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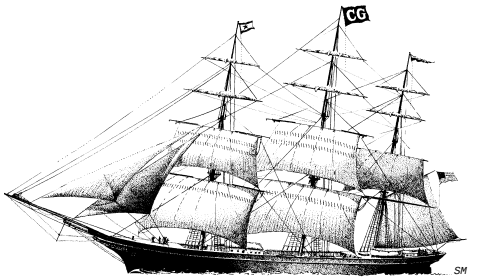

Navigating Information Technology Horizons℠

Published Since 1993 Report #TCG2006040R May 23, 2006

IBM's *System z9 Business Class* — A Mainframe for the Not-So-Large Enterprise

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Management Summary

The world of business has changed in ways that are significant and permanent. E-mail has become a critical business system. Collaborative capabilities that started with e-mail have now extended to full-fledged social networks. Self-service elements have proven to be so cost effective that they have spread to all sorts of system clients. Personalization promises to make web transactions as - and perhaps more - comfortable than dealing with strangers face to face. **All of these 21st-Century elements strive to increase efficiency (and thus lower operational costs) and widen the scope of addressable markets (thus, giving a business greater viability).**

Unfortunately, all of these usage enhancements have effects on the IT systems that support them. **The load on IT is more variable, requiring more capacities to deal with spikes in demand, and needing complex clustering to deal with unanticipated failure of hardware and software elements. The costs of those capacities have whetted an appetite for the use of partitions that let you slice up IT assets more thinly, each being sized to match more closely the processing capacity required. This has led to more widespread use of virtualization that provides the containers and mapping needed to make better use of IT infrastructure.**

***Service Oriented Architectures (SOAs)* add another level of opportunity to build flexibility into an IT environment. The customizable business processes that SOA can support - and the hardware and software costs it can prevent through application re-use - give a competitive edge over older processes that are more rigid.** SOAs also allow business applications across the enterprise to be more broadly compatible with each other (a good thing), and to be evolved more easily as business needs change (a very good thing).

Nevertheless, the application decomposition that is the basis of SOA produces a lot more hardware and software elements to be managed. There are many more relationships between these elements than in traditional architectures. One could compare the SOA environment to a very busy airport, but when you add in hardware's capacity on demand, the complexity comes in more than three dimensions, and involves many more kinds of dynamically adjustable elements. New requirements may be added at any time, which can change the dependencies between underlying resources. **Enterprises need a pervasive coordinating element that can support and secure the enterprise's IT environment in various breadths - as a whole, as aggregations of resources supporting a particular business process, and as individual assets**. This IT challenge is met most efficiently by a system constructed on the assumption of *multiple workloads*, with *different priorities*, and *expandable hardware support* of those workloads (without disruption), both of which may *change dynamically*. It is met most effectively by a system that has been specially optimized for Java processing, data serving, and supporting unpredictable edge environments. It is met most elegantly by security and encryption that are a part of an intelligent system that knows *what is needed where*, rather than by a collection of *attached-on* appliances. **Quite specifically - it is better done by a mainframe.**

IBM has just announced a new, game-changing low-end mainframe. For those familiar with mainframes, the price/performance benefits are compelling. For those unfamiliar with mainframes, the new IBM *System z9 Business Class (z9 BC)* offers great business value through its pervasively useful set of highly-evolved self-management and workload management capabilities that empower, extend, and secure the business that it supports. For more details, please read on.

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The Enterprise Need for Pervasive Control

These days, a lot of the profitability of business is tied to the distributed business processes that cross the Web to branch offices, points of sale, business partners, and customers. The underlying business processes need to be reliable and the IT infrastructure must be able to respond quickly to customer needs. All of this must be transparent and any bottleneck must be analyzed quickly, and then remedied.

Additionally, partner access to some enterprise systems is now part of this new era of business interdependence, allowing businesses to thrive with lower overhead, because costs are shared with partners and information systems are linked to operate as one. For example, a supplier of parts cannot deliver in a just-in-time manner without being connected to its customers' manufacturing systems, promotion plans, and business forecasts. While the data that the partners access may be limited, it still must be consistent, accurate, and secure. Encryption must be easy to invoke, where it is necessary, and avoided, where it is not.

Change seems to be the underlying constant for the 21st-Century business, especially as enterprises integrate business processes to achieve greater efficiencies. The consequences of all of this change can bear heavily on many elements of the IT environment.

