IBM zEnterprise System: Smart Infrastructure for Today's Heterogeneous Business Applications

Redguides
for Business Leaders

Alex Louwe Kooijmans
Nancy Burchfield
Fernando Ferreira
Tomoyuki Maekawa
Daniel Raisch

- Barriers to realizing business value from your IT infrastructure

- zEnterprise value proposition to solve top IT challenges

- Guidance on getting started with the IBM zEnterprise System

Redbooks

Executive overview

Do you find yourself focusing too much on your IT infrastructure these days - and not enough on providing value to your business?

Increasingly, business applications span heterogeneous platforms, appliances and devices, and this wide range of resources creates real issues for IT shops trying to meet business objectives. Simply adding servers, routers, and other IT equipment ultimately will not solve your IT challenges, and may even make them worse. Even using virtualization techniques can only go so far in helping you to manage a massive number of servers, routers, and other devices. The ability to manage resources for these heterogeneous applications as one logical entity has been lacking - until now.

The IBM® zEnterprise™ System technology, referred to as *zEnterprise*, combines scalable computing power with a groundbreaking new architecture that is able to manage heterogeneous workloads from a single point of control. It combines faster and more powerful IT infrastructures with innovative ways to take advantage of IT resources in an efficient and dynamic manner. zEnterprise is designed with a new vision in mind, in which scalable computing power, world class Quality of Service, virtualization, provisioning, and resource management are layered on top of a multiplatform architecture, connected through a dedicated and highly secure network.

This IBM Redguide™ publication shows you sample application topologies that illustrate the zEnterprise value in solving your most urgent IT challenges. Read on and discover how zEnterprise could become a game changer in managing your complex IT landscape!

Today's business maxim: Innovate or die

Growth in earnings without corresponding growth in revenues is achieved primarily through cost reductions. Often it is easier to control costs than to create innovative products and services that fuel top-line growth. However, "the low hanging fruit" has already been picked. Global markets and substantially more volatile economies have created a highly competitive arena where survival depends on a continuous stream of successful new products and services. Competitive positioning is now based on innovation, and a company's innovation capabilities determine its future growth potential. Only innovation increases "the size of the pie," which means its mastery is vital to a company's long-term well-being.

This business climate is creating a special challenge for today's Chief Information Officer (CIO). While the importance of core IT responsibilities has not diminished, today's CIOs are increasingly held accountable for delivering real business value to their organizations. As a result, CIOs' focus on company-wide concerns has increased sharply. To better understand the challenges and goals of today's CIOs, IBM met face-to-face with 2,598 CIOs from 78 countries, across 19 industries, and representing organizations of all sizes.[1] IBM learned that today's CIOs are working to achieve three primary goals: making innovation real, raising the return on investment (ROI) of IT, and expanding business impact (Figure 1).
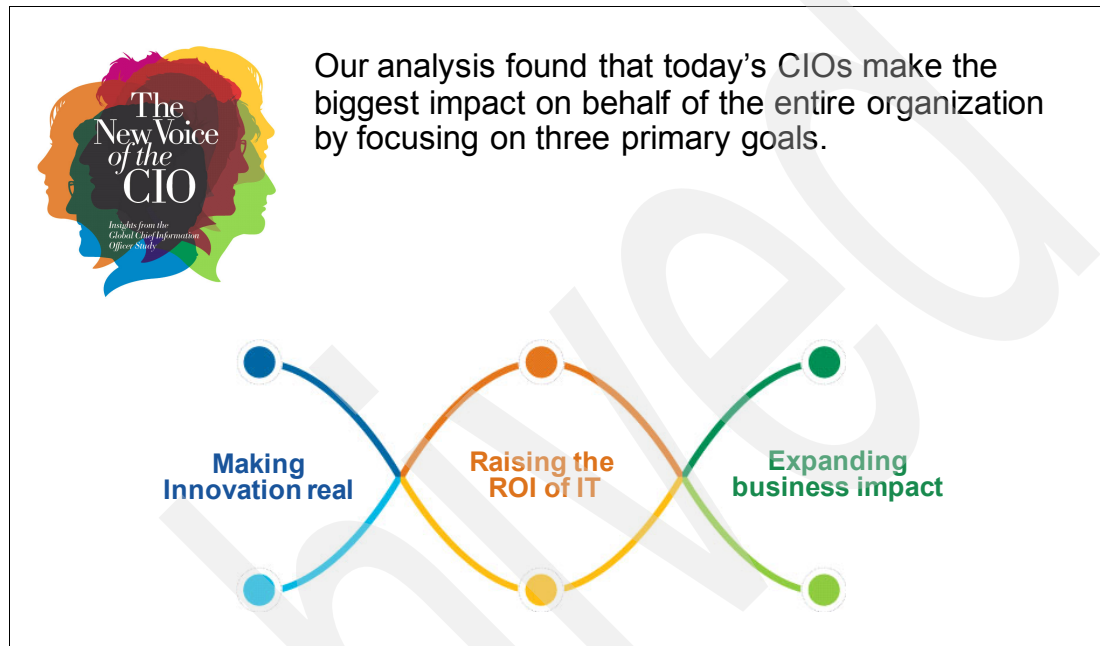

Figure 1   IBM CIO Study found that successful CIOs focus on three business goals

Making innovation real

It is not enough to simply plan for innovation; profitable business innovation demands a robust and responsive technological foundation. Today's CIO must promote a broad IT agenda that contributes to the profitability of leading-edge business initiatives. Successful CIOs make innovation real by actively integrating business and IT across the organization and across products and services life cycles. IT is not viewed as something separate or something to be "aligned" but rather as integral to the "what" and "how" of business strategy, performance, and innovation.

Without question, technology must support the core strategy of the business. But traditional approaches to business-IT alignment are not enough. Companies that adopt a "waterfall" approach, in which the IT strategy is created from a completed business plan, tend to treat technology planning as a secondary activity, thereby possibly losing out on innovative responses to business imperatives or missing opportunities for new IT-enabled customer products. Organizations that develop business and technology strategies in parallel leave room for "disconnects" that often cost companies millions each year in unrealized value.

Market-leading companies think differently. Championed by their CIO, market leaders *integrate* business and technology strategies so tightly that they are inseparable. With the boundaries around what is technically possible (and practical) constantly expanding, these executives view technology as the prime stimulus for business innovation.

---

[1] IBM CIO Study 2009: http://www-935.ibm.com/services/us/cio/ciostudy/

Raising the ROI of IT

The global economic crisis left indelible marks on businesses and governments worldwide. Using IT to produce greater business value is vital, accompanied by an ongoing focus on lower costs and higher efficiency. Successful CIOs raise the return on IT investments by proactively integrating data company-wide and advising the business on how to convert it into a competitive asset: business intelligence. Today's CIOs will extend this idea far beyond collecting and responding to business and customer requirements. Direct input and interaction with the consumer will build strong business insight capabilities that will enable CIOs to drive operational efficiency, recognize market opportunities, react faster, and ultimately predict changes in the business environment.

It is comparably easy to deliver positive returns on IT investments when business is booming and budgets are fat; as they say on Wall Street, "everyone is a genius in a bull market." However, CIOs who effectively lead innovation and drive service improvement programs during tough times provide superior value to the business, as compared to just keeping operations going.

Expanding business impact

To contribute the most to an organization, proven expertise in both business and technical matters is critical. Today's CIOs expand business impact by exploiting the multiplier effect: excelling in both IT operations and business transformation. Individually, each of these areas delivers business impact, but outperformers leverage their IT insights to jointly drive new business initiatives and cultural shifts with fellow CxOs. IT is valued most when it truly understands what is going on in the business, is able to envision and communicate game-changing IT solutions effectively, and is in a position to exert influence where needed.

The urgent challenge: Innovating through economic uncertainty

Current economic uncertainty combined with increasingly global markets is putting a premium on business responsiveness, but IT is often perceived as the "brake on business." Increasingly, though, today's CIOs view this as an opportunity to change that perception and are focused on business-oriented initiatives that deliver the flexibility their businesses need to survive in this environment (Figure 2).
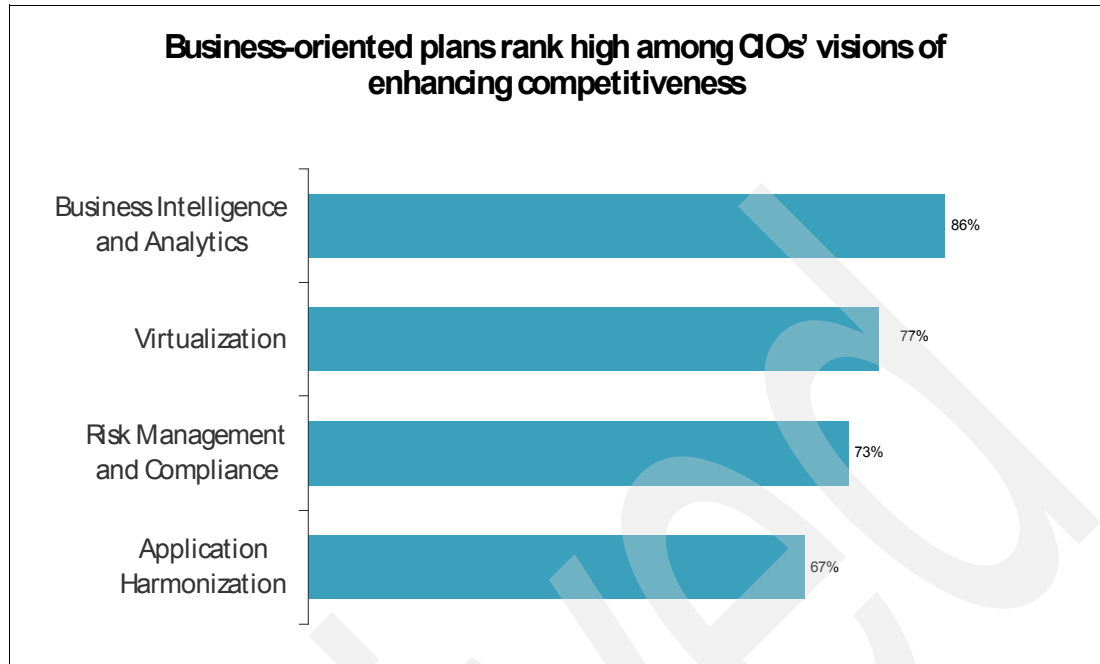
Business-oriented plans rank high among CIOs' visions of enhancing competitiveness

Business Intelligence and Analytics	86%
Virtualization	77%
Risk Management and Compliance	73%
Application Harmonization	67%

Figure 2   CIOs ranked business-oriented initiatives high for enhancing firm competitiveness

The potential for enhanced business value and agility that IT can affect through business intelligence and analytics, virtualization, risk management and compliance, and application harmonization is significant. But these initiatives are often challenged by limitations of current technologies and systems.

The following sections examine these IT challenges in more detail.

Business intelligence: Running behind reality

Businesses operate in a highly competitive environment. Organizations struggle to gain market share, deploy new products faster, and provide better service for their clients.

Business intelligence (BI) is a strategic and mission-critical initiative that helps organizations achieve business objectives by providing better insight into the market and clients, thereby enabling executives to make better and more informed decisions, improve service quality, and increase customer loyalty.

The term "business intelligence" encompasses a broad concept referring to a set of technologies, methodologies, processes, and applications with particular characteristics that address the objectives of different segments inside the organization by mining the data collected by the transaction systems and extracting meaningful information. Business intelligence applications are characterized by being highly CPU-intensive, long-running, complex queries over a very large amount of data, which demands a specific infrastructure.

Because detailed knowledge about clients and markets is so critical to business success, BI solutions are expanding their scope of deployment within organizations. Initially used as a marketing tool, BI has since been deployed in areas such as strategy, fraud analysis, predictive analysis, risk management, and money laundering analysis. More recently, BI applications have been developed that combine commercial and scientific requirements used in solutions for logistics and health and transportation analysis, among others.

The business drivers behind BI have elevated it to one of the highest priorities of CIOs and CTOs. To maximize their return on investment, realize the full value of BI to the business, and enhance their business competitiveness, IT executives need keen awareness of the challenges related to BI projects.

> **Challenge:** The main challenge in the BI area is to be able to retrieve meaningful information from massive amounts of data, in a timely manner, and make it available to the right individuals.

With respect to the IT infrastructure, we now see three major challenges:

► Provide sufficient resources to run complex queries, including predictive analytics

► Provide an IT infrastructure capable of running intelligent extract, transform, and load (ETL) processes across multiple locations, databases and servers in an increasingly timely manner

► Provide an IT environment that is highly available

It is all about speed

Business intelligence is about speed, time to market, and making decisions in real-time or near real-time. *Analytics* is a recent extension to the BI solution that enables you to perform predictive analysis by applying statistical and trends models over collected data. It is a more sophisticated and resource-intensive usage. Driven by business requirements, BI usage has changed its deployment methodology and has become more in-line and real-time, using operational data instead of historical data. This new behavior demands high processing capacity and the ability to manage priorities according to business goals.

