Smarter Computing And Breakthrough IT Economics

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Executive Summary

The IT industry is faced with the challenge of meeting an ever increasing demand for processing while holding finite budgets. Leading clients are already addressing this challenge through a new era of computing - Smarter Computing. Smarter Computing is about transforming IT to deliver breakthrough economics and support innovation. It is a path that clients can take to transform their IT infrastructure by integrating, automating and securing their IT. This approach results in breakthrough economics that dramatically lowers the cost of delivering workloads.

Powerful servers in this era of Smarter Computing can run many workloads simultaneously. In this context, cost per workload becomes an important metric to discuss and quantify IT economics. How can clients deliver their workloads at the lowest cost per workload?

In this whitepaper, we will look at multiple case studies that demonstrate how Smarter Computing delivers improved IT economics. The case studies cover different IT domains - optimized systems, federated data, Cloud and new service delivery models.

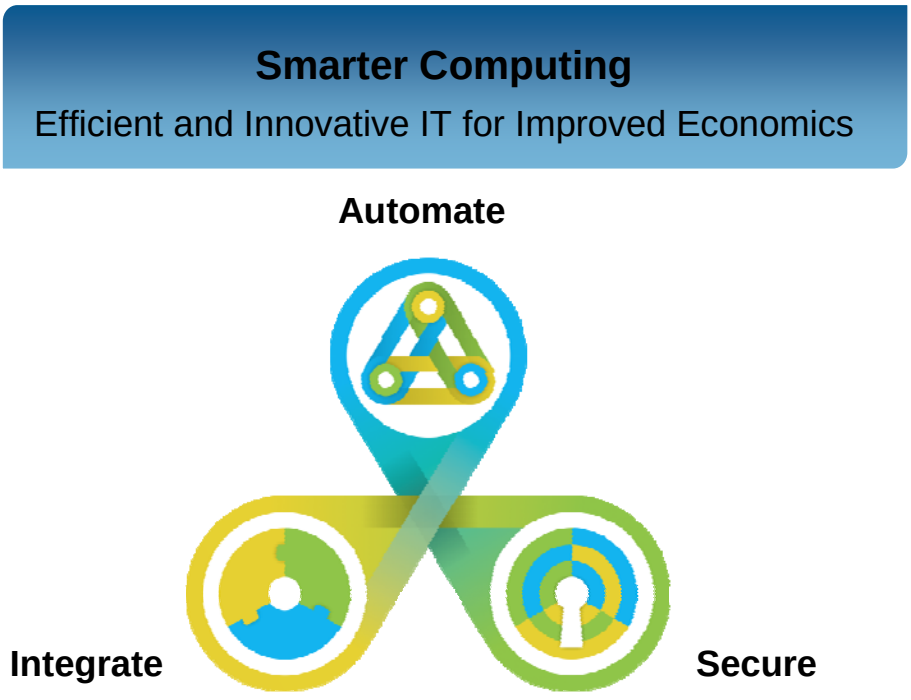
Leaders who are embracing the Smarter Computing approach recognize that as intelligence is infused into products, processes, and systems, the possibility arises to create entirely new revenue streams and business models. More importantly, they are actively transforming their IT infrastructures, to realize the IT efficiency and innovation that is required to capture these business opportunities.

Smarter Computing

On a Smarter Planet, opportunities for innovation are tremendous across industries. Leading enterprises in every industry are helping to transform the world we live in. Entire industry ecosystems are becoming instrumented and interconnected. With this, the possibility to create entirely new operating models arises. These opportunities for innovation bring challenges with them. Every IT organization faces the reality that the demand for computing capacity is nearly insatiable while their IT budgets are increasingly viewed as a means of cost control. To address this "IT Conundrum", forward thinking IT leaders are embracing the next era of computing – Smarter Computing.

Leaders in this new era understand that the traditional approach of just adding more servers, storage, networking and other system components to meet increasing demand is no longer a sustainable model. This traditional approach ends in hardware sprawl, bloated software and labor costs, higher environmental costs, all contributing to higher total IT costs. A smarter approach to computing makes it possible to meet increasing demand and to support innovation while managing to stay within nearly flat IT budgets. Smarter Computing applies architectural choices to **integrate, automate and secure** IT infrastructures, thereby transforming the economics of IT while freeing teams to focus on new innovation.

IT leaders are realizing that they need to understand the true cost of delivering workloads, especially with the emergence of new hybrid and mission critical workloads. With the right technology and data center architecture, clients are able to deliver a broad set of workloads at dramatically lower costs.



