



IBM Smart Business Desktop Cloud & Atlantis ILIO

The Application Developer Use Case

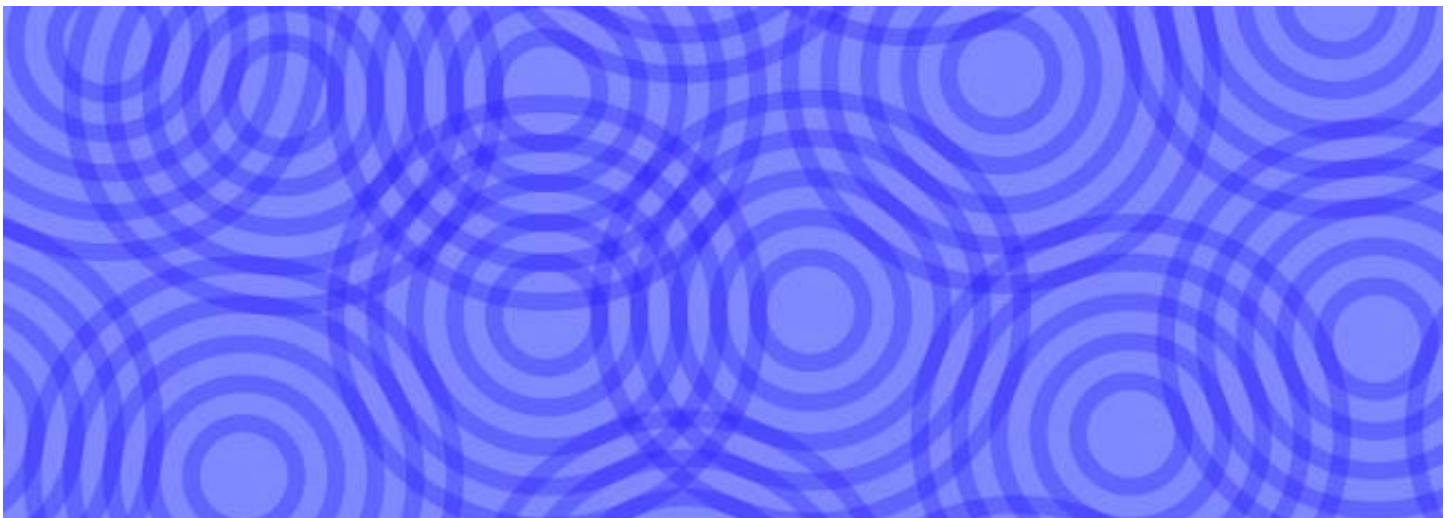


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IBM Smart Business Desktop Cloud

IBM Smart Business Desktop Cloud (SBDC) is an innovative solution that reduces costs and significantly increases flexibility. It leverages best-in-class virtualization technologies to provide a right-sized desktop computing environment that improves security, streamlines desktop management, and reduces the overall cost of desktop administration. IBM SBDC is designed so that applications can be accessed from almost any access device with an IP connection.

IBM SBDC centralizes the processing and storage for end user devices into the data center and offers a secure and robust infrastructure from which applications are delivered. This solution enables a smooth and phased transformation from a complex distributed platform to a secure centralized environment for most types of end user devices.

IBM's SBDC (Smart Business Desktop Cloud) Services are available in three implementation strategies:

- **Project Based Services** – Organizations that are interested in Smart Business Desktop Cloud and need help designing and implementing a solution, but have their own management capability
- **Managed Services** – Organizations that are interested in Smart Business Desktop Cloud and would like IBM to design and implement a solution at their location, and manage the centralized data including the updates and security of the information
- **Hosted Services** – Organizations that are interested in a turn-key hosted solution

Benefits of an SBDC solution include:

- Improved end user computing experience
- Faster desktop performance
- Lower overall Total Cost of Ownership of end user devices
- Predictable operational cost
- Improved security
- Availability to highly skilled IBM IT Virtualization Architects
- Scalable, flexible, infrastructure with access from virtually anywhere on practically any device
- Responsive and recoverable service
- Incorporation of IBM's advanced virtualization technology developments and patents for:
 1. Storage de-duplication
 2. Advanced mobile computing
 3. End user profiling algorithms
 4. Resource optimization

Atlantis ILIO: A Critical Component of IBM SBDC

Cutting Storage Costs, Boosting Performance and Streamlining Image Management

Atlantis ILIO is a critical component of the IBM Smart Business Desktop Cloud that reduces storage costs and complexity, boosts desktop performance and streamlines image management. By leveraging the Atlantis ILIO best-in-class Input/Output (IO) virtualization technology, IBM can provide customers with a cloud-based desktop computing solution that delivers the performance that users demand, the single image management that IT administrator need to reduce desktop management costs and the storage cost reductions that are required to deliver cloud-based computing at a lower cost than physical PCs.

Achieving User Acceptance: Cloud Performance Acceleration

Atlantis ILIO makes cloud-based desktops perform faster by efficiently handling virtual desktop storage access requests locally at the rack level, offloading 95% of storage traffic from the network and storage servers. The result is faster desktop boot times, logon, and increased desktop and application performance. In addition, Atlantis ILIO will eliminate VDI bottlenecks caused by boot storms, logon storms, anti-virus scans, patching and IO intensive developer tasks such as compiling source code.