> **Challenge:** Business intelligence and business analytics increasingly require massive computing power.

Raw data is meaningless

Business intelligence and analytics rely on the availability of the massive amounts of data that organizations generate every day. The BI and analytics challenge involves coping with the amount of data dispersed all over the different parts of the organization, bringing it together to form meaningful knowledge, extracting meaningful information, and providing this information to the business in the right format, at the right time, and to the right individuals.

Building a BI or analytics solution requires a sequence of steps to ETL the data into a data warehouse. These steps are usually performed by sequences of long-running batch jobs that run at certain intervals. These solutions become even more complex if the data sources are scattered across multiple geographies, databases, and servers with different availability windows and differing levels of data accuracy.

> **Challenge:** Populating a data warehouse from timely and accurate data scattered across databases and servers in different geographies is a major challenge.

BI is becoming mission-critical

As the use of BI becomes more widespread, from the IT perspective it begins to resemble traditional transactional processing (OLTP), which makes business intelligence applications more critical in terms of infrastructure requirements. For example, executives often have a dashboard panel where they track business performance in real time. Depending on the performance indicators, they may take actions and receive rapid feedback on the dashboard. Behind that dashboard sits a set of BI applications feeding the executive interface. Such

dashboard applications require high availability, reliability, and consistent response time. This typical scenario illustrates the mission-critical nature of BI solutions and shows that they require the same quality of service as a transactional application.

According to a 2007 Gartner Group study, fewer than 15% of data warehousing environments have been designed to provide high availability, failover, disaster recovery and the remaining components of mission-critical systems.

> **Challenge:** Business intelligence and business analytics solutions are increasingly becoming mission-critical and require an IT infrastructure that provides high availability and disaster recovery.

Virtualization: No free lunch

Virtualization refers to the presentation of computing resources as an abstract layer, independent of their underlying physical equivalents. Because the abstracted, or logical, view is not tied to specific physical units, virtualization technologies allow you to share computing resources among users and applications and thereby realize greater business value than through a dedicated implementation of those resources (Figure 3).

For example, the Processor Resource/Systems Manager™ (PR/SM™) is a feature of IBM System z that allows the physical System z® server to be partitioned logically into one or more virtual servers called logical partitions (LPARs). Additionally, virtualization also refers to the ability to aggregate physical entities into a uniform pool to simplify their use and management.
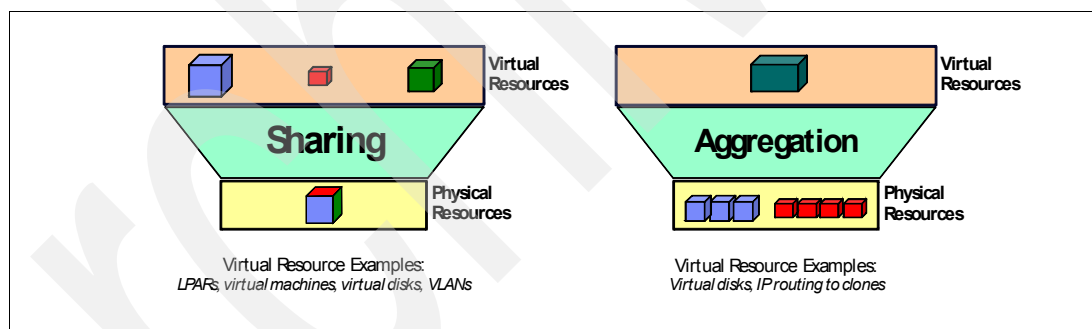

Figure 3   Virtualization enables physical resource sharing and aggregation

Many CIOs have pursued virtualization-based strategies to reduce the number of physical infrastructure resources required to deliver IT services and to more fully utilize the physical resources that comprise the infrastructure. Some virtualization solutions, though, have delivered limited business value, predominantly cost reduction or avoidance, because they are specific to a single platform. As well, platform-specific deployments introduce new challenges to successful virtualization. The more common challenges include virtual server sprawl, virtual infrastructure management complexity, workload performance and service level conflicts, virtual machine security breaches, and virtualization stall.

Controlling virtual sprawl is even more difficult

Although virtualization is often used to combat distributed server sprawl, meaning the proliferation of physical servers as a result of locating application, email, file, and database servers local to users, many organizations are learning that virtual server sprawl, which is the exponential rise in number of virtual servers, creates a variety of management, security, and compliance challenges. After the basic virtualization infrastructure has been purchased, it

might seem as if spinning up additional virtual servers is free. Left unchecked, though, organizations can quickly end up with more virtual servers than they can handle, and unwittingly expose the organization to security vulnerabilities and financial or legal penalties if software licensing is left unmanaged.

Today's virtualization management tools come up short

Today's infrastructure has reached its breaking point (Figure 4). Multiplatform application deployments have resulted in islands of IT resources connected together through multiple networks. Although virtualization and consolidation offer many benefits, ultimately complexity is added because each island contains both physical and virtual resources. Managing such an infrastructure is driving current costs and complexity to unsustainable levels; trying to extend and expand such an infrastructure to support business growth and innovation will be costly, error prone, and slow.

Typical complexity and limitations include:

- ► Many tiers/nodes of independent resources connected over multiple corporate networks are less dynamic, with limited resource sharing.
- ► Managing infrastructure islands affects human productivity.
- ► Platform management is not an end-to-end view.
- ► Automation policies are limited to tier or node boundaries.
- ► Redundancy is pervasive for operational staff, hardware, and software.
- ► Software and policies often are unable to communicate across architectures.
- ► Managing this complexity currently involves using a significant portion of the IT resources to maintain the existing infrastructure, rather than for adding new capabilities.
- ► Supply inefficiencies and demand spikes put pressure on environmental concerns dealing with increasing power, cooling, and physical space, and the proliferation of hardware.
- ► A significant percentage of infrastructure capacity is underutilized.
- ► There is reduced flexibility and responsiveness to deliver end-to-end business solutions.
- ► A complex and fragile infrastructure exists.
- ► Systems connected over multiple corporate networks are facing a proliferation of new risks and threats.
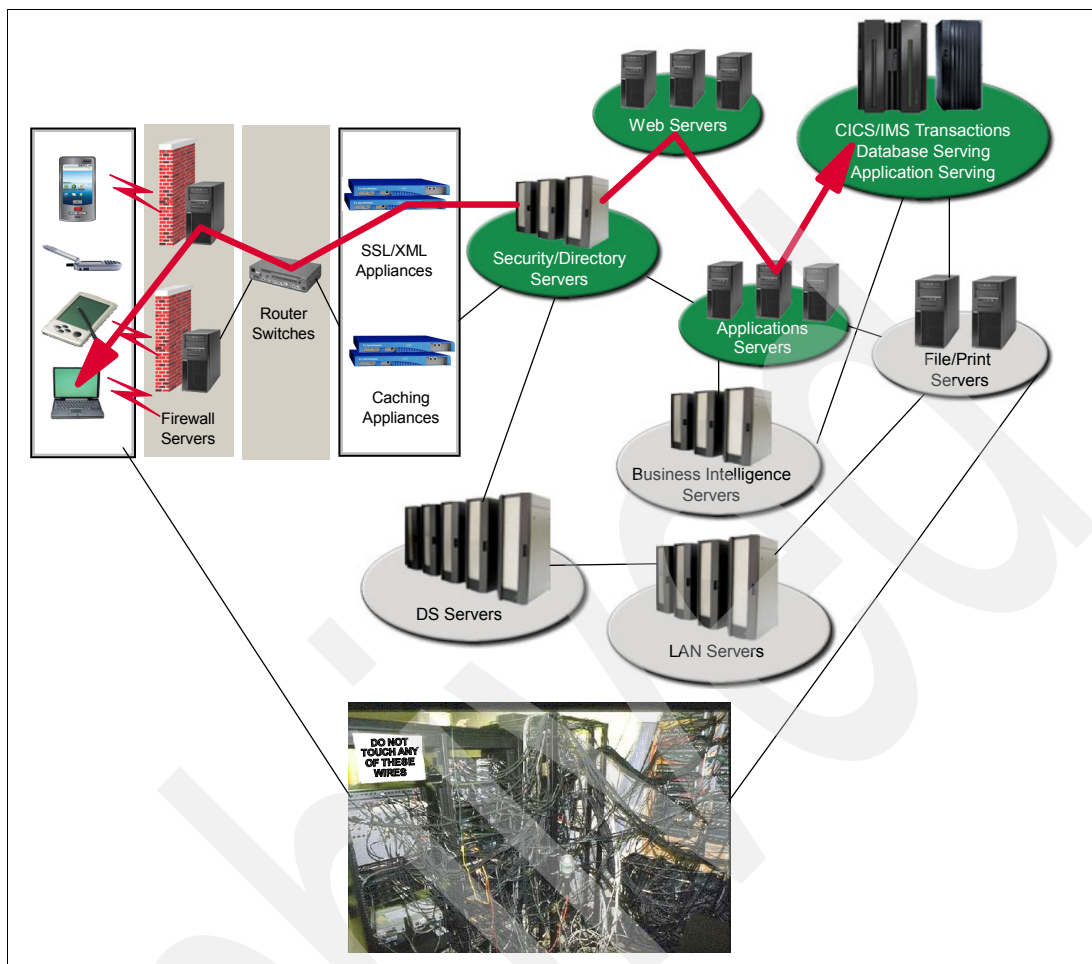
Figure 4   What's in your wiring closet?

Accelerating into the wall

A relatively new challenge to the virtualization arena is "virtualization stall," which is a term used to describe the tendency of virtualization deployments to diminish or stop after the "easy pickings" have been migrated. Most virtualization initiatives begin by targeting migration of relatively low-risk, low-impact workloads such as internal IT infrastructure applications, web servers, file servers, development and test servers, and so on, to the new virtual environment.

But faced with the next round of candidate workloads, which are typically mission-critical or customer-facing business applications, ISV applications, multitier and composite applications with heterogeneous architectures, the virtualization initiative stalls. If allowed to become a permanent stall, virtualization becomes a significant business problem for affected CIOs because such stalls significantly reduce the realized return on virtualization investments.

Risk management and compliance: Innovation and risks

Managing your risk is critical in a competitive marketplace that requires improved availability and secure key processes to keep your business operations running. Downtime or security breaches can result in millions of dollars of lost revenue, as well as damage to your brand reputation and increased customer dissatisfaction.

Mitigating risk should be accomplished, though, without jeopardizing the innovation process. The explosion of information and devices, combined with the growing interconnectedness of

people and processes, generates both new business opportunities and operational risks. The current business environment is increasingly complex and risky.

Complexity

The Internet has moved well beyond static web pages to power dynamic web applications that enable business partners and clients to work together in new ways and integrate business processes, with web-enabled applications driving these changes.

These dynamic components create new challenges for availability, security and compliance, as exemplified in the multitier business applications topology.

A large set of components supported by various utilities and tools running on different servers have to interact with mainframe applications to complete a business request. Integration and communication is performed through a complex topology made by various groups of switches, routers and security servers. This complexity favors operational errors and expands security exposures, and is a prevalent cause of downtime.

Data integrity and availability

Companies must deal with ever-increasing amounts of data today. They need to store it, manage it, secure it, ensure its integrity, and meet compliance requirements, all in a cost-effective manner. The data should also be continuously accessible to support business requirements, where and when it is needed, despite any disruption that may be caused by IT failures or disasters.

Data integrity and data accuracy are no less critical. In the information management workload illustrated in Figure 4 on page 8, large quantities of data must be moved through the network and then integrated into different platforms in a timely manner. But the amount of data to collect, transfer, and integrate is so huge that increasingly the infrastructure is a recurrent bottleneck. In such architectures the data in the data warehouse could be at least 24 hours old, and in certain cases even as old as 7 days. Resulting decisions could be based on outdated information.

Application harmonization: Technical disharmonies abound

Organizational changes due to mergers, acquisitions, and business unit divestitures have given rise to heterogeneous business processes and application landscapes. "Harmonization" is the name given to the effort to replace the heterogeneous processes and applications with uniform global standards. Harmonization of business processes and applications is a key lever for lowering the total cost of the application portfolio, while also providing flexibility and scalability for the business.