At that busy airport example used on the first page, the commercial air traffic controllers have a relatively limited number of paths to watch and, for the most part, an expected number of planes to monitor. Intelligent computer systems, by contrast, have many thousands of variables with which to deal and the timeframe is more likely to be measured in microseconds. Systems may need to reallocate resources in an on-demand manner (a.k.a., *just in time*), while juggling complex and potentially-interdependent work processes (application workloads). For example, systems may need to reallocate more capacity (processing power, memory, bandwidth, etc.) in a distributed, sense-and respond fashion across hundreds of applications and many thousands of users. This is the equivalent of responding to many dozens-to-hundreds of unexpected flights suddenly appearing over a major airport, each with special demands and all of which must be managed to complex operational policies. Managing the ensuing situation is an additional magnitude of difficulty.

System z9 BC Specifics

- Two models: the *R07* (26-172 MIPS) and the S07 (193-1786 MIPS). Each is a single frame. The larger *S07* can be used as a Linux-only or ICF-only server.
- 73 capacity settings: Sub-capacity settings let you minimize your cost of entry to the platform.
- Evolvable: the R07 can be upgraded to the S07, and the S07 to the z9 EC (shipped last year)
- Processors: Up to 4 standard server engines, (1-3 on the R07, 0-4 on the S07); up to three specialty engines (see body of text for description of types)
- Memory: up to 64GB per server
- On-Off Capacity on Demand
- FICON Express 4
- CryptoExpress 2
- ATM/POS Remote Key Load
- EWLC and Tiered EWLC Software Pricing (the greater the MIPS, the more cost-efficient the software license)
- Support for z/OS.e

Improvements from z890 (full-capacity model):

- 37% more capacity on standard engines
- 37% hardware performance improvement for IFLs, zAAPs and ICFs, with price reduced to $95K for IFLs, zIIPs and zAAPs.
- Up to 170% more bandwidth
- Up to double the memory
- 2.6 times the capacity settings
- Up to 40% more FICON channels
- Double the concurrent FICON operations
- Same footprint

Source: IBM

All these activities and changes must be managed, ideally, in the context of the requirements of the business. These requirements embody corporate governance, business policies, accounting standards, etc., to ensure that the enterprise will do business honorably, reliably,

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and safely. Ideally, requirements should be man\aged in an overarching, business-wide context, by some kind of very intelligent, dynamically adjustable, and scalable locus of control.

IBM's *System z9* BC can be used is this manner, as a centralized systems resource manager operating to policy specifications, either for applications running totally within its system boundaries (as it has been doing for many decades) or by extending its reach and control to other systems environments (including those that are not mainframes). Let's take a closer look at this.

Mainframe Advantages

An Operating System Built for the Task

z/OS is a very complete, comprehensive operating system. It was built - from its beginning more than four decades ago - to support many unrelated workloads of different priorities. Amenities like *process retry*, which ensures that applications will not freeze, stall, or produce errors, have been optimized over decades of releases. z/OS supports the *arbitration* that allows real resource sharing, not just the controlled *cohabitation* of partitions on the same machine (though it does this, too). The in-memory networking called *HiperSockets* connects applications to each other and to databases without the latency of traditional networking. z/OS and its predecessors have included security and encryption as core capabilities, along with the intelligence to support them in a granular fashion, now going as far as to support row-level security in the *DB2*. All of z/OS's extensive elements and capabilities now can be used to coordinate complex enterprise IT environments. Much of z9's role as the *hub* of the enterprise systems infrastructure is enabled by IBM's *Virtualization Engine*, which is best run on the resilient and sophisticated mainframe.

Built-in Virtualization

In the mainframe, virtualization is not just a feature of a processor. It is everywhere. Containers (LPARs, virtual storage, and VLANs, to mention a few) and pooling are part of the picture, but so are containers-within-containers, and the intelligence to bring hardware resources to application workloads, in an optimized and dynamic fashion. Mainframe virtualization has evolved (through a large, multi-decade investment by IBM) into a more complete capability. It is like a car with automatic shift, a DVD player, and a full gas tank rather than just a chassis, body, engine, and a set of assembly and operating instructions. System z can coordinate subsystems and tiers of subsystems, as well as its own processes. System z simply brings more to the enterprise than other server platforms.