Dramatically reduce cost per workload

Cost Per Workload – A Key Metric For IT Economics

In order to understand the true economic benefits from a Smarter Computing approach, we need to understand the true cost of delivering a set of workloads. Often, when people compare the cost of deployment options, they limit the comparison to the cost of hardware acquisition. This can be quite misleading. It is important to consider all of the key elements of cost. Even for a Total Cost of Acquisition (TCA) calculation alone, the different elements of cost may include software acquisition costs, software S&S (support & subscription) costs, hardware maintenance costs etc., in addition to the base hardware acquisition costs. A Total Cost of Ownership (TCO) calculation typically is much broader and includes many other relevant elements of cost – some being administration/labor costs, systems management software costs, power and cooling costs, facilities costs, refresh costs etc. Another important aspect to consider is the amount of work being done on the two systems. If two systems being compared have been sized upfront so as to guarantee the same amount of work is being done on both, a direct total cost comparison is valid. In scenarios where we compare systems delivering different amounts of work, it is imperative that we reduce it to a cost per workload comparison to understand true value.

As an example, look at the case study below. It shows two options for deploying a set of banking workloads. In one option, we look at deploying the entire set of workloads onto a homogeneous (in this case, Intel) environment. In the other option, we look at doing a "Fit for Purpose" deployment of the workloads onto a zEnterprise system – where workloads with different characteristics are best fit onto the different runtime environments supported in zEnterprise. We see how looking at just one item of cost can be misleading. In order to understand true value, we need to understand the major line items of cost and also the amount of work being done on the systems being compared. This allows us to compare the cost per workload, which in turn gives us a way to quantify IT economics benefits.

Cost Of Hardware Alone Is Misleading

True Value: Cost Per Workload

	Cost of Hardware (servers + infrastructure)	Cost of Software	Number of Workloads	Cost per Workload
 56 Intel Blades (8 cores per blade) **448 cores total**	$1.7M	$9.8M	500	$23.0K
 **Add 192 cores (IFLs + zBX Blade cores) to** 1 zEnterprise	$2.7M	$4.7M	500	$15.0K

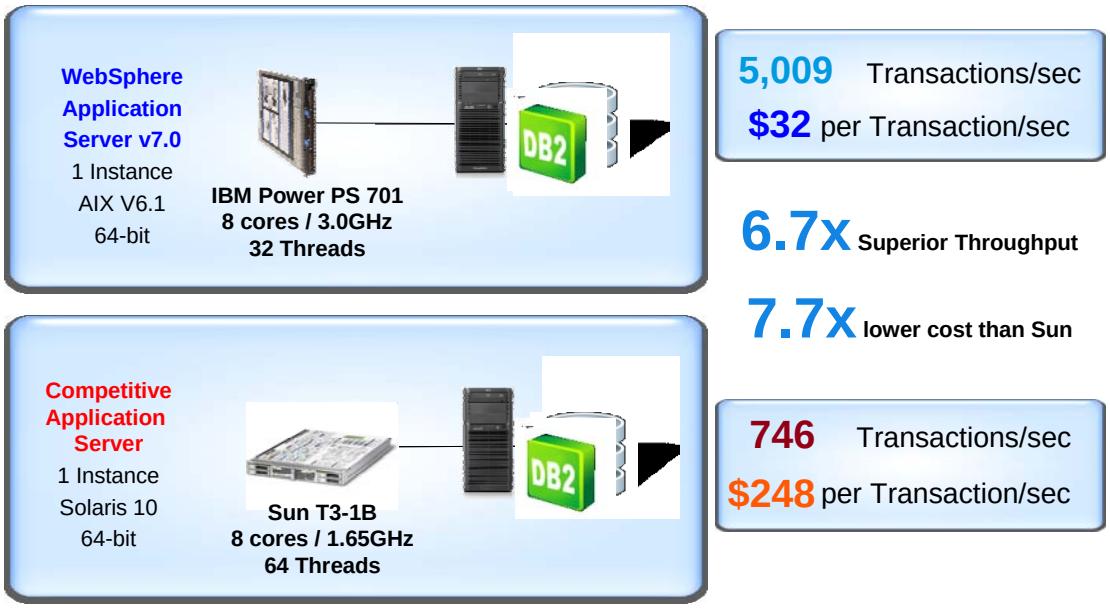
Note: 3yr TCA based on IBM internal benchmarks.
US prices, prices will vary by country.

