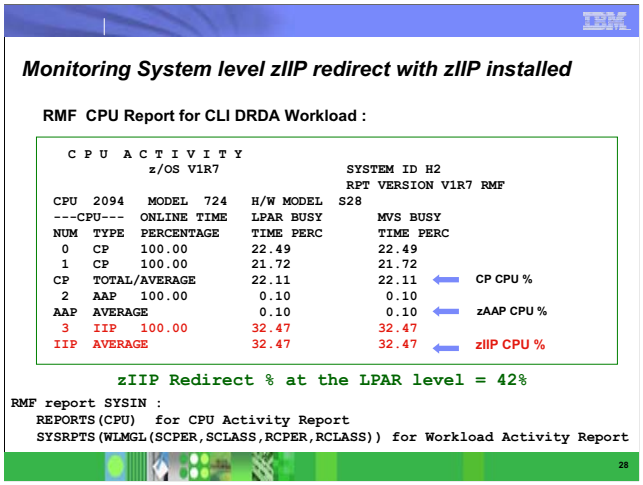
- This is the configuration used for the DB2 tests and benchmarks I'll be showing you. The driving system is System p running AIX and connecting with DB2 Connect or a Java type 4 Universal Driver to DB2 for z/OS.



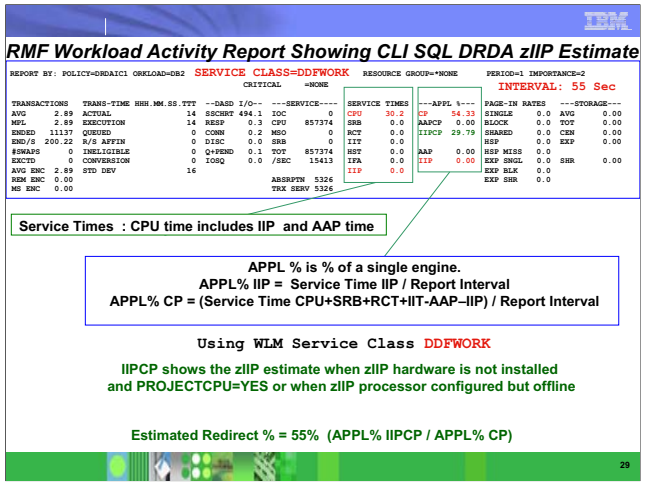
- Once a zAAP or zIIP is installed (with appropriate maintenance), monitoring zAAP and zIIP activity is as follows:
  - For zIIP, Set up WLM policy with Service Class(es) for SUBSYSTEM TYPE=DDF
  - RMF Monitor 1 Type 70 Record will monitor overall zIIP and zAAP activity:
    - Logical processor busy 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
  - For DB2 and zIIP - 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.



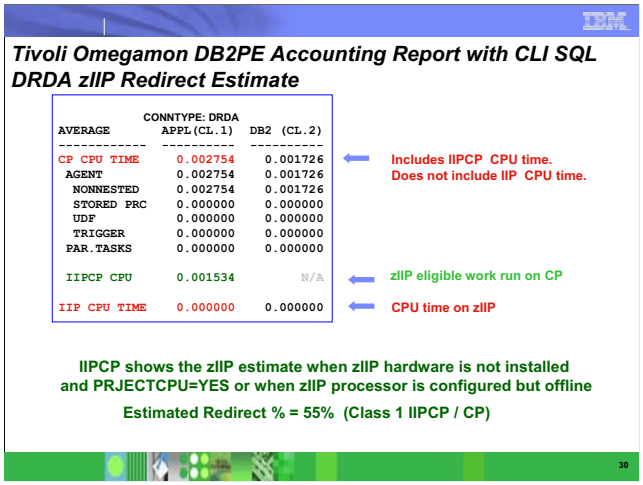
- The z/OS PROJECTCPU option in IEAOPTxx (available on z/OS 1.6 with zIIP PTF) can help determine if a zIIP or a zAAP is right for you – zAAP or zIIP not needed.
- Setting the IEAOPTxx parmlib member option PROJECTCPU=YES directs z/OS to record the amount of work eligible for zAAP or zIIP processors.
  - SMF Record Type 72 subtype 3 is input to the RMF post processor.
  - The Workload Activity Report lists workloads by WLM service class.
  - In this report the field APPL% AAPCP indicates which percentage of an processor is zAAP eligible, while the field APPL% IIPCP indicates which percentage of an processor is zIIP eligible.
- Because the price of zIIP and zAAP specialty processors is less than that of general purpose processors – hardware and software - values as little as 25% for APPL% AAPCP or AAPL% IIPCP can make a new zAAP or zIIP processor worth your while.



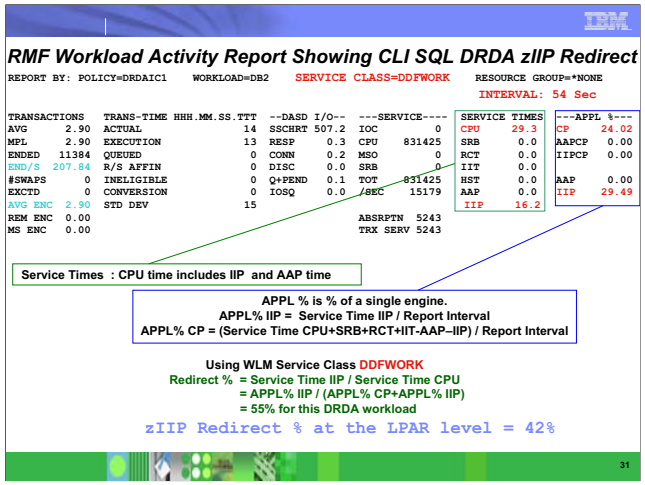
- Chart shows the CPU utilization of the different processors in the LPAR generated by the RMF batch CPU report. Bottom of the chart shows the RMF batch report control cards to generate the RMF CPU report and the Workload activity reports.
- The RMF CPU activity report shows 2 CPs, 1 zAAP and 1 zIIP engines.
- The report is for a distributed ODBC/CLI workload showing 42% zIIP redirect at the LPAR level.



