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DataDirect TECHNOLOGIES

LOWERING MAINFRAME TCO THROUGH zIIP SPECIALTY ENGINE EXPLOITATION

DataDirect Shadow - version 7.1.3 - Web Services Performance Benchmarks

BUSINESS CASE: MAINFRAME TCO AND zIIP

For many large organizations, IBM System z mainframes are an essential component of their enterprise. The platform's robust database management systems, security and transaction processing capabilities have contributed to the mainframe playing a unique role in today's modern IT architectures. However, three critical factors have emerged over the last ten years that present unique challenges to the mainframe:

- agility – the ease in which older legacy based applications and data can be integrated with new applications,
- diminishing skills - the decline in the availability of mainframe development and operational skill sets
- total cost of ownership or TCO - mainframe hardware, software, processing costs and increasing license fees from mainframe independent software vendors

Organizations continue to assess the role of the mainframe in the context of these challenges. Service oriented integration approaches such as Web services and Data services are enabling greater infrastructure agility by allowing organizations to transform legacy data and applications into industry standard artifacts that are more easily re-used and recombined into new business services. Mainframe integration tools have evolved from green-screens to point and click integrated development environments (IDE) that provide an intuitive bridge between COBOL and Java or .NET. The remaining challenge has been costs. Even with the improvements in hardware performance and energy consumption, the mainframe is still viewed as a high cost platform. This has driven organizations that are dependent on the mainframe to explore strategies for lowering mainframe TCO. For some this might mean migrating off the platform in total or in a staged process.

Recognizing this trend, IBM has added new hardware features to handle specialized workloads. These specialty engines differ from the traditional General Purpose Processors (GPP) in that their processing capacities are not included in calculating the overall speed and capacity, typically measured in terms of MIPS – Millions of Instructions Per Second, of the mainframe which is a common mechanism for determining software licensing charges. Using these engines to handle eligible workloads is seen as a significant new means to lowering mainframe TCO. This report will examine the System z Integrated Information Processor (zIIP) specialty engine, and how it can be used in combination with DataDirect Shadow to lower the processing costs of mainframe SOA workloads, reducing annual MIPs consumption and delay costly upgrades.

The transformation of mainframe assets into Web services to support integration with an SOA requires additional processing. This additional processing is justified given the benefits of interoperability afforded to the mainframe by an SOA. This processing uses CPU to un-marshal and marshal the XML, which is necessary to communicate with the underlying mainframe asset and to return the response, authenticate and authorize access to mainframe assets and provide operational management capabilities.

Levels of mainframe CPU consumption from SOA initiatives are expected to increase as mainframe SOA adoption matures and the number and complexity of Web services on the mainframe grows. Therefore, scalability and processing efficiency are important considerations for achieving your mainframe SOA goals.

PRODUCT DESCRIPTIONS

DataDirect Shadow v7 is mainframe middleware software that deploys as a unified foundation architecture designed to reduce the complexity of integrating mainframe data, business logic, and screens with new Java, .NET or web applications. Included in Shadow is a comprehensive platform for mainframe SOA enablement - Shadow z/Services, which provides bi-directional web services capabilities (publishing and consumption), as well as orchestration using BPEL 2.0. Shadow v.7 includes unique, patent-pending technology that allows customers to divert processing intensive Web services workloads away from the mainframe General Purpose Processor, to significantly reduce the costs of integration. The result - with Shadow z/Services v7 your SOA initiatives can:

- ✓ Increase throughput
- ✓ Lower CPU consumption
- ✓ Increase your control over mainframe cost of ownership

Use of Shadow does not require a zIIP to be present. However, it is required to fully receive the benefits described. If you do not have a zIIP but are interested in exploring the benefits of Shadow's unique zIIP exploitation, an audit can be performed to determine workloads within your mainframe that are eligible for specialty engine offload.