Improve IT Economics With Optimized Systems

The last few years have seen a tremendous increase in server hardware capabilities, especially in the number of processor cores and hardware threads available per server. For example, IBM POWER7 can support 4 simultaneous threads per core (SMT-4) and can scale to 256 cores, making available a massive 1024 hardware threads in a single frame for meeting the ever increasing demand for processing. However, having this kind of hardware capability is not as useful if the software running on that machine cannot exploit those hardware capabilities. The IBM Software suite of products is designed to take better advantage of available hardware computing capabilities. Together with IBM hardware and their differentiated features, IBM Software exploits the higher number of cores and threads, increasing application utilization efficiency, and delivers better price/performance for many workloads.

This case study demonstrates how IBM WebSphere Application Server exploits the hardware capabilities of an IBM POWER7 server. The end result is that the IBM solution is able to deliver an online banking workload at a much lower cost per workload than a competitive option.

Case Study: IBM WebSphere Application Server Designed To Leverage Available Threads In POWER7

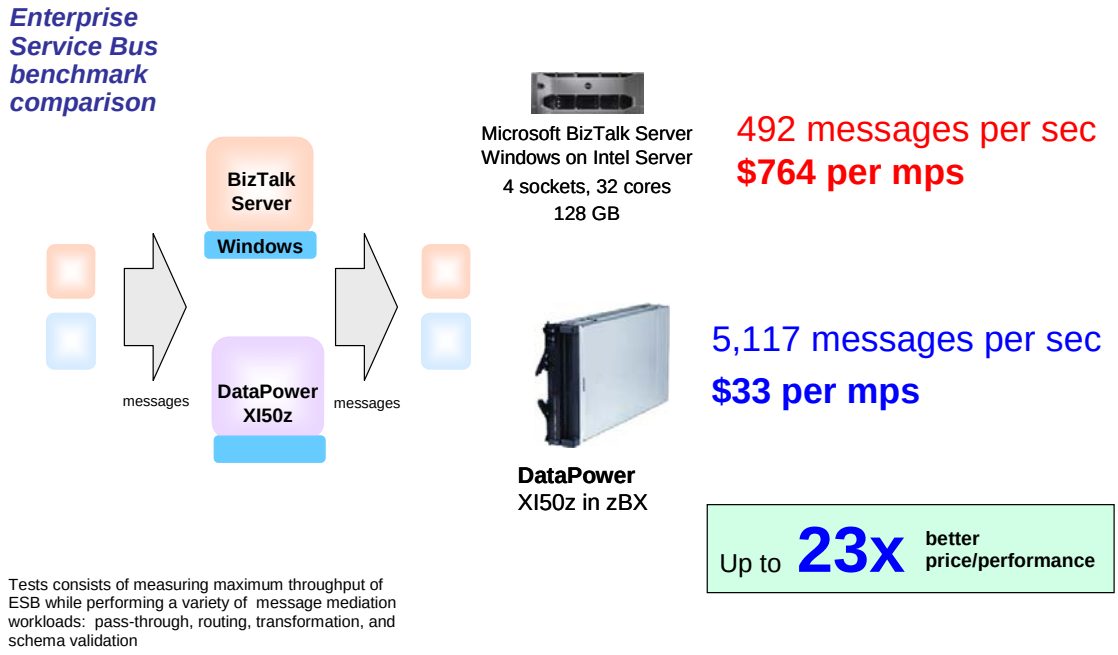


Source: IBM SWG internal studies

Beyond more cores and threads per server, IBM also offers a wide range of hardware innovations. For example, the Turbo Core mode in POWER7 allows the server to switch to a configuration with more cache per core, ideal for memory hungry data workloads. The MAX5 memory controller in System x eX5 servers provides unparalleled memory capacity on x86 systems. The Parallel Sysplex is a unique System z capability to cluster mainframes to achieve near linear scale and unmatched availability characteristics.

IBM also offers specialized, purpose-built appliances for running specific types of workloads. The IBM DataPower appliance is optimized for delivering Enterprise Service Bus (ESB) workloads. The following case study demonstrates how this purpose-built appliance far outperforms competitive ESB software running on general purpose hardware.

Case Study: Purpose-Built DataPower Appliance Delivers Stunning ESB Price/Performance



These case studies illustrate the "**Integrate**" concept of Smarter Computing. In these cases, IBM has taken on the task of integration for the client – we have integrated hardware and software to create optimized systems, driving down cost per workload dramatically.

