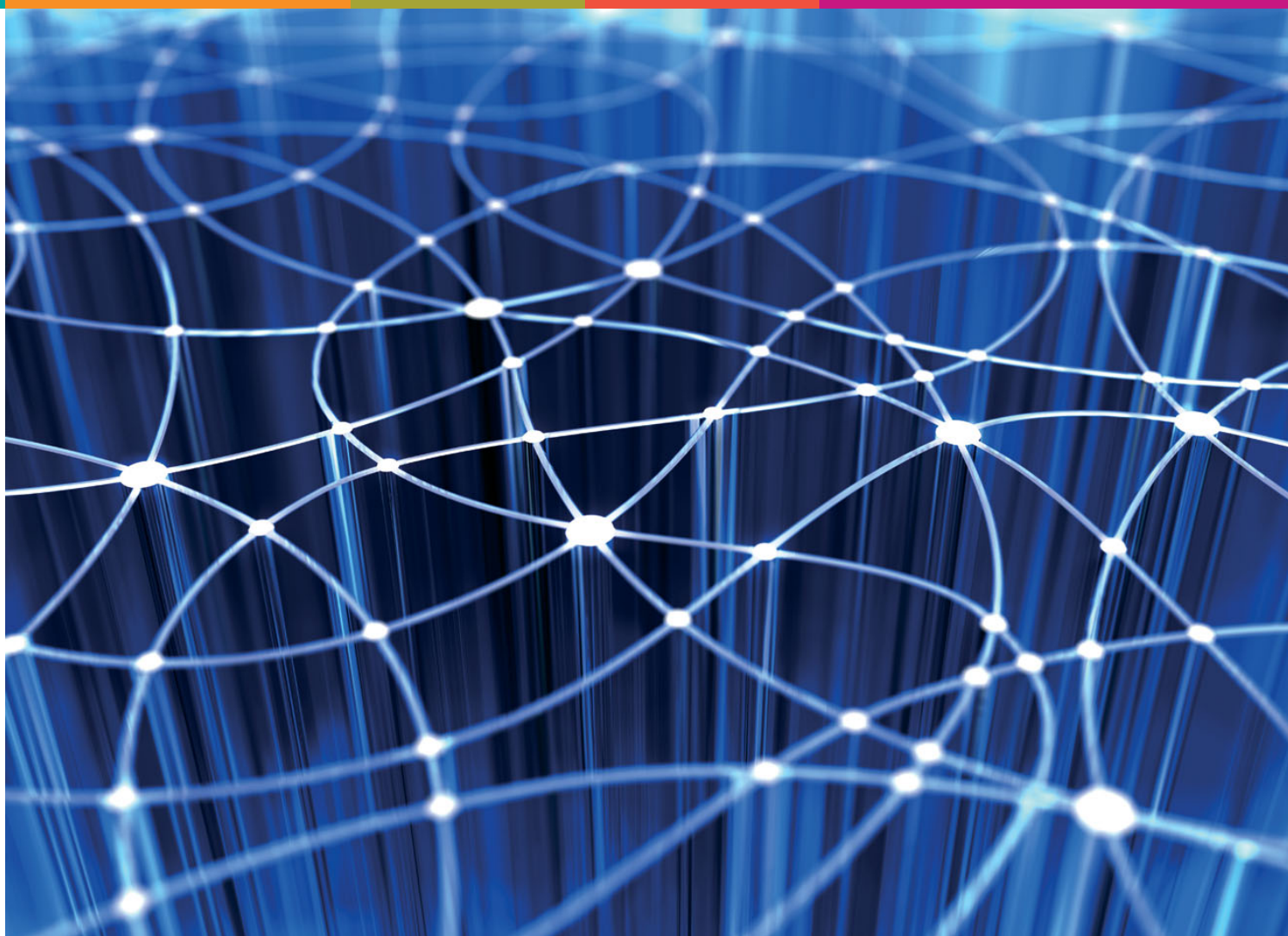
Dynamic Infrastructure

Creating a Dynamic Infrastructure through Virtualization



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The dynamic infrastructure: Solving today's problems while seizing tomorrow's opportunities

For organizations today, achieving optimal business results demands a bold new approach to IT.

