



## The Mainframe Evolves Again — IBM's z990 Delivers More, Much More

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### Management Summary

*"The mainframe is dead!"*

*"No, it's still alive; but it's a dinosaur!"*

*"Oh no, it just mutated, again!"*

*"I don't know what it is, but it surely is huge!"*

*"It better be friendly, or we've got a real problem on our hands!"*

This could be a script from a *Godzilla* sequel, but it suggests the drama that has accompanied the venerable mainframe through the last dozen years. **IBM has gone and done it again, this time morphing the eServer z900 into a supersized, but friendly, behemoth of enterprise computing called the z990.** Don't let the z990 nomenclature deceive you, this is a big upsizing over the z900, but it's not only for those maxing out on the z900.

Much maligned, significantly misunderstood, this denizen of history refused to die, and wouldn't even retreat to some remote island. **As revolutionary as its System/360 ancestor, today's IBM mainframe - now called the zSeries - is still turning heads.** How can that be, after more than a decade of dinosaur name-calls? The answer is quite simple and it could have been predicted by Charles Darwin. Two Darwinian principles sum it up:

- **Survival of the Fittest** – It wouldn't be here if it didn't offer some continuing extraordinary value to the enterprises that rely upon it.
- **Improvement through Mutation** – This is not the mainframe of the 1980s and early 1990s. It has mutated several times and in many dimensions. It is a hardy symbiotic organism, bringing much new benefit and improved value to its host enterprise.

**The mainframe has always been fit, i.e., fit for nearly non-stop operation for a dynamically-changing mixed workload of mission-critical applications.** Unlike the Unix and Windows servers that wanted to grow up into mainframe qualities (remember all of the marketing hype about being *mainframe-like*), the qualities have been built in from the beginning. All of the recent hype about virtualization ignores the fact that the mainframe, including both hardware and operating systems, has been doing most of this for 20 to 30 years. So why all of the erroneous predictions about death and belonging in a museum?

First, the value equation was misunderstood and out of balance. It's value was known only to a limited number of data center insiders, who used it as a control point for restricting access. In those olden days, you needed to be an expert to use it, which clearly increased the value of the expert organizations. Of course, this all backfired with the empowerment of the end user. So the mainframe was labeled as obstructionist to new ways of doing business. There's some truth in this, but little applies today. Second, the mainframe was an expensive solution, supposedly too expensive for many uses. There is some truth in that accusation as well. Third, it was perceived as something old, and all of the glitter was coming from the new server offerings, from IBM and others. Last, and most wrong, was that it was stagnant, that it was incapable of changing its stripes and becoming what enterprises wanted, and needed.

In this issue of The Clipper Group Navigator, we will explore why **the new zSeries mainframe is what many enterprises want and need.** Read on to find out why zSeries continues to be a player in a sea of alternatives.

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## 21<sup>st</sup> Century Infrastructure Requirements

Though not frequently articulated in this manner, what most enterprises want is *invisible infrastructure that satisfies key requirements at a reasonable price point*. Very few enterprise executives are looking for an information technology showcase.<sup>1</sup>

Using a railroad as an analogy, a manufacturer wants to be able to add more cars of cargo to a freight train when they need to, but not be required to pay for peak capacity when they do not need it. It is up to the railroad to worry about adding an engine to pull the load, if the total burden requires it. The manufacturer wants to focus on optimizing its factories and let the railroad, acting like a utility, worry about moving the goods to their destination.

### *Invisible Infrastructure*

Just like air conditioning, **enterprise executives want IT infrastructure, need it, expect it, and don't really want to think about it**. They want the temperature and the humidity to be just right, without intervention. That's invisible infrastructure. They don't really care who made the equipment or how it was made, as long as it is efficient, reliable, and easily controlled.

This requires the separation of the underlying infrastructure from the ways that it is used. **In IT parlance, this means that you need to separate the applications from the infrastructure that makes it happen**. While the right or best infrastructure might make it happen better, nothing at all will happen without the applications.

### *Satisfies Key Requirements*

Reliability means meeting or exceeding the expected norms of operation, in terms of quality, quantity, availability, and more. **For most enterprise operating in a demanding world of 24-hour operations, reliability really means *being available almost all of the time, in terms of planned and unplanned outages, with the necessary resources to get the work done, in a manner that is***

*appropriately responsive to the demands for resources*.