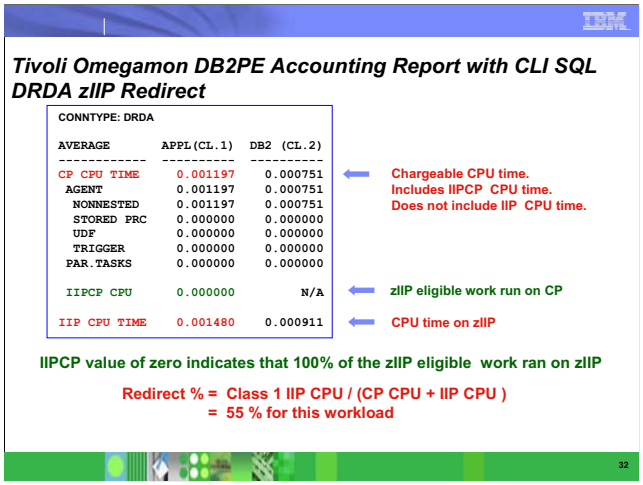
- The chart shows the RMF workload activity report showing the zIIP redirect estimate for the DRDA CLI SQL workload before installing the zIIP hardware and using the SYS1.PARMLIB(IEAOPTxx) PROJECTCPU=YES parameter.
- The WLM policy has been setup for Subsystem DDF and Service Class DDFWORK.
- Service Times block shows the information in seconds for the interval. CPU time include IIP and AAP time. IIPCP (zIIP eligible on CP) is not shown under Service Times.
- APPL % values are % of a single engine and is calculated from the Service times and dividing by the report interval. APPL% CP includes AAPCP and IIPCP.
- Estimated redirect % = APPL% IIPCP / APPL% CP.
- Estimate shows 55% redirect for the DB2 DRDA SQL CLI workload.



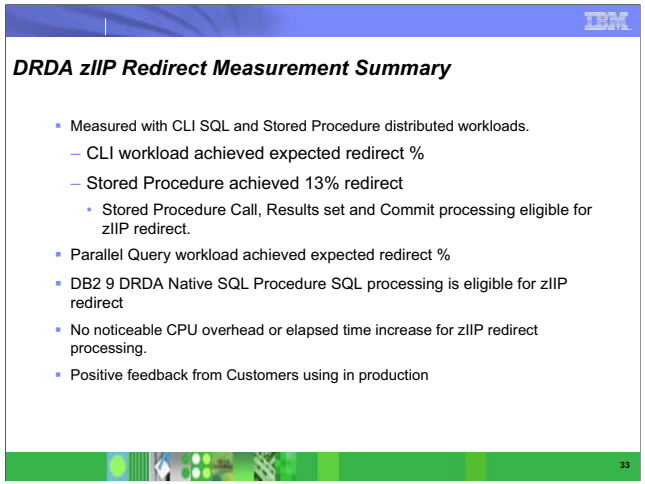
- This chart shows how one can estimate the zIIP redirect using the IBM Tivoli Omegamon DB2 Performance Expert accounting report using PRJECTCPU=YES paramater when zIIP hardware is not installed. The estimation uses Class 1 CPU times. Class 1 is used because it include DDF CPU time and DB2 Class 2 CPU time.
- IIP CPU time is the CPU time on zIIP. The IIP CPU time is zero since zIIP was not installed for this measurement.
- IIPCP CPU time will show any zIIP eligible processing that ran on CP because zIIP was not installed or when the installed zIIP processors are too busy to handle the scheduled work. IIPCP CPU time is non-zero because zIIP is not installed and PROJECTCPU=YES.
- The example shows zIIP redirect estimation of 55% at the DB2 DRDA workload level.



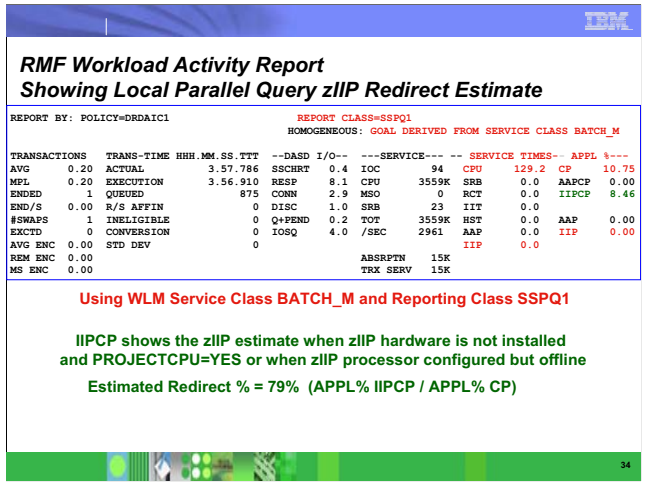
- This chart shows the zIIP direct % when zIIP is being used.
- It shows the redirect % of 55% at the DRDA workload level using the APPL% formula.
- The effective redirect % for this workload at the LPAR level is 42% as shown in chart 27. It is lower at the LPAR level because of the CPU consumed by other non DB2 DRDA components (other DB2 address spaces, TCP/IP etc).
- The DRDA redirect % can be calculated using the Service times also.
- The formula is : Service Times IIP / Service Times CPU.



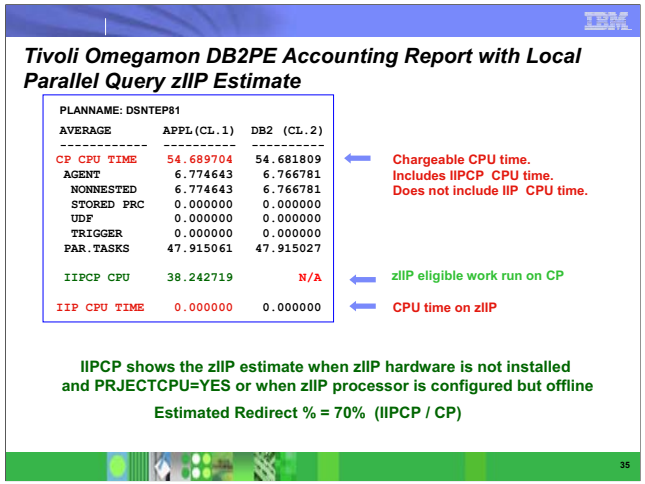
- The chart shows the DRDA workload zIIP redirect % using the DB2 Performance Expert accounting report for Connect Type DRDA.
- IIP CPU time is the CPU time on zIIP.
- IIPCP CPU time will show any zIIP eligible processing that ran on CP because zIIP processor was busy.
- High non-zero value will indicate a need to configure more zIIP processors. In this example the zero value for IIPCP CPU indicates that there is no need to configure additional zIIP processors.