Improve IT Economics With Advanced Data Capabilities

We are seeing an explosion in data – the volume of information being generated has increased exponentially in the last few years. This data needs to be stored, managed and used efficiently. Storage systems need to be able to handle this growth. Software for managing data needs to leverage hardware capabilities. Business analytics and deriving intelligence from information is becoming an increasingly important factor that decides how competitive a company will be.

IBM software, servers and storage systems are meeting this challenge. IBM offers a broad portfolio of storage systems, ranging from small to mid range to enterprise class. There are numerous innovations in this space. For example, IBM's Easy Tier capability can automatically allocate optimum amounts of Solid State Drives (SSD), thus maximizing SSD performance gains while minimizing costs. Another example of innovation in this space is the IBM Smart Analytics Optimizer – a purpose-built appliance for optimizing business analytics on zEnterprise.

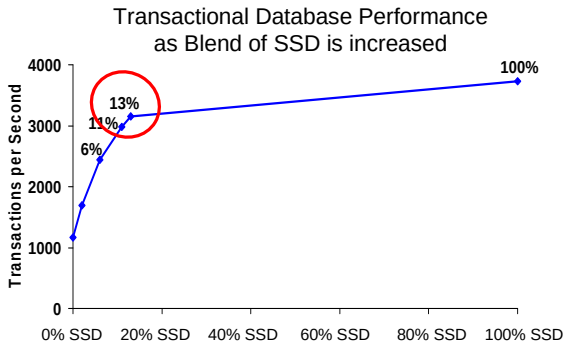
Real world Business Analytics workloads need to support concurrent performance. A typical Business Analytics solution will need to support multiple users executing a wide variety of queries and reports concurrently. IBM offers packaged solutions like the IBM Smart Analytics System (ISAS) that have been built as pre-packaged, pre-configured solutions to support this kind of real world usage patterns.

Solid state disk drives are revolutionizing storage performance – they support much higher Input/Output Operations (IOPS) than traditional hard disk drives (HDDs). However, SSDs are also more expensive than HDDs. Over provisioning storage systems with SSDs in the hope of getting the best performance often results in huge storage cost increases. We find that, often a small fraction of SSDs will yield the majority of the performance gain possible for a given workload. The ideal price/performance point is reached by having a judicious mix of SSDs and HDDs. Doing this manually is quite cumbersome and inefficient. IBM's Easy Tier can optimize the amount of SSD allocated. It dynamically moves data to SSD, based on hot spots detected. Further, Easy Tier can dynamically share the available SSDs across many workloads, efficiently allocating the SSDs to the hottest spots.

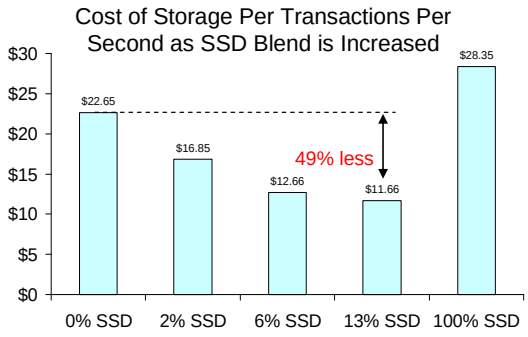
The following case study demonstrates how Easy Tier helps improve IT economics when dealing with data workloads.

Easy Tier In IBM Storage Systems Automates Optimum Use Of SSD

Just 13% blend of SSD to HDD achieves 171% performance gain



13% blend of SSD to HDD achieves lowest cost of storage per transaction per second



Easy Tier achieves 78% of the maximum SSD performance potential with a blend of just 13% SSD

Source: IBM Internal Study of Benchmark Factory transactional database workload performance as Easy Tier migrates data to SSD. The performance data contained herein was obtained in a controlled, isolated environment. Actual results that may be obtained in other operating environments may vary.

This is an example of the "**Automate**" principle of Smarter Computing. Automatic allocation of expensive SSD resources in an optimum way results in lowering overall storage costs.

Automation also reduces labor costs. IBM offers a comprehensive suite of software products aimed at efficiently automating various data center tasks. Some examples are software that automatically provisions systems, software that synchronizes the start and stop of sequenced applications, software that automatically adjusts system resources available to workloads to meet varying demand etc. Automation not just reduces labor costs; it also improves the quality of service delivery. This is especially true as automating mundane repetitive tasks eliminates the risk of manual operations error.

