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WinterGreen Research, Inc.

Whitepaper

The Hybrid Computing Proposition: Challenging and Overcoming Past Bias is Key to Achieving Breakthrough Gains

The next generation of application server solutions has arrived but will you recognize them when you see them?

It's time to take another look at how new technologies challenge the efficacy of traditional architectural approaches, beyond virtualization and into the future.

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I. Introduction

Scaled-out distributed application servers have achieved exponential growth largely driven by innovative new web-based applications. As those applications have evolved into an ecosystem of composite applications running across networks of heterogeneous servers, it has become evident that the complexity of the architecture makes for an environment that is difficult to manage, maintain, change, and tune for high performance as well as one that is challenging from a recovery, scalability and cost aspect.

Graphical user-oriented browser-based smart devices are now in use at every level of the business. Companies cannot remain competitive unless they find ways to harness, scale out, scale up and implement web services more economically while continuing to deliver agility within line of business applications.

It is in this context, that line of business (LOB) IT architects need to position themselves to satisfy the demand for more servers, for access to more data, and for the ability to respond to the explosion of opportunities. New business applications need new and better platforms. Business IT architects are adopting agile processes to maintain competitive advantage. To more cost effectively handle the higher transaction volumes and expanding number of networked servers needed to support business growth, LOB architects have already migrated images of scaled-out smaller physical servers into shared virtualized server images on consolidated more powerful VMware ® servers.

However, the virtualization of scaled-out server images has barely stemmed the year-to-year increases in overall IT cost, and more economies are needed to control IT budget growth as current levels are acknowledged to be simply unsustainable. Moreover, the complexity inherent in the current approach is impeding growth.

More manageable and flexible approaches and new scale up options are needed.

What is the next generation of solutions? How will they attack the cost issues without sacrificing innovation, and where will they come from? One needs to keep an open mind, and approach the problem as one of computer science to recognize the significance of what is coming next and how it will provide a breakthrough of unparalleled significance.

II. IT Evolution Leads Naturally to Hybrid Computing

Hybrid computing is a natural evolution of IT that is aimed at addressing the various challenges encountered in scaled out distributed computing implementations. Tougher LOB service level agreements (SLAs) have spurred new techniques aimed at improving the performance and economics of Java-based and web services-based composite network-enabled applications.

> *We started our modernization project with open systems servers where I had been a Java developer. We were also heavy VMware users. What we really needed was a more stable, scalable environment.*
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> *Gustavo Tadao*
> *Senior Architect*
> *Serasa Experian*
> *Brazil*

Looking at IT challenges in the context of the different approaches that are inherent in hybrid computing systems yields some surprisingly user friendly new alternatives. Cost efficiency is the acknowledged immediate problem. Lowering IT costs to below industry averages depends on choosing between multiple architectural options that utilize hybrid computing. To bring down IT costs dramatically without requiring major rework and within relatively short timeframes requires analysis. Being able to provide all combinations of options with a common hybrid server technology is a significant breakthrough that addresses the complexity issues.

Many of the existing distributed computing architectures that have sprung up over time were in support of applications that were not mission-critical before but have become so now. Web-enabled applications and infrastructure proliferated without consideration of reliability, security, and integration to backend mainframe data and applications. Implementers in the LOB often placed time to market as a higher priority than other computing factors such as security or reliability. Those attributes had to be added later which contributed to the cost of the deployment. As architects modified computing environments to make them more web enabled, they were forced to make compromises to accommodate LOB requests for easy to use and quick to implement distributed servers. The resulting composite applications are comprised of an interconnected set of line of business-centric web-enabled servers and services, fundamentally disconnected from the complex mission critical back end transaction management systems. Data replication to these servers has become expensive and difficult as volumes and types of data are expanding exponentially.

This web-connected, complex computing matrix is actually the product of years of IT progress and is characterized by scaled out implementations running across existing

networks of heterogeneous systems. However, server images are difficult to govern and manage. The sheer number of servers involved makes maintenance and disaster recovery a lengthy process.