PERFORMANCE ANALYSIS

The performance analysis of DataDirect Shadow z/Services v7.1.3 (Shadow z/Services v7) was conducted at the DataDirect Technologies mainframe products development lab in Sugar Land, Texas during the month of January 2009. Testing was performed in a controlled environment using Shadow z/Services v6.1, which represents non-zIIP enabled middleware (typical of most mainframe integration middleware) and Shadow v7.1.3, which utilizes DataDirect's patent-pending zIIP exploitation technology. Your results may vary due to environmental factors including but not limited to: the hardware and software configuration, test scenario configuration, concurrent workloads and the monitoring techniques used to collect performance data.

Tests were run for each of the major mainframe Web services provider integration types: Business Logic Integration (BLI), Screen Logic Integration (SLI), and Data Logic Integration (DLI).

Business Logic Integration (BLI) – Web service invokes an existing COBOL COMMAREA program. The program has no inputs. Output is populated into 800

separate fields within the program and returned in the output COMMAREA for a total output COMMAREA length of 32K. Shadow z/Services builds the resulting SOAP response and returns it over HTTP.

Screen Logic Integration (SLI) -- Web service invokes existing CICS terminal oriented transaction. Input is a 2 byte company name and 3 byte flight number. The SLI navigates through 20 CICS screens and returns a flight destination field of 3 bytes. Shadow z/Services builds a SOAP response and returns it over HTTP.

Data Logic Integration (DLI) – Web service executes the SQL statement "SELECT ID, NAME, DEPT, JOB, YEARS, SALARY, COMM FROM Q.STAFF" to DB2 for z/OS and returns 7 columns consisting of a numeric, char and varchar data totaling 34 bytes per row and fetching 35 rows. Shadow z/Services converts this to a SOAP response over HTTP.

Data collection for the test consisted of collecting transaction counts from Parasoft SOA test; all other data including CPU time and zIIP CPU time were taken from Shadow z/Services interval SMF/Logging records recorded for each web service operation.

zIIP EXPLOITATION BENCHMARKS

It is common for organizations to address increased demand for throughput by adding additional hardware (in a distributed environment) or capacity (in the mainframe environment). The reality of adding hardware to increase processing capacity has its limits. Organizations who have taken this approach must deal with the additional costs to maintain data centers, specifically, power usage, floor space and labor costs. These issues are fueling the market demand for virtualization and consolidation, two areas that are mainframe strengths, fueling an increase in demand. However, moving SOA processing to the mainframe has its costs too. The most significant being the increase in licensing and maintenance fees for mainframe software. Most mainframe software fees are tied to the capacity of the mainframe, which is typically measured in MIPS. As the volume of Web services on the mainframe grow so does the increase in CPU consumption and therefore the capacity of the mainframe must be managed to balance the additional processing needs with that of the IT budget.

As figure 1 shows Shadow z/Services v7 compared to Shadow v6.1,a non-zIIP enabled version, provides across the board increases in Transactions per Second (TPS). Business Logic Integration (BLI) showed the greatest increase of greater than 300% and an impressive 175% increase across all types of Web services test scenarios – Business Logic Integration, Screen Logic Integration, and Data Logic Integration.