Inherently heterogeneous landscapes thwart technical consolidation

Often sold directly to the CEO and carrying price tags in the tens of millions, process harmonization initiatives are highly visible and CIOs are under pressure to demonstrate benefits capture. Critical to realizing the financial promise of globally harmonized operations is the successful rationalization and consolidation of the packaged applications and the associated IT infrastructures that support those operations. Often the technical consolidation efforts result in the implementation of a shared services model (Figure 5) for company-wide management and support of packaged applications and IT infrastructure.
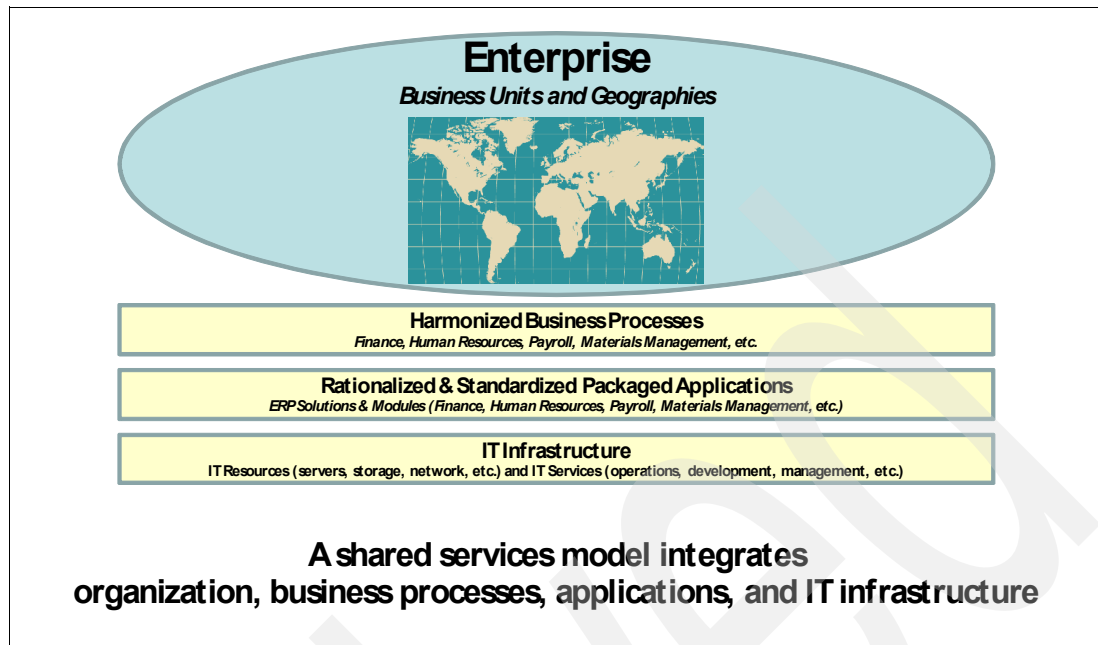
Figure 5   Shared services model

Packaged application landscapes, though, are inherently heterogeneous, comprising multiple types and versions of packaged application components, each with different infrastructure platform, storage, and network requirements, running in geographically dispersed data centers. Furthermore, individual packaged applications often have different development life cycles which require multiple environments for development, test and certification, production, and maintenance. As a result, designing the harmonized infrastructure solution is labor-intensive and complex. Because dedicated IT resources (servers, storage, and network) must be used to satisfy heterogeneous requirements, the total cost of the solution can end up eroding the harmonization business case return.

Cost-effective scalability proves elusive

Application harmonization initiatives are expected to deliver more than point-in-time cost and efficiency improvements; senior business leaders expect to gain competitive operating leverage through flexible and agile global execution capabilities. This means that packaged application landscapes will also need to cost-effectively respond to shifting and increasingly diverse business growth and shorter strategic planning horizons. Such landscapes will need to affect operational efficiencies across the enterprise, while also enabling local customization. Scalability and flexibility, therefore, become key design points of the IT infrastructure supporting enterprise business applications.

However, today's infrastructure solutions, from servers and systems to management and administration tools, are siloed and constrained by hardware architecture. The result is a collection of systems and tools that do not interoperate, are expensive to maintain and manage, and whose workload performance and growth issues are solved by "adding another box."

IBM zEnterprise System value proposition

Today, many clients deploy their multitier workloads on heterogeneous infrastructures. For example, their mission-critical workloads and data serving need the availability, resiliency,

security and scalability strength of the mainframe. Meanwhile, other workloads, such as those handling intensive computations or low-cost, non-mission-critical transactions, can be better suited to run on UNIX® or x86 architectures. Creating and managing these multiple and heterogeneous workloads, implemented on many physically discrete servers, can lead to inefficient and ineffective solutions.

To address this issue, the zEnterprise System provides a new architecture, consisting of heterogeneous virtualized processors that work together as one infrastructure. The system introduces a revolution in the end-to-end management of heterogeneous systems, while offering expanded and evolved traditional System z capabilities.

This architecture breaks out of the current IT infrastructure paradigm. With this paradigm shift, zEnterprise delivers exceptional data management capabilities while accommodating mixed workloads with a close affinity to the data.

Overview of IBM zEnterprise System capabilities

The zEnterprise System consists of three components: IBM zEnterprise 196 (z196), IBM zEnterprise BladeCenter® Extension (zBX), and IBM zEnterprise Unified Resource Manager (Unified Resource Manager); Figure 6 summarizes these components.
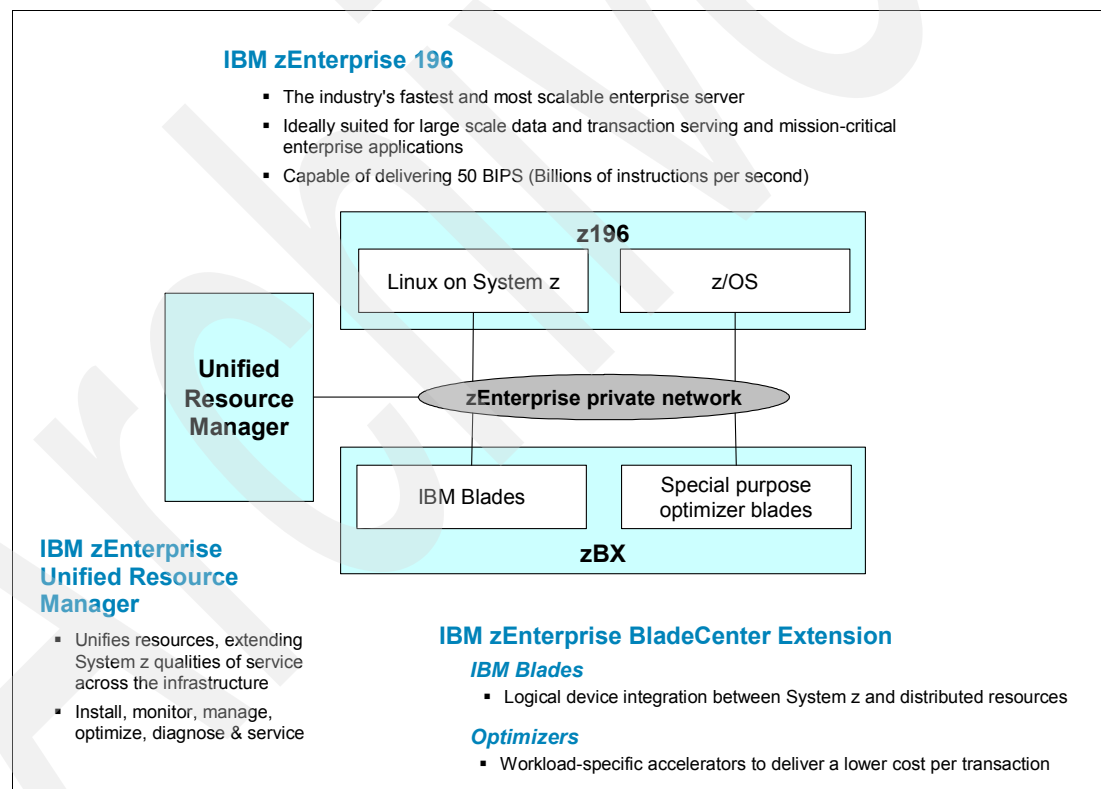

Figure 6   IBM zEnterprise System - the three components of zEnterprise

The zEnterprise is designed to advance your business agenda and overcome your IT challenges. With zEnterprise, end-to-end solutions based on multiplatform workloads can be deployed and jointly managed. As shown in Figure 7, existing capacities have been improved upon and additional capacities have been added by using heterogeneous technology and Unified Resource Manager.
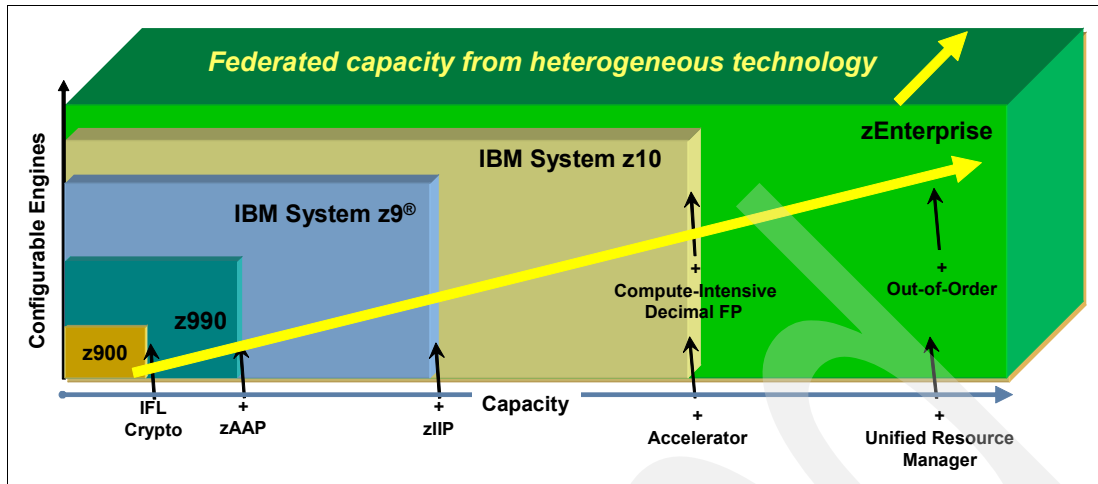
Figure 7   IBM zEnterprise System - capacity and scalability

Next, we take a closer look at each component and its capabilities.

High-end mission-critical platform: z196

The z196 is the industry's fastest and most scalable enterprise server, and it improves upon the capabilities of its predecessor, the System z10® Enterprise Class (z10 EC). The z196 not only has the capabilities and scalability of physical resources (for example, processor, memory, I/O and so on), but also offers better reliability, availability and serviceability (RAS). It is the ideal platform for mission-critical enterprise workloads.

Traditional workloads and data serving - z/OS

The z/OS® Operating System offers extremely high scalability and performance for applications and data serving, and high availability and cross-system scalability enabled by Parallel Sysplex® and GDPS® solutions. z/OS provides a highly optimized environment for application integration and data management, with an additional performance benefit if both the application and the data are hosted on z/OS. It provides the ideal environment for both traditional application workloads and leading-edge technologies, as well as large scalable data serving, especially for mission-critical workloads.

Mission-critical scale-out workload - z/VM and Linux

The z196 offers software virtualization through z/VM®. The extreme virtualization capabilities provided by z/VM enable the high virtualization of thousands of distributed servers on Linux® on System z. Linux on System z is an ideal platform for mission-critical scale-out workloads such as web applications, business intelligence applications, and more.

Cost-effective application and special purpose optimizer - zBX

The zBX supports two types of blade servers: IBM blades, which can run a wide variety of applications; and IBM special purpose optimizer blades, which are dedicated to a specific task, such as the query processing of databases.

IBM blades

The IBM blades provide the ability to run the wide variety of applications typically found in UNIX and x86[2] architectures. This provides opportunities for lower-cost consolidation of distributed workloads.

---

[2] In the first half of 2011, IBM intends to offer a System x blade running on Linux on System x in the IBM zEnterprise System on zBX Model 002.

Special purpose optimizer blades

zEnterprise provides an architecture that allows you to attach IBM special purpose optimizer blades. The first of this kind is *IBM Smart Analytics Optimizer for DB2® for z/OS V1.1*, which may dramatically accelerate certain data warehouse queries for DB2 for z/OS running on the z196, thereby contributing to reducing operational costs and improving the performance of business intelligence processes.

zEnterprise Unified Resource Manager

The *zEnterprise Unified Resource Manager* is Licensed Internal Code (LIC), also known as firmware, that is part of the Hardware Management Console (HMC). Unified Resource Manager is a key component of zEnterprise. It provides integrated management across all elements of the system. Unified Resource Manager will improve your ability to integrate, monitor, and dynamically manage heterogeneous server resources as a single, logical virtualized environment, while contributing to cost reduction, risk management, and service improvement.

zEnterprise ensemble

A zEnterprise *ensemble* is a collection of up to eight nodes, each composed of a z196 and optionally a zBX. The physical resources of servers are managed as a single virtualized pool by the Unified Resource Manager using the Hardware Management Console.