Improve IT Economics With Private Clouds And New Service Delivery Models

Cloud computing is poised to transform the service delivery model. At an abstract level, it is about delivering hosted services with some key distinguishing attributes:

Elastic Scaling - Resources scale up and down by large factors as the demand changes,

Flexible Pricing - Utility pricing, variable payments, pay-by-consumption and subscription models make pricing of IT services more flexible

Ease Of Use - End user often just needs a PC with Internet access to request services, without IT skills or knowledge of the system.

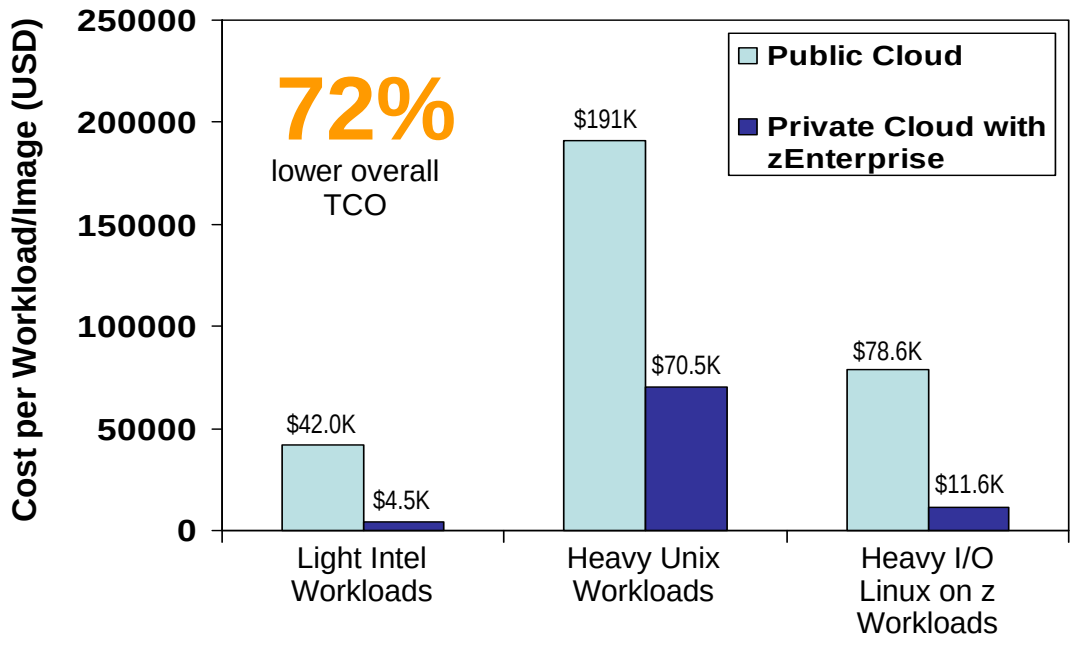
Many businesses are moving to a Cloud Computing model. Line-of-business units within organizations are going to public cloud providers as their low cost, pay-per-use model is seen as more cost effective. Furthermore, faster provisioning of resources offered by them can enable users to respond with agility. In some cases, the public cloud model makes the most economic sense. However, IT leaders need to be aware that in many cases they may be able to provide private cloud services to their end users much more cost effectively than paying for external public cloud services.

In general, private clouds are a model for delivering IT services in a pay-as-you-go fashion similar to what public clouds can offer. The difference is that a private cloud is built from resources inside an organization and is typically hosted within the data center to be used by line of business and other end users within the organization. Workloads run on large scale virtualization platforms. This approach reduces hardware, software and labor costs. Users request services via a self-service portal and virtual machines are quickly provisioned. Labor costs are significantly reduced via standardization and automation. Furthermore, users may be given tools to manage their applications on the virtual machines that are running their services and they only pay for what they consume.

IBM offers a wide range of capabilities in the Cloud Computing space. For example, IBM provides large scale virtualization environments in POWER7 and zEnterprise that are ideal to host private clouds. IBM provides software that manages the entire lifecycle of virtual servers – everything from self-service automated provisioning to metering and billing based on usage. IBM also offers industry specific Cloud Service Platforms. An example is the recently announced **IBM Cloud Service Provider Platform**, a comprehensive set of hardware, software and services to help providers rapidly deliver cloud computing on their own.