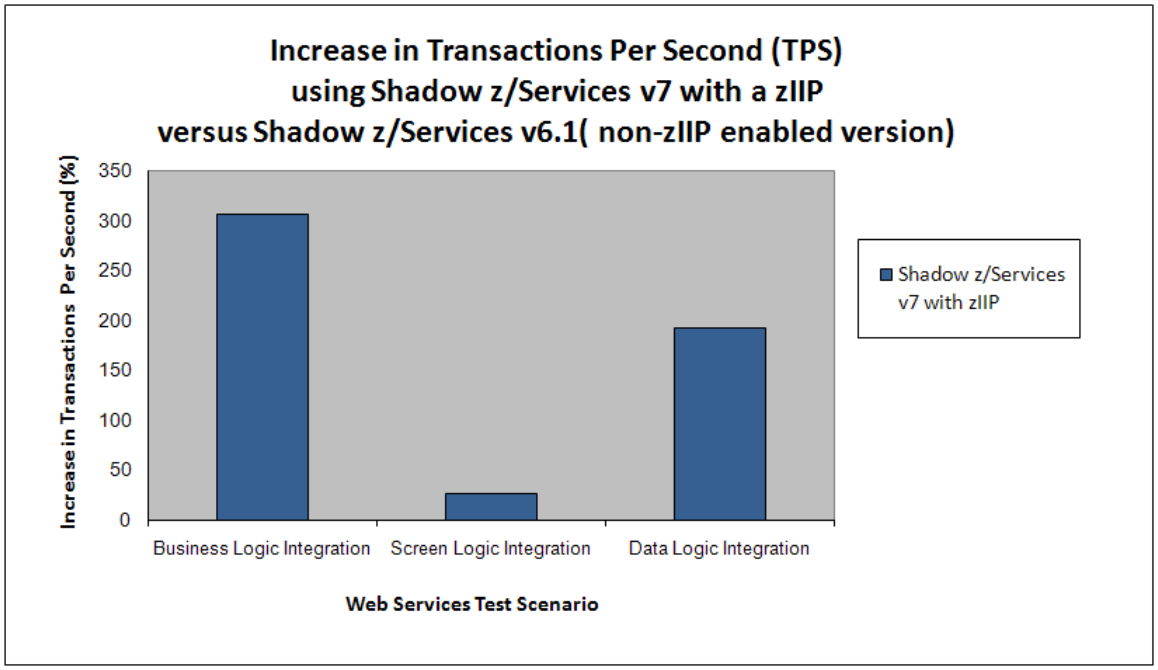

Figure 1: Shadow z/Services Throughput

Understanding the processing efficiency, as measured by the amount of CPU time required to process each transaction, gives your organization a key piece of information necessary for modeling MIPS capacity requirements and planning capital expenditures for the mainframe. Shadow z/Services v7 helps reduce your MIPS growth for processing SOA workloads by dramatically improving the efficiency of processing these workloads.

A case in point is illustrated in figure 2. On average, the zIIP-enabled Shadow v7 per transaction CPU consumption is 91% less than non-zIIP enabled Shadow v6.1 for the same workload, thus providing a significant CPU dividend to organizations using prior releases of Shadow z/Services, thereby allowing organizations just now adopting SOA to better manage their MIPS growth as these initiatives mature. This efficiency allows you to re-allocate these MIPS to new workloads or absorb increased MIPS requirements from existing workloads.