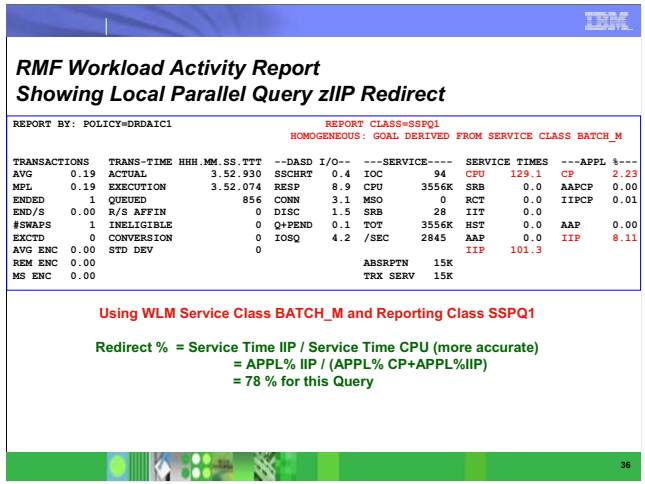
- This chart summarizes the DB2 DRDA zIIP redirect measurements.
- Parallel query via TCP/IP DRDA will get the redirect benefit from DRDA zIIP redirect for the main task and parallel query zIIP redirect for the parallel query child tasks.
- Native SQL Stored Procedure calls from TCP/IP DRDA applications will under enclaves in DBM1 (instead of under WLM) and hence eligible for zIIP redirect.
- Several customers are running successfully in production (Acxium / Trans Union, AEGON, Caterpillar, Baldor Electric, Citigroup, Mayo Clinic…).



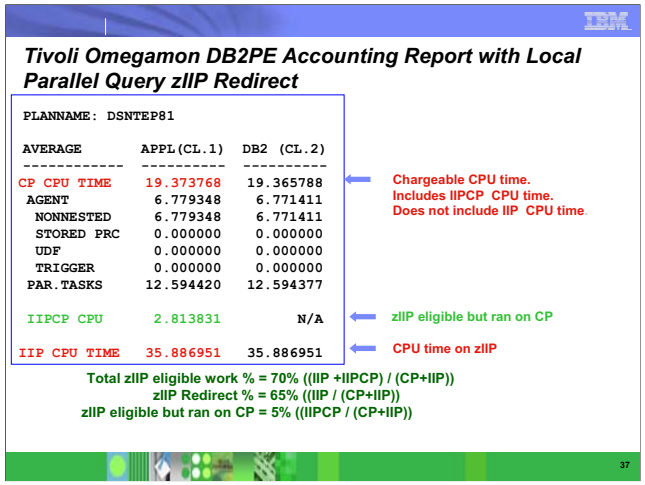
- This chart is showing the zIIP redirect estimate for batch parallel query workload.
- The WLM policy was setup for Subsystem JES, Service class BATCH_M and reporting class SSPQ1 for the parallel query Job name.
- The example shows zIIP redirect estimate of 79% for the parallel query.



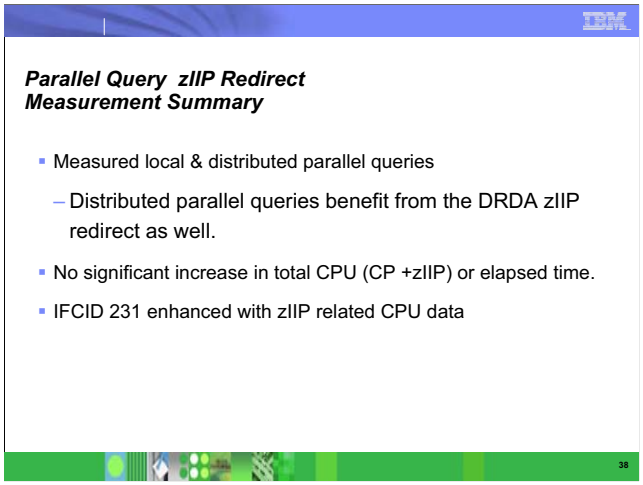
- This chart shows the zIIP redirect estimate for all the parallel queries run under the Plan name DSNTEP81.
- The estimated redirect % using the accounting report is 70%/



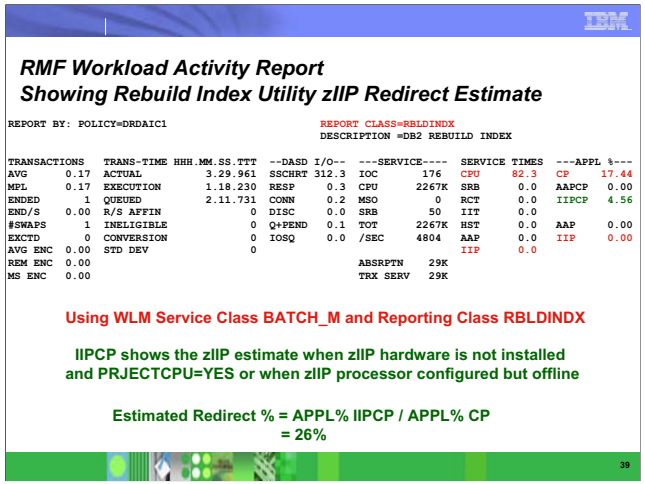
- This chart shows the actual parallel query zIIP offload for the WLM reporting class SSPQ1 when the zIIP is installed .