New consolidated hybrid systems are built to be integrated and secure, and the servers within are 'fit to purpose'—that is, configured and designed to allow users to put workload on the server type most likely to handle each workload in the most efficient and cost effective manner. Hybrid computing across a multi-server ensemble managed as a single system footprint was never before possible.

III. IBM's Hybrid Computing Capability

At a time when the Internet is introducing staggering volumes of new business opportunities, IBM has introduced unique new hybrid computing solutions that anticipate the coming challenges and provide innovative architected responses.

New hybrid servers provide composite application hosting with mainframe-like but user friendly enhanced management capabilities. Managed as a single system image containing a cluster of heterogeneous servers, use of hybrid servers begins to address the scale-out complexity and performance issues.

Advanced middleware further reduces complexity. By combining multiple server types with an integrated set of common middleware software, hybrid system architectures enable composite applications to scale-out across as well as up into the various server environments. Each of the multiple server types suited to different workloads can be utilized within the IBM zEnterprise "hybrid computing" environment while taking advantage of advanced automation and management capabilities. Multiple options for attacking the complexity, performance, scalability and cost issues are available with a customizable "fit for purpose" approach in which common development, information management, service management, application integration and other middleware is available from IBM regardless of the type of server selected.

IBM hybrid computing technologies can and will enable users to improve performance and lower operational costs, while responding to even the unexpected in terms of innovation and transaction and data growth – and all this while delivering more robust qualities of service to achieve expected service level agreement targets and best of breed economics. Already, early adoption of hybrid server approaches is yielding examples of how to profoundly impact costs while enabling the new types of applications that deliver high return on investment (ROI). Hybrid computing does

require users to let go of some historically ingrained perceptions. For example, consolidation of processing has advantages; large numbers of distributed servers is not always the answer; efficiency, security, manageability, and price/performance are factors to be considered. It is the need to cut costs while improving data throughput and growth that provides sufficient incentive to give this approach serious consideration.

The zEnterprise can be configured and used with a number of different faces to the user. These include: classic z/OS mainframe computing, Linux only environments running standard Linux deployments on either System z "Integrated Facility for Linux" (IFL) processors, Power or Intel System z blade server extensions (zBX) running AIX, Linux or Windows, or any combination of the above.

IBM has focused on delivering a highly scalable, and recoverable but simplified operating environment. The IBM System z (mainframe) and IFLs run a standard LINUX build from either Red Hat ® or SUSE ® that sits on top of IBM's zVM (for "virtual machine"). IBM zVM has been hosting virtualized server images on mainframes for decades and is much more function-rich than VMware. The System z hardware and underlying microcode and hypervisor enables pooling of shared system resources and management by IBM's Unified Resource Manager™. This results in more efficient use of memory and other system resources, and average utilization exceeding 80-90%.

IBM has enhanced its integrated set of middleware software so it runs on any platform, distributed or mainframe, thereby creating a more advanced set of hybrid options. When needed, firmware has been modified to enhance performance and throughput. These new hybrid systems enable self-provisioning, thereby providing a low cost cloud computing construct "in a box".

IBM's zEnterprise™ server platform, in combination with IBM middleware, facilitates "best fit" thinking and supports scale out virtualization and/or consolidation as well as scale up capabilities. Because the IBM middleware components run on any platform, system and application design can be done before the platform is chosen, leaving the best fit decision to deployment time, based on the attributes of the workload.

The IBM zEnterprise System 196 and new hybrid system ensembles should become a "first choice" keystone for line of business IT architects. The capability to run work across a range of open server options makes zEnterprise hybrids foundational to application server hosting decisions with a needed growth path for the largest midrange environments.

The hybrid computing solutions delivered by zEnterprise with IBM middleware are appealing because they provide: 1) access to the extreme virtualization capabilities of System z; 2) a common middleware portfolio available on all platforms allowing flexibility to deploy across any or all application server types; 3) common developer and management tools available on all platforms; 4) superior, reliable capacity for hosting sub-second transaction processing with automated disaster recovery; 5) environmental and operational improvements that reduce TCA and TCO.