At a time of extraordinary market challenges, when revenues are threatened and budgets are diminished, IT costs must clearly be more tightly contained than in the past. Yet, IT service levels—so essential to customer satisfaction and employee productivity—must also be enhanced. In short, IT must achieve more while using less.

> *"Through 2010, IT infrastructure consolidation will remain the focus of IT infrastructure and operations cost reduction initiatives."*
>
> — Gartner[1]

Achieving a competitive distinction in a tough market also means delivering innovative new services designed to map as directly as possible to customer needs and interests. Where, in such a difficult business climate, will the resources come from to develop and support such services? For many organizations, up to seventy percent of the overall IT budget is dedicated merely to maintaining the operational status quo—leaving only thirty reserved for development.

Ideally, this ratio would be reversed, putting the organization in a superior strategic position designed to spur both business growth and business resilience. But reversing that ratio is usually going to require reconceiving and reworking, in numerous ways, the way IT creates and supports key services for its host organization and its external clients, customers and business partners.

In response to these complexities, IBM offers a compelling new vision: the dynamic infrastructure.

What is the dynamic infrastructure? It is not an offering of any kind; it is not a specific service, solution or combination of the two. The dynamic infrastructure is better understood as an idea: an evolutionary strategy through which organizations can minimize operational costs, anticipate and control business risks and improve service levels. A dynamic infrastructure is one that can best equip organizations to cope with many difficult challenges—today and tomorrow.

A dynamic infrastructure achieves the most business value using the fewest IT resources. It is one in which business and technological management converge in the pursuit of shared organizational goals, maximizing IT flexibility and scalability to address business needs cost-effectively, flexibly and rapidly. A dynamic infrastructure also positions the organization to capitalize on new opportunities with speed and efficiency whenever they appear, and thus helps to translate a bad economy into a growth opportunity.

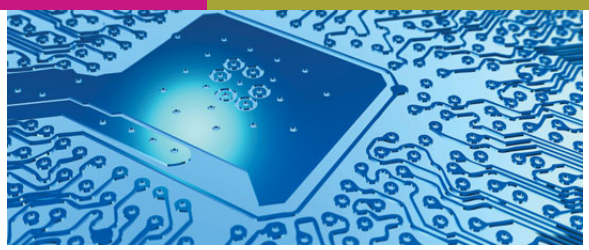
Because each organization operates in a unique context, utilizes a unique infrastructure and faces unique challenges, creating such a dynamic infrastructure implies a unique transformational process in each case. No two organizations are alike; no two can create a dynamic infrastructure in exactly the same way.

Fortunately, organizations need not undergo this transformational process alone. They have, in IBM, a trusted partner ideally positioned to help them address any and all aspects of it—at every stage. IBM is the only single-source provider in the technology industry with the full range of technologies, services, solutions and proven expertise that organizations need to create a dynamic infrastructure. With IBM's help, they can get the best business results, in the shortest time, through a tailored infrastructural transformation suited well to their needs, goals, processes, assets and strategies.

Virtualization is a key building block of the dynamic infrastructure

In almost every case, the transformation to a dynamic infrastructure will involve virtualization.

Many IT professionals think of virtualization specifically in terms of servers. IBM, however, has a broader perspective, in which virtualization is seen as a general approach to decouple logical resources from physical elements, so that those resources can be allocated faster, more cost-effectively and more dynamically, wherever the business requires them in real time to ideally meet changing demand levels or business requirements.



> *"While server consolidation made enormous gains in 2008, these advances are only the leading edge of changes that will come in the coming year through the virtualization of the enterprise. Gartner says virtualization will be the No. 1 technology initiative in 2009, a year when more cost savings will be sought with tangible urgency because of the down economy."*
>
> — Charles Babcock, InformationWeek[2]

The strong relationship between virtualization and the dynamic infrastructure is apparent in this context: virtualization helps to make the infrastructure dynamic. Furthermore, by moving to virtualized solutions, an organization can expect substantial benefits to accrue as perceived from both IT and business perspectives.