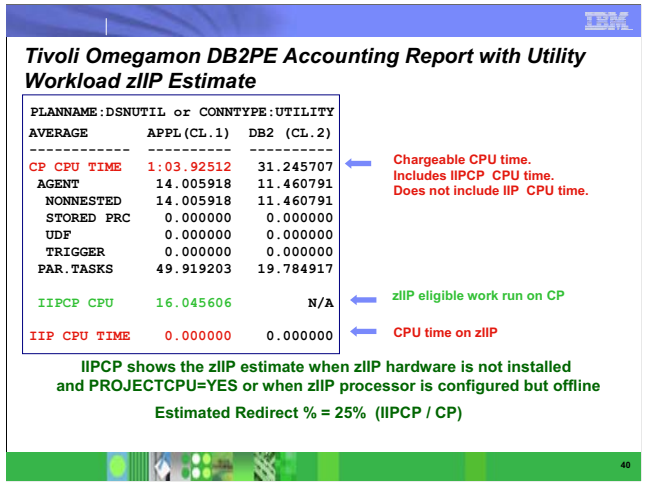
- This chart shows the actual zIIP direct for all the parallel queries run under the Plan name DSNTEP81 when the zIIP is installed.



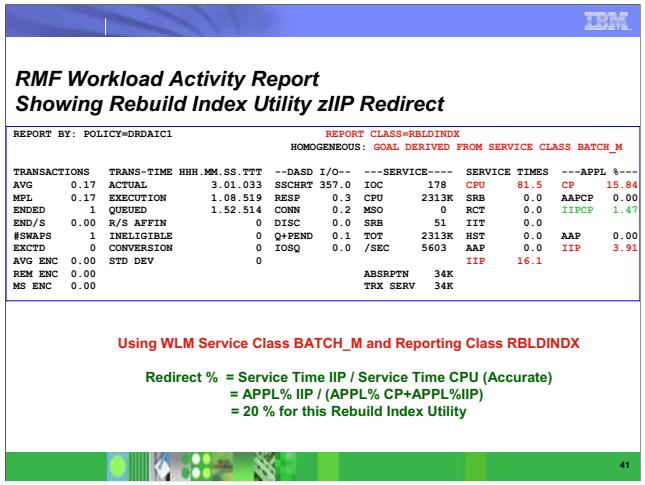
- This chart summarizes the zIIP measurements for the parallel query.
- CPU intensive parallel queries after their parallel group CPU consumptions exceeds certain threshold (100 ms) then subsequent child task processing will be scheduled to run under enclave SRB and a portion of it will be redirected to zIIP.
- Parallel queries coming in via TCP/IP DRDA will get the DRDA zIIP redirect for the main task and also the parallel child task zIIP redirect after a certain parallel group CPU threshold is reached.
- IFCID 231 has been enhanced to show the CP and IIP CPU time for the parallel child tasks.



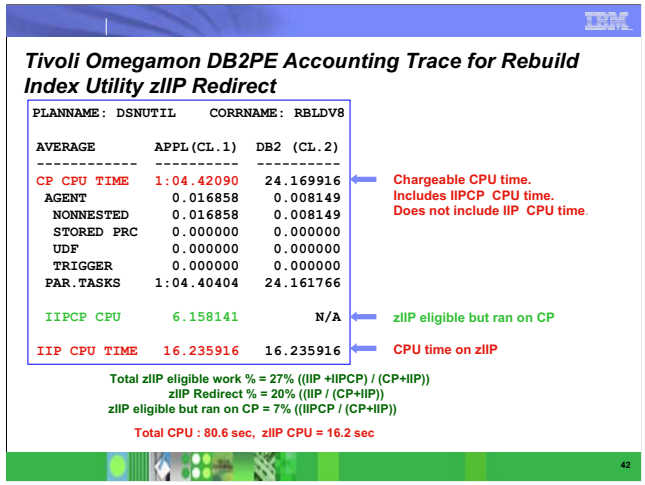
- This chart shows the zIIP redirect estimate formula for the DB2 Rebuild Utility when the zIIP processor is not installed.
- The WLM policy has been setup for Subsystem JES, Service Class BATCH_M and reporting class RBLDINDX for the DB2 Rebuild Utilities.



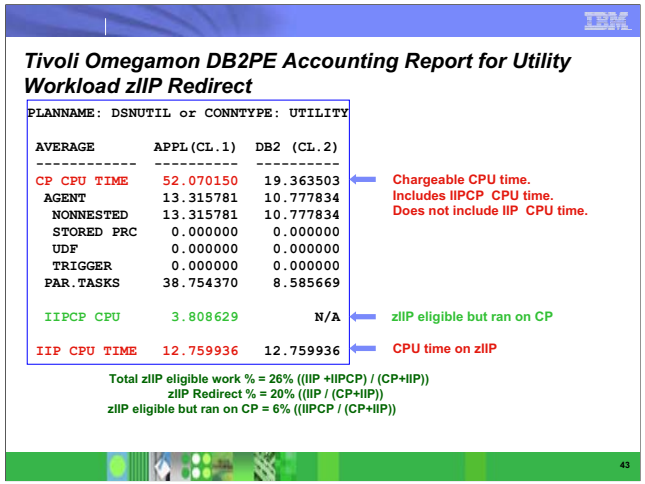
- This chart shows the zIIP redirect estimate for all the DB2 Utilities that were run under Plan name DSNUTIL or Connect type Utility, when the zIIP hardware is not installed.
- DB2 Class 1 IIPCP and CP CPU time is used to estimate the zIIP redirect.



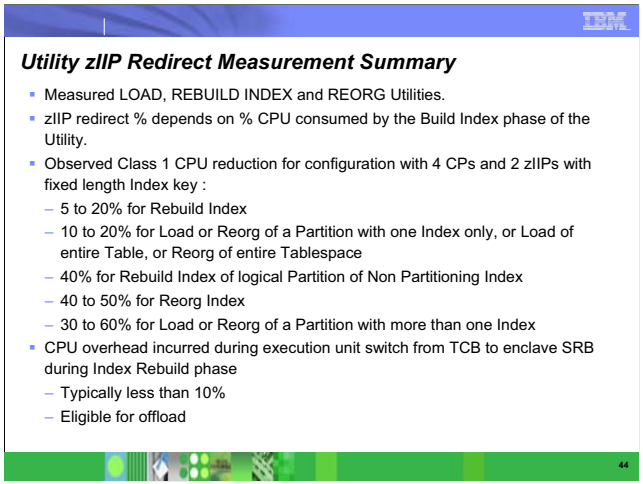
- This chart shows the actual zIIP redirect % for the DB2 Rebuild Index Utilities under the WLM reporting class RBLDINDX.