IV. Server Ensemble Offers Breakthrough Alternatives

The zEnterprise™ system offers breakthrough new alternatives via hybrid configurations that permit placing of application workloads on optimized servers. All aspects of the benefits of hybrid computing can be visualized by describing the fit in terms of types of workload. With the newly enabled capability to run work across a range of open server options within a single hybrid server ensemble, focus shifts to managing what type of workload should run where. Using total cost of acquisition (TCA) and total cost of ownership (TCO) comparisons as a guide is now a key part of the application server hosting and architecture decision.

IBM has taken the best attributes of each type of server and simplified and extended those attributes into a hybrid ensemble that is easy to use at every level. Hybrid servers enable provisioning and capabilities that permit the LOB to be instantly and affordably responsive to new business opportunities.

Our disaster recovery test showed we can recover the entire System z environment including Linux within 2 minutes, with I/O back up within 15 seconds and some applications up within 30 seconds.

Bernd Bohne
Manager, Central Systems
Sparda-Datenverarbeitung eG, Germany

LUW (Linux/Unix/Windows) servers are now being reexamined in light of the emerging new hybrid ensemble server architectures that enable a blending of all servers, in combination, to leverage the strength of each server and software type for varying types of application workloads. New enablement of workload management hypervisors and shared resource pooling capabilities that were architectural advantages once contained exclusively in enterprise class servers are now able to be applied to connected LUW servers within the ensemble. This brings a blending of the best of both worlds.

The user friendly capabilities of the LUW world can be brought into the mission critical enterprise world while the technological advantages of the enterprise class servers are being extended across the attached LUW servers.

While many have strived to deliver this capability to date, at this time only IBM has delivered such a capability with the zEnterprise Server Ensemble combined with a complete middleware portfolio. The strategy that uses common SOA enabled layers including runtimes such as WebSphere Application Server (WAS) to deliver a common application server enablement across all server types is compelling.

Performance for MQ was really impressive and we moved a lot of MQ workloads to System z. Now we are looking at other Java applications to move next.

Gustavo Tadao
Senior Architect
Serasa Experian
Brazil

Using a "best fit" approach with aligned economics was needed and is now possible without having to rip and replace.

"WinterGreen Research, Inc. economic analysis clearly shows that complex workloads depend on utilizing the best server for the purpose. By matching the individual server platform strengths to the characteristics of each workload a single *hybrid computing* model delivers versatility for the data center and the line of business while also providing lowest TCA and improvements in TCO." (Susan Eustis, President and Sr. Analyst)

The IBM zEnterprise server includes new System z processors that are 5.2Ghz, is scalable to support up to 50 distributed servers on a single core and up to thousands on a single system, a 10GB Ethernet for high speed application connectivity, and capability to configure IBM p (Power) or x (Intel) blade servers via the zBX (zEnterprise BladeCenter ® extension), using a common user-friendly Unified Resource Manager hypervisor that is enabled across all server types within the ensemble.

Operationally, the zEnterprise ensemble includes automation-enabled functions that provide capabilities previously only available to mainframe applications and extends them across the heterogeneous hybrid server footprint including: automated hot failover redundancy and disaster recovery for all compute environments in the ensemble; shared resource pooling management that dramatically reduces memory requirements; energy management that reduces consumption to 1/12 of comparable distributed server configurations at 1/25 of the floor space; channel-like network performance for connection between applications within the ensemble to improve

composite application performance and reduce network costs; and a cloud computing automated framework to enable self-provisioning of server images in minutes.

