Windows Server platform introduction

To compete in the global economy and keep up with the pace of innovation, IT organizations must improve their agility when responding to changing business needs, and their ability to improve efficiency and better manage costs while enabling their business and their users to stay continuously productive.

There are several key technology and IT trends that are creating opportunities for IT to better address these needs, including innovations in datacenter compute, storage, and network resources; cloud computing; new application platforms; the explosion of available data; and the proliferation of consumer computing devices.

Microsoft has gained expertise from years of building and operating some of the largest cloud applications in the world, and has combined this expertise with their experiences in delivering market leading enterprise operating systems, platforms, and applications to develop a platform. This platform, which Microsoft calls “the Cloud OS,” addresses the technology and IT trends discussed above.

The Microsoft Cloud OS delivers a modern platform of products and services that helps enterprises transform their current infrastructure to a highly elastic, scalable, and reliable infrastructure; quickly and flexibly build and manage modern applications across platforms, locations, and devices; unlock insights from volumes of existing and new data; and support user productivity wherever and on whatever device they choose.

Microsoft uniquely delivers the Cloud OS as a consistent and comprehensive set of capabilities that span on-premises, service provider, and Windows Azure datacenters, enabling enterprises to improve scale, elasticity, and availability of IT services.

The heart of the Microsoft Cloud OS is Windows Server 2012, which delivers upon the promises of a modern datacenter in four ways:

- It takes you **beyond virtualization**: Windows Server 2012 offers a dynamic, multitenant infrastructure that goes beyond virtualization to provide maximum flexibility for delivering and connecting to cloud services.
- It delivers **the power of many servers with the simplicity of one**: Windows Server 2012 offers excellent economics by integrating a continuously available

and easy-to-manage multiple-server platform with breakthrough efficiency and ubiquitous automation.

- It opens the door to **every app on any cloud**: Windows Server 2012 is a broad, scalable, and elastic server platform that gives organizations the flexibility to build and deploy applications and websites on-premises, in the cloud, and in a hybrid environment, using a consistent set of tools and frameworks.
- It enables a **modern workstyle**: Windows Server 2012 empowers IT to provide users with flexible access to data and applications from virtually anywhere, on virtually any device, with a rich user experience, while simplifying management and helping maintain security, control, and compliance.

IT Priorities

Business needs

Today's fast pace of business innovation, coupled with the globalization of the economy which has opened deeper and wider varieties of markets, potential business partners, and competitors, drives an urgent need for enhancing fundamental business capabilities.

Ideas and invention can fuel competitive business innovation, but only if they are effectively executed upon. Realizing innovation inevitably involves the modification of business processes and, in some cases, the implementation of entirely new business processes that must be effectively integrated, along with their supporting systems, across the value chain.

Furthermore, enabling innovation should be quick and flexible, enabling new ideas to be piloted with minimum lead time, startup cost, and risk. As the changes prove their ability to add value, they must be flexible to allow optimization and to scale capacity as needed.

In addition to implementation of new ideas, there is a standing imperative to improve employee productivity. Productivity improvements directly yield competitive differentiation, including increased efficiency, improved business velocity, and deeper relationships with customers and partners. New mobile technologies are enabling productivity improvements with whole new work scenarios, from access to colleagues and systems from personal devices, to

ubiquitous access to data and systems in the field while interacting with and servicing customers and partners.

The information age has created exponentially growing volumes of data available to be tapped to drive better business decisions. This data comes from a variety of sources and formats, such as operational data from intelligent devices, social data from consumers, and syndicated data from third-party sources. Effectively harnessing this data can drive business innovation and promote a data-driven business by infusing data into day-to-day decisions.

Finally, the denominator of the bottom line, costs, must be continually assessed and managed in order to provide the fuel for innovation, richer customer experiences, and a competitive cost position.

Technology and IT trends

To address these business needs, there are key technology and IT trends that are making impacts, creating opportunities, and/or being driven across enterprises.

Information Technology Innovations: Moore's Law has continued to hold true with increasing chip density, enabling increased performance and reduced costs of datacenter compute, storage, and network resources. At the compute level, more powerful, multicore processor chips enter the datacenter every day. Tiered storage solutions, with increased density and lower cost memory chips for SSD that supplement the performance and reliability of commodity disk drives, provide huge opportunities for the datacenter. Finally, faster network interconnects and new network offload technologies, such as Remote Direct Memory Access (RDMA), have become mainstream. The key to unlocking the full potential of these resource innovations is integrated software control, which allows agility and coordination of resources beyond what is possible with fragmented control.

New Applications: Business innovation and agility drive the need for more system and integration flexibility. Such flexibility demands new application and services architectures that promote component application architectures that have greater connectivity, are built upon new application frameworks with richer sets of common services, and can readily take advantage of familiar productivity, collaboration, and social networking tools.