Private networks

Two new internal, secure networks are introduced for the zEnterprise ensemble. These networks are the *intraensemble data network* (IEDN) and the *intranode management network* (INMN). Existing external networks are supported as well. An IEDN is used for application data communications. An INMN is used for platform management within a zEnterprise. These networks have enough bandwidth for their purposes (10 Gbps for IEDN and 1 Gbps for INMN).

Hypervisors

The IBM POWER7 blade provides *PowerVM™* for IBM POWER7™. PowerVM offers industry-leading virtualization capabilities for AIX®. This hypervisor is managed, along with the hypervisors of z196 (PR/SM and z/VM), by a single point of control using Unified Resource Manager.

zEnterprise solves today's business intelligence and analytics challenges

The world is rapidly becoming fully digitized, where practically everything can be represented by a sequence of bits stored on electromagnetic devices and accessed through electronic devices. This capability is generating massive amounts of data every day. Innovative organizations are actively looking for ways to realize value from this data, and this is where business intelligence and analytics come into play.

BI applications have become mainstream at an increasing number of organizations, with business analysts driving the process and demanding a fast response from their IT departments. This development clearly illustrates how IT and business areas can come together to deliver better results: successful BI projects make a positive impact on business, raising the CIO's corporate visibility and helping IT demonstrate its value.
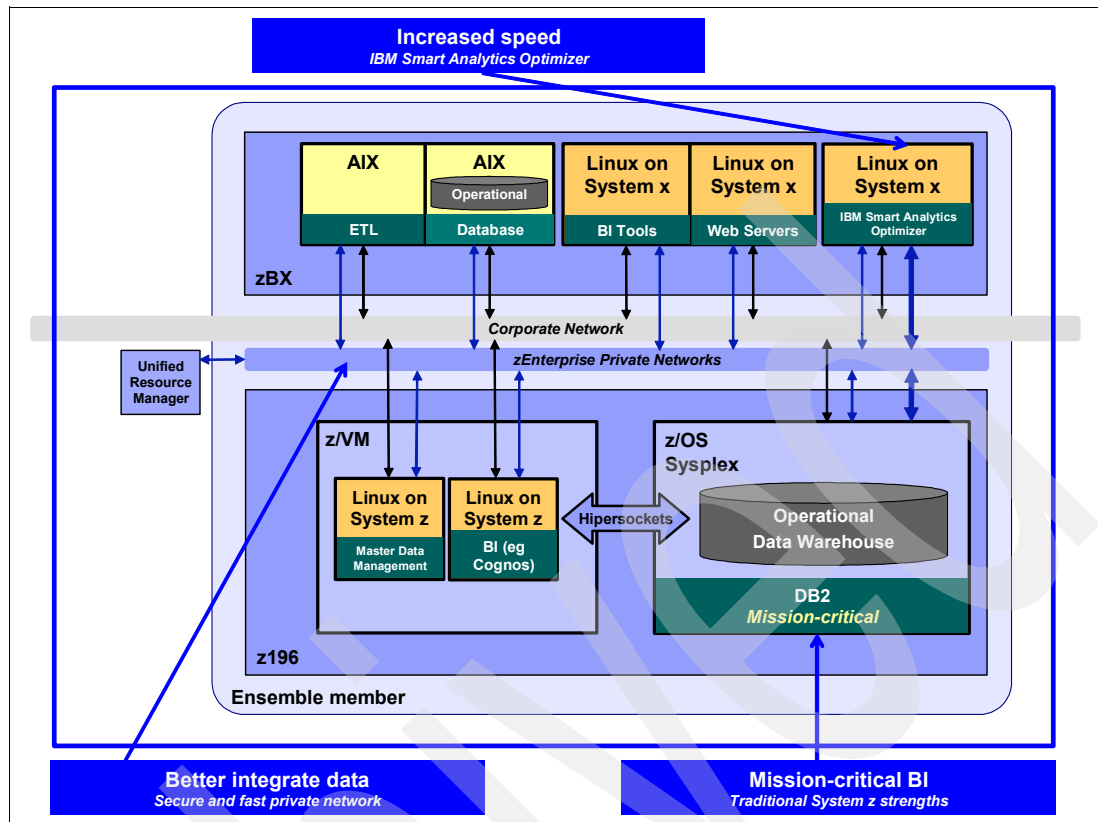
Figure 8   zEnterprise value in BI and analytics

Increasing speed: The IBM Smart Analytics Optimizer

With the introduction of the zEnterprise, IBM expands its presence in the BI and analytics space (Figure 8) by providing a new system capability, one that is unprecedented in the marketplace: the IBM Smart Analytics Optimizer, which speeds up the response time of the BI and analytics applications by one to two orders of magnitude.

The Smart Analytics Optimizer is a workload optimizer, appliance-like add-on that enables the integration of business insights into operational processes to drive winning strategies. It accelerates selected queries, with unprecedented response times.

The Smart Analytics Optimizer is a combination of hardware accelerators running on the zBX component, tooling for development and deployment, and additional DB2 for z/OS features, all provided as a single and integrated out-of-the-box package. For the BI applications and for the DBAs, the Smart Analytics Optimizer is a logical extension of the DB2 for z/OS capabilities that is totally transparent to the entire process. Queries against the DB2 for z/OS tables are automatically routed to IBM Smart Analytics Optimizer when certain criteria are met.

After the data warehouses or data marts are loaded, when users run the applications, the Smart Analytics Optimizer becomes automatically engaged in the process. It uses in-memory data and IBM patented compression algorithms on multicore, multithread parallel processing, for vastly improved performance. No change is required to existing solutions because IBM Smart Analytics Optimizer deployment is totally transparent.

zEnterprise and Smart Analytics Optimizer deliver value for your business in several ways, by producing a robust and highly available solution; enabling faster output from BI and analytics

solutions; providing consistent response times; reducing investment by lowering the amount of storage required compared to other solutions through the use of compression algorithms; and reducing the need for human intervention by automating the BI infrastructure setup process and DBA tasks.

Better integrate data: zEnterprise topology

zEnterprise addresses the BI and analytics challenges in a new and innovative way. By incorporating multiple servers and databases into one architecture so servers are connected to each other through a high-speed, dedicated private network and managed from a single point of control, ETL processes can be better streamlined and significantly reduced in time.

By hosting source files and databases on IBM blades, in Linux on System z or z/OS, all managed by zEnterprise, the information in the data warehouse can be actualized quicker and more frequently. Extraction and transformation of data can take place wherever it makes most sense from a performance and throughput point of view, and transmission to the data warehouse takes place over a super-fast internal network.

Data is often sensitive and confidential. In zEnterprise the risk of security breaches is greatly reduced, because data travels over the internal private and secure network.

Making BI mission-critical: traditional System z strengths

System z is well known in the IT industry for its strengths in housing corporate data and its ability to handle huge amounts of data, in batch or online mode. DB2 for z/OS is the cornerstone of IBM strategy for BI and analytics solutions, and is tightly integrated with the IBM System z hardware and software portfolio. All of these strengths are available in zEnterprise and are improved even further.

The z/OS Workload Manager component assigns business importance to workloads and prioritizes accordingly. To accelerate complex queries using the Smart Analytics Optimizer, System z has the capabilities to deliver a complete solution for BI. zIIP processors in the z196 component continue to play an important role in reducing cost in scenarios where remote applications, including those on zBX, access DB2 for z/OS data. This scenario is very likely in ETL processes or during BI and analytics queries processing.

By deploying zEnterprise with the Smart Analytics Optimizer, clients benefit from the DB2 for z/OS strengths, the z/OS batch subsystem, workload management capabilities, zIIP specialty engines and the classic System z qualities of high performance, and highly scalable processing power.

User BI and analytics applications that run on zEnterprise accessing DB2 for z/OS may also benefit from the Smart Analytics Optimizer, regardless of where the queries come from. In this scenario, if zEnterprise is configured with the zIIP specialty engine, it gets involved as well, which represents additional cost savings.

zEnterprise solves today's virtualization challenges

Realizing business value from virtualization investments demands more than simply reducing the cost to deploy new business applications; it requires establishing the virtualized infrastructure as a versatile instrument of business strategy and a flexible, low cost foundation for building innovative end-customer products and services. Today's multitier and composite business applications, with their heterogeneous infrastructure deployments, require more advanced virtualization capabilities of their infrastructure. These business applications need virtualized deployment designs that are "fit for purpose", that is, application components are deployed to virtualized resources that best match the component's functional and nonfunctional requirements.

To cut deployment cycle time, today's business applications also need their storage and network requirements to be satisfied virtually. Reducing the total cost to deploy, secure, manage, and maintain such business applications will remain a business imperative. As a result, virtualization management capabilities that integrate and automate IT service management across heterogeneous and virtualized platforms are required.

IBM zEnterprise answers today's virtualization challenges with practical heterogeneous virtualization (Figure 9) that provides real business value now because paradigm shifts at the application level are not required.
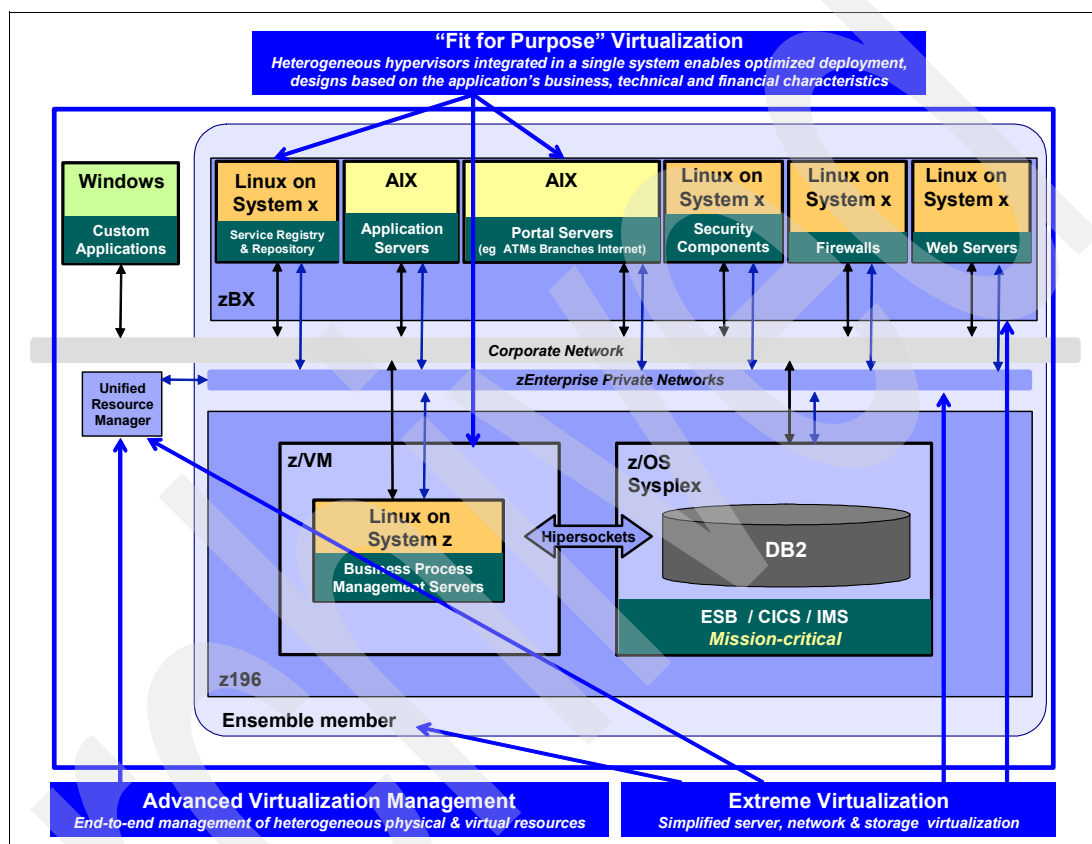

Figure 9   IBM zEnterprise virtualization: real business value for today's heterogeneous applications

Extreme virtualization

Virtualization has become a "must do now" in today's data centers. Current economic uncertainty, however, demands more extreme virtualization capabilities to expand an organization's capacity to innovate for competitive advantage. Business applications are, and will continue to be, inherently heterogeneous. Heterogeneity, therefore, is the cornerstone of extreme virtualization for IBM zEnterprise. With zEnterprise extreme virtualization, enterprises can significantly increase IT resource utilization and thereby realize a higher return on investment, while simultaneously reducing management, facility, and energy costs, which lowers operating expenses. The net result is real savings passed directly to the bottom line, where they contribute to profitability.

The zEnterprise introduces a new concept in IT infrastructures called an *ensemble*. An ensemble can comprise up to eight nodes, with each node consisting of a z196 and its optional zBX. The zEnterprise ensemble provides a logical system of highly virtualized heterogeneous systems that is managed as a single entity and on which today's heterogeneous business applications can be deployed. Additionally, for new applications,

zEnterprise offers a lower-cost yet rich and versatile development environment for getting mission-critical applications up and running fast.