From the IT side, costs will fall; this commonly occurs via reduced complexity, enhanced resource utilization, recaptured floor space in space-limited data centers and improved energy efficiency. Service levels will climb; the performance and scalability of existing services will both be boosted and new services can be developed and rolled out much more quickly. Risks, too, will be mitigated, because the uptime and availability of key, mission-critical and revenue-generating systems, applications and services will generally climb with virtualization.

From the business side, virtualization can help to create a foundation for growth. When new strategies are suggested by changing market conditions, those strategies will be easier to create and deploy via a virtualized, dynamic infrastructure. Actionable business intelligence is acquired faster through real time processing, helping to quantify the extent of any given strategy's success (or failure). Operations and systems control are consolidated, spurring time-to-solution, and should there be redundancy within the infrastructure or staffing, it is more easily identified and resolved as a result. Finally, employee productivity will typically climb—a logical outcome of all prior benefits.

Many types of virtualization combine to yield a more dynamic outcome

The best results will often come when every major element of the infrastructure is virtualized

Virtual servers are perhaps the best-known example of virtual solutions. Instead of a one-to-one relationship between physical hosts and logical servers, one physical host (if its performance and reliability are exceptionally high) can act as a platform for many logical servers. This reconception and reimplementation of what a server means—literally and virtually—translates into many powerful business benefits. Among others, these include reduced server sprawl through consolidation, reduced energy consumption per server, dramatically higher hardware utilization, greater flexibility in assigning processing power to IT services when they require it and higher service availability.

IBM recognizes, however, that virtualization as a key element of the dynamic infrastructure can and should involve many other virtualized elements in addition to servers; in fact, best results will often come when every major element of the infrastructure is virtualized.

Virtual storage, for instance, helps by allowing the organization to approach storage not as a fixed element tied to specific hardware, but as a fluid resource which can be allocated to any application or service that requires it, in real time. Databases, for example, in which new records are continually being created, can

grow in proportion to the business need without regard for the size of the hard drives on the specific systems hosting them or other predetermined storage assets. When applications, systems and services continually have access to the storage they require, overall IT availability, productivity and service levels will climb, helping to maximize the return on investment of all the elements that use storage. And virtual storage also enables centralized management of storage resources from a single point of control, reducing management costs.

> *"Desktop virtualization remains the most promising green field, ripe for huge cost savings... IT administrators are likely to get a push from CFOs to realize more savings as fast as they can by moving to desktop virtualization."*
>
> — Charles Babcock, InformationWeek[3]

Virtual clients can directly address the problem of desktop sprawl. This is a major issue for many organizations; as more and more desktops with a complete operating system and application stack are deployed to more and more users, such "thick" clients translate into a substantial and operationally expensive burden on IT teams already challenged by budget shortfalls and minimal free time. In particular, mass rollouts such as new applications or operating system versions can require months to finish, creating a substantial business impact. Virtual ("thin") clients represent an attractive alternative. Thin clients are essentially identical from unit to unit; end user data and applications are migrated to shared servers and then accessed by users over the network using the thin clients. Such an approach means that end user resources can be centrally managed by IT in an elegant, accelerated fashion, substantially reducing both desktop sprawl and all of its associated costs.

A virtual application infrastructure can also deliver powerful benefits. Imagine an organization in which many key services are supported by core Java™ applications operating on server clusters. Now imagine that an unexpected spike in demand requires higher performance from one of those applications, while the others remain comparatively idle. By virtualizing the application infrastructure, application workloads can be dynamically assigned across clusters, ensuring that such spikes are quickly and effectively addressed via more processing power whenever and wherever it's required.