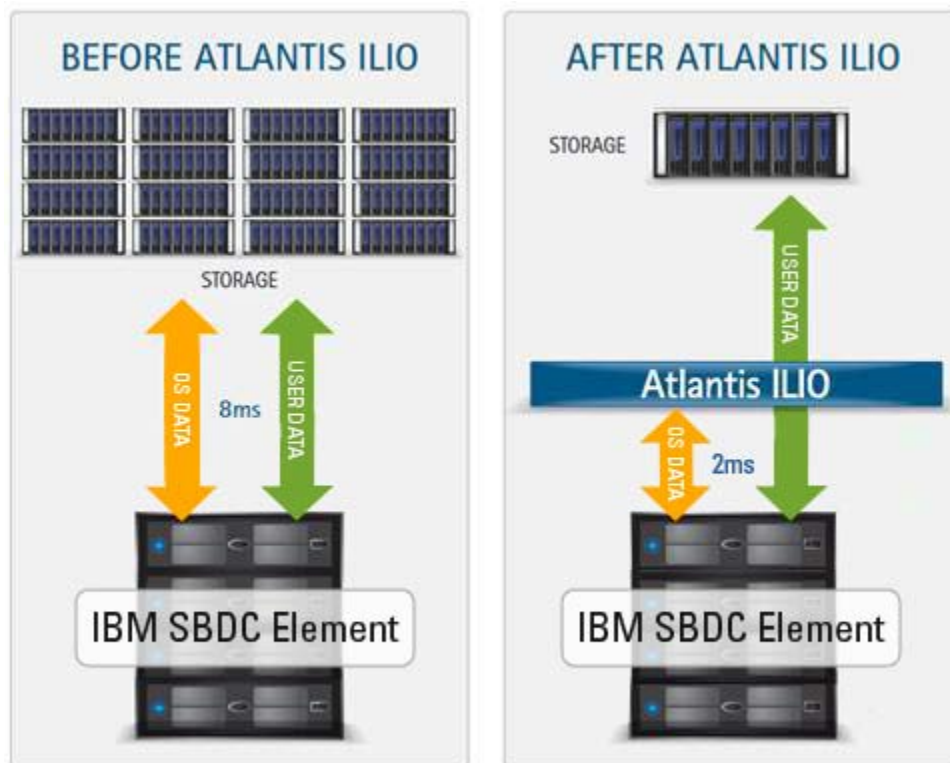


Figure 2 - Atlantis ILO IO Virtualization Technology

Reducing Desktop Management Costs: Cloud Image Management

Atlantis ILIO enables IBM SBDC to transform the way IT organizations manage desktop images from manually configuring, upgrading and patching hundreds of monolithic images to managing a single set of master image components. By taking a new approach to image management for cloud desktops, ILIO provides the benefits of centralized image management with the ability to allow users to install applications and give administrators the ability to instantly patch and update all desktops.

Delivering a Low-Cost Cloud Desktop: Storage Cost Reduction

With Atlantis ILIO, virtual desktops perform more efficiently with cloud-based storage solutions and require up to 20 times less storage. Atlantis ILIO consolidates physical storage by eliminating duplicate information contained in virtual machine images in real-time before it hits the storage cloud. Storage needs are further reduced by providing massive amounts of storage throughput (measured in IOPS) at the IBM SBDC rack level to terminate locally windows operating system traffic from cloud-based desktops. In addition, Atlantis ILIO enables customers to choose low tier storage options.

Atlantis ILIO IO Virtualization Technology

Atlantis ILIO technology analyzes IO flow and intelligently shapes virtual desktop IO into file-based and block-based disk image components, deduplicating shared operating system and application components and caching up to 95% of IO on the Atlantis ILIO appliances to reduce the number of input/outputs operations per second (IOPS) that are serviced by the storage cloud.

Application Developer Use Case

Overview

Application developers have proven to be one of the most popular and cost justified use cases for a desktop cloud solution. A traditional developer desktop is highly complex, requires high performance and is difficult to manage. In addition, more and more developers are working remotely or are working offshore to the actual development environment. All of these factors make a traditional laptop and desktop very restrictive and costly for application developers.

Requirements

High Performance Desktops and Low Latency Source Code Environments

Application developers and engineers in general use complex applications and generate workloads that required significantly higher levels of desktop performance than the average enterprise knowledge worker using productivity applications. Specifically, applications developers have IO usage patterns that require more overall IO traffic, the ability to instantaneously burst to 10 times normal IO and complete a large volume of small transactions with the source code environment at low latency. For example, when an application developer compiles source code on a cloud-based desktop, the source code application generates a tremendous amount of read/write IO traffic by opening, analyzing, processing and generating thousands of small temporary files before creating an executable. In some cases, a single engineering desktop can create and delete 50,000 to 100,000 files during a workload and burst up 1300 IOPS. When multiple developers simultaneously launch IO

intensive tasks, all other desktops that rely on the same shared storage infrastructure will slow significantly until the tasks are complete. Without adequate IO capacity for application developers virtual desktops, a boot storm, anti-virus scan, patch or application update can bring all user desktops to a halt.

Flexible and Customizable Desktop Environment

Application developer desktops must be configured properly, have the latest developer tools and be updated with the latest patches, antivirus updates and configurations to ensure that developers remain productive and that code isn't compromised by malware. When an application developer moves to a new project requiring a new development environment, IT organizations need to be able to rapidly provision a new environment and related tools to the developer. To ensure that application developers accept the transition from physical PCs to cloud-based desktops or VDI, it is important that they have a persistent desktop with the ability to install their own application and customize their environment. For many application developers, the standard is to provide them with administrative rights to the PC.

In addition, application developers have the following requirements:

- Multiple environments
- Quick/Self Provisioning
- Remote Access

Challenges

Achieving High Performance and Low Latency in the Cloud

Cloud-based desktops execute on hypervisors in a compute cloud and generate IO traffic to a storage cloud. The latency between the compute cloud and the storage cloud is a critical factor in achieving a high performance application developer desktop environment. Today's operating systems and developer tools are designed to operate with a low latency dedicated local disk for every desktop. For example, the Microsoft Windows family of operating systems is dependent on performing IO intensive tasks such as file layout optimization, background defragmentation, antivirus scanning and virtual memory paging. Application developer tools must be able to read and write large numbers of small files quickly in order to compile code. However, in a cloud environment, these tasks result in placing a heavy tax on the storage cloud as each developer, application and desktop compete for limited IO capacity (measured in input/output per second-IOPS). Without adequate storage IOPS and low latency, applications and virtual machines take longer to boot and applications respond sluggishly.

“The second factor—which is ultimately the most important in the success of VDI—is the storage I/O required to provide a better-than-PC or equal-to-PC end-user experience. From a business point of view, a VDI initiative won't get past the pilot phase if it becomes clear that the design doesn't provide a satisfying, scalable user experience. With the exception of the most expensive storage solutions, storage serving VDI is often incapable of providing the necessary I/O required to deliver a solid end-user experience.”

**—John Premus and Daniel Beveridge
Virtual Acceleration
Virtualization Review**

Delivering a Cloud-Based or VDI Desktop that Application Developers with Accept

Application developers are accustomed to using high performance physical PCs that give them the ability to completely customized their environment and install user applications. However, traditional VDI requires IT organizations to choose between three undesirable virtual desktop deployment scenarios:

1. Non-Persistent VDI Desktop — The operating system and corporate applications are installed in the virtual desktop. After every session, all user data including user files, settings and installed applications are lost. This approach minimizes storage but is not useable by application developers who want to have access to their customized development environment or user-install applications.