Standard and Specialty Processors

z/OS Standard Engine

z9's *standard engines*[1] handle security, encryption, database, and other management-of-the-whole activities, including workload management and offload arbitration. Of course, standard engines also run older mainframe applications, like those that were written in *COBOL* or are tied to *CICS* or *IMS*. For enterprises with smaller legacy workloads or none at all, the z9 BC engine can be scaled back to a quite modest size, to keep down software licensing costs, as well as hardware costs.

System z9 Specialty Engines

Because of mainframe virtualization and the potency of z/OS, z9's specialty engines can be used to offload particular tasks without changing the application. The workloads can be diverted (*Java* and *DB2*) on z/OS or can run independently of z/OS (Linux), with execution on the specialty engines, thus avoiding some or all of z/OS's capacity-based pricing.[2] An added, important benefit is more control (by running in a mainframe environment) at a lower average cost of execution (than if run solely on z/OS standard engines).

The following specialty engines are available on the z9 BC model.

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[1] A little explanation of "mainframe speak" is required for those who have not been exposed to this dialect. The *engine* is a *processor unit*, or group of processors that function as a physical unit. These engines deliver the "horsepower" that drives the operating environment(s) and applications. This is a major difference between the architectures deployed in most "open" systems and that of a mainframe, where all work is done on the standard processors. Each z9 engine has more processors than show up in a count of engines (or Processor Units (PUs), with the many additional processors used to accelerate I/O, encryption, and more, to engage in service management, and to serve as spares. This is one way that a mainframe can handle the heavy processing requirements of enterprise applications with (apparently) fewer processors than the competition. A z9 *standard engine* is capable of running all applications, including applications built with COBOL, CICS, and IMS. z9's *specialty engines* are dedicated to a specific use - for running Linux applications, for executing Java, for DB2 acceleration, etc.

[2] This represents a significant discount for work run on the specialty engines, putting z9's Linux, Java, and DB2 execution at costs similar to "open systems".

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- ***IFL (Integrated Facility for Linux)*** - There are many ways to run Linux on a mainframe. As a job under z/OS, the Linux workload benefits from the direct management by z/OS. Or, running under the *z/VM*[3] operating system in z9's IFL special-purpose Linux engine, Web servers and other edge-facing applications, and other applications are offloaded from the higher-cost standard engine. Thus, they do not incur the licensing costs of z/OS and other mainframe applications that are priced according to total capacity of standard engines, whose collective processing power is often expressed in MIPS (Millions of Instructions Per Second).
- ***zAAP (zSeries Application Assist Processor)*** *is a specialized Java execution environ*ment. Java is used for many eBusiness functionalities and its modularity makes it popular with many of the SOA architectures that are being developed today[4]. However, Java takes time to compile, and offloading that processing to a specialty engine makes the systems environment easier to manage and lowers the average cost of operation, as well.
- ***zIIP (z9 Integrated Information Processor)*** - Like the zAAP processor, zIIP offloads – this time database transactions, rather than Java. The workloads run on zIIP can include integrating data from different sources so that supply chains and business intelligence can be more broadly useful. When importing real-time data from multiple sources, zIIP does the load balancing and locking to keep the data consistent without undue performance penalty or over allocation. Because the soon-to-be released version of *Universal Database for z/OS* can address a wide variety of data sources within the enterprise, zIIP can be the magic that supports data quality and sews enterprise business processes together[5].
- ***ICF (Internal Coupling Facility)*** - ICF connects one mainframe to another for aggregate functionality, and supports the capabilities of the famed *Parallel Sysplex* (and its extension, *Geographically Dispersed Parallel Sysplex*, usually referred to as GDPS)[6]. ICF preceded the other specialty engines and represents a significant savings to the alternative of deploying a physically-separate (standalone) piece of mainframe hardware, called a *Coupling Facility*.

Granularity of Functionality

System z9 has a greater scale than any other kind of server - the largest z9 EC (Enterprise Class) server is almost 700 times the smallest z9 BC[7] server) and it has more granularity of capacity settings[8]. All z9 models host spare processors as part of the base configuration, which is why z9's mean time to failure is measured in decades. All current models also have *On-Off Capacity on Demand*, which will turn on a spare processor for a sudden spike – without charge for a spike of less than six hours, or while additional permanent capacity is procured, which can happen automatically, depending on the policies that have been set. Another practice is to activate and pay for extra additional processors to facilitate end-of-quarter or end-of-year business reporting.