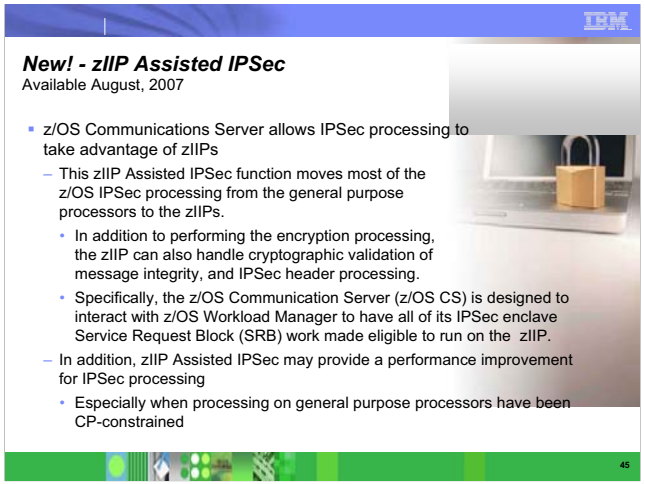
- This chart shows the actual zIIP redirect % for the DB2 Rebuild Utility job RBLDV8 when the zIIP is installed.
- Notice non zero value for IIPCP CPU indicating some of the zIIP eligible processing was redirected back to run on CP since the zIIP processor was busy. High number for IIPCP CPU value is an indication that additional zIIP processors could be added.
- Note that the Total CPU seconds and IIP CPU seconds shown in accounting trace at the bottom matches the WLM Service times CPU and IIP seconds in chart 43.



- This chart shows the actual zIIP redirect for all the DB2 Utilities that were run (Plan name DSNUTIL or Connect Type UTILITY) when the zIIP processor is installed.
- Notice non zero value for IIPCP CPU indicating zIIP was processor was unable to process all the zIIP eligible work.



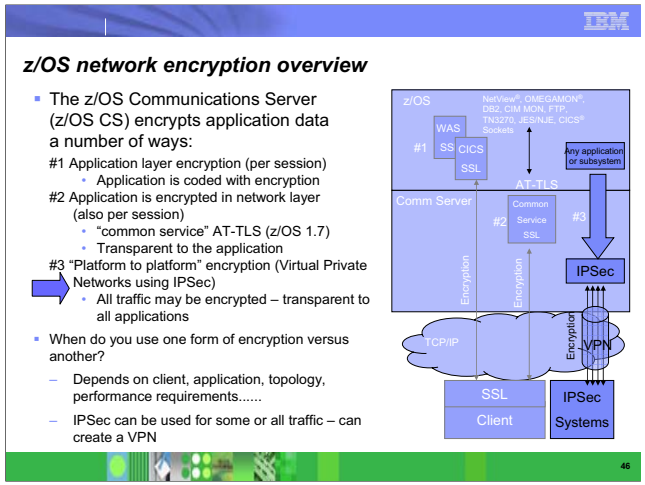
- This chart summarizes the zIIP redirect measurements for the DB2 Utilities.
- The zIIP redirect % is proportional to amount of build index processing.
- CPU cost associated with SORT and Compression are not eligible for zIIP redirect.
- To support zIIP redirect the build index processing was changed from TCB processing to enclave SRB processing which introduces execution unit switch CPU overhead. The zIIP redirect % shown in this chart have been adjusted for the CPU overhead. The measurement were done with a Tablespace with 10 partitions and varying number of indices up to 6.



IBM is previewing an enhancement to the z/OS Communications Server that allows the IPsec processing to take advantage of zIIPs. This IPSec zIIP Assist function moves most of the IPSec processing from the general purpose processors to the zIIPs. In addition to performing the encryption processing, the zIIP will also handle cryptographic validation of message integrity, and IPSec header processing. This capability is planned to be available on July 2007 via PTF for z/OS V1.8. Previewed is an enhancement to the z/OS Communications Server that allows the IPsec processing to take advantage of zIIPs. The zIIP, in effect, will be a high-speed encryption engine that is designed to provide better price performance. IPSec is an open networking standard used to create highly secure connections between two points in an enterprise - this may be server-to-server, or server to network device, as long as they support the IPSec standard. End-to-end encryption is deployed to provide a highly secure exchange of network traffic.

Business demands to protect sensitive data on the Internet have increased the requirement for users to implement end-to-end encryption on Virtual Private Networks (VPNs). At the same time as businesses are seeing an increased need for data protection, they are also increasing their use of more open networks such as the Internet. Moving secure business data and transactions from proprietary, trusted networks to more open networks creates an ever-increasing need for new technologies to protect this data.

The IPSec support was integrated into z/OS Communication Server in z/OS V1.7, and provides authentication, integrity, and data privacy from z/OS to other network endpoints that support IPSec. In addition to allowing you to run host based IPSec for secure end to end network flows, the V1.7 IPSec added IP filtering to protect your host. Since the IPSec support is implemented in the IP protocol layer, you can use it to protect a variety of network traffic types to/from any application without change. The new zIIP Assisted IPSec function that IBM is adding to z/OS V1.8 by PTF, moves most of the IPSec processing from processors to the zIIPs. In addition to performing the encryption processing, the zIIP will also handle cryptographic validation of message integrity, and IPSec header processing. This is designed to allow you to take advantage of the cost saving benefits of the zIIP when you implement IPSec to secure your valuable business tranactions and to protect your host.



This is a background on encryption within the z/OS Communication Server (a component of z/OS).