2. Persistent VDI Desktop — User data, settings, applications and operating system files are all stored in the virtual desktop, requiring massive storage capacity and IOPS throughput that increases linearly with every additional user. This approach preserves user files, settings and applications across multiple sessions but comes with prohibitively high storage cost and poor performance. Solving the performance problem for persistent desktops without adding massive amounts of Tier 1 storage IOPS capacity requires adding IO virtualization into each rack of VDI desktops.

3. Non-Persistent Desktop with a Shared Master Disk (AKA Linked Clone or Copy on Write) — The operating system and corporate applications are created in a read-only shared master disk. User files, settings and applications are written to a differential disk image. The two components are combined at boot time. However, each time you change the shared master disk to patch the operating system or upgrade a corporate application, the VM's differential disk image stops working. So, after you create the first shared master disk, you must provision each patch and application one at a time using traditional desktop management tools such as Microsoft SMS. In addition, application developers can't install their own applications or make changes to the environment that requires administrative rights. This approach adds tremendous complexity and has minimal benefit in terms of storage or IT operations cost reduction.

“In general, Citrix's non-persistent model works well... The only real problem with this non-persistent model is that there is no support for saving files or changes that were made outside of the area that administrators have configured to be redirected into the differential file. In other words, users can't install their own applications or change really deep Windows settings. (Of course an easy fix is to use Provisioning Server in "persistent" image mode, where the differential files are saved from session-to-session. This allows users to install their own applications, but it also means that if the administrator changes the master read-only image, all the differential files are invalidated. So if you want to use Provisioning Server with persistent images, you're back to using something like SMS or Altiris to maintain your images.)”

Brian Madden
Brianmadden.com
February 18th, 2009

In addition, delivering desktops to application developers has the following challenges:

- Working remotely
- Patching and updating the development environment
- Quick enablement of workstation
- Workstation CPU power and age
- Productivity loss due to data loss, PC downtime

Desktop Cloud for Developers

The IBM Smart Business Desktop Cloud addresses the performance, manageability and cost requirements and challenges that IT organizations face when delivering desktops to application developers. IBM provides customers with a centralized, secure and low cost desktop environment for application developers by segmenting the business IT environment from the development environment and integrating best-in-class virtualization technologies that are specifically designed to handle the unique performance characteristics of application developers. The desktop cloud connection to backend development environments and storage are built for low-latency, high IOPS capacity and high-bandwidth to ensure a faster and more reliable environment.

Business Benefits

The business drivers for cloud-based desktops include providing a low cost, highly secure, and productive development environment. In our experience, companies have found significant savings per year per developer and many hours of productivity gains when they have implemented cloud-based desktops.

CAPEX: Developers typically have at least one and likely several high-cost workstations that must be replaced often. In the desktop cloud, this is replaced with a low cost traditional business PC or even a thin client. By using Atlantis IO virtualization technology, IBM can deliver a cloud-based desktop at a significantly better price/performance levels when compared to deploying traditional VDI internally.

OPEX: Supporting developers is very difficult for IT since the environment is typically complex. The applications are mixed in with the corporate supported IT environment causing potential conflicts and support issues. In addition, most developers are granted administration rights, which can also cause problems. With Desktop Cloud, there is a clear separation between the corporate environment and the development environment.

DATA LOSS: Typically there is a policy which states that developers not store or maintain code or valuable corporate assets on their own. However, this policy is often broken. PC hard drives break (especially laptop) often. The risk of data loss and the associated productivity loss with application developers is high.

OFF SHORE: Companies are looking more and more to offshore development partners to pick up workload in development. Without a solid Desktop Cloud environment, this is virtually impossible to do in an effective way.

SECURITY: Going hand and hand with the data loss, code and intellectual property can fall in the wrong hands with PCs as it sits exposed on many hard drives.

DEVELOPER PRODUCTIVITY: Using a developer PC is very restrictive and causes a significant amount of developer productivity loss. Because the environment is so complex, it takes a long time to provision and support. In addition, performance degrades quickly in a desktop developer environment, causing the need for more re-builds, re-boots, and resets.

FLEXIBILITY FOR THE DEVELOPER: Developers typically need more than one environment to effectively do their jobs. They want to be able to work from anywhere at anytime. The fat client workstation model does not provide the developer with the flexibility to work anywhere and they are constrained by whatever resources their current laptop or desktop has. The Desktop Cloud allows the developer to dynamically receive more resources, and with policy, check out additional desktops for periods of time. Additionally, since the execution of the environment occurs on the server, there is minimal dependency on the end user device. All the end user device needs to support is a screen display, keyboard and mouse movements. Therefore, the developer is able to work from any device, anywhere there is a network and a thin client or minimal PC.

FLEXIBILITY FOR THE DEVELOPMENT MANAGEMENT: Application development management deals with peak and valley workloads. With the current workstation environment, it is very difficult to dynamically add and remove resources to a high priority project because the provision time is too long to justify the movement. However, with a Desktop Cloud environment, a fully functioning development environment can be provisioned seamlessly to an application developer in seconds. Therefore management may quickly add resources to projects even for short periods of time, without incurring substantial provisioning and logistic costs.

Customer Cases

Financial Services Company

One of the largest global financial services firms was interested in transforming their desktop client delivery model to make it more secure, cheaper and flexible to manage. The customer envisioned a future where over 10,000 desktops could be provisioned securely in seconds with the right applications, configurations, access controls and management infrastructure. The desktop would be served securely from datacenters in a private cloud that could be accessed globally. The desktop experience would be an order of magnitude better in terms of performance than the physical PCs that were in use by a variety of employees including knowledge workers, traders and application developers. Initially, the customer deployed a pilot using traditional VDI products but found that the amount of storage and IOPS required to deliver better-than-PC performance made the project cost-prohibitive. In order to achieve the objectives of the project and work within their budget, the IT organization took a different approach by using persistent virtual desktops with the Atlantis ILIO to reduce storage costs and increase performance.

The benefits of implementing Atlantis ILIO as part of their cloud-based desktop compared to traditional VDI include:

- **Density of users per host:** increased from 15 VMs per host due to IO bottlenecks to 50 VMs per host with ILIO (3.2X)
- **Amount of user storage ultimately consumed:** decreased from 30GB per user to 1.5 GB per user. This was an improvement of 20X. Note: the previous solution without ILIO had thin provisioning and data de-duplication on the primary storage environment.
- **IO Throughput:** IO throughput between a fully loaded rack of servers and the back end storage: reduced by 80% with Atlantis ILIO. Only end user data is sent back to the SAN while all Windows and Application transient IO are handled by the ILIO appliance on the rack.
- **Reduction in IO latency and response:** IO latency between primary storage and virtual desktop hosts was reduced from an average of 8ms (peak of 12ms) to an average of 2ms (peak of 5ms). This is primarily due to the ILIO IO Virtualization Technology freeing up the storage system by eliminating its need to process the majority of IO generated by the virtual desktops.
- **User acceptance:** End users responded positively to the high speed at which they were able to login, load and run applications, load and save data.