Extreme virtualization in zEnterprise comprises more than just virtualizing heterogeneous server resources; it also includes storage and network resources. Virtual LANs (called HiperSockets™) and virtual switches (called VSWITCH) replace physical routers, switches, and their cables while eliminating security exposures and simplifying administration tasks.

Because HiperSockets implement memory-to-memory data transfer, performance is improved for many business applications with a multitier, information management, application serving, or packaged application topology. Physical storage resources can be defined to the zEnterprise ensemble as a pool from which virtual disks can be created and allocated/deallocated to business applications. Not only is virtual storage management simplified, but also performance scales easily by adding storage controllers and capacity to the managed storage pool.

Extreme virtualization is essential to reducing cost, energy, and complexity in today's data centers. But virtualization capabilities and maturity differ significantly among UNIX, x86, and mainframe platforms. IBM zEnterprise delivers the virtualized infrastructure demanded by today's existing heterogeneous business applications, while also supporting business growth and innovation.

Fit for Purpose virtualization

Fit for purpose is an optimization approach to designing the deployment architecture of a business application such that the application's fundamental purpose is achieved: creating maximum business value. Fit for purpose is distinguished from other deployment design approaches because it addresses holistically 12 key considerations that are critical to ensuring an optimal match of IT resources in the application's deployment design.

As shown in Figure 10, the four classes of business applications have very different computing characteristics which need to be matched optimally to the computing capabilities of a platform because UNIX, x86, and mainframe platforms differ in their ability to fulfill the different computing requirements well. For example, mainframes and some implementations of UNIX excel at processing very high volumes of transactions while delivering world-class levels of service, resiliency, and security. UNIX servers are stronger choices for numerical and floating point computation-intensive and business analytical functions. x86 platforms are better suited for throughput-oriented functions that implement high thread counts.
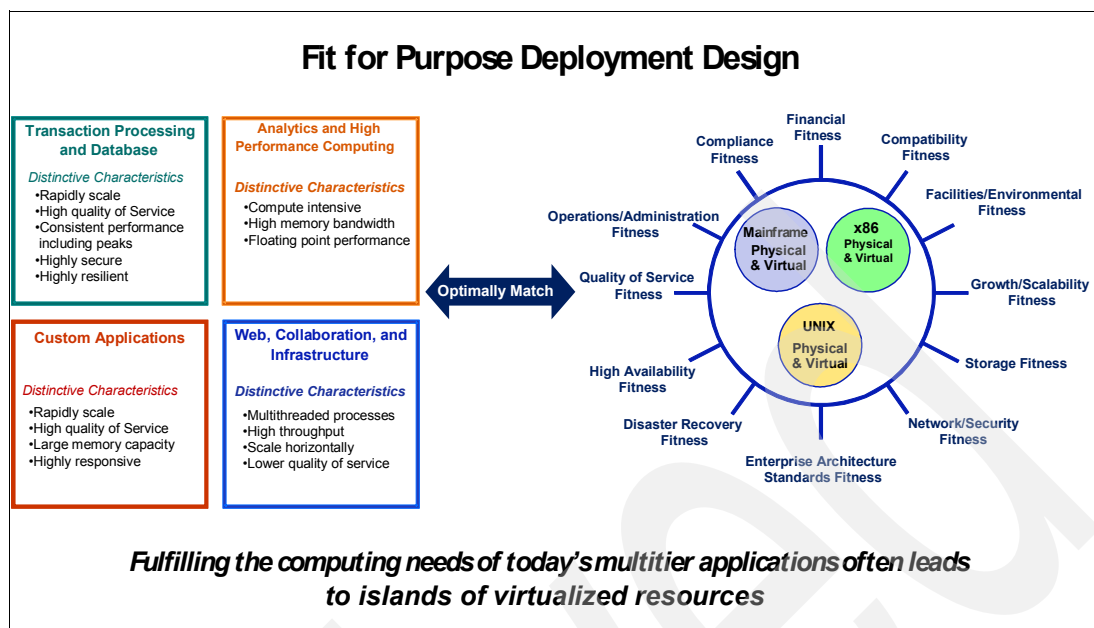
Fit for Purpose Deployment Design

Transaction Processing and Database

Distinctive Characteristics
•Rapidly scale
•High quality of Service
•Consistent performance including peaks
•Highly secure
•Highly resilient

Analytics and High Performance Computing

Distinctive Characteristics
•Compute intensive
•High memory bandwidth
•Floating point performance

Custom Applications

Distinctive Characteristics
•Rapidly scale
•High quality of Service
•Large memory capacity
•Highly responsive

Web, Collaboration, and Infrastructure

Distinctive Characteristics
•Multithreaded processes
•High throughput
•Scale horizontally
•Lower quality of service

Optimally Match

Financial Fitness
Compliance Fitness
Compatibility Fitness
Facilities/Environmental Fitness
Operations/Administration Fitness
Quality of Service Fitness
Growth/Scalability Fitness
Storage Fitness
High Availability Fitness
Disaster Recovery Fitness
Network/Security Fitness
Enterprise Architecture Standards Fitness

Mainframe Physical & Virtual
x86 Physical & Virtual
UNIX Physical & Virtual

Fulfilling the computing needs of today's multitier applications often leads to islands of virtualized resources

Figure 10   Heterogeneous islands of virtualized resources ultimately limit deployment fitness

Today's heterogeneous and multitier business applications are the result of leveraging tiered architectures to more optimally match application functions to the strengths of the different platforms. Fit for purpose virtualization tries to improve the deployment "fitness" of an infrastructure to fulfill the diverse computing requirements of business applications, but it ultimately results in more islands of virtualized resources, which only complicates the end-to-end management of the applications.

IBM zEnterprise improves fit for purpose virtualization by providing more deployment options and enhanced flexibility in deployment designs for multitier business applications because it delivers a multiarchitecture, integrated hardware system that spans UNIX, x86, and mainframe technologies (Figure 11).
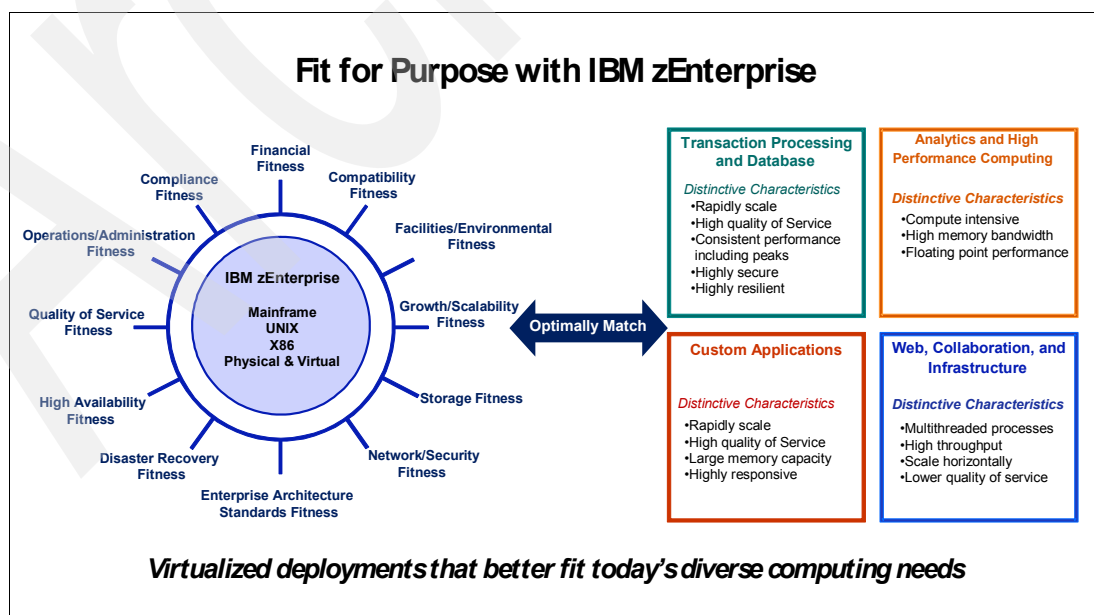

Fit for Purpose with IBM zEnterprise

Financial Fitness
Compliance Fitness
Compatibility Fitness
Operations/Administration Fitness
Facilities/Environmental Fitness
Quality of Service Fitness
Growth/Scalability Fitness
Storage Fitness
High Availability Fitness
Disaster Recovery Fitness
Network/Security Fitness
Enterprise Architecture Standards Fitness

IBM zEnterprise
Mainframe
UNIX
X86
Physical & Virtual

Optimally Match

Transaction Processing and Database

Distinctive Characteristics
•Rapidly scale
•High quality of Service
•Consistent performance including peaks
•Highly secure
•Highly resilient

Analytics and High Performance Computing

Distinctive Characteristics
•Compute intensive
•High memory bandwidth
•Floating point performance

Custom Applications

Distinctive Characteristics
•Rapidly scale
•High quality of Service
•Large memory capacity
•Highly responsive

Web, Collaboration, and Infrastructure

Distinctive Characteristics
•Multithreaded processes
•High throughput
•Scale horizontally
•Lower quality of service

Virtualized deployments that better fit today's diverse computing needs

Figure 11   IBM zEnterprise enhances each dimension of deployment fitness for a business application

The zEnterprise ensemble provides a single logical system from which virtualized heterogeneous resources can be provisioned for a multitier application using its uniform management interface, the Unified Resource Manager. As a result, major architectural changes at the application level are not required: the existing heterogeneous architecture can be preserved when the business application is virtualized on zEnterprise (Figure 12).

Moreover, each dimension of deployment fitness is enhanced by zEnterprise's integrated and unified management capabilities for both physical and virtual resources. In this way, the distinctive capabilities of all platform architectures can be deployed optimally for business applications, and thereby significantly increase their capacity to create business value.
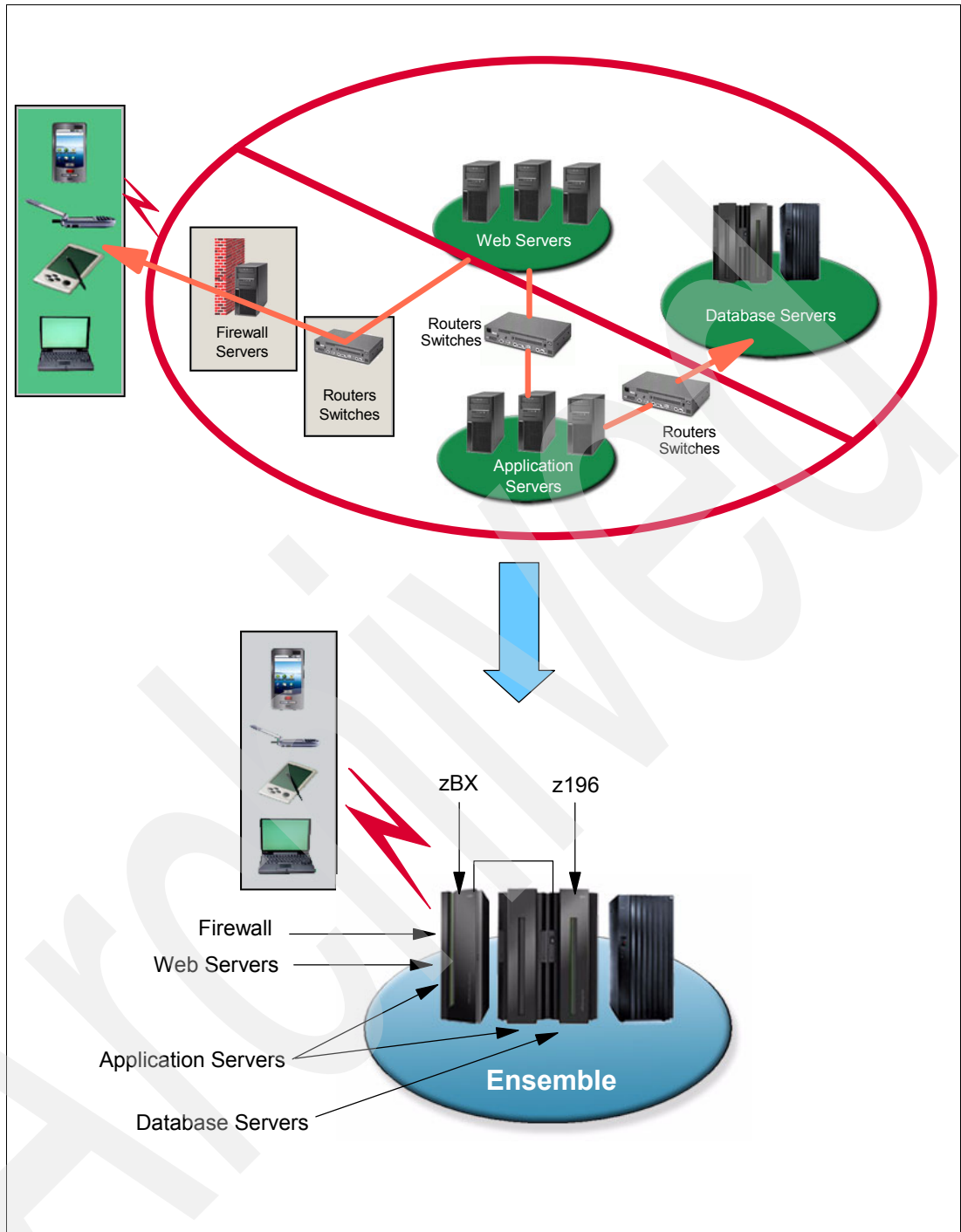
Figure 12   Paradigm shifts at the application level are not required

Advanced virtualization management

Virtualization can deliver significant business value but it also introduces a new form of IT management complexity when the infrastructure is heterogeneous. To properly and efficiently manage today's multitiered and composite applications deployed on heterogeneous infrastructure, administrators require tools that provide end-to-end views of applications, enable dynamic and policy-based workload performance management capabilities, and automate the virtual server management life cycle.