Virtual networks can also play a major role in helping an infrastructure to become more dynamic. A single physical network node can be virtualized into several virtual nodes in order to increase network capacity. Multiple physical switches can be logically consolidated into one virtual switch in order to reduce complexity and ease management costs. Virtual private networks deliver similar security and performance to remote users as private physical networks would, yet at a far lower cost, while also increasing employee productivity when offsite. Even network adapters can be virtualized, helping to decrease the number of physical assets in play throughout the infrastructure.

"If your IT organization is anywhere on the continuum of cloud computing adoption—from service management, to dynamic infrastructure, to purchasing cloud services, to building a cloud computing environment—IBM has something to offer."

— Paul Burns, EMA[4]

Maximizing IT responsiveness and flexibility through cloud computing

One virtual architecture of growing appeal, due to the extraordinary levels of agility and flexibility it delivers, is cloud computing. Based on a number of virtualized elements, cloud computing gives organizations the power to create and deliver services faster, more consistently and more transparently than ever before—a new benchmark in the history of IT architectures.

Organizations today need to translate ideas into reality in the shortest possible time—as well as incubate ideas that might never have occurred without a straightforward opportunity to implement and test them. Cloud computing is commonly utilized as a test platform for new services; IBM itself has created and maintains such a platform. Cloud computing can also support many other powerful business initiatives, such as infrastructure outsourcing, software as a service to external audiences and next-generation distributed computing. It maps well to, and can help drive, new usage models such as Web 2.0, empowering organizations to better serve their employees and customers through a powerful, scalable, flexible and extremely efficient architecture—effectively a new evolutionary step in how virtualization can be leveraged to create business value.

Virtualization plays a central role in making cloud computing possible.

To understand cloud computing, conceive of it as a logical combination of existing technologies designed to spur an accelerated response to changing strategies, needs or goals. Just as services are created within and supported by virtual servers, virtual servers are created within and supported by cloud computing. Furthermore, in a policy-based system, cloud computing can create those servers automatically on demand. It thus essentially functions as another layer of logical abstraction, allowing organizations to focus more directly on their needs and how those needs are met through services, and less on the technical details of how those services are created, managed and optimized.

Virtualization plays a central role in making cloud computing possible. When users request a new service through a self-service Web portal, the virtual servers required to support it are automatically created and provisioned by supporting technologies. These might commonly include bladecenters or other high-end computational platforms, to serve as physical hosts, as well as advanced software provisioning, to create the virtual servers on those hosts from prepared disk images, then customize them with whatever application stack, middleware and data are required.

Such a design represents a quantum leap in the process of service creation. Under normal circumstances, delivering on such service requests would usually be a very time-consuming process, involving many stages such as procuring

hardware, finding suitable floor space in the data center, manually installing and configuring virtual servers designed to support the service with appropriate resources and securing the entire environment to limit access solely to appropriate users and groups.

Through cloud computing, those and other complexities are largely abstracted out of consideration. Instead, new services can be imagined by users, requested through a Web-based catalog of service options and brought online literally in a matter of hours. Because these services are capitalizing on the cloud platform, they automatically inherit an environment designed to support them in an optimized way. Users submit a qualified request and the cloud does the rest of the work of creation.

Subsequently, the services are tracked and monitored using other tools (available to the requesting entities, or IT administrators, over the Web) to ensure target levels and desired features have been delivered or to make logical adjustments to improve the service in new ways. Should services require extra processing power, storage or memory, workloads can be dynamically adjusted for higher performance using the massively scalable, heterogeneous virtualized infrastructure, in which these elements are all essentially treated as a fluid resource that can automatically be dialed up or down in accordance with unpredictable requirements.

When the services reach end of life, they can be retired by the user using a Web interface to the cloud—no specific work on the part of IT is required. Alternately, users can be notified in advance that they must retire the service within predefined time limits, to ensure that its resources are freed for other purposes, unless the user can demonstrate that the service represents an ongoing asset to the organization which should be maintained. This represents an automated way to help track and control IT costs by limiting the duration of service requests to suitable timeframes and thus preventing key resources from being hoarded, despite going largely unused (a common problem in enterprise-class infrastructures).