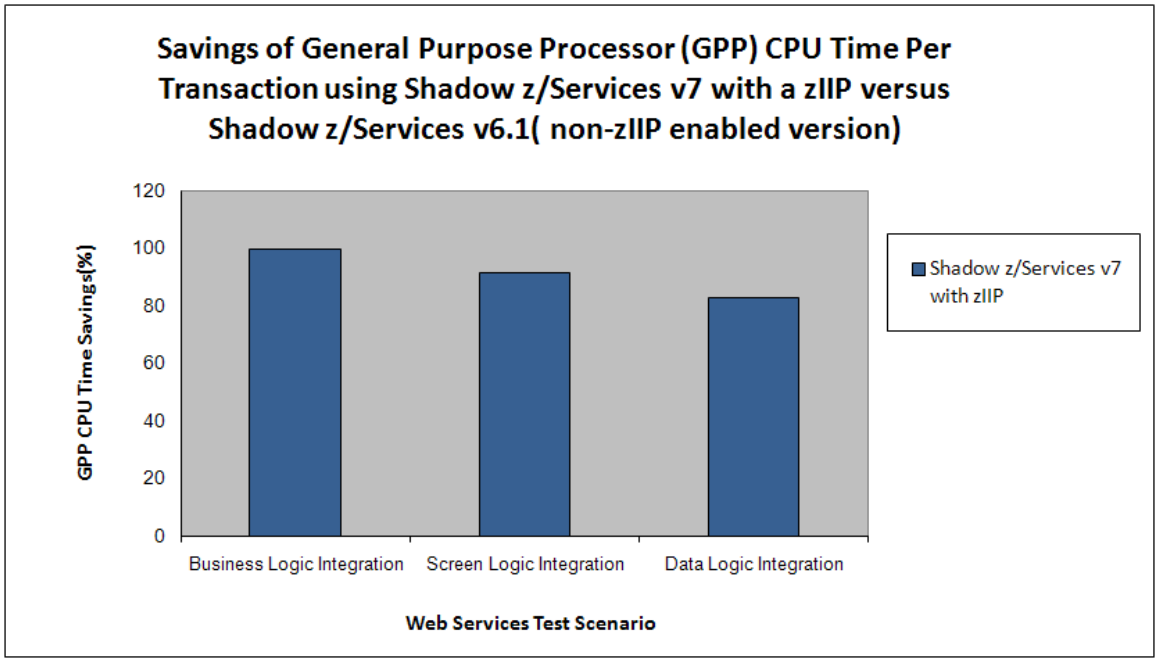

Figure 2: Shadow z/Services Transaction Efficiency

So how does Shadow z/Services v7 increase throughput while decreasing per transaction CPU consumption? It does so through numerous optimizations for security, operational diagnostics, optimizing access to the back-end assets and through broad exploitation of the IBM mainframe specialty engine, the System z Integrated Information Processor, sometimes referred to as the zIIP.

Shadow v7 includes patent-pending mainframe threading model called the Logical Dispatchable Unit (LDU). Most, if not all mainframe middleware utilize Task Control Blocks (TCB) threads to handle integration functions. This poses a problem when attempting to access a zIIP specialty engine which requires a Service Request Block (SRB) thread. Shadow's LDU is a hybrid threading model that dynamically switches from TCB mode to SRB mode for optimized performance and zIIP access.

Unlike other products that cannot exploit the zIIP or do so under narrow circumstances, the LDU enables almost all necessary processing, such as XML un-marshaling and marshaling, security processing as well as Shadow exclusive value-added capabilities that simplify development, enhance performance, and greatly improve operational management, to be migrated from the General Purpose Processor (GPP) to the zIIP. The zIIP is unique in that the work it performs is not measured for the purposes of calculating mainframe capacity and it is non-speed restricted.

The result is the ability to conserve GPP MIPS by migrating SOA processing to the zIIP where it typically can be processed faster and at lower cost. Therefore, the more zIIP

exploitation you have, the better your throughput and the lower your mainframe software costs. As figure 3 shows, Shadow z/Services v7 is extremely effective in its utilization of the zIIP specialty engines, qualifying an average of 90% of Shadow related Web services processing for BLI, SLI and DLI integration methods, thus ensuring the improved throughput and lower total cost of ownership necessary for your organization to cost-effectively integrate your mainframe into an SOA. For BLI the benefits are even better as 99.8% of the processing performed by Shadow z/Services is zIIP Qualified. The use of "zIIP Qualified" is what we consider the most accurate measurement for gauging the effectiveness of zIIP specialty engine utilization.