The zEnterprise system provides the broadest architectural support for building a private cloud. Different environments in zEnterprise may be used to run workloads without requiring a port or rewrite. Where there is an option, workloads may be best fit to an environment to run at the lowest cost per workload. A Fit-for-Purpose deployment strategy aims to assign a workload to the environment that best satisfies the particular requirements of that workload. For example, workloads with heavy IO demand may be best fit on Linux on z/VM on the z196 portion of zEnterprise. Workloads that have high CPU demand and that can exploit multithreading may be best fit on the POWER7 blades in the zBX. Large scale virtualization on z/VM drive down acquisition costs. The private data network as well as the private management network between the z196 and the zBX plus network access control mechanisms ensure a secure network environment. Managing this environment with zManager capabilities and with Integrated Service Management software results in lowering operational costs.

Case Study: A Fit For Purpose Private Cloud On zEnterprise Dramatically Reduces Costs



With its broad Fit-for-Purpose architectural support, zEnterprise and Integrated Service Management yields the lowest cost per workload when delivering private cloud services.

Integrate, Automate And Secure To Transform IT

zEnterprise as a private cloud foundation is a perfect example of how the three principles of Smarter Computing - **Integrate, Automate and Secure** – come together to transform IT and deliver workloads at the lowest cost.

Integration: By integrating the traditional mainframe with POWER7 and Intel* blades, zEnterprise provides a compelling multi-architecture, "Fit for Purpose" platform for deploying diverse data center workloads with different characteristics. A best fit assignment of workloads onto the appropriate environments lowers the cost of delivering those workloads while meeting requirements. Multi-tier and hybrid workloads can also leverage this tight integration. For example, web facing applications on the blades can access backend data in a highly efficient manner, avoiding complex and expensive network hops.

Automation: High levels of automation reduce the labor needed for setting up and maintaining this hybrid virtualized environment. For example, when a new POWER blade is added to a zEnterprise system, automation kicks in to dramatically cut down the steps for setting up and configuring the hypervisor and network environments. Lab tests show that the average time taken for hypervisor setup and configuration of a single blade goes down from about 46 minutes when done manually to about a minute and a half. The average time taken for network setup and configuration went down from 26 hours to 5 hours. That is an 81% reduction in labor time for a specific set of tasks due to automation and translates into labor cost savings and improved time to solution. The zManager component of zEnterprise ensures that service levels are met automatically by making computing resources available to the different virtual machines on demand. For example, if mean demand changes, zManager can automatically change the LPAR processor entitlement values in the POWER7 blade to meet service level agreements. This ability translates into cost savings as well, as we avoid having to over provision to meet changes in workload demand.

Secure: The zEnterprise system builds on the highly secure environment that traditional mainframes have always provided. Traditional System z security mechanisms ensure isolation of users/tenants and centralized access control of all system resources. System z holds the highest Common Criteria security rating for commercial operating environments with an Evaluation Assurance Level 5 (EAL5) certification of its logical partitions. System z also provides advanced encryption capabilities – from built-in encryption capabilities on the processor chip and specialized crypto cards to IBM software like DB2 that can leverage these capabilities and encrypt data all the way from storage media to channels and buffer pools. Hipersockets provide internal secure communication between virtual machines, eliminating the risk of potential exposures on the physical network. Private networks between the mainframe and blades in the attached BladeCenter Extension(zBX) provide secure environments for hybrid and multi-tier workloads. With comprehensive and sophisticated security features pre-built into everything from

the hardware, networks, channels, virtualization environments and software, zEnterprise provides an unmatched secure foundation for implementing a private cloud.

In this use case, we see how Smarter Computing principles come together to transform service delivery models.

We have seen examples of Smarter Computing in three key IT domains. The principles of Smarter Computing are not limited to just these, but apply to a broad spectrum of IT domains and industries.

Conclusion

Integrate: The era of traditional system acquisition strategies is being replaced by an era of optimized system acquisition strategy. Make sure you leverage the price/performance advantages of software/hardware integration and systems that have been optimized for the particular needs of your workloads.

Automate: Leverage every opportunity to take advantage of self tuning and automation capabilities provided by systems. Eliminating manual repetitive tasks will cut down systems management and administration costs while meeting service level agreements.

Secure: The economic impact of a security breach could be devastating. Make sure your computing foundation is rock solid in terms of security, privacy and compliance requirements. Ensure your data is secure in all phases of use – whether at rest or in motion.

Judicious use of these principles of Smarter Computing will help clients transform their IT service delivery and drive down costs. As Smarter Planet transformations continue to bring business opportunities as well as accompanying IT challenges, this new era of Smarter Computing promises to support innovation with breakthrough IT economics.

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