The benefits of the zEnterprise system include:

- Adoption of the best attributes of open system servers and legacy mainframes
- Utilization of common open systems middleware available for all servers
- Delivery of variable Qualities of Service that today's applications require
- Provisioning of extreme virtualization for infrastructure cost reduction
- Capability to extract more value from existing assets
- Shared workload management for maximum utilization of system resources
- Scalability that accommodates growth and rapid response for provisioning
- Supporting economics that fit varying application workload requirements

I do not come from a mainframe background myself but felt we should consider all possible options. We ran a number of TCO platform comparisons for WAS (WebSphere Application Server) and MQ messaging—and in every scenario, Linux on System z TCO came out far better.

Brent Halsey
Infrastructure Manager,
Enterprise Middleware Infrastructure
Huntington Bank, USA

A word about virtualized open system servers

Here we introduce the concept of using System z (mainframe) hardware as a virtualized open system server for the line of business, just as any other server hardware could be implemented.

The advantage of this approach is most clear when looking at return on investment and total cost of ownership comparisons achieved when analyzing by workload,

combined with the inherent benefits of the underlying server and firmware capabilities.

By looking at the comparative platform costs and virtualization advantages in the context of workload analysis, a broader and more precise vision of choices becomes apparent.

V. Java-Based Middleware Products Support Hybrid Computing

Many Java-based middleware products from IBM (ex. WebSphere Application Server) and other vendors deliver common application server components that provide application portability across multiple types of servers to avoid costly migrations when a server change is needed. However, only the IBM WebSphere Application Server bridges all platforms including z/OS natively. Such a server change may be warranted if the business architect decides it is best to co-locate the application with the data to accommodate rapid response time or transaction volumes.

Ironically, it was the distributed database team that asked for new virtual Linux server on System z so they could avoid being plagued with the problems caused by differences within the multiple Linux image builds comprising their distributed platform.

Bernd Bohne
Manager, Central Systems,
Sparda-Datenverarbeitung eG,
Germany

Composite web and Java-based applications have evolved and matured, and many of the new distributed server application components are the predominant front end to the enterprise applications and data servers that remain in place. The complex network of intertwined "composite applications" that has emerged over time requires new products and services to support user requirements. Web-based application components needed to be quick to roll out, easily accessible to LOB developers, with the features and ease of use of single distributed servers. Core enterprise environments that have been tagged as candidates to be re-hosted to newer more web-centric, open-server environments that seem less complex and more cost-effective are in fact more appropriately modernized in place.

Changes that have already taken place

Middleware software is one of the game changers

Along with SOA, web services, and Open Standards came new middleware software enablement layer products that have changed how applications are built and deployed. Only business logic is to be contained inside application programs while connectivity and enablement is moved to surrounding middleware enablement layers. Examples from IBM include for example: a common WebSphere Application Server for all platforms including LUW, mainframe z/OS, zVM and Linux on z; WebSphere Message Broker which utilizes underlying MQ messaging; WebSphere Process Server; WebSphere ESBs; DB2 Universal Databases; Tivoli service management tools; and Rational development toolsets including common developer desktops supporting all platforms.

The new common middleware portfolio is now available as a suite of products available to run across all hardware platforms. This allows the same staff to support and run work on any platform and allows the infrastructure architects to make the best server hosting decisions free from the dependencies of the past. The new computing paradigms such as Web 2.0 can extract more business value from CICS, IMS and COBOL to enable interaction and integration between once isolated environments and the modern web ecosystem.

> *A typical Linux server can be installed and turned over to users within 40 hours or less of Vicom services.*
>
> *Tom Amadio*
> *President,*
> *Vicom Infinity*

One no longer chooses the server to host workload based on what developer or infrastructure toolsets that the server can support, because now the same tools are commonly available across all platforms. That means developers and infrastructure staff can work across all the platforms, using the tools they know and like.

VI. Architects: How to Present the Business Case

How should the line of business architect most effectively introduce hybrid computing to users who have never known anything different than scale out models? Clearly there must be a case for new technology options that highlights possible cost

reductions tied to selection of the "right" platform for a particular application using flexible technologies.

The approach typically used by architects embraces analysis of workload for "best fit" and best economics vs. favorite platform thinking. Architects should think about scaling up using the newly available hybrid systems to complement the well-known scaling out strategies, and by adopting the system that is the most flexible and cost efficient for each workload. What that configuration looks like depends on many variables.