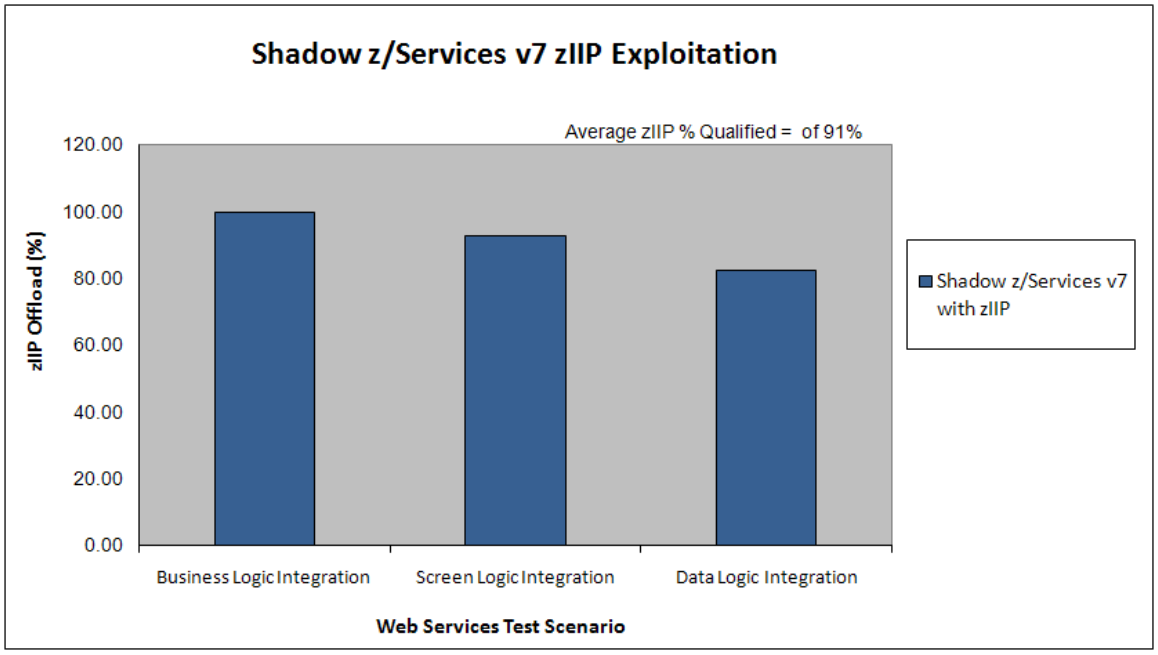

Figure 3: Shadow z/Services zIIP Exploitation

LOWERING MAINFRAME TCO

Using Shadow z/Services not only helps achieve your SOA specific goals with scalable, efficient SOA processing, it also helps your organization achieve a lower total cost of ownership (TCO) by conserving your GPP MIPS, which in turn helps slow your rate of MIPS growth. This helps your organization avoid or defer a potentially costly mainframe capacity upgrade.