Use Scenarios

There are at least five likely ways to use the new System z9 BC in the enterprise.

1. If you are a smaller mainframe owner, System z9 BC is a potent replacement for existing smaller mainframes, giving higher performance and more memory at lower prices. (See box on page 2 for details.)
2. For small mainframe owners who want to do more, the System z9 BC offers more value. New specialty engines (zIIP, zAAP, et al) run better and cheaper on BC than on the older z800s. Also, the System z9 BC offers up to seven Processor Units (engines) of greater power, in comparison to the z890's four. This gives space for more specialty engines and a much larger range for scaling.

[3] IBM's VM is the original virtual machine environment, and has continued to evolve (get enhancements).

[4] For more details, see **The Clipper Group Navigator** entitled *zSeries Zips Through Java with zAAP*, dated April 7, 2004, and available at http://www.clipper.com/research/TCG2004030.pdf.

[5] For more details, see **The Clipper Group Navigator** entitled *System 9z Adds zIIP to Ally with DB2 on z/OS to Better Serve the Onslaught of Business Data*, dated January 24, 2006, and available at http://www.clipper.com/research/TCG2006006.pdf.

[6] While Coupling Facilities are primarily for large enterprises, if you are big enough to wonder about how you would recover from a primary data center disaster, you are big enough to ask about a remote z9 BC!

[7] The entry BC is 26 MIPS and the largest EC is approximately 17,800 MIPS.

[8] There are a total of 151 settings for the BC and the larger EC models.

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3. If you are a larger mainframe owner, z9 BC presents new ways to add segregated capacity (say, for development) or a remote data center (for disaster recovery)

4. For enterprises that do not have a mainframe environment, even just one z/OS engine might deliver great value as a *hub* for pervasive coordination of security and workload management, i.e., getting the work done to completion safely. A *z9 hub* combined with z9 special-purpose offload engines (for Linux, Java, and DB2e can become a harmonic balancer for the whole environment, including heterogeneous servers.

5. Those enterprises with multiple mainframes – including, perhaps, older mainframes – can use the small BC model as a way to organize their mainframe environment for greater cost efficiencies. One way is to use one of z9 BC's engines as a coupling facility (with greater capacity than older engines) or for use as a vehicle for transitioning out (migrating off) the older mainframes (without needing to shutdown).

Conclusion

In the worlds of an old song, *time has come today*, today there is no time for manual performance (administrators' execution) of time-consuming tasks that must be consistently done. This is something that is better left to sophisticated, policy-driven workload and systems management software (for which the mainframe has long been recognized). Furthermore, time is limited for the arbitration between disparate systems (required by SOA-based solutions) – and better spent on policies that enable the system to handle the arbitration whenever it is needed.[9] The interdependencies of enterprise business systems have evolved past the point at which they can be described on the back of an envelope – or in a spreadsheet. The need for large-scale coordination of workloads with individual requirements has never been greater.

The time has come for many businesses to leverage partnerships, both to deliver the products that fit customer requirements and to provide the services to keep customers satisfied. For these businesses, this imperative means more fully sharing information with people they less-than-fully trust. This, in turn, demands a comprehensive and increasingly specific control of *who* can see *what*, as well as a synchronization of information so no partner is misled about what is possible and what is required. The price for inadequate security, not just on some arbitrarily-defined perimeter, but also within the enterprise domain, is high.

As more enterprises use SOA's increased enterprise flexibility, arbitration of resource use and quick response to changing priorities will become keys to business success. Achieving this flexibility inefficiently or without pervasive security will be dangerous. It is the mainframe that has the fullest range of integrated resources ready to meet this need.

Now, with the System z9 BC, smaller enterprises who thought they could not afford a mainframe may now find that the costs of inadequate or inefficient control are rising. With today's quickly-evolving business models, and enterprises' growing needs for process coordination (including the need for many levels and kinds of security), System z9 BC is worthy of your consideration. Don't be foolish; the mainframe is an option that should not be overlooked.[10]

[9] SOA's service arbitration in an enterprise service bus can mange the applications, but there is an important need to manage both the hardware and software in a tightly-integrated fashion.

[10] If you are still skeptical that a mainframe could ever make good sense for your enterprise, see *The Clipper Group Captain's Log* dated May 23, 2006, entitled *Mainframe Mythology Lives On — Setting the Record Straight*, available at http://www.clipper.com/research/TCG2006038R.pdf.

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