IBM zEnterprise delivers advanced virtualization management through industry-leading security, availability, scalability, virtualization, and management capabilities. The zEnterprise ensemble provides a logically integrated and managed view of the infrastructure resources through the Unified Resource Manager. The Unified Resource Manager provides extensive management capabilities that integrate, monitor, and dynamically manage heterogeneous server resources and storage resources as a virtualized logically single environment.

zEnterprise solves today's risk management and compliance challenges

System z has been acknowledged as the platform of choice for running mission-critical workloads, and is especially appreciated by clients that are averse to risk. Due to its unique capabilities it has unmatched levels of availability, security, and resiliency that mitigate risk for the business.

zEnterprise not only improves these capabilities for traditional mainframe workloads but also provides, through its heterogeneous architecture, the foundation to extend some of these qualities to the distributed environment where key components of business applications are found.

Simplification

Simplification is probably the clearest value of zEnterprise. Its unique capabilities for system management are used to reduce complexity and increase security for dynamic and changing environments.

Unified Resource Manager integrates and centralizes the hardware management including virtualization components that are shipped, pre-tested, pre-configured, serviced, and deployed as microcode. This simplifies management, avoids operational errors, and improves availability and performance control, thereby mitigating the risk of missing Service Level Agreements.

zEnterprise provides cost-effective risk management by allowing you to standardize the placement of components where they best fit according to their required qualities of service. An example is shown in Figure 13, where the ESB component was moved to z/OS and Web servers were kept on x86 but moved from the Windows® operating system to the Linux operating system.
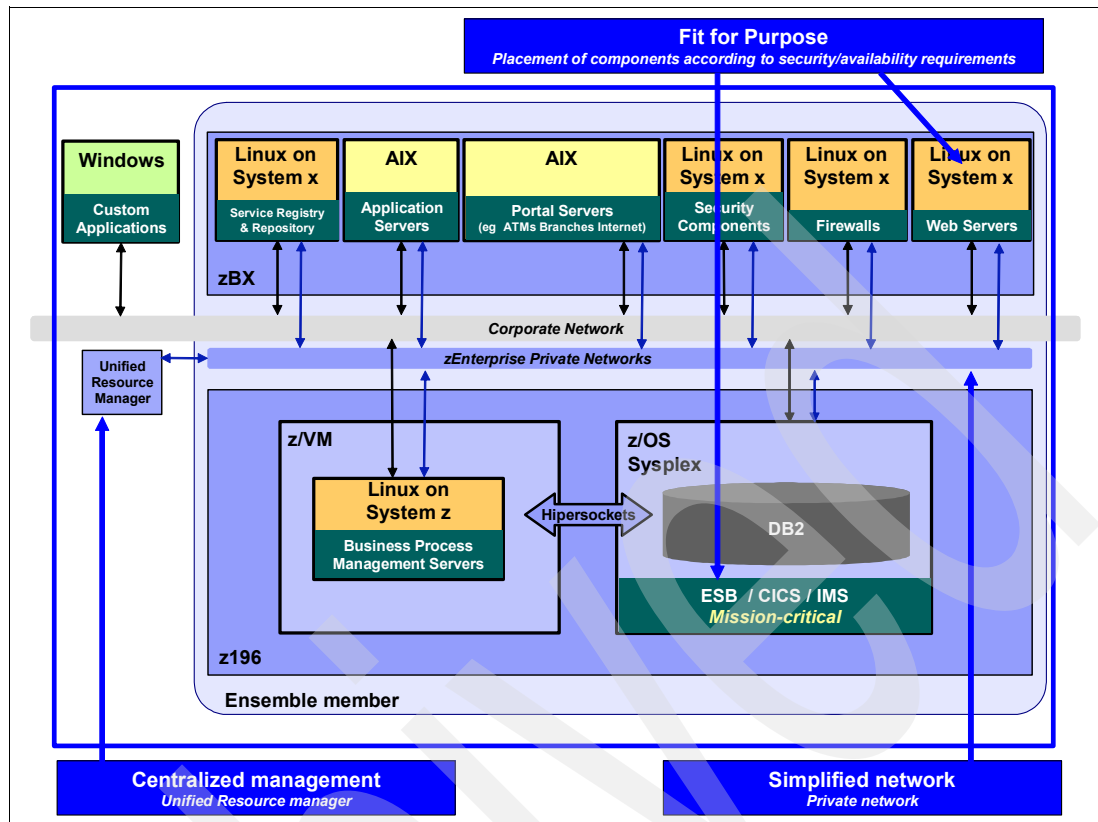
Figure 13   zEnterprise value in reducing complexity

zEnterprise addresses the complexity of the network previously depicted with a private network to connect the servers inside its environment, thereby simplifying efforts to secure and manage the network.

Continuously available and reliable

With its heterogeneous architecture, zEnterprise joins the proven capacity of IBM System z to manage vast amounts of data with the highest levels of availability, to create a unique value proposition.

The z196 with DB2 for z/OS takes advantage of mainframe near-linear large scalability, unmatched in the IT world, to build a robust and highly secure environment with continuous availability processes, thereby minimizing planned and unplanned outages. The use of Parallel Sysplex technology will help eliminate single points of failure.

This implementation might also benefit from the disaster recovery (DR) infrastructure that often exists in the mainframe environment, as shown in Figure 14 on page 23. Inside zEnterprise disaster recovery sites might be managed together within the same ensemble.
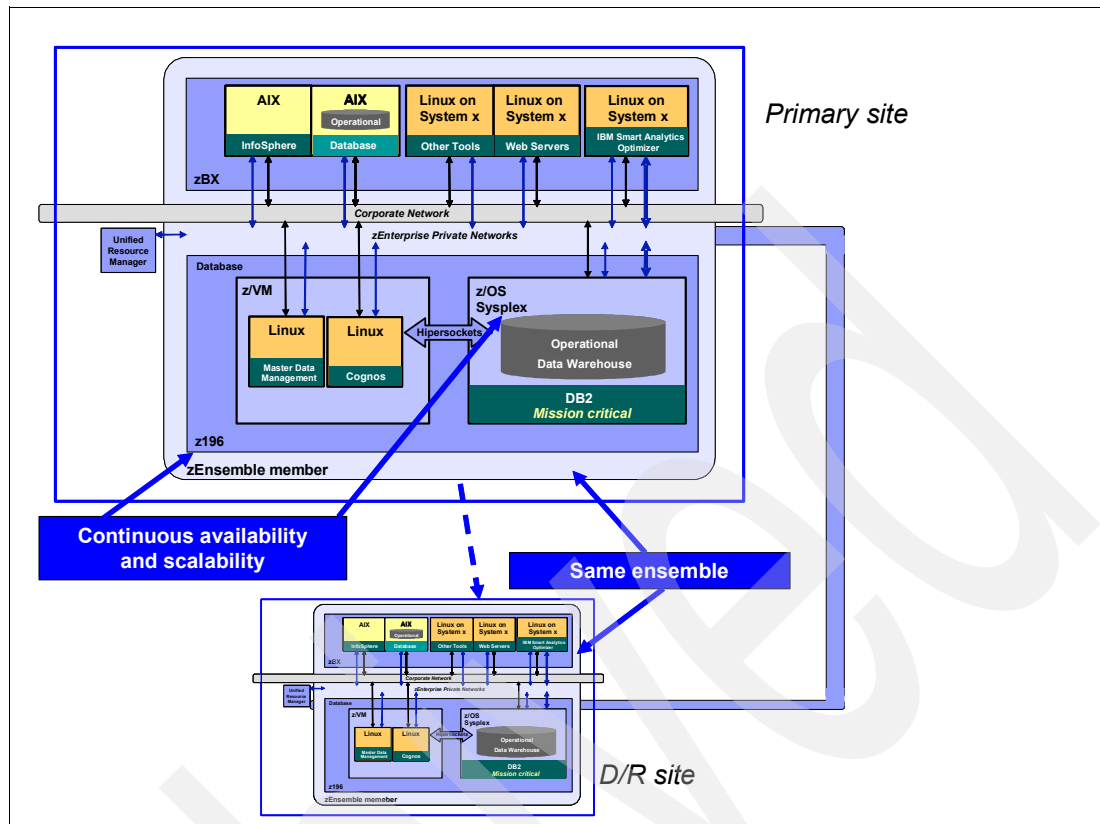
Figure 14   zEnterprise value in providing availability and disaster recovery

Business intelligence and data warehouse processes would benefit from the use of an accelerator on a zBX that allows up to a 10-time performance gain for certain types of queries without the need to transfer large quantities of data through the external network. zEnterprise with Smart Analytics Optimizer could speed up the process of refreshing the data used by analytics so that decisions could be based on more current information, thereby creating an opportunity to implement risk management analysis such as fraud prevention.

zEnterprise solves today's application harmonization challenges

Application harmonization initiatives have often proved to be a watershed event in IT's relationship with the business. Time-to-value and benefits capture metrics not only signal the importance of such high-profile investments to the business, but also are the decisive measure of IT's value-add. Application harmonization initiatives are therefore prime opportunities for CIOs to expand business impact and increase the return on IT investment.

Application harmonization efforts typically implement a shared services model that consolidates and centralizes application management and hosting services. However, "one size fits all" shared services models do not work; effective application harmonization implements an appropriate level of commonality across business units, product lines, and regions. Increasingly, having the "right information" at the "right time" across the extended enterprise is key to staying ahead of the competition, innovating faster, and improving operational efficiency. Consequently, packaged application landscapes must optimally balance standardization with local customization and have the flexibility to accommodate change from both internal and external organizations. The packaged application infrastructure must therefore integrate heterogeneous platforms, optimally utilize IT resources, and cost-effectively scale on demand.

IBM zEnterprise answers today's application harmonization challenges with an innovative infrastructure foundation that supports harmonized shared services models and that can keep pace with the diverse demands of globalization (Figure 15).
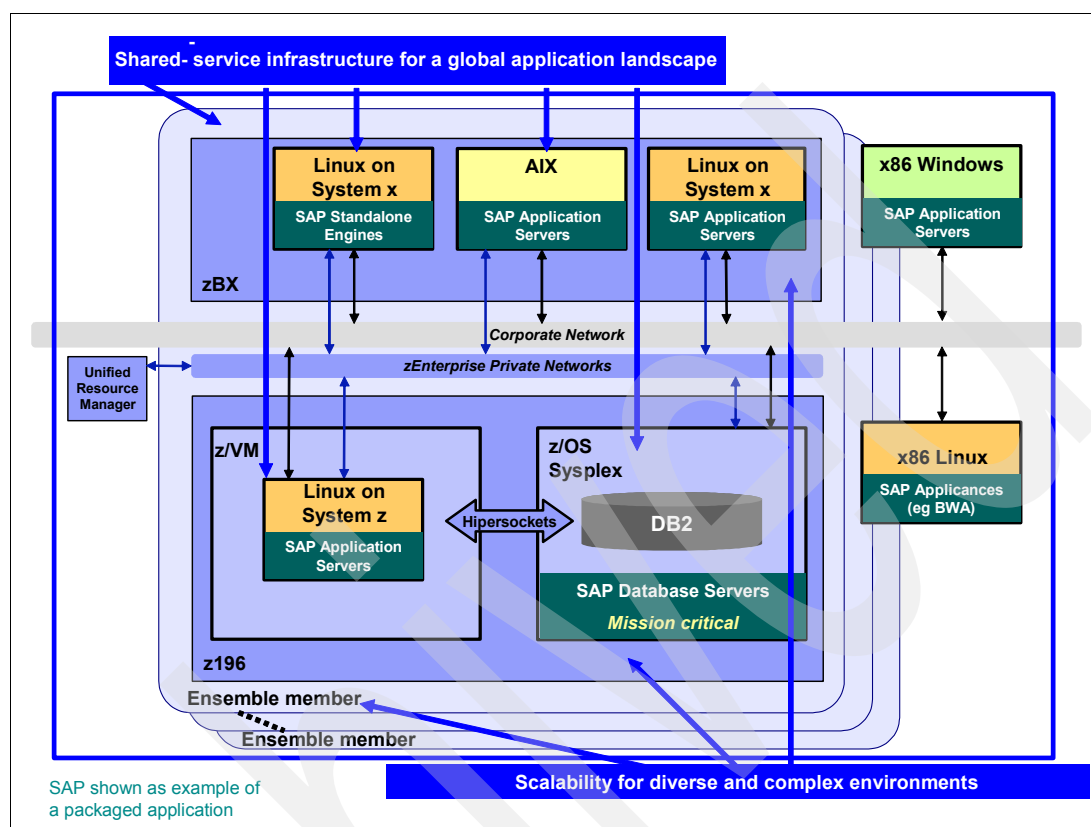

Figure 15   zEnterprise value in application harmonization

Shared-services infrastructure for a global application landscape

The vision of harmony is the easy part; deploying and operating the shared services infrastructure is a different matter. Often encompassing the hundreds to thousands of different versions, modules, and customization that comprise the packaged application landscape, consolidation to a common IT infrastructure is a complex technical undertaking. For example, the IBM internal SAP harmonization initiative included the consolidation of 600,000 SAP instances and over 80 TB of online data. IBM zEnterprise offers a new infrastructure paradigm that simplifies and speeds up the technical consolidation of the packaged application landscape.