Implementing Atlantis ILIO as part of their cloud-based desktop enabled the financial services firm to handle the following scenarios without impacting user performance:

- **Virtual Machine boot storms:** Increased from 15 VMs concurrent boot to 140 VMs concurrent boot per rack. The boot time reduced from 30 seconds per VM to 7 seconds per VM. A full rack could be booted in under 5 minutes.
- **User login storms:** Average user login time was reduced from 8 minutes to under 90 seconds.
- **Anti Virus scans:** Anti-virus scans were no longer saturating the storage system but were localized to the individual VM. The time taken to scan a virtual desktop was reduced from over an hour to less than 10 minutes.

Insurance Company

A US based insurance company made the decision to outsource its development operations to save money, improve development cycle time and bench strength and leverage several outsourcing partners. While this decision was valid from a business point of view, it put tremendous strain on the IT department. The IT department was expected to provide a secure, rapid, and stable development environment to these partners which were all located off-shore. Once the decision had been made to proceed, a very aggressive plan had been put in place. Initially IT gathered a number of PCs and loaded the standard image on the environment, enabled RDP (Remote Desktop Protocol) and gave the offshore development team access to those PCs. As the amount of developers required increased exponentially, the team realized that supporting PCs in their datacenter would hit a limit quickly. They looked at PC Blades and eliminated them for being excessive and too expensive, and did not meet the dynamic provisioning requirements. They also looked at providing laptops/desktops to the outsourcers providing a VPN into the corporate infrastructure for their workstations to connect directly to the developers on their site. This was very costly and the performance of the development environment over the WAN was insufficient and insecure. Ultimately, the company decided to go with a private Desktop Cloud approach. The Cloud approach allowed them to build developer templates that could be quickly provisioned and updated. The Desktop Cloud was installed in an IBM datacenter with low latency connections to their application development environment. The Desktop Cloud saved them an estimated \$1M a year across their 750 user developer community, as well as providing secure, flexible support.

Retailer

A US based retailer made a decision to optimize office space by moving all of their contractors out of the office, requiring them to remotely connect into their infrastructure. Initially, they moved their physical PCs into a closet and the contractors accessed their PC through an RDP session. This was deemed not scalable, expensive and difficult to maintain. Therefore, the retailer made a decision to implement virtual desktops. The initial design called for pools of non-persistent virtual desktops for all of the developers. This design was implemented so a desktop could be built dynamically when needed and then destroyed after the first use. Unfortunately, the way the development tools operate, it was very difficult to get all of the tools to work in that environment and much time was spent trying to make it work. Eventually, it was decided that a persistent desktop would be used and storage would be optimized to reduce costs. The persistent desktop allowed the developer to customize and retain their settings, and all of the development tools ran as they were designed to run. As a result the retailer was able to ramp up the environment to 3,000 plus contractors, speed up projects and reduce real-estate costs by 40%.

Smart Business Desktop Cloud Architecture

Overview

The picture below is a high level view of the IBM Smart Business Desktop Cloud (SBDC) Platform as well as delineation of responsibility. The black line running diagonally through the diagram represents a logical division of the SBDC environment. Your company is the Enterprise, shown on the left hand side. Similar to today, you are responsible for supporting and maintaining your existing “Business apps”, “User data”, and “Active Directory”. The “Elements” and “Access Fabric”, defined below, are the plumbing and compute in the SBDC solution and the responsibility of IBM as the service provider to maintain.