Device Proliferation: Innovations in consumer computing devices offer opportunities for enterprises to foster increased productivity by enabling users to work in new ways, such as working from home and on the go. Innovations in highly mobile device form factors—with instant on, connectivity via Wi-Fi and cellular networks and integration of powerful features such as touch screens, cameras, and GPS—have created rich user experience preferences that carry expectations and requirements into the enterprise. This “consumerization of IT” trend offers enterprises opportunities to support and incorporate these experiences and devices to improve productivity and enable whole new work scenarios, such as convenient access to data and applications in the field, and new device applications that are contextually relevant.

Data Explosion: The exponential growth of available data creates significant challenges for IT. The data comes from a variety of internal and external sources, exacerbated by a proliferation of business and personal computing devices in use, and in many different structured and unstructured formats. Relevancy and useful insights into the data are often sparse and hidden in combinations of multiple data sources. In many cases, the sheer volume of data prevents organizations from capturing and analyzing it with traditional methods such as storage in a database for query and analysis. In some cases, the data streams at a rate and volume that prevents any capture or process of anything beyond a limited window of time.

Cloud Computing: To address the challenges of new applications, device proliferation, and data explosion, organizations need to take new approaches for effectively and efficiently harnessing the latest IT innovations in a converged datacenter infrastructure. Abstracting resources from individual hardware components to a pooled set of resources, while maintaining workload isolation, allows organizations to achieve highly agile workload provisioning, continuous availability, and elastic scaling, while optimizing utilization of their resources. This "cloud computing" delivery model has evolved with new IT service delivery models to render and manage these capabilities to their full potential.

Many enterprise IT departments have recast their datacenter services into "private cloud" computing models, have automated their delivery model with self service provisioning and administration portals, and instituted chargeback based on resource usage. Datacenter service providers have also transformed their service delivery to cloud computing models, offering even more attractive resource pooling economics at often higher levels of IT service maturity. With

consistency of the cloud environments and proper automation, enterprises can use the offerings of public service provider clouds to extend their private cloud to further improve service scale, elasticity, and availability.

The Microsoft Cloud OS

Microsoft has anticipated and harnessed these trends and disruptive technologies into innovations in their datacenters, and in turn, in their products and services that enable enterprises to realize these new capabilities and efficiencies. With a diverse array of some of the world's biggest applications that serve hundreds of millions of people globally, such as MSN, Microsoft Bing, Xbox LIVE, Windows Live, Office 365, and Dynamics CRM, Microsoft operates multiple major datacenters across the globe, with hundreds of thousands of machines, terabits of network access, and hundreds of petabytes of data. Microsoft brings this experience of building and operating these applications and services to deliver a highly dynamic, continuously available, and cost-effective platform consisting of the right operating system, the right management stack and tools, and the right services – the Microsoft Cloud OS.

The Microsoft Cloud OS delivers a modern platform of products and services that enables enterprise IT to more effectively address today's technology and IT trends:

The Microsoft Cloud OS provides enterprises with a highly elastic and scalable infrastructure with always-on, always-up services. Automated management, robust multitenant support, and self-service provisioning help enterprises transform their datacenters to support the coordination and management of pooled sets of shared resources at the datacenter level, replacing fragmented management of individual server nodes.

The Microsoft Cloud OS enables enterprises to quickly and flexibly build and manage modern applications that interact and exchange data with other applications built on multiple platforms and languages, and that live on-premises and/or off-premises. These modern applications must be supported on multiple types of devices, and may integrate social data or foster social connections among users.

The Microsoft Cloud OS enables enterprises to help users make faster, better business decisions by capturing and analyzing growing volumes of

unstructured, streaming, and/or voluminous data ("Big Data"), from existing and new sources, and delivering this data to more users with the right IT oversight.

And last not least, the Microsoft Cloud OS helps enterprises make their users productive wherever they choose, on whatever device they choose, with easier device management and secure delivery of applications and data in extended, mobile environments.