> *"This dynamic infrastructure becomes the foundation for customers to deliver cloud-based services to their users, and taps cloud computing to take costs out of the equation and reduce inefficiencies."*
>
> — InfoWorld[5]

Cloud computing represents a powerful new architecture of incredible efficiency and elegance, suitable for many different contexts and illustrative of just how effective virtualization can be in helping to create a dynamic infrastructure. It conveys many technological benefits, such as a substantially improved efficiency of service creation and management, while also lowering related costs; organizations can rapidly scale up the number, nature, performance and availability of services, and manage them as holistic resources, all without requiring a comparable increase in IT staff headcount.

Perhaps even more compellingly, cloud computing also delivers improved organizational and business outcomes, such as fostered innovation, faster time-to-market of services and improved collaboration within the organization, as well as outside it in the larger ecosystem of clients, customers and partners.

Key solutions to empower virtualization strategies

In response to the full spectrum of needs faced by organizations today, IBM supplies the industry's most comprehensive portfolio of best-in-class, key solutions and services to deliver the central benefits of virtualization—reduced costs and complexity, mitigated business risks, unified management and superior service levels.

> *"With the IBM System x solution…it takes minutes rather than weeks, and we utilize the hardware much more effectively."*
>
> — Shaun Taylor, St. Helens Council[6]

Virtual server management

One important IBM solution designed to help organizations manage complex virtualized infrastructures is IBM Systems Director. This powerful tool delivers centralized control and management of everyday functions pertinent to virtual servers—configuration, discovery, health status, provisioning and others—whether they are hosted by IBM Power Systems™, IBM System x® systems, IBM System z® mainframes, IBM BladeCenters® or even some third-party x86 systems.

Based on a plug-in architecture for expandability to meet future needs, IBM Systems Director can also provide the information it collects from hardware hosts to higher-level management packages, such as IBM Tivoli® Monitoring, IBM Tivoli Provisioning Manager, IBM Tivoli Netcool® and others (including third-party packages) for more detailed business analysis and to support related processes.

Virtual storage management

IBM TotalStorage® Productivity Center similarly delivers a unified, simplified, automated point of control for virtual storage assets, addressing key functions and tasks that might normally require many separate tools. Both physical and virtual resources can be managed; the solution will seamlessly interoperate with the many different multi-vendor, heterogeneous storage solutions often deployed in enterprise-class data centers. End-to-end topology views depict how much storage is utilized, where and for what purposes, empowering administrators with the information they require to take appropriate action and ensure an optimized outcome.

Organizations looking to unlock storage from particular assets and redeliver it as a fluid resource to any requesting application or service will also be interested in the IBM SAN Volume Controller. By making storage across different assets available on demand as a pooled resource, this hardware solution helps drive overall application performance and availability, user productivity and overall storage utilization while also consolidating the management of all storage assets it controls. It can also be used to create a tiered storage scheme, in which more expensive storage is assigned on an as-needed basis to more crucial applications and data for a cost-optimized outcome.

Virtual clients

IBM stands ready to work with your organization to develop a customized virtual client solution built around an IBM-provided thin client device and supported by proven offerings from providers such as Citrix and VMware. In this way, user applications and data will be stored on central systems, where they can easily and cost-effectively be managed by administrators, yet also transparently accessed by end users whose client-side hardware is effectively identical from desktop to desktop. The results will be that the significant costs and complexity that stem from desktop sprawl will dramatically decline; at the same time, organizational flexibility will improve, because users can access their unique virtual working environments from any thin client, anywhere in the infrastructure.