IBM zEnterprise is uniquely suited to be the shared-services infrastructure for the harmonized application landscape (Figure 16). zEnterprise provides, in a single logical virtualized system, the heterogeneous computing resources needed to optimally deploy and run today's packaged applications. Whereas distributed deployments typically require additional physical resources (hardware and software) for supporting the development, test, and disaster recovery environments for a packaged application, a single zEnterprise can support all of the operational environments needed. Because resources can be shared across workloads, zEnterprise utilization normally ranges between 85% to 100%; for distributed implementations, server utilizations run significantly lower even when using a distributed hypervisor.

Packaged application deployments on zEnterprise benefit from near-zero downtime and continuous availability even during maintenance for hardware, operating system, and

database components. Distributed operating systems and servers, on the other hand, provide fewer recovery capabilities and in many cases the common response to problems is to reboot. z196 continues to provide best-in-the-industry reliability, availability, and serviceability (RAS), as its predecessors have done for decades.

Moreover, zEnterprise offers several new RAS enhancements to further reduce or eliminate planned, scheduled, and unscheduled outages. For example, to increase memory availability, zEnterprise introduces redundant array of independent memory (RAIM), a fully redundant memory system that can identify and correct memory errors without stopping.

Distributed operating systems and hypervisors provide varying degrees of security. In contrast, zEnterprise provides comprehensive protection of business-critical data from all types of IT security threats and is designed to achieve Common Criteria EAL 5 certification[3]. Further, zEnterprise's 10 Gbps private network reduces the number of hops as well as points of failure and security vulnerabilities involved in accessing that data, thereby ensuring the security, performance, and reliability demanded by the packaged application landscape. With respect to data privacy, the z196 provides data encryption with both clear key and secure key, tape encryption, disk encryption, secured key and storage management, and database oriented multi-level security (MLS) using z/OS and DB2.

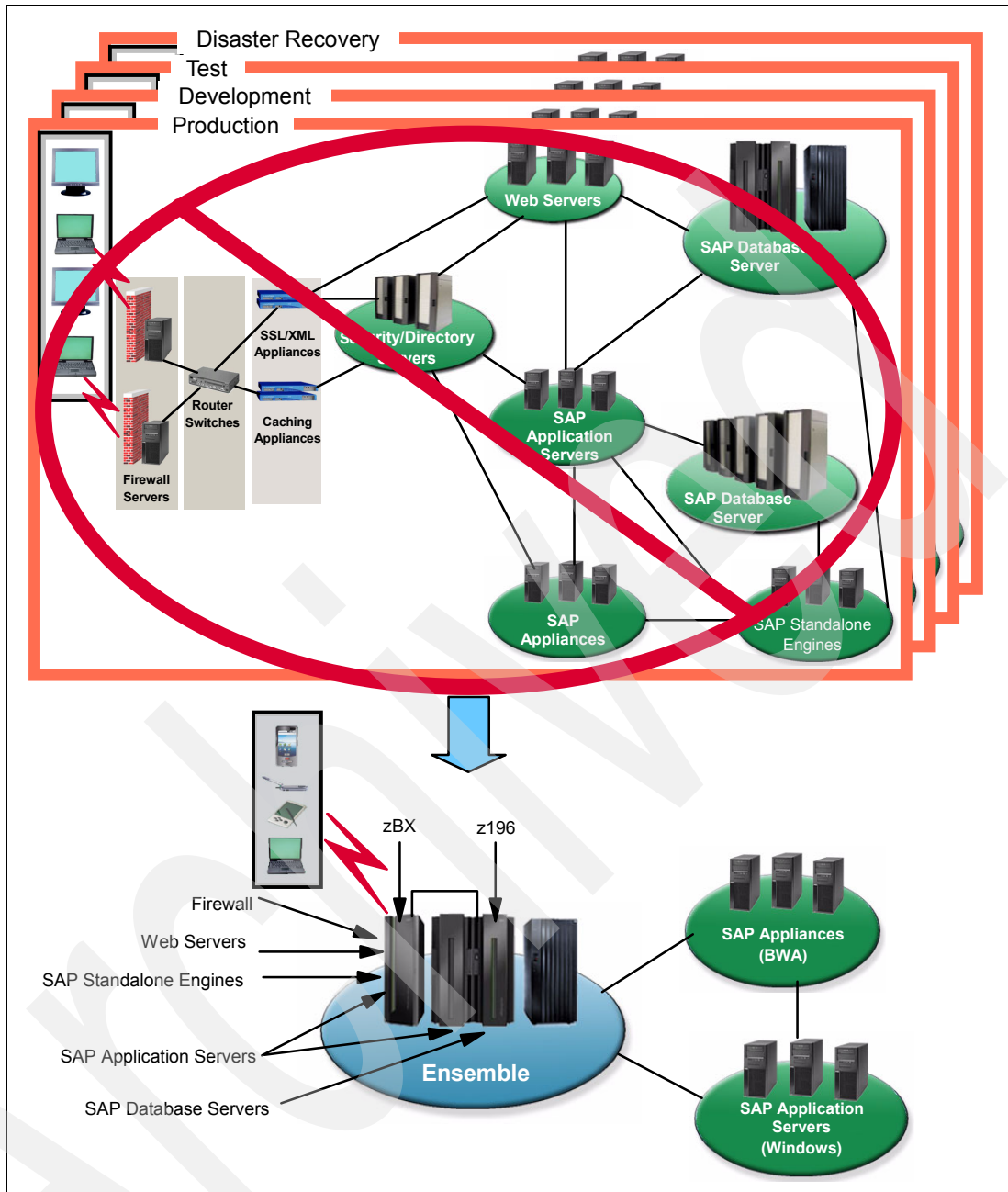
[3] Certification is pending for z196.

Figure 16   zEnterprise: a smarter infrastructure for harmonized packaged application landscapes

Scalability for diverse and complex environments

For companies to realize rapid time-to-value from their application harmonization initiative, the enabling IT infrastructure must deliver quick wins as well as long-term benefits. As previously described, IBM zEnterprise delivers quick wins by speeding up the technical consolidation phase for packaged application harmonization initiatives. Regarding long-term benefits, IBM zEnterprise is unmatched in satisfying the scalability and workload management demands of the harmonized application landscape.

z196 can be configured with up to 80 processors, with each processor running at 5.2 GHz on a quad-core chip, which is the fastest in the industry. Most modern distributed servers are in the 2.0 to 3.0 GHz range. Itanium® technology only runs at 1.5 to 1.7 GHz and Nehalem technology is estimated at only 2.7 GHz.

In addition, zEnterprise processors can be characterized dynamically as specialty processors that are optimized for packaged application components such as enterprise database and transaction processing and for workloads like Java™ and Linux. In contrast, most distributed systems do not provide specialty processors for optimized instruction processing for diverse workloads like those of packaged applications.

IBM zEnterprise takes advantage of InfiniBand, an industry-standard specification that defines first-order interconnection technology, to deliver unmatched data throughput and input/output (I/O) performance: up to 1024 I/O channels can be configured that can run data rates of up to 8 Gbps. For seamless network and Internet connectivity, zEnterprise supports up to 96 ports that provide bandwidths up to 10 Gbps. Moreover, zEnterprise offloads I/O processing to its I/O subsystem and thereby increases CPU cycles for business workload processing. For distributed servers, I/O competes for CPU cycles with business workload instructions.

For managing the diverse workloads that comprise packaged applications, Unified Resource Manager delivers dynamic, automated, and policy-based resource provisioning, deployment, allocation/reallocation, and optimization. The Unified Resource Manager has a global performance view of all the resources, physical and virtual, that support workloads deployed in a zEnterprise ensemble. This type of knowledge is used to optimize resource allocations based on the service level policies defined for the various workload components that comprise the packaged application. In this way, zEnterprise is able to efficiently and effectively support the processing needs and service level objectives of packaged application landscapes across the application life cycle, from development and testing to production.

Getting started with IBM zEnterprise

With IBM zEnterprise, today's CIOs have new and significant infrastructure options that can be leveraged in their quest to make innovation real, raise the ROI of IT, and expand business impact. Like their financial counterparts, knowing what options to acquire depends on the business model for which they will be acquired and the operating assets that they enable. Once acquired, knowing when to exercise for optimal value depends on the uncertainty of the products and services markets in which the operating assets will be used. A staged investment approach, such as the one shown in Figure 17 on page 28, is therefore recommended to maximize business value captured and to minimize time to capture.
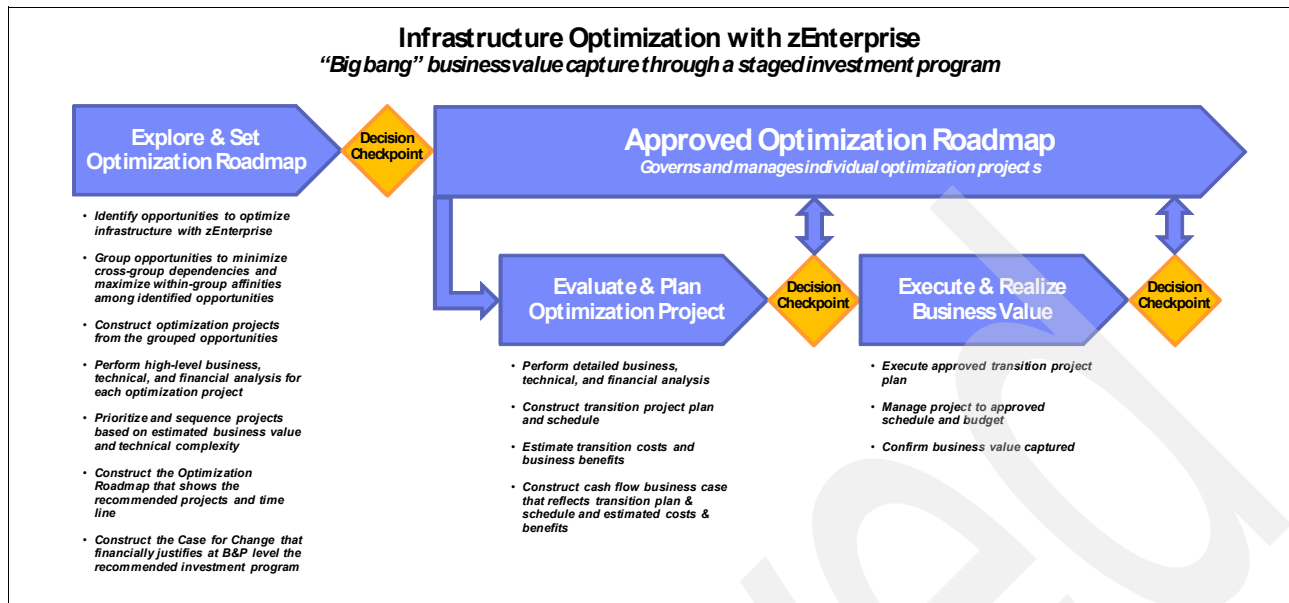
Figure 17 For maximum business value, take a comprehensive view and execute in stages

Explore and set the infrastructure optimization roadmap

The overarching business purpose of the IT infrastructure is to provide a flexible, low-cost technological foundation that continuously improves the flow of business processes, both today's and tomorrow's. Because infrastructure affects process efficiency and effectiveness through the business application layer, the starting point is to understand how IBM zEnterprise optimizes current and planned business applications and their life cycles.