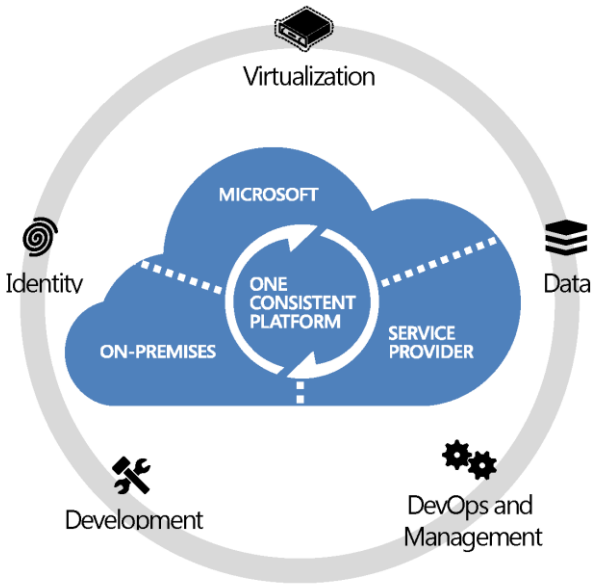

Figure 1 – The Microsoft Cloud OS

Microsoft uniquely delivers the Cloud OS as a consistent and comprehensive set of capabilities across the enterprise private cloud datacenter and public cloud datacenters, such as Windows Azure or public cloud offerings from service providers. The consistency of these capabilities enables the seamless and agile integration of private and public clouds needed for enterprises to further improve service scale, elasticity, and availability:

- **Agile Development Platform**: The Microsoft Cloud OS allows enterprises to build applications they need using the tools they know, including Microsoft Visual Studio and .NET, or open-source technologies and languages, such as REST, JSON, PHP, and Java.
- **Unified DevOps and Management**: The Microsoft Cloud OS supports unified DevOps and unified application life-cycle management with common application frameworks across development and operations. With Microsoft

System Center integration with development environments such as Visual Studio, enterprises can achieve quick time-to-solution and easy application troubleshooting and management.

- **Common Identity**: The Microsoft Cloud OS implements Active Directory as a powerful asset across environments to help enterprises extend to the cloud with Internet scale security using a single identity and to securely extend applications and data to devices.
- **Integrated Visualization**: To help enterprises achieve the modern datacenter, the Microsoft Cloud OS includes an infrastructure which provides a generational leap in agility, leveraging virtualization to deliver a highly scalable and elastic infrastructure with always-on, always-up services across shared resources and supporting cloud service delivery models with more automated management and self-service provisioning. With Windows Server 2012, the Microsoft Cloud OS is engineered for the cloud from the metal up with virtualization built as an integrated element of the operating system, not layered onto the operating system.
- **Complete Data Platform**: The Microsoft Cloud OS fully supports large volumes of diverse data, advanced analytics, and enterprise BI life-cycle management, with a comprehensive set of technologies to manage petabytes of data in the cloud, to millions of transactions for the most mission-critical applications, to billions of rows of data in the hands of end users for predictive and ad-hoc analytics.

Realizing the Vision

The heart of the Microsoft Cloud OS is Windows Server 2012, which delivers upon the promises of a modern datacenter and people-centric IT in four key ways:

- It takes you **beyond virtualization**: Windows Server 2012 offers a dynamic, multitenant infrastructure that goes beyond virtualization to provide maximum flexibility for delivering and connecting to cloud services.
- It delivers **the power of many servers with the simplicity of one**: Windows Server 2012 offers excellent economics by integrating a continuously available and easy-to-manage multiple-server platform with breakthrough efficiency and ubiquitous automation.

- It opens the door to **every app on any cloud**: Windows Server 2012 is a broad, scalable, and elastic server platform that gives organizations the flexibility to build and deploy applications and websites on-premises, in the cloud, and in a hybrid environment, using a consistent set of tools and frameworks.
- It enables a **modern workstyle**: Windows Server 2012 empowers IT to provide users with flexible access to data and applications from virtually anywhere, on virtually any device, with a rich user experience, while simplifying management and helping maintain security, control, and compliance.

Beyond virtualization

IT must extend the evolution of its datacenters beyond the virtualization of server, storage, and network resources to enable cloud services that can easily and more securely connect and integrate with other cloud services.

Windows Server 2012 provides a mature, full-featured datacenter and cloud platform that supports fully isolated multitenancy, guarantees the right amount of resources, and provides comprehensive Quality of Service (QoS) management for each workload as well as usage-based chargeback to business units and customers. These capabilities enable Windows Server 2012 to help organizations build private clouds, offer cloud services, and connect them more securely to public cloud services.

Figure 2 – Beyond virtualization – key Windows Server 2012 capabilities

Complete virtualization platform

To support business process agility, organizations must minimize lead times for the implementation of new, fit-for-purpose applications, services, and system

integrations. Not all investments in change will be successful and deliver a positive return, so it is important for organizations to reduce financial risks by minimizing project costs. With resource pooling and virtualization, organizations can deploy infrastructure and servers for new applications more quickly by simply spawning another instance of a pre-configured virtual machine on existing hardware.

As the demand for existing applications grows and shrinks, IT must be able to scale capacity elastically by dynamically reallocating resources to applications as needed, with minimal service disruption. To maximize this flexibility, resource pooling and virtualization technologies should be able to move virtual machines not only among servers of a cluster, but also among servers that may be in different datacenter or cloud environments.