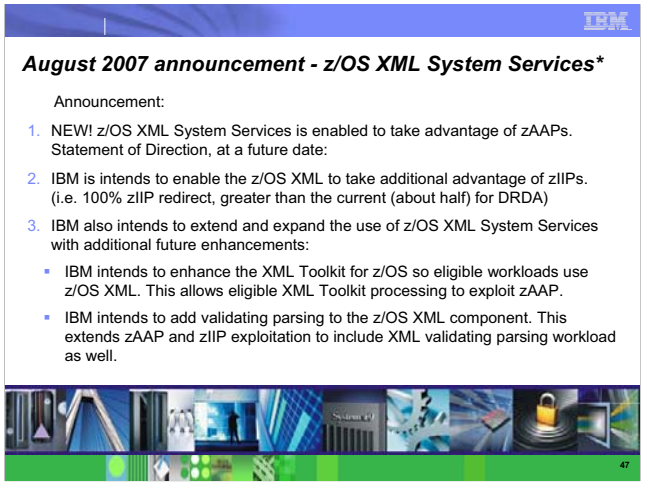
z/OS Comm Server can provide encryption in a number of ways.

We are focusing on zIIP Assisted IPsec with is #3 VPN technology and the dark blue column on the right hand side.

Which encryption technology one would use will depend on your requirements.

Again – going forward we are focusing on those who are interested in end-to-end encryption via IPSec.

Please note, one thing that could be confusing about z/OS V1R7.0 Communications Server IPSec support is that it has been packaged together with IP filtering support and is referred to as integrated IP Security. That is because there is a very close affinity between IPSec and IP filtering in the z/OS Communications Server; while you can implement IP filtering without IPSec, you cannot implement IPSec without IP filtering



STATEMENT OF DIRECTION: z/OS XML enabled for both zAAP and zIIP specialty processors

This SOD is broken down into 3 parts so that it is easier to explain and communicate.

In z/OS V1.8, IBM introduced a new system component of z/OS, z/OS XML System Services (z/OS XML), a system-level XML parser integrated with the base z/OS operating system and designed to deliver an optimized set of services for parsing XML documents (z/OS XML has also been made available on z/OS V1.7). The initial beneficiaries of this system component are middleware and applications requiring high performance non-validating XML parsing. z/OS XML may currently be accessed by an Assembler programming interface and one of the first exploiters, DB2 9 for z/OS, uses this Assembler interface for XML native support. IBM plans to add C/C++ support for z/OS XML with z/OS V1.9 (satisfying the Statement of Direction in Software Announcement 206-039, dated February 28, 2006).

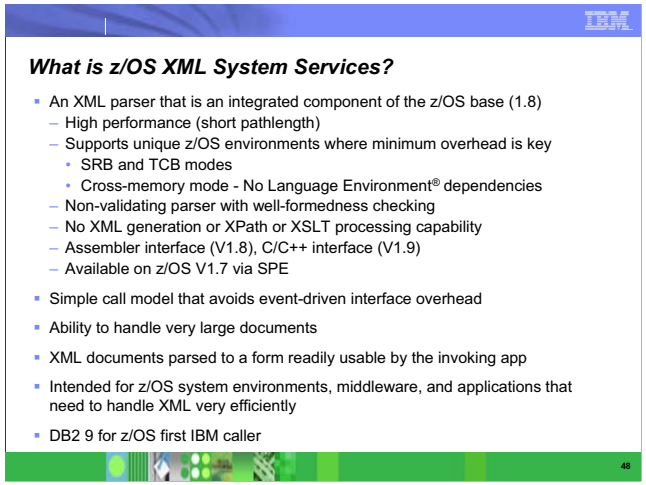
1) IBM announced its intent to enable the z/OS XML component to take advantage of zAAPs. This future enhancement means that middleware and applications requesting z/OS XML System Services (for example DB2 processing via local connection) will have z/OS XML System Services processing execute on the zAAP. Specifically, all z/OS XML System Services parsing executing in TCB mode will be redirected to the zAAP.

2) In addition, IBM is announcing its intent to enable the z/OS XML component to fully take advantage of zIIPs, when present. With respect to DB2, z/OS XML processing may be partially directed to zIIPs when utilized as part of a distributed request (like DB2 DRDA). The future enhancement will further benefit DB2 by directing the full amount of the z/OS XML System Services processing to zIIPs when it is utilized as part of any zIIP eligible workload (like DRDA). Specifically, all z/OS XML System Services parsing that is executed in SRB mode from zIIP-eligible enclaves will be redirected to the zIIP.

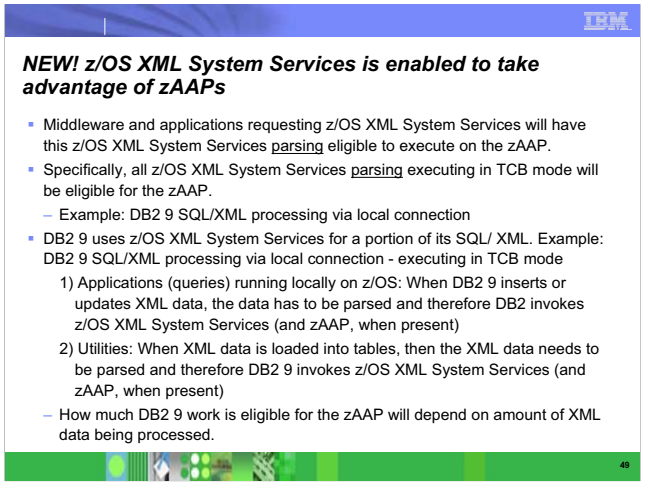
zAAPs and zIIPs are designed to help free-up general computing capacity and lower total cost of operation for select new workloads such as Java, business intelligence (BI), ERP, CRM and IPSec encryption on the mainframe. IBM does not impose software charges on zAAP and zIIP capacity. Collectively, z/OS XML System Services support of zAAP and zIIP means that you have the advantages of XML processing on z/OS with TCO benefits of either the zIIP or the zAAP processor regardless of the invocation environment.