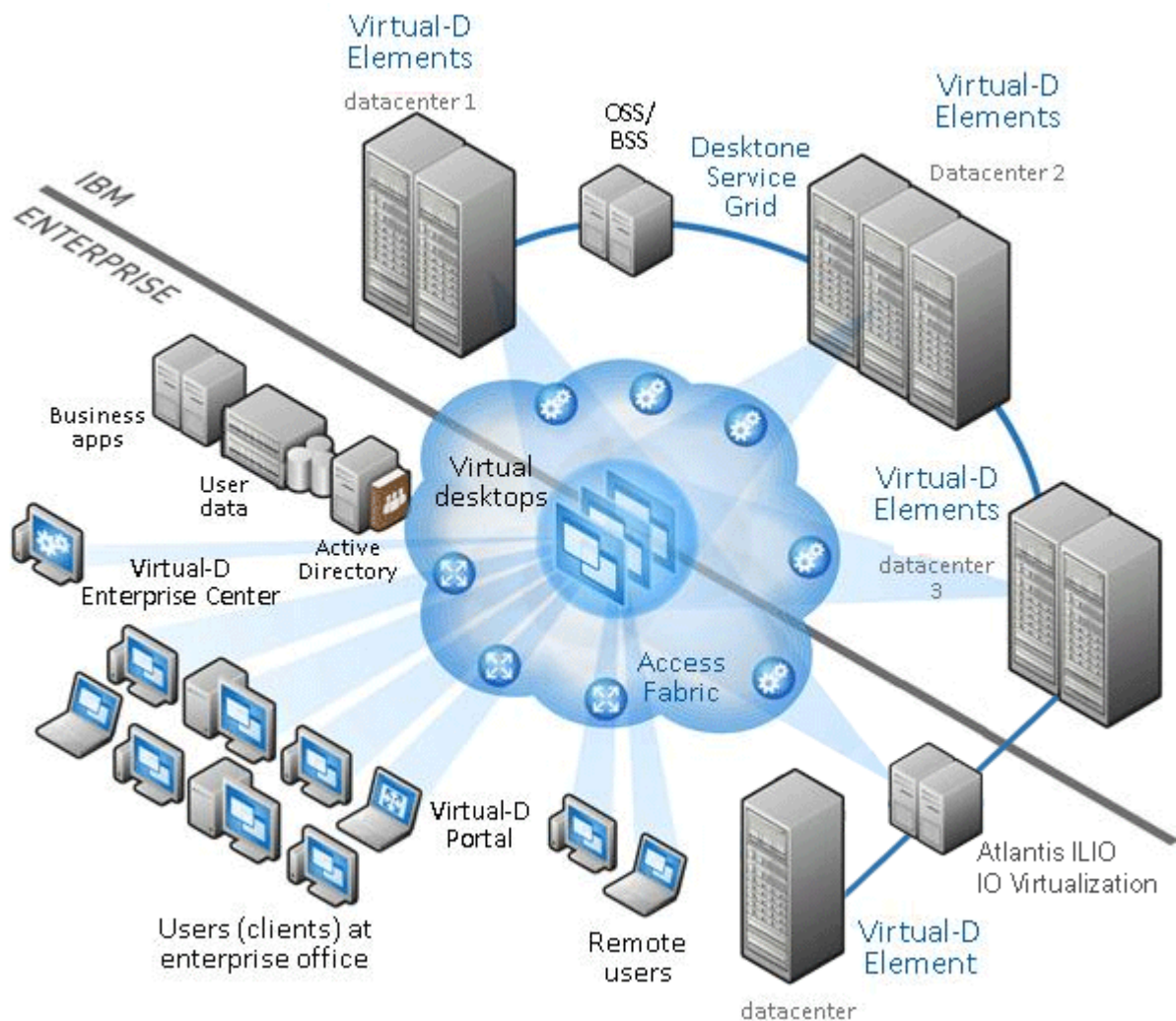


Figure 2 - Virtual-D Element

IBMSBDC Enterprise Center

The Enterprise Center is a web-based management console that allows the desktop administrator to create and manage virtual desktops. In the SBDC model, this interface is provided to you as part of the solution. The Enterprise Center requires no local installation or additional cost, as it is a web-based management interface.

Enterprise Center is the primary management interface for provisioning of virtual desktops. Through the Enterprise Center you will be able to perform several management features.

- The assignment of resources can be done through assignment of single desktops or pools of similar desktops. Individual desktops or pools are assigned to structures inside the existing Active Directory domain.
- Enterprise Center provides a management interface for uploading of golden images, and the cloning of those images. This allows for multiple core images to be leveraged throughout the global environment.
- The interface allows for basic monitoring of the provided desktops, from the perspective of CPU, RAM and disk space. The information is displayed in generic terminology, and the end user is abstracted from the specifics of the underlying management interfaces.

The integration between the IBM SBDC platform and the underlying technologies is completed as part of the implementation process. In addition, maintenance, software updates and new features are also included in the service.

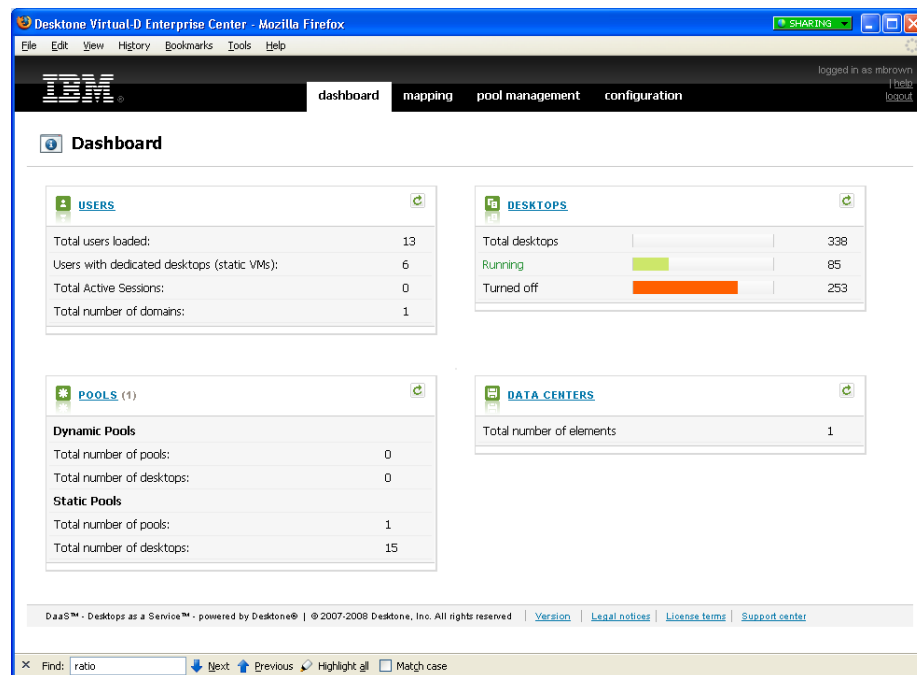


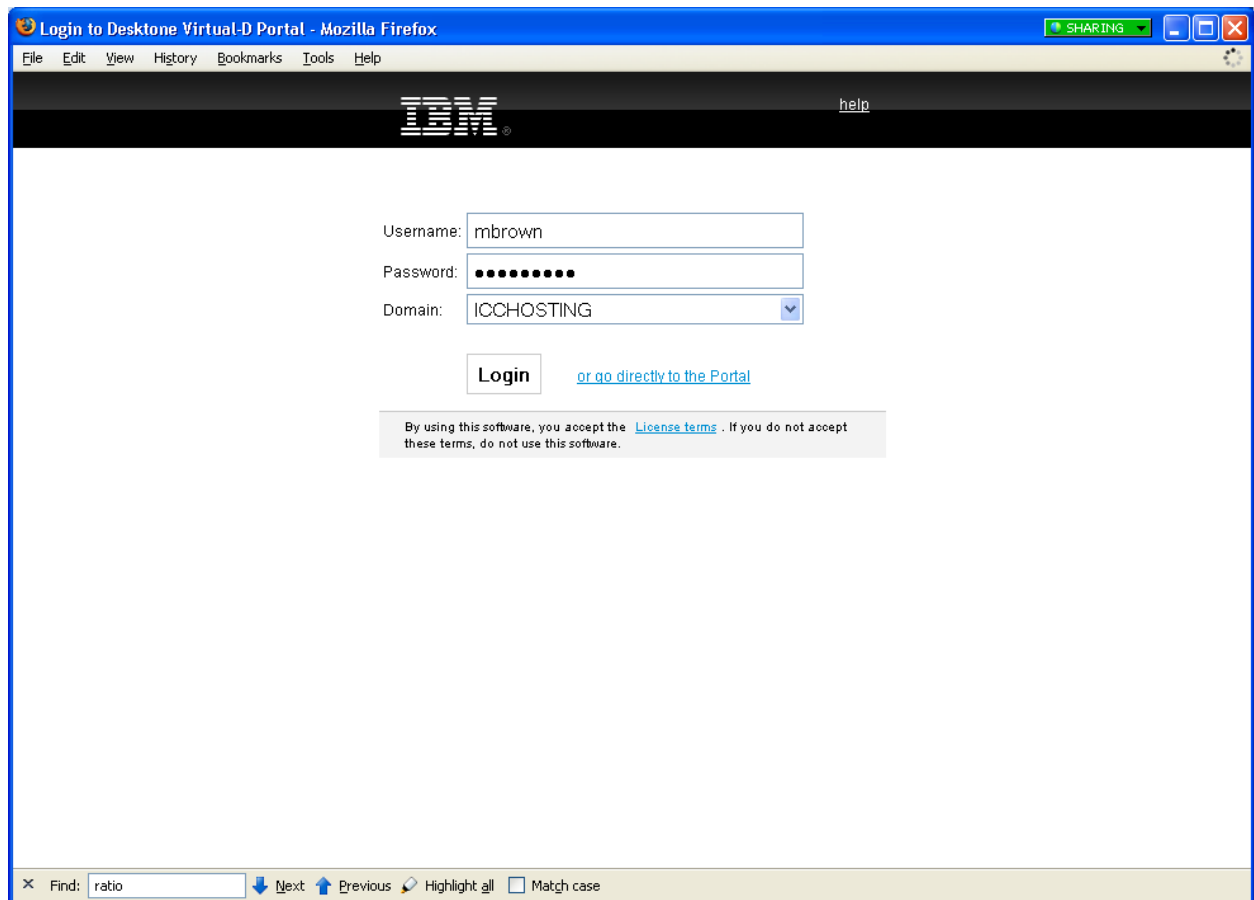
Figure 1 - Screenshot of Enterprise Center