Virtual application infrastructure

IBM WebSphere® Virtual Enterprise is a powerful offering designed to drive the performance and availability of key applications by shifting workloads dynamically across clusters in accordance with fluctuating conditions or requirements. Overall flexibility, agility and user productivity will climb, because applications are always supported by sufficient processing power and memory, and operational and energy costs will typically fall—a consequence of the optimized utilization, through which idle time can be made less expensive. Should applications require an upgrade, that upgrade can occur without incurring downtime of the current versions; the upgrade is operationally transparent. Simplified administration of the application infrastructure and easier adherence to the performance specifications of service level agreements round out the list of business benefits of this offering.

> *"The performance of our applications [thanks to IBM WebSphere] has been phenomenal. The speed of interactions has exceeded our expectations." "*
>
> — Marlin Clark, Rotech Healthcare[7]

"HP doesn't appear to have all the networking for these cloud services ready for prime time just yet. It appears to be moving a bit slower [than IBM], asking more tactical-type questions about how this is all going to play out."

— eWEEK[8]

Virtual networks

Sharing physical resources across logical partitions is essential to gaining best business value from virtual servers. In such cases, the IBM Virtual I/O Server delivers exactly the required functionality by sharing physical I/O resources—such as SCSI and Ethernet—across AIX® and Linux® partitions. This tool can even create more logical partitions than there are I/O slots or physical devices, increasing the total possible network utilization of any given physical host and all the servers it supports.

For IBM BladeCenters, which offer many blades in a shared chassis, network resources must be made available to servers as quickly as possible. The IBM BladeCenter Open Fabric Manager delivers on this premise, making it relatively simple to manage the various I/O and network interconnections for as many as a hundred chassis, each of which supports up to fourteen blades. Furthermore, thanks to preconfigured LAN/SAN connection information, I/O connections happen automatically with insertion of a new blade for exceptionally fast time-to-value. This offering also supports many third party Ethernet and Fibre Channel switches from leading vendors for extraordinary interoperability and seamless integration.

Physical servers

Best-in-class virtual servers require best-in-class physical hosts. IBM delivers a broad array of leading server offerings designed to drive virtualization strategies in any business context.

IBM System z mainframes, for example, support extreme virtualization initiatives, such as the consolidation of hundreds of Linux servers onto a single, ultra-reliable and high-performance host bolstered by industry-leading scalability, advanced security and complete hardware redundancy. IBM Power Systems, based on IBM's own POWER6™ processor architecture, deliver dynamic resource allocation with advanced mobility for AIX (IBM's flavor of UNIX®), Linux and IBM i OS; they are well suited for high availability scenarios for the most mission-critical applications. IBM System x servers, which include many proprietary design optimizations based on the fourth-generation of X-Architecture® for high reliability, are best-of-breed x86 hosts designed to allow organizations to consolidate many lower-performing servers, thus reducing server sprawl, dramatically improving hardware utilization and minimizing energy costs.

Physical storage

IBM System Storage™ offerings deliver storage in a high-availability, high-performance package that is ideally suited to support storage virtualization in SAN and NAS environments. Paired with IBM TotalStorage Productivity Center and IBM SAN Volume Controller, they can play a key role in delivering on-demand storage to ensure it is available whenever and wherever it is required, spurring application and service availability and helping to address the explosion in data volumes confronted by many organizations today.

The IBM Tivoli suite of system and service management tools is designed to help drive business value at all layers of the IT infrastructure.

IBM Tivoli Service Management Platform

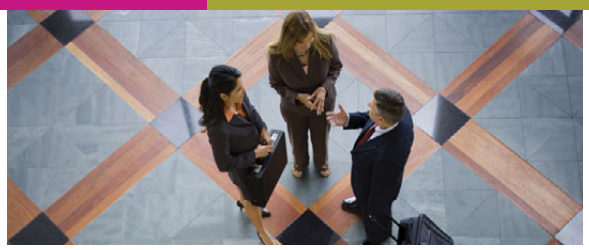
The IBM Tivoli suite of system and service management tools is designed to help drive business value at all layers of the IT infrastructure, including virtualized assets, by delivering improved visibility (to see the business), control (to govern the business) and automation (to drive business agility through industrialization where possible). Many tools are available to track, enhance or support key aspects of the virtualized infrastructure. An example is IBM Tivoli Provisioning Manager—a leading provisioning tool that IBM Systems Director can leverage to provision virtual servers using prepared disk images and scripts for a fully automated, exceptionally consistent IT response to business demands. This tool also plays a key role in fulfilling cloud computing strategies by automatically provisioning virtual servers in accordance with user service requests.