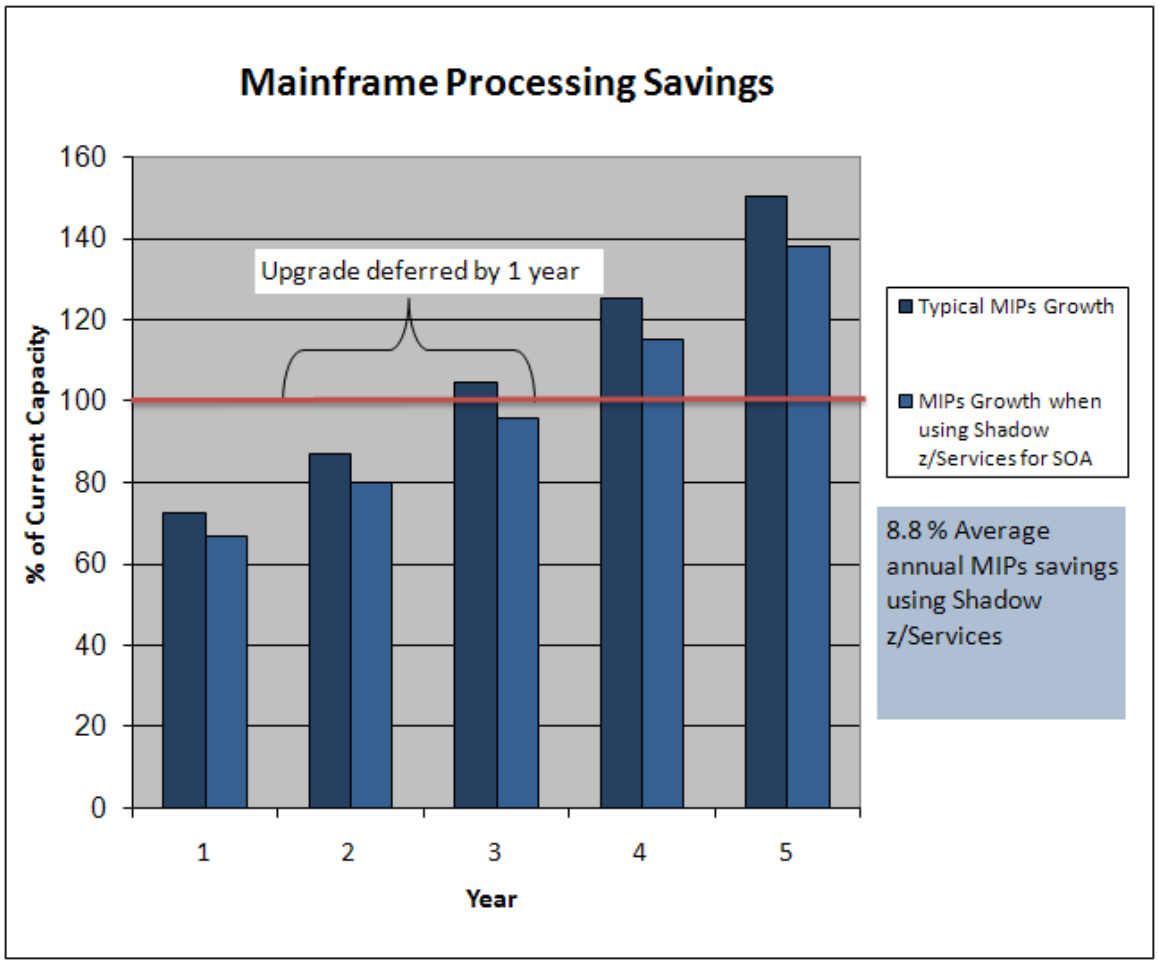

Figure 4: MIPS Growth Comparison

As an example, assume a 20% Compound Annual Growth Rate (CAGR) for MIPS, current capacity utilization rate of 66%, and an average incremental SOA load of 10%. With traditional solutions, your organization will require a capacity upgrade in year 2 in order to avoid capacity constraints starting in year 3. As figure 4 shows, using Shadow z/Services and assuming an 80% SOA offload rate (see figure 3), **you can delay that upgrade until the end of year 3, a full year later**. In addition, the total MIPS required are on average 8.8% less due to the efficiencies of Shadow z/Services. Considering the fully loaded costs of each MIP can run into the thousands of dollars, the savings provided by Shadow z/Services are significant and provide a measurable way to reduce the Total Cost of Ownership (TCO) for the mainframe.

SUMMARY

Mainframe infrastructures of today bear little resemblance to the rigid, monolithic systems of the past. Industry standards and integration tools have matured to provide increased flexibility and intuitive integrated development environments to simplify re-using legacy data sources in new application development initiatives. As this report has shown, utilizing zIIP specialty engines as part of your SOA enablement strategy can significantly lower mainframe TCO. However, without software to exploit the zIIP across multiple data and applications environments for Web services, SOA or data connectivity, its true potential cannot be realized. DataDirect Shadow is a single unified-platform, built exclusively for integration with IBM System z mainframes. It uses patent-pending technology to deliver broad exploitation of zIIP engines and enabling customers to deliver business systems that involve the System z platform in a timely manner and with a material reduction in overall TCO. DataDirect Shadow provides a new benchmark in mainframe integration, one that not only allows the mainframe to be a full participant within an SOA, but extends the value of the platform to business by enabling it take on new workloads with dramatically reduced costs.

Regardless of the size, scope and maturity of your SOA and whether you have a zIIP engine or not DataDirect is ready to help you realize the full potential of SOA on System z. More information on DataDirect Shadow is available at http://datadirect.com or contact Americas, 800-876-3101 or International at 0800 169 1907, or email at insidesales@datadirect.com.

ENVIRONMENT CONFIGURATION INFORMATION

Hardware

IBM z9 mainframe

- CPU Model 2096 R07
- Physical CPUs 4
  - 2 Central Processors running at approximately 87.43 MIPS each
  - 1 - System z9 Integration Information Processor (zIIP) running at approximately 476.5 MIPS
  - 1 - System z Application Assist Processor (zAAP) running at approximately 476.5 MIPS
- 5 LPARs, one of which is a Coupling Facility
  - One LPAR inactive
  - Test system set with an initial weight of 60 and all LPARs capped
- 8GB Real Storage partitioned across 5 LPARs
- Test system allocated 1536MB

Software

- z/OS 1.7
- CICS 3.1
- DB2 V9.1
- Shadow z/Services: v6.1.7606 and v7.1.3.5516