3) As part of a comprehensive plan, IBM intends to extend and expand on the use of z/OS XML System Services enabled for zAAP specialty processors as the basis for future enhancements:

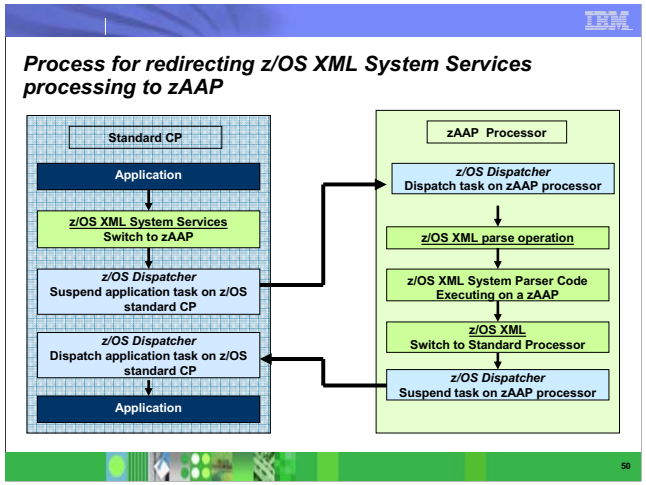
IBM intends to enhance the XML Toolkit for z/OS so that eligible workloads may exploit the z/OS XML component -- this extends zAAP exploitation to the XML Toolkit for z/OS. IBM intends to add validating parsing to the z/OS XML component -- this extends zAAP exploitation for XML validating parsing as well.



- In z/OS V1.8, IBM introduced a new system component of z/OS, z/OS XML System Services (z/OS XML), a system-level XML parser integrated with the base z/OS operating system and designed to deliver an optimized set of services for parsing XML documents (z/OS XML has also been made available on z/OS V1.7). The initial beneficiaries of this system component are middleware and applications requiring high performance non-validating XML parsing. z/OS XML may currently be accessed by an Assembler programming interface and one of the first exploiters, DB2 9 for z/OS, uses this Assembler interface for XML native support. IBM plans to add C/C++ support for z/OS XML with z/OS V1.9 (satisfying the Statement of Direction in Software Announcement 206-039, dated February 28, 2006).
- Simple call model that avoids event driven interface overhead
  - **z/OS XML System Services is a lower level interface – z/OS XML parser looks at the whole document and parses everything it can thus avoiding interactive overhead.**
  - **Other parsers on parse interactively thus causing some performance overhead.**
- Ability to handle very large documents
  - **a lot of parses have difficulty handling large documents – they want to bring in the whole doc but cannot... z/OS XML has large input and output buffers and can process more/ larger docs... in the event the buffer fills z/OS XML can request more memory from the application**
- XML documents parsed to an output buffer in a form readily usable by the invoking application
  - **The binary form is sharable within z/OS systems and provides possible performance improvement by avoiding relocation overhead. (ie you move the XML parsing from one address space to another, no need to relocate the code)**
- Intended for z/OS system environments, middleware, and applications that need to handle XML very efficiently
- **Well- formedenss checking – checks the syntax of the docuemtn (puncuation, brackets, spaces)**



- Middleware and applications requesting z/OS XML System Services will have this z/OS XML System Services parsing eligible to execute on the zAAP. Only the XML parsing being performed by z/OS XML System Services (a base element of z/OS) is eligible for zAAP.
- Please note, there is a Java-based XML parser in the IBM SDK 1.3 (and above) – the technology is called XML4J. This Java-based XML parser is already fully eligible for zAAP because it is Java workload. Other C++, COBOL, PL/I and roll-your own parsers are not eligible for zAAP.
- Specifically, all z/OS XML System Services parsing executing in TCB mode will be eligible for the zAAP. Example: DB2 9 SQL/XML processing via local connection
- Currently DB2 9 is the only IBM exploiter of z/OS XML System Services (via an Assembler interface)
- DB2 9 utilizes z/OS XML System Services for a portion of its SQL/ XML.
- Please note, not all DB2 9 XML processing is done using z/OS XML System Services. XML Validation is not eligible.
- Example: DB2 9 SQL/XML processing via local connection. When executing locally, DB2 9 is already executing in TCB mode
- Types of DB2 9 XML parsing workloads that are eligible for zAAP would be
  - 1) Applications (queries) running locally on z/OS
  - When DB2 9 inserts or updates XML data, the data has to be parsed and therefore DB2 invokes z/OS XML System Services (and zAAP, when present)
  - 2) Utilities
  - When XML data is loaded into tables, then the XML data needs to be parsed and therefore DB2 9 invokes z/OS XML System Services (and zAAP, when present)
- How much DB2 9 work is eligible for the zAAP will depend on amount of XML data being processed. As a reminder.. Please note, XML validation not eligible for zAAP



- Essentially, z/OS XML System Services workload is dispatched to the zAAP the same way that Java workload is dispatched to the zAAP.

Information on DB2 9 and z/OS XML benchmark testing

- New Whitepaper showing results of XML benchmark tests and estimated zAAP eligibility is planned to be available August 2007.
  - Initial results: Under DB2 laboratory benchmark conditions, it was found that z/OS XML System Services consumed approximately 15% to 50% of total CPU time in XML insert or LOAD operations. This portion of CPU time is eligible to exploit zAAP redirection. **
  - White paper planned to be updates 1Q 2008 to add XML mixed transaction workload, additional application tuning and performance, and DB2 9 accounting record updates. *
- Current zIIP documentation can help with sizing XML and DRDA workloads
- If you are testing with DB2 9 and XML today, with the proper levels of software, you can use the PROJECTCPU facility in z/OS to measure what portion of XML insert, table load, and query workloads are eligible for zAAPs and zIIPs
- Future tool support indicating z/OS XML CPU usage as function of XML document size and complexity planned*

** As the measurements were run under a strictly controlled laboratory environment and with minimum application logic, the results should not be viewed as an estimate of usage for the average customer workload. These measurements should not be used for sizing purposes as it is expected that a customer workload will show different results. Nevertheless, it shows the approximate redirection possible for this workload at this DB2 service level.