IBM Virtualization Services

IBM also offers a suite of services, backed by proven best practices and rendered by skilled professionals and incorporating best-in-class technologies to help organizations capitalize on the promise of virtualization in the most tailored and effective way within their unique business contexts. All services are tied to a consistent reference architecture designed to help discover and target the investment areas most likely to yield the desired outcome in each individual case—a custom IT transformation blueprint.

- IBM IT Strategy and Architecture Services include an infrastructure and planning workshop, as well as network optimization, to ensure that organizations know how best to move forward with virtualization, incorporating many elements and possibilities to deliver an optimized roadmap for change.
- IBM Server Services can help optimize, integrate and implement services pertaining to third party virtualization environments such as VMware and Microsoft® virtualization, as well as IBM offerings such as IBM PowerVM™ and System z/VM® server consolidation.

- IBM Storage and Data Services can help create and implement strategies for storage consolidation and virtualization.
- IBM Network and Desktop Virtualization Services address the different ways organizations can virtualize networks and desktops to reduce sprawl, control costs, simplify management and maximize utilization within those contexts.
- IBM Virtualization Maintenance and Support can help meet the ongoing needs of organizations that have already deployed virtualization solutions and seek to obtain the best business value from them over time.
- IBM Remote Managed Infrastructure Services are also available to allow organizations to outsource whatever aspects of their virtualization strategy they do not wish to create or support themselves. This option can reduce operational costs, capitalize on IBM's deep expertise and broad array of offerings in the virtualization space and enable organizations to focus on their core competencies, which the outsourced virtualization infrastructure will then support in a modular way which aligns well to specific needs.



"IBM can monetize across more business types–hardware, storage, professional services, systems integration, infrastructure software, groupware software, specialized outsourcing and applications, and a lot more. Microsoft not so. IBM can adopt the cloud aggressively and find new innovative models from its diversified portfolio."

— Dana Gardner, ZDNet[9]

IBM is committed to helping today's organizations achieve the full potential of virtualization

In the pursuit of an optimized virtualization strategy, IBM can be the trusted partner today's organizations require—a single-source provider of consulting, expertise and hardware and software solutions they need to ensure that virtualization is leveraged in the ways that make best business sense for them.

No single path or combination of technologies is likely to yield an ideal outcome for any two organizations. In every case, the process to a dynamic infrastructure will mean striving to achieve a tailored fit, implemented in a way that minimizes business impact and maximizes return on investment. Getting that tailored fit means selecting the right partner, and no competitor offers the breadth and depth of virtualization expertise that IBM does. IBM's proven history as a virtualization specialist extends across more than forty years and many thousands of customer engagements around the world; as a result, IBM is better positioned than any other solution provider to advise organizations on what a dynamic infrastructure can help them achieve, and how best to go about achieving it.

IBM also offers the industry's broadest set of virtualization capabilities, from specific infrastructure and management offerings to complete virtualization solutions for single servers and multi-system environments. IBM has design and implementation networking solutions to support a highly available and virtualized environment and the ability to manage both physical and virtual server and storage environments in single- and multi-vendor environments. IBM can support even the most advanced, next-generation strategies and architectures, such as cloud computing, to deliver on the full promise of virtualization through exceptional scalability, flexibility, responsiveness and cost-efficiency.

In short, IBM is ideally positioned to help today's organizations create a more dynamic infrastructure through virtualization—reducing costs, increasing service levels and managing risks for a better business outcome.

For more information

To learn more about Virtualization in a Dynamic Infrastructure® please contact your IBM representative or visit:

ibm.com/itsolutions/virtualization/

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