IBMSBDC User Portal

The IBM SBDC User Portal is a self-service, policy-based portal that enterprise users can access from any browser as the entry point to their virtual desktop. Through the User Portal, end users simply provide their username, password and domain, so they can:

- Activate, power on, and suspend virtual desktops based on enterprise policy
- Submit requests for additional virtual desktop resources
- Troubleshoot
- Rate their virtual desktop experience

Users perform these functions without relying on a system or desktop administrator, reducing helpdesk calls. The User Portal can be made available through the corporate intranet or over the internet and is accessed through an end point device.



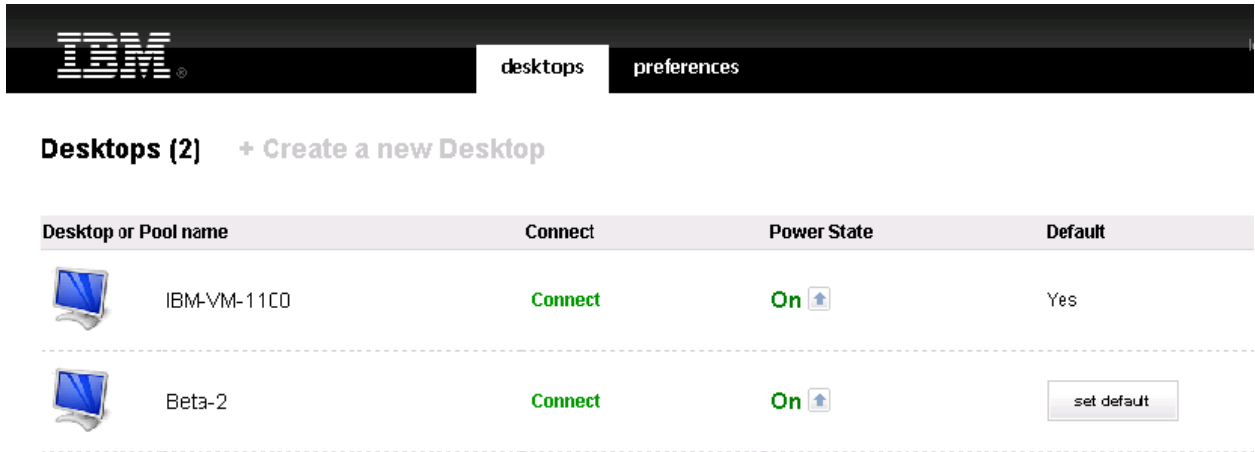


Figure 2 - Screenshot of User Portal Login

End Point Devices

The IBM SBDC Platform is designed to allow flexibility around the end point devices. There are several supported manifestations of the end point device

Thick Clients: Thick clients are traditional machines that run a full blown OS. The User Portal is accessible through any industry standard web browser including Internet Explorer and Mozilla Firefox. Access is supported from any client that can support the required protocol, by default RDP. In addition, it has been tested and certified from Mac OS, Windows and Linux.

Thin Clients: Thin clients are not a requirement in the IBM solution but are leveraged by numerous customers as they provide a longer life cycle, lower carbon footprint and lower capital costs than standard PCs.

IBMSBDC Element

The IBM SBDC Element manages all the compute resources (servers, storage, and networking) and is optimized for hosting virtual desktops. The Element is the basic unit of scalability for the virtualized desktop infrastructure. The Element contains the storage, computing, and virtualization software necessary to support several thousand users. The administration software included in the Element is responsible for monitoring the proper operation and publishing the capabilities and status of the Element to the Access Fabric. As additional capacity is required, additional Elements are added providing unlimited horizontal scalability. Each Element is self-contained and operates independent of other Elements. This allows the performance of the Element to be optimized and characterized in advance of deployment. The redundancy of the Elements also limits the exposure in the event of catastrophic and unexpected failure of a single Element. The below diagram is an example of the Element architecture. The SBDC Element can sit within your datacenters or IBM's.