*Appropriately responsive* recognizes that there are different performance and completion requirements for applications and users; all are not created equal. **Enterprises need to determine the level of criticality and the appropriate critical response time.**

### *Reasonable Price Point*

Reasonable pricing is in the eyes of the beholder, in comparison to those in similar circumstances. **An enterprise should desire to pay no more than the next business with similar requirements**. To expect to always pay less is not desirous, because the supplier is likely skimping somewhere to meet the lower price, or transferring more of the support burden to the enterprise; you may prefer to pay for more support, reliability or functionality. It's nice to get a very favorable deal; you just shouldn't expect it to happen all of the time.

### **IBM's New z990**

The mainframe has had many utility-like characteristics for decades. In the last few years, it has become the scaleable backbone of many data centers, optimizing mission-critical workloads to enterprise requirements and adding capacity when needed. **The mainframe has become the invisible infrastructure satisfying the most critical requirements for both legacy applications<sup>2</sup> and new Linux workloads.**

#### *The new eServer zSeries Model 990 (z990)*

<sup>2</sup> The term *legacy applications* has been given a derogatory tone, as if everything that an enterprise did needed to give way to a new replacement. The problem was not necessarily with the application, but in the legacy cost of ownership and operation, which was perceived to be much higher than something new running on new age servers. It turns out that many of these legacy applications, even after a decade of innuendo, are still the backbone of many larger enterprises, because their total costs are still advantageous for the benefits provided. To achieve this on mainframes, the hardware and software costs had to be reduced significantly, and they have. Yes, applications have been modernized in many ways, via middleware and webification. And yes, many so-called *standard applications* have replaced legacy applications. But at the end of the day, **the mainframe is the champion of both traditionally mainframe applications as well as new-age Linux applications, for certain customers with large needs and an open mind**. Of course, this is all further compounded by *legacy* taking on many meanings, as an example any computer not based on Intel's 86 instruction set.

<sup>1</sup> See *In Search of - Utility Computing* in **The Clipper Group Explorer** dated June 2, 2003, available at <http://www.clipper.com.research/TCG2003025>.

extends this capability to handle significantly larger workloads, in a scaleable and economic way. Leveraging the integration, automation and virtualization that it pioneered and leads the industry in many ways, the z990 is a significant upgrade from its predecessor, the z900.

- At over 9000 MIPS<sup>3</sup>, **the z990 will be the most powerful SMP computer.** Its engines run more than 50% faster than the z900 Turbo engines, the faster version of the standard z900 engines introduced last year.
- **The z990 will likely have the broadest range of scaling**, almost twenty times from the entry model to the full configuration<sup>4</sup>, satisfying the needs of customers from mid-sized to very large with an appropriately sized product, with a lot of room to grow into the full capacity, when needed. And if you consider the smaller z800 as the bottom of the line, zSeries scales even further.
- **It has been further refined to run a mix of workloads**, not just a mix of applications, and also a mix of operating environments, all with the highest levels of security and isolation. It is capable of tightly integrating applications, data, and business processes.
- **The z990 has been redesigned for the uncertainties and irregularities of large on-demand enterprises**, and there is new pricing to complement new on-demand capabilities.
- **With all of these changes, the z990 becomes the new baseline for advanced mainframe computing.** Future operating system and middleware offerings from IBM build on the z990's new functionality. The latest releases of z/OS and z/VM have been enhanced to take advantage of z990's new capabilities.
- **To top it off, the z990 offering has a number of changes that improve price performance over the z900.**

All of this makes the z990 an ideal cornerstone for delivering the power to

satisfy the needs of an on-demand e-business.<sup>5</sup>

In addition, **the z990 builds upon a series of mainframe pricing changes by IBM since the introduction of the zSeries; these better reflect the needs of e-business in an on-demand enterprise.** While the mainframe may seem expensive upon a cursory glance, it is much less expensive than it was five years ago, especially for:

- Very large mainframe sites;
- Small mainframe sites;
- Occasional surges beyond licensed software capacities; and
- Linux deployment

These are but a few examples of how IBM has mutated its mainframe and software pricing to better meet the continuing and changing needs of its customers.