Windows Server 2012 supports this flexibility with features such as Share-Nothing Live Migration, which enables users to create or copy a virtual machine on one Hyper-V host and migrate it to another Hyper-V host that has nothing in common but a shared Ethernet cable, with no interruption in service. Windows Server 2012 accomplishes this by mirroring writes to the source and destination storage while the move is occurring, before finally switching execution of the virtual machine to the destination host.

IT may have a need to host applications and services from different divisions or even different organizations in a manner that provides complete virtual isolation of the computing environments from each other. With technologies that provide multitenant isolation, these different environments can still run on a pooled set of resources. This isolation helps secure the applications and information of a tenant from access by other customers by logically isolating the virtualized compute, storage, and network resources. In addition, isolation ensures the availability of a minimal level of resources for a tenant's workload, protecting it from automatic allocation to another tenant's workloads that may request additional resources to handle a spike in load.

Windows Server 2012 offers a fully isolated, multitenant infrastructure that goes beyond virtualization technology to a complete platform for building a private cloud. Windows Server 2012 virtualizes compute, network, and storage resources, helping to enable full isolation that includes securing access to information and protecting resource allocations. Windows Server 2012 supports robust and extensible multitenancy with a rich set of multitenant-aware capabilities, such as the extensible Hyper-V Switch, Hyper-V Network

Virtualization, and Network QoS, which provide the ability to separate virtual machine workloads from each other and adhere programmatically to service level agreements (SLAs) by guaranteeing minimum bandwidth available to a virtual machine or port. For example, the QoS feature in Windows Server 2012 enables convergence of all types of network traffic onto a single network adapter, while setting the correct allocation of bandwidth to meet QoS levels. Organizations can streamline how they deliver an accurate view of pooled resources and their use.

When rationalizing the enterprise IT platform, organizations can minimize investment risk by avoiding capital expenditures in lieu of operating expenses that can vary with services offered and capacity demanded, and by using capital investments that have the flexibility to support new scenarios and help avoid adverse momentum that undermines change.

In a virtualized environment where resources are pooled, it is difficult to determine incremental costs for a new application or to scale up an existing application. In a traditional datacenter, capital expenditures for new servers would simply be charged back to the requesting organizations. In a private cloud, where resources are typically shared among multiple organizations, resource consumption by each application or service should be metered. Metered data can then be used to charge back cloud customers only for the resources that they use, effectively converting a higher, riskier capital expenditure to a lower, less risky operating expense. In this model, IT assumes the risk of under-utilization of the platform instead of the business, although the expenses are much lower due to resource pooling.

The resource metering feature in Windows Server 2012 makes it easier to track historical data about each tenant's use of virtual machines. Hyper-V aggregates use data across the multitenant environment, which can then be used to perform capacity planning or monitoring.

Improved scalability and performance

As successful initiatives mature and grow, further agility is needed to dynamically and elastically scale the capacity of applications and services to maintain performance levels while meeting growing business demand. Resource pooling can dramatically improve the ability to manage application performance, while maximizing the utilization of hardware assets. Resource pooling shares virtualized computing, storage, and network resources across applications and

services, in a manner that they can be allocated elastically on an as-needed basis, while the application or service is running, and without any apparent interruption in operation or availability. This ability to dynamically balance application loads across the pool of available resources maximizes available hardware utilization, alleviates the need to purchase additional hardware for new applications, and allows applications to handle peak loads more effectively. Resource pooling technology also simplifies resource capacity management with better visibility and scaling—when the platform crosses (or is projected to cross) a certain threshold of utility, IT simply plugs in more hardware and turns it over to the resource pool.

In addition to optimizing the utility of hardware resources and scalability and availability of applications, virtualization and resource pooling provide a level of consistency that simplifies the logical architecture of the platform, making it easier to manage and change.

Windows Server 2012 provides significant improvements in scalability and performance for virtualized platforms that deliver a high-density, scalable environment that can be adapted to customer needs. Hyper-V has been enhanced to provide greater support for mission-critical, performance-intensive tasks, allowing a fixed amount of resources to run more workloads faster.

Hyper-V greatly expands support for host processors and memory for large, high-performance virtual machines to support workloads that might need to scale up significantly, including support for as many as 32 virtual processors and 1 terabyte of memory for Hyper-V guests, a new VHDX virtual hard disk format with larger disk capacity of up to 64 terabytes, and new, advanced features such as Offloaded Data Transfer (ODX), which supports speeds virtual machines read from and write to storage that rival that of physical hardware. In addition, Hyper-V has many enhancements and new capabilities to improve virtual machine density, including increased cluster sizes, a significantly higher number of active virtual machines per host, and advanced features such as NUMA-Aware Scalability, which improves efficiency of memory access, and Minimum Memory, which uses smart paging to lower the amount of memory required to start up a virtual machine.

Connecting to cloud services

Organizations can pool resources within a datacenter, across their datacenters, and even with third-party service provider datacenters. Such an extension