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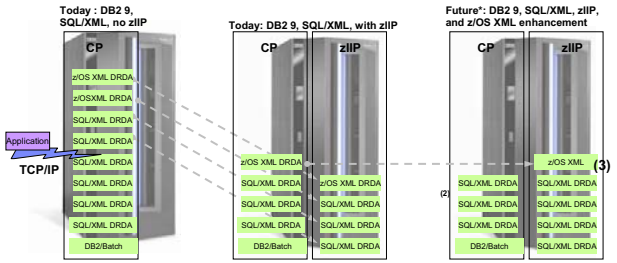
- In laboratory DB2 benchmark performance runs, z/OS XML System Services consumes approximately 15% to 50% of total CPU time in XML insert or LOAD operations. This portion of CPU time is eligible for zAAP redirection.
- The amount of CPU time for z/OS XML System Services will vary widely for other applications, based on the document size, its complexity, and number of indexes defined on XML tables.
  - When the size and number of nodes of the documents increase, the redirection percentage could increase accordingly, up to about 60%, according to laboratory measurements. Beyond that, there is no additional redirection because the corresponding DB2 processing to construct the internal representation of the XML document increases at the same time.
  - As more XML indexes are defined in XML tables, the percentage of redirection will be lower, as there is then more index processing within DB2 that is not related to z/OS XML System Services.
  - When encoding conversion is necessary, the percentage of redirection will be lower. DB2 always uses UTF-8 to process XML data. If the source XML that is inserted/updated or loaded is not in UTF-8, z/OS conversion services will be invoked to convert it to UTF-8.
- As the measurements were run under a strictly controlled laboratory environment and with minimum application logic, the results should not be viewed as an estimate of usage for the average customer workload. These measurements should not be used for sizing purposes as it is expected that a customer workload will show different results. Nevertheless, it shows the approximate redirection possible for this workload at this DB2 service level.

*Example: z/OS XML and DB2 9 DRDA and zIIP**

Enterprise Applications that access DB2 9 for z/OS via DRDA over a TCP/IP connection can have portions of eligible SQL/XML requests directed to the zIIP (1)



1) For illustrative purposes only. Single application only. Actual workload redirects may vary
2) DB2 9 for z/OS retains some XML processing (example: XML validation) and executes on CP
3) All z/OS XML System Services processing eligible for zIIP*

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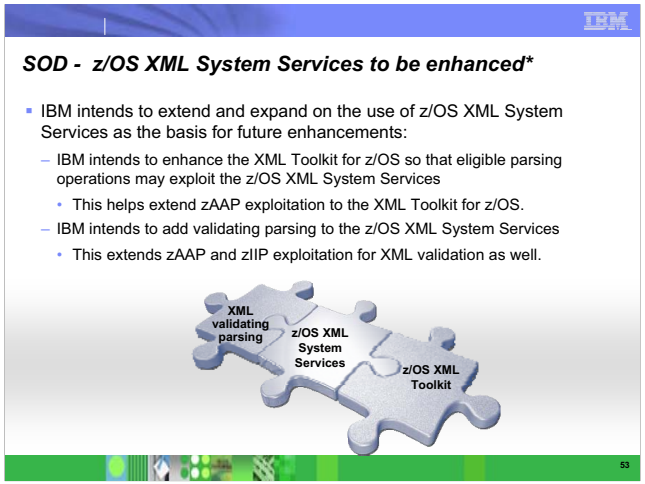
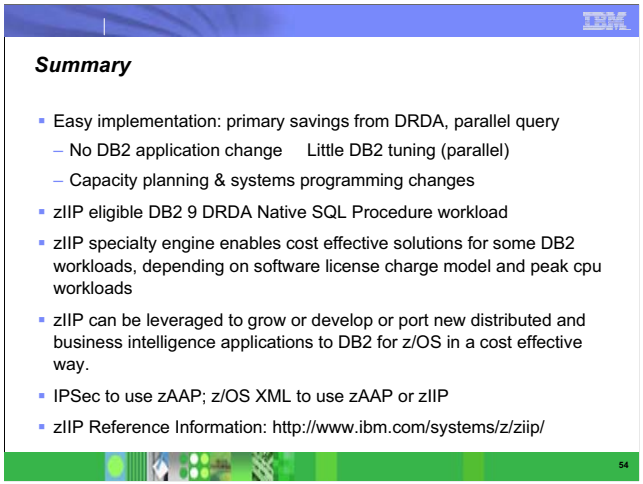
- Remote SQL processing of DRDA network-connected applications over TCP/IP: These DRDA applications include ERP (e.g. SAP or PeopleSoft), CRM (Siebel), and business intelligence running on other platforms.
- Remote SQL is expected to provide the primary benefits to customers, as it is commonly part of the peak load. Stored procedures and UDFs run under TCBs, so they are not generally eligible for zIIP, except for the call, commit and result set processing.
- V9 remote native SQL Procedure Language is eligible for zIIP processing.



But wait, there is more ... As part of a comprehensive plan, IBM intends to extend and expand on the use of z/OS XML System Services (enabled for zAAP specialty processors) as the basis for future enhancements:

- IBM intends to enhance the XML Toolkit for z/OS so that eligible parsing operations may exploit the z/OS XML System Services
  - This helps extend zAAP exploitation to the XML Toolkit for z/OS.
  - Please note, not ALL XML Toolkit workloads will be eligible for zAAP.
- IBM intends to add validating parsing to the z/OS XML System Services
  - This extends zAAP exploitation for XML validation as well.
  - Therefore, in the future both XML parsing and XML validation are planned to be eligible for the zAAP.
  - Remember, the previous parts of the SOD stated that only z/OS XML parsing is eligible for zIIP and zAAP.



While the applications do not change and little DB2 tuning is needed, systems programming is needed to get the appropriate service and settings. Capacity planning is needed to have the right number of zIIPs. The DB2 tuning may be desired to change some applications to use parallel processing.

Resources

- z/OS 1.9 Announcement Letter
- z/OS XML System Services site
  - ibm.com/servers/eserver/zseries/zos/xml/
- System z Specialty engines
  - ibm.com/systems/z/specialtyengines/
- DB2 9 for z/OS
  - ibm.com/software/db2zos/
  - DB2 9 performance benchmark paper (planned)
  - Detailed XML introduction presentation:
    ftp.software.ibm.com/software/data/db2zos/db29zospureXMLgzhang.pdf
  - DB2 z/OS XML Guide:
    publib.boulder.ibm.com/infocenter/dzichelp/v2r2/topic/com.ibm.db29.doc.xml/bknxspsh.htm

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- Please see the web for much more information.

Trademarks

AIX*	IBM eServer	z/VM*
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