IBM zEnterprise offers new options for virtualizing, consolidating, harmonizing, automating, and interoperating the application components and the infrastructure resources that comprise the business application landscape. From an application life cycle perspective, zEnterprise also provides new options for enhancing the efficiency of IT service management activities related to operating, managing, and supporting the application landscape.

This stage explores the potential business value of each new option, both short- and long-term, by performing a high-level business and technical analysis of the optimization opportunities identified, and it documents the expected business impact in a budget-and-planning level business case. IBM has many services offerings and analytical tools that can assist with identification and analysis of optimization opportunities relevant to your business application landscape and current infrastructure. For example, the IBM zEnterprise Workload Assessment offering and tool can be used to identify business applications that best fit a zEnterprise deployment. For target sizing and financial analysis of the candidate business applications, a Right-Fitting Applications into Consolidated Environments (RACE) study can be performed.

A comprehensive view of infrastructure optimization is advocated to maximize longer-term business agility and the return on any infrastructure investment. More narrowly scoped optimization projects often fail to realize their business cases because such projects tend to exacerbate the "islands of computing" problem and significantly understate the integration and IT operational costs.

Armed with the results of the analysis of optimization opportunities, a roadmap of optimization projects needed to achieve your business agility goals can be constructed. The companion "case for change" that financially justifies at a budget-and-planning level is constructed by

aggregating the individual business cases for the projects that comprise the infrastructure optimization roadmap.

After it is approved, the Infrastructure Optimization Roadmap then provides the governance and management framework for executing the individual optimization projects. Such a framework is critical to mitigating risks and maximizing business value because it represents a staged investment program. With each execution of an individual optimization project, new information regarding market, business, and technical uncertainty is made available and can be used to adjust the optimization roadmap.

Evaluate and plan optimization project

This stage is performed for each approved optimization project, and conducts the detailed business, technical, and financial analysis. For this stage, business case accuracy is the critical concern because that is the basis for committing the funding for the project. Therefore, getting the "facts" is essential and often requires that additional data be collected. For example, a virtualization and consolidation project will need to collect current application configuration and utilization data to analyze and decide the optimal set of business applications for migration to IBM zEnterprise.

The Evaluate stage also constructs the transition plan that defines the implementation activities and schedule needed to accomplish the project's optimization goals. The transition plan must not only define the implementation "whats" but also the "hows" because how a given implementation activity is executed determines its time and cost estimate.

The transition plan becomes the basis for estimating transition costs and defines the expected time-to-value schedule. As a result, the transition plan must be tightly interlocked with the business case. As with the Explore stage, IBM has many optimization service offerings and assets that can aid this analysis and planning stage.

Summary

Throughout this document you have seen how we mapped zEnterprise value to IT challenges. We have chosen four major IT challenges and translated those in zEnterprise capabilities, while using typical application topologies. Figure 18 on page 30 summarizes this mapping.
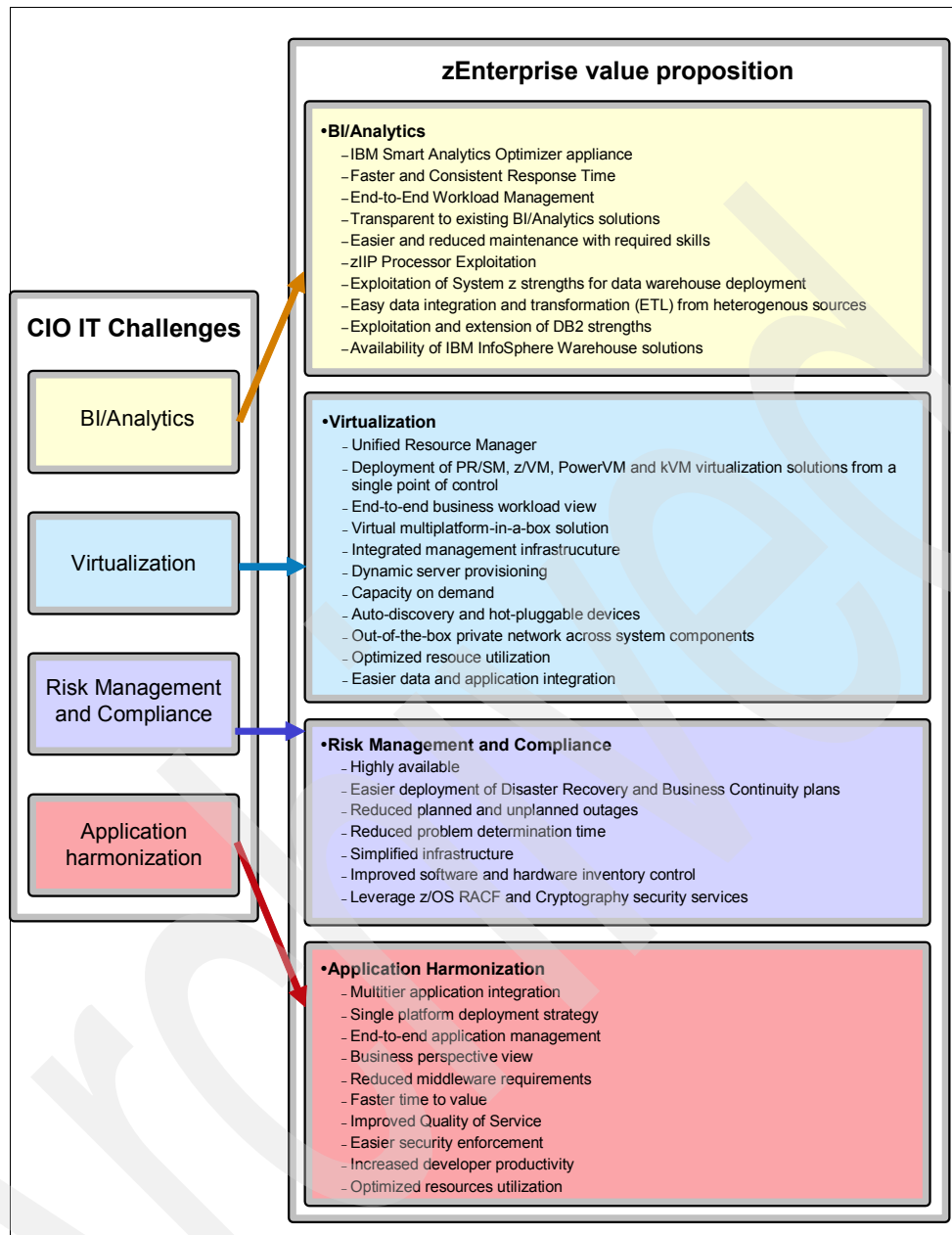
Figure 18   zEnterprise value proposition to solve CIO top IT challenges

Other resources for more information

Refer to the following sources for more information on zEnterprise and System z:

https://www.ibm.com/servers/resourcelink/
http://www.ibm.com/systems/zenterprise

The team who wrote this guide

This guide was produced by a team of specialists from around the world working at the International Technical Support Organization (ITSO).

Alex Louwe Kooijmans is a Project Leader with the International Technical Support Organization (ITSO) in Poughkeepsie, NY, who specializes in SOA technology and solutions on System z as well as application modernization and transformation on z/OS. Previously, he worked as a Client IT Architect in the Financial Services sector with IBM in The Netherlands, advising financial services companies about Information Technology issues such as software and hardware strategy and on demand. Alex has also worked at the Technical Marketing Competence Center for zSeries® and Linux in Boeblingen, Germany, providing support to clients with Java and WebSphere® on System z. From 1997 to 2000, he completed a previous assignment with the ITSO, managing various IBM Redbooks® publications projects and delivering workshops around the world in the areas of WebSphere, Java, and e-business technology on System z. Prior to 1997, Alex held a variety of positions in application design and development, product support, and project management, mostly in relation to the IBM mainframe.

Nancy Burchfield is a Distinguished Engineer, IBM Academy of Technology member, and Certified IT Consultant with IBM Global Technology Services in the United States. She has 33 years of experience in Information Technology with a BS in Mathematics and Computer Science, an MBA with a Finance specialization, and is a PhD candidate in Applied Management and Decision Science. Nancy was the National and Western Regional large systems Systems Engineer Specialist for her first 15 years with IBM, specializing in systems design, development, and engineering; performance management; and capacity planning for System/390®, MVS™, VM, CICS®, IMS™, and DB2. The second half of her IBM career has been focused on the IBM services business, where she has both developed and delivered complex services solutions to clients across multiple industries. Her expertise is both broad and deep, and includes product lifecycle management and development practices, financial management and analysis, IT strategy and planning, IT optimization and benchmarking, IT outsourcing, and IT governance. Most recently Nancy was the lead architect and methodologist for the GTS server consolidation and application migration services solution, which helps clients reduce the time and effort needed to migrate distributed workloads to Linux on System z. She can be reached at nburchfi@us.ibm.com.

Fernando Ferreira is a Certified Consultant IT Specialist with IBM STG System z in Brazil, and has 23 years of experience in Information Technology. Prior to joining IBM in 1996 he worked for nine years at an IBM account, first as an MVS system programmer and later as the technical support manager. At IBM he is an FTSS, working mostly with Financial Industry clients, and as the RDS for WebSphere on System z in Latin America. Fernando is a zChampion and a member of the TLC-BR Technology Leadership Council Brazil, which is an IBM Academy of Technology Affiliate. His areas of expertise include WebSphere on System z, Parallel Sysplex, System z hardware, and zOS. He has co-authored several IBM Redbooks publications.

Tomoyuki Maekawa is an IT Specialist with IBM Japan. He has nine years of experience in the System z field. For the last five years he has provided technical sales support for many clients in the Public and Communication sectors. Tomoyuki's areas of expertise include cross-platform system design and implementation, and performance tuning of z/OS and Linux on System z.

Daniel Raisch is an IBM Senior Certified IT Architect and is Open Group Master Certified, with more than 25 years of experience in Information Technology. He holds a degree in Mathematics and Computer Science and is a member of the WW System z technical council. Daniel works with clients extending core applications to new technologies and has co-authored several IBM Redbooks publications. He can be reached by email at raisch@br.ibm.com.

Thanks to the following people for their contributions to this project:

Terry Barthel
IBM Poughkeepsie

Debbie Beatrice
IBM Poughkeepsie

Jenna Bucher-Brown
IBM Poughkeepsie

Paul Dimarzio
IBM Poughkeepsie

Fernando Nogal
IBM Portugal

Karl-Peter Stenfors
IBM France

Michael Storzer
IBM Germany

Bill White
IBM Poughkeepsie

zBLC Business Value Workgroup

Now you can become a published author, too!

Here's an opportunity to spotlight your skills, grow your career, and become a published author - all at the same time! Join an ITSO residency project and help write a book in your area of expertise, while honing your experience using leading-edge technologies. Your efforts will help to increase product acceptance and customer satisfaction, as you expand your network of technical contacts and relationships. Residencies run from two to six weeks in length, and you can participate either in person or as a remote resident working from your home base.

Find out more about the residency program, browse the residency index, and apply online at:

`ibm.com`/redbooks/residencies.html

Stay connected to IBM Redbooks

► Find us on Facebook:

http://www.facebook.com/IBMRedbooks

► Follow us on Twitter:

http://twitter.com/ibmredbooks

► Look for us on LinkedIn:

http://www.linkedin.com/groups?home=&gid=2130806

► Explore new Redbooks publications, residencies, and workshops with the IBM Redbooks weekly newsletter:

https://www.redbooks.ibm.com/Redbooks.nsf/subscribe?OpenForm

► Stay current on recent Redbooks publications with RSS Feeds:

http://www.redbooks.ibm.com/rss.html

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:
IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

This document, REDP-4645-00, was created or updated on July 21, 2010.

IBM®

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. These and other IBM trademarked terms are marked on their first occurrence in this information with the appropriate symbol (® or ™), indicating US registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the Web at
http://www.ibm.com/legal/copytrade.shtml

Redbooks®

The following terms are trademarks of the International Business Machines Corporation in the United States, other countries, or both:

AIX®	POWER7™	System z®
BladeCenter®	PowerVM™	System/390®
CICS®	PR/SM™	WebSphere®
DB2®	Processor Resource/Systems	zEnterprise™
GDPS®	Manager™	z/OS®
HiperSockets™	Redbooks®	z/VM®
IBM®	Redguide™	z10™
IMS™	Redbooks (logo) ®	zSeries®
MVS™	System x®	
Parallel Sysplex®	System z10®	

The following terms are trademarks of other companies:

Java, and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Windows, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

Itanium, Intel logo, Intel Inside logo, and Intel Centrino logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Linux is a trademark of Linus Torvalds in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.