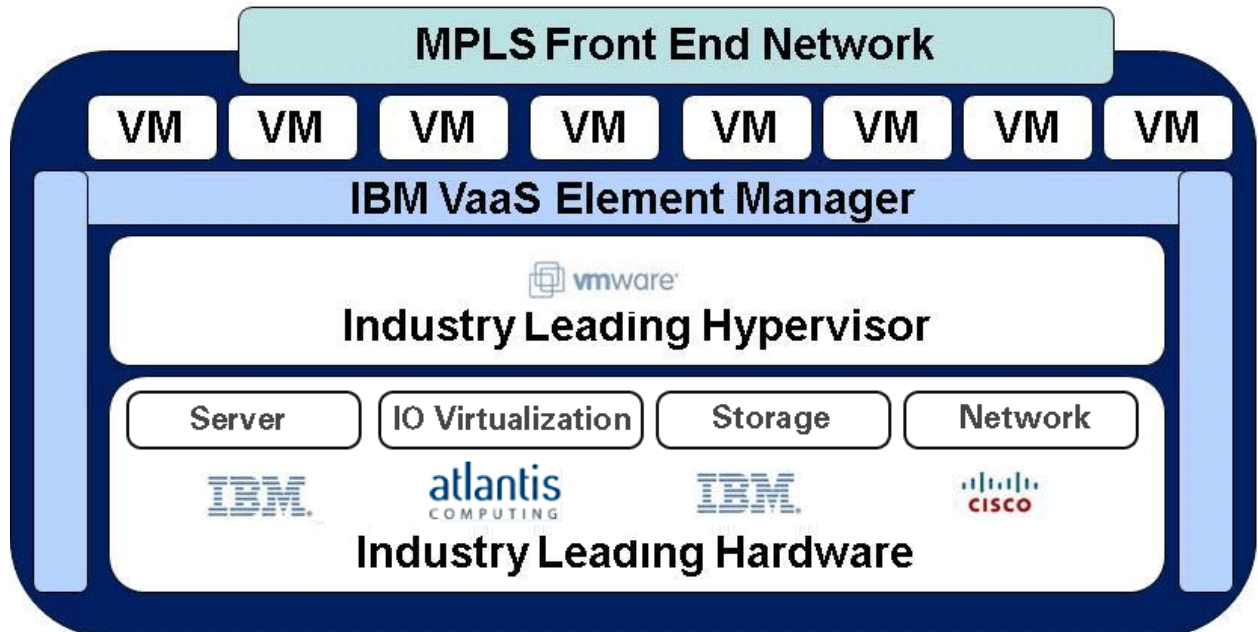


Figure 3 - MPLS Front End Network

Note: The cost and management of Elements is not the responsibility of the customer in the IBM SBDC model. The specific technologies are outlined below to highlight best practices. From a consumption standpoint, the technology can be considered a blackbox.

Hypervisor

IBM SBDC Elements leverage industry standard Hypervisors, as it is our approach that this problem has been adequately solved by other vendors. The IBM SBDC solution utilizes VMware vSphere, as this has been proven to be the best performing and cost effective Hypervisor in the industry. IBM SBDC has performed basic validation testing with Xen from Citrix and Hyper-V from Microsoft. If there is customer demand, then these will be certified for production deployment.

Servers

IBM SBDC solution leverages the IBM System x platform for the core of the Elements. This server decision is based on the equation between cost, performance and standardization in the IBM SBDC environment.

Atlantis ILIO IO Virtualization

Atlantis ILIO is a cloud desktop storage and performance optimization solution that is deployed in the IBM SBDC Element rack to offload 95% of IO traffic, deduplicate shared desktop components on-the-fly before they hit the IBM storage cloud and compose desktops on-demand from a single set of image components to simplify desktop management.

Storage

IBM SBDC leverages IBM N-Series NAS storage. NAS is economical and performs well. Using NFS mount points for the Hypervisor allows for scalability beyond traditional Hypervisor clustering technology and proprietary file systems like VMFS. In addition, IBM leverages Atlantis ILIO to increase storage throughput (IOPS), consolidate physical storage and enable customer to use lower tier storage than is possible with traditional VDI.

IBM SBDC Access Fabric

The IBM SBDC Access Fabric manages IBM SBDC Elements and serves as a highly scalable, distributed network service that allows users to log on to their desktops from any location without needing to specify the IBM SBDC Element that is hosting the users' desktop. The Access Fabric can broker connections to the following technologies:

- Virtual Desktops: Windows and Linux
- Physical and Blade PCs
- Terminal Service Session
- ICA/HDX, VNC or Remote Graphics Software (using RDP)

The Access Fabric, unlike a connection broker, is not associated with any particular group or cluster of virtualized desktops. Instead, the Access Fabric includes a data fabric that maintains the state of the available virtualized desktop resources and the connection policy used to route users to the most appropriate virtualized desktop. The data fabric is a lightweight data structure that is globally replicated across all Access Fabric nodes. This architecture supports the requirement to connect any user to any virtual desktop from anywhere based on policy using the "right" display protocol and is the only system on the market to support the HDX protocol as well as RDP, RGS and VNC. Policies for allocation of resources are optimized using a "best-fit" algorithm between the Access Fabric and the Element. The Element Manager, a layer of management software, collects real time statistics on the environment. The collected metrics that are the foundation for the algorithm include availability, latency, uptime, and existing usage.

The Access Fabric is deployed by a service provider as virtual appliances, pre-built Linux VMs with installed services. These nodes are light weight and low cost. The Access Fabric nodes come in two basic flavors:

- **Portal nodes:** Portal nodes provide users with access to virtual desktops.
- **Management nodes:** Management nodes provide communication between the Access Fabric and the Elements, including the provision and management of pools of virtual desktops SBDC the Enterprise Center.

Portal nodes are small, light-weight nodes that can be geographically distributed to accommodate user distribution. There will generally be many more portal nodes than management nodes.