### **z990's New Design**

There are a number of changes from z900 to z990, as seen inside the cabinet; these changes are transparent to applications and users. **These transform the z990 into a new mainframe from the inside out, creating a new baseline reference point for future zSeries servers.** This is a forward-looking design, in that z990's full set of benefits require the latest releases of operating systems (z/OS 1.4 and z/VM 4.4) to take full advantage of the z990's new capabilities and that some older peripherals are no longer directly supported

#### **Four z990 Models**

There are four models:

- *A8* with 8 available engines
- *B16* with 16 available engines
- *C24* with 24 available engines
- *D32* with 32 available engines

Notice the common denominator of eight. **Eight available engines, with two additional I/O processors<sup>6</sup> and two additional spares, make up a new unit called a book.** The z990 will be able to house up to four books when the

<sup>3</sup> This is the size of a fully-utilized 32-way, to be available in the fall of this year. Read further for more details.

<sup>4</sup> A single engine is rated at about 450 MIPS and the 32-way is more than 9000 MIPS.

<sup>5</sup> See *In Search of - Utility Computing* in **The Clipper Group Explorer** dated June 2, 2003, and available at <http://www.clipper.com/research/TCG2003025.pdf>.

<sup>6</sup> The I/O Processors offload input/output processing and server administration from the available processors, which run applications. This allows for increased performance.

C24 and D32 models are available in October. Until then, the z990 is limited to two books.

The books are central to z990s new design. **Each book is installed with all 12 processors<sup>7</sup>.** No processors can be added later to a book. **More importantly, you pay only for the processors that are activated.** If you activate only one of the eight processors, then you will only pay for a single engine z990. So the available range of z990's processors goes from one to 32, providing exceptional granularity, especially in light of the significantly faster z990 engine.

Enterprises can choose to have more than one book installed, even though the first book has less than eight of the available processors activated. Each additional book provides for increased input/output and connectivity; this may be attractive to many high-volume transaction or processing situations.

### *Cryptography*

**On first shipment, z990 will be the fastest server for secure transactions, up to 11,000 SSL transactions per second. Security even gets better when the Secure Key Cryptography and PCIxCC adapters debut in the autumn.** The cryptography co-processor used in earlier models has been eliminated. Each new cryptography adapter will occupy an I/O slot, but will not require Channel Path IDs. This gives more scalability, and importantly, more future programmability to take advantage of evolving security algorithms.

### *More Connectivity*

**The z990's new architecture is extremely flexible, and now includes the ability to have multiple logical channel subsystems (LCSSs).** Each sub system supports up to 256 channels and 15 LPARs (logical partitions). A second subsystem will be available in October, doubling the z990's operating capacity, with the capability to expand even further in later models. There is no correlation between the number of LCSSs and the model, i.e., in the fall you can have a z990 with one book and two LCSSs. This makes z990 an ideal platform for server consolidation, especially from older pre-zSeries mainframe models. Each LCSS will allow enterprises to bring over all of their I/O and LPAR definitions from an existing main-

frame, without the need to change their workload definitions and configurations. When the second LCSS is available, the enterprise can migrate a second mainframe to the z990.

**The high-speed connectivity between applications via HiperSockets is being increased to 16 in the z990 (from 4 in z900) and the number of stacks that can be supported is being increased to 4000 from 1000.<sup>8</sup>**

### *But Legacy Peripherals Not Supported*

Peripherals, such as disk and printers, that connect via the decades' old parallel connection are not directly supported on z990. Most can be attached via available adapters, but it may be simpler for customers to embrace newer methods for connection, such as ESCON, FICON and IP.

### **z990's Many Benefits**

All of the z990's new features are designed to deliver more flexibility, which an on-demand enterprise requires, and greater ease in delivering streamlined efficiency to business processes.

### *More Capabilities with Less Hassle*

**Enterprise computing is not only about bigness, it's also about how well the enterprise can use the capacity it has acquired. For many enterprises, this can be a great challenge, because there is so much happening on a single system.** But the z990 has removed all of the needs to worry about the physicality of resources, reducing the burden on staff specialists. **All resources (like partitions, memory and channels) are handled virtually<sup>9</sup>, regardless of where they physically reside in the z990. They are accessed, as needed, to meet processing and**

<sup>8</sup> This is very important as more zSeries-based Linux applications need high-speed connections to databases and transaction processors running elsewhere in the same zSeries server, under Linux or z/OS.

<sup>9</sup> Virtualization has been part of mainframe technology since the 1960s. Very sophisticated virtualization defines the mainframe and separates it from other servers. With zSeries, you get virtualized memory, virtualized processors (a.k.a. LPARs or logical partitions), virtual machines via hypervisors that support many operating systems simultaneously, virtual application environments (like Linux under z/VM), and high-speed virtual networks (like *Hipersockets* and *VLAN*).

<sup>7</sup> Of which eight are available for enterprise uses.

connectivity requirements of each application workload.

As an example, the enterprise sees the power of its activated z990 processors spread across up to four books as a single pool of processing power that can be securely subdivided logically (rather than physically) to meet the needs of a mixed workload. An application loaded into a logical partition, with virtual memory and logical connections between applications<sup>10</sup> and logical external network connections does not see any of the physicality of hardware, and administrators don't have to worry about managing at the hardware level. **PR/SM is the magic that makes much of this possible. It gives the z990 the ultimate in resource sharing and flexibility.**

### ***Significant Boost for Linux Workloads***

As discussed previously<sup>11</sup>, a Linux image running on an a dedicated zSeries engine (called an IFL) under control of z/VM is no different than a traditional PC server (node) that is separately housed in a rack or blade server, except that the processing power of a zSeries Linux image can be dialed up or down to meet on-demand needs. **So a z990 can replace many hundreds (or even many thousands) of traditional Linux servers with a scaleable and manageable Linux environment, and can be or be part of a grid computing network.**<sup>12</sup>

**The greater engine capacity is especially good news for the zSeries' growing set of enterprises running Linux on their mainframe. A dedicated Linux engine has 45% more workload capacity than the z900 Turbo engine, allowing larger applications or more Linux sessions on an IFL engine. More importantly, the cost of a z990 IFL engine is the same as it was on the z900, so there is a significant benefit in the price performance for Linux on z990.**

<sup>10</sup> Called *HiperSockets*.

<sup>11</sup> See *Dealing with the Aggravation of Aggregation - IBM Grabs the Linux Bull by Its Horns* in *The Clipper Group Captain's Log* dated January 25, 2002, and available at <http://www.clipper.com/research/TCG2002002.pdf>.

<sup>12</sup> See *Using zSeries as a Grid Server - Many Unexplored Possibilities for the Enterprise* in **The Clipper Group Navigator** dated March 31, 2003, and available at <http://www.clipper.com/research/TCG2003012.pdf>.

**z/VM 4.4, available in the fall, delivers more management capabilities for Linux environments.** There are new systems management APIs to facilitate dynamic start of virtual grid nodes, a new z/VM adapter interrupt to lessen overhead, and a new GB Ethernet adapter to speed communications.

### ***New Twist for On-Demand Capacity***

**zSeries has always had spare processor(s) waiting to take over if an engine failed, allowing continuous operation.** z900 introduced *Capacity Upgrade on Demand (CUoD)*, where one or more additional processors could be installed to provide for later additional capacity<sup>13</sup>. This too would allow continuous operation during upgrade (i.e., you don't have to stop the system to upgrade) and the customer would not pay for the processor until it was needed.

**Any z990 model may contain unactivated engines. These engines can be activated when the workload looks like the combined workloads are regularly reaching a new high-water mark in utilization. This can be done under CUoD.**

But what if there is a spike that is not expected to last, such as one or two exceptionally high-volume transaction days during the week before Christmas or Valentine's Day or when closing the accounting books for the fiscal year? There are continuing costs, especially software licensing, which may increase with each added processor, in addition to the capital cost of buying a new processor on demand. For these and similar circumstances, **z990 now offers *On/Off Capacity on Demand (On/Off CoD)***<sup>14</sup>, which **allows additional engine(s) to be rented on a daily**<sup>15</sup> **basis. This avoids the capital cost, and limits exposure to additional software license charges.**<sup>16</sup>

<sup>13</sup> Assuming that the mainframe had room for one or more additional processors, i.e., that the maximum number of processors was not already installed.

<sup>14</sup> For a detailed discussion, see *On-Off Capacity on Demand - Does This Make Sense for Your IT Infrastructure?* in *The Clipper Group Log* dated May 8, 2003, and available at <http://www.clipper.com/research/TCG2003019.pdf>.

<sup>15</sup> Actually, a 24-hour period that begins when a processor is activated.

<sup>16</sup> Many IBM applications and middleware with processor-based charging schemes are available for rental on a daily basis. So you would pay for the monthly licensing charges

While this is the ultimate in flexibility, On/Off CoD is not a feature to be casually deployed. Like renting a power tool at your local rental center, after a short period of time it would have been less expensive to buy it, if you actually knew that you would need it for a longer period. For z990, this breakeven point is 45 days, if the same number of engines is enabled for all 45 days.<sup>17</sup> Don't forget, however, that your temporary spikes may require more than one engine, and that the need for multiple engines complicates the breakeven calculation and the possible buy/rent scenarios.

On/Off CoD adds to a growing number of other on-demand capabilities and offerings for zSeries, including:

- *Capacity Upgrade on Demand (CUoD)*, discussed earlier
- *Customer Initiated Upgrade (CIU) and CIU Express* to allow customers to prestage the addition of capacity, which they can initiate on the fly;
- *Capacity Backup Upgrade (CBU)* for disaster recovery to another zSeries server

Not surprisingly, zSeries is endowed with more on-demand capabilities than any other server.

### Lowered Software Pricing

**Because the zSeries is capable of running many separate environments within a single server, each potentially with many applications, it is important for software license charges to be based on the workloads being executed** and not the capacity of the machine as activated, or worse, the capacity of the machine as installed (with its full books, of which many may be unactivated). IBM has reworked its *Workload Licensing Charge (WLC)* to be the vehicle for accounting for all of this. The minimum unit for many applications has been reduced to 3 MIPS, which is less than the capacity of most new PCs. So the charging granularity now more closely matches the actual processing capacity allocated to run a workload, regardless of size. To change pricing to represent workloads more meaningfully, IBM has also introduced *Value-Unit* pricing and new entry pricing for many of its

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on purchased processors and could rent the software on rented processors.

<sup>17</sup> For example, if the enterprise orders two temporary engines and uses them for 45 days, they will have paid the same amount as if they had purchased two engines.

middleware products.

### Additional Offerings

IBM is also offering *Open Infrastructure Offerings (OIO)*, which allow a number of products and services to be bundled together and priced as a single bottom line. OIO also allows for flexibility in technology upgrades and deployment, price performance improvements, and interest rate protection. OIOs also leverage attractive procurement options from IBM Global Financing.

### Conclusion

There is a lot new about z990, and this bulletin has only scratched the surface in addressing the implications for existing and potential zSeries owners. **With z990, the mainframe's potential value to the enterprise has been increased significantly.** In the last decade, the mainframe has mutated from a very sophisticated system running what had been classified as *legacy applications*, to a significantly more powerful server capable of running contemporary applications<sup>18</sup> for the on-demand enterprise.

**The time has come to leave the dinosaur moniker behind.** It's been useful and even cute. But when IBM begins to code-name its mainframes after dinosaurs<sup>19</sup>, you know that it's time to move on.

This is the 21<sup>st</sup> Century and what enterprises need is an invisible, scalable infrastructure that satisfies key, ever-evolving enterprise requirements at a reasonable total cost of ownership and operation. **zSeries, in general, and z990, in particular with all of the new features and offerings, may be the best of breed for achieving this goal and worthy of serious consideration. There is important value to consider whether converting from an earlier mainframe, upgrading from a z900, or moving to the mainframe for the first time. Check it out!**




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<sup>18</sup> Of course, if you want to run your enterprise applications in Microsoft's *Windows* environment, the mainframe is not your solution.

<sup>19</sup> The z990 was code-named *T-Rex*, for example.

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