Key considerations for decision makers:

- New hardware and software technologies from IBM deliver the kinds of user-rich capabilities once thought to be only for distributed environments, across the spectrum of servers including the largest enterprise servers.
- Common middleware, preferred by LOBs for modern applications, is available on all platforms and can be supported by the same staffs on all platforms.
- The perceived economic gap no longer exists between server options and in fact some surprising breakthroughs are already in play. Workloads can now be deployed based on "best fit" best economics vs. traditional platform thinking.
- Many LOBs have already turned management of their distributed servers over to the data center and shared VMware implementations, and they have been able to do that while maintaining end user ownership of the supporting IT budget.
- Manageability needs to be considered in the business case *before* deployment and not after.

  --The entire zEnterprise environment, including the System z Server and the zEnterprise Blade Center Extension (zBX) managed by a single "Unified Resource Manager" which extends the management techniques previously reserved for mainframe only configurations across the blade server topology with a single user-friendly interface.

  --To achieve high availability and disaster recovery, the zBX utilizes mainframe-like hardware redundancy for high availability and hot-failover fault tolerance. For users of a Linux-only configuration, the Unified Resource Manager supports

both the System z IFLs and any zBX attached blades. The zEnterprise truly provides users with a single environment that can support workloads that run best on the z hardware or workloads that run best on p-Series or x-Series technology.

When one considers the dual breakthroughs in composite application support, integration systems, and hardware capability, price/performance combined with the new zBX hybrid server capability, all enabled by common middleware, zEnterprise represents a transformational event in the IT industry.

We have seen that scaled out solutions have not continued to be as affordable or flexible as they first seemed. This is because as applications grew and began to take on the attributes of "mission critical" applications, they needed the attributes that only mission critical applications were thought to require. Throughput performance (vs. raw engine speed), memory management, energy conservation, backup/recovery/restart capability, enhanced security, and the ability to scale up/down to accommodate unexpected new business requirements top the list of challenges facing application owners.

We see the dividing line for who owns and supports the server environment being the ESB layer. Infrastructure below the ESB is supported by the infrastructure team for System z servers which means the resources come from mainframe heritage. Within and above the ESB is now common middleware and is supported by the same team that supports our distributed open systems middleware implementations.

Gustavo Tadao
Senior Architect
Serasa Experian
Brazil

Workload type as the new common application server metric means consolidation and virtualization alone do not resolve issues implicit in scale out implementations. Taking advantage of different deployment technology options to provide for variances in workload types and accommodating the requirements of each means looking at all possible server options in terms of the parameters listed above.

VII. Summary

We have reviewed the reasons why IT organizations now find they are in a position of unprecedented cost overruns. The fact is, most do not understand how they got here - because they thought they chose lowest cost solutions.

Hybrid computing platforms support a new and different IT architectural approach. Innovative approaches are needed that will drive down cost while enabling growth and innovation. New options should be considered using a fact-based approach that embraces a business-value based approach.

We currently support over 6M transactions per day, use far less memory than before, and are now looking for other workloads that are a fit for moving to System z for cost reductions.

Brent Halsey
Infrastructure Manager,
Enterprise Middleware Infrastructure
Huntington Bank, USA

Delivery of enhanced TCO and ROI as well as enabling business agility to support their lines of business is the goal of every IT organization.

This whitepaper has presented not only some recommendations for how to embark on a fact-based approach for selecting servers for hosting modern applications based on workload attributes, but we have also introduced some new technologies that we believe are realistic options for those who may never have embraced System z servers in the past.

Everyone is encouraged to closely examine how they evaluate TCO and ROI of the many alternatives and test that they correlate with real data as available.

All enterprise and application architects are encouraged to learn about and consider the zEnterprise as an important new open systems server technology that solves many of the IT economic and operational challenges and enables unprecedented growth at a price performance level that is required for improving business value while reducing cost.

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