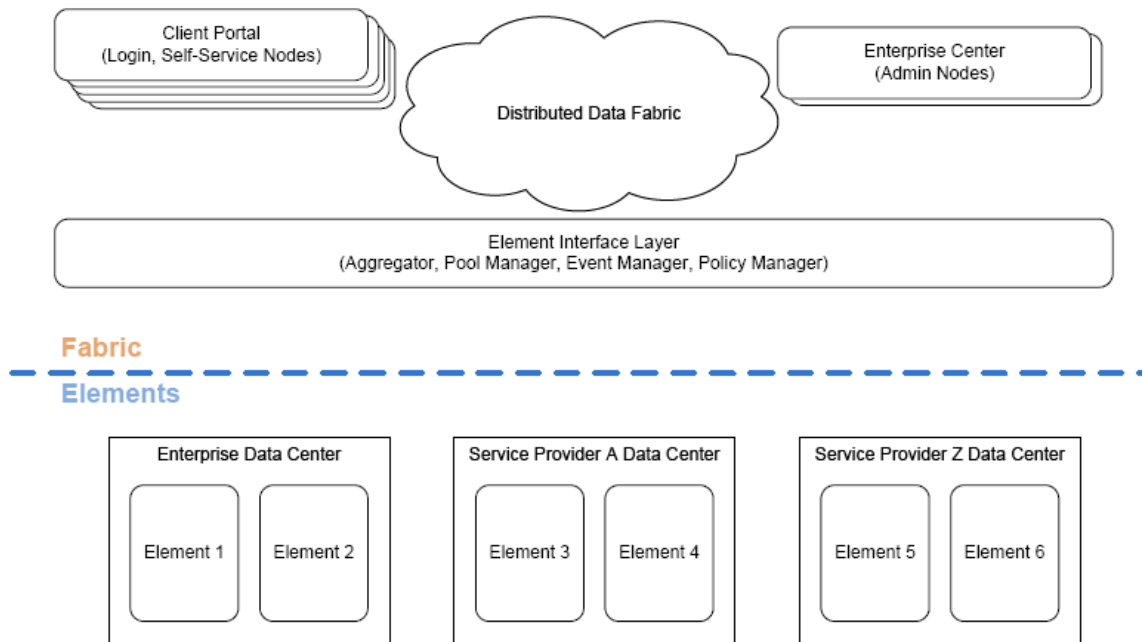


Figure 4 - Fabric/Elements

Rational Lifecycle Tool Suite

IBM has optimized the desktop cloud for running the Rational Lifecycle Tool Suite(LTS). By consuming the IBM Private or hosted Desktop Cloud solution, the application development community uses the Rational LTS suite as a common vehicle for support and management. It essentially converts the application development environment into a seamlessly delivered service. The customer continues to have support from the Rational lab team, as well as the infrastructure support from the desktop cloud team. These two teams work together to provide the customer an integrated and low cost operating environment. In addition, application developer productivity is maximized.

Scalability

IBM SBDC Enterprise Center

The Enterprise Center is optimized for a highly scalable environment. In addition, it is a Web 2.0 inspired interface designed specifically for management of virtual desktops and has been tested with over 70,000 users and desktops.

IBM SBDC Access Fabric

Because of the architectural separation between the Access Fabric and the Element, both are independently scalable and adjustable. Nodes can join the Access Fabric with virtually zero configurations required because the Access Fabric nodes communicate with each others using SBDC multicast. Once a node joins the network, it advertises itself to all the other nodes and becomes part of the Access Fabric. Access Fabric nodes can also be shut off when demand for

logins or for admin sessions is low, independent of how many virtual desktops may actually be in use.

The enterprise interface layer (portal and admin nodes) is the top layer of the fabric and the only layer that is visible to the enterprise users. The underlying data fabric is not visible but is very important because it provides fast, distributed access to common data including user to virtual desktop mapping, pool inventory, and task queues for pool manager, etc. The DHT (distributed hash table), which is present in every node, is used to store key/value pairs where the values are actually objects. In normal operation, all of the data is accessed from memory in the fabric nodes. There is also a persistence layer to provide an additional level of fault tolerance, but this is separate from the normal operation of the fabric nodes.

IBM's Approach

IBM will focus on understanding your company's needs and creating a customized offering based on those needs using standard components. Our detailed recommendations will be based on analysis of your current environment and resources, the target implementation that will meet your goals, and the gaps that exist between them.

Our assessment will review the design of your end user environment, including your existing application hosting servers, network services (DNS/DHCP/WINS), directory services and authentication, recovery procedures and policies, and availability requirements. We will review your security procedures such as user authentication, data confidentiality, integrity and availability protection, remote access (i.e. VPN), and account, auditing and group policies. Recently developed IBM technology will be used to assist in a "real world" automated analysis of your current application, bandwidth, and system usage profiles by end user group.

We will spend time understanding your end user community and their use cases including: remote, mobile, WAN, and LAN requirements. In addition, we will also include your access, workflow, and collaboration requirements. We will also analyze your application portfolio requirements. We will review systems management processes for your end user environment system administration and support, including patch management, asset management, backup and restore, and training requirements.

At the end of our analysis, we will provide you with a document detailing our findings and recommendations, including those for cost reduction, process improvement, and enhanced data security. By combining the technical acumen of our industry-leading Research organization with the experience of delivering working virtualization infrastructures to IBM clients and internal teams around the world, IBM Smart Business Desktop Cloud services delivers the right virtualization solution for the unique needs of your business. After the assessments are completed, a successful Proof of Concept has been implemented, and we agree to the best infrastructure to support your company's most valued assets and end users, IBM will construct the infrastructure and manage it.

Why IBM?

Over the last 10 years, IBM has helped to deploy 1 million server based computing seats and currently manages, as a service, over 4 million desktops and 200,000 Smart Business Desktop Cloud (SBDC) seats worldwide. IBM is committed to leveraging this experience to enable your success with this project.

In addition to its proven experience with the desktop virtualization, IBM provides the design, development, and delivery of a range of hardware, software, services and maintenance offerings for all areas of information technology. IBM is a manufacturer of state-of-the-art, compatible, and reliable hardware and software. If any issue should arise that is related to IBM systems, there can be no better problem resolution resource than the company that actually wrote the original specifications. When you work with IBM, your IT problems and concerns become ours and we will work with you to see that your needs are met.

IBM is a leader in the IT Services industry serving thousands of customers globally. We constantly strive to improve our ability to bring innovation to our demanding clients and to address the changing needs of the overall IT Services industry, IBM made a strategic and transformational change within IBM Global Technology Services (GTS) in March 2006. Recognizing the growing demand for integrated IT solutions that solve business problems and the demand for more pre-integrated, standard offerings that can be continuously enhanced with innovation, we re-organized around Service Products. We began investing in Service Product portfolios and have developed multi-year road maps for each product leveraging 'best of breed' products and solutions in the marketplace. Smart Business Desktop Cloud is an example of the results of this investment. We are also applying IBM's advanced research technologies from our many research labs for leading edge innovation. The end result is a continuous flow of innovative Service Products that are pre-priced, pre-packaged and offer a well invested future of improvement, allowing our clients to focus on their core business solutions.

IBM has a wealth of experience in supporting customer implementations, including skilled project managers, architects, and IT specialists.

There are over 16,000 Project Managers within IBM worldwide. More than 2,400 of those Project Managers have achieved IBM 'Senior Project Management' certification and many more have been further certified as Project Management Institute (PMI) Project Management Professionals (PMPs). These professionals have successfully executed hundreds of thousands of projects, across all business domains. IBM has over 100 project managers experienced in thin-client implementation projects.

IBM is justifiably proud of our thousands of technical experts, with titles such as architect, IT specialist, and network specialists. Many of these skilled practitioners are certified by IBM, technology suppliers, and professional organizations. IBM has over 235 Technical Architects/Solution Architects experienced in designing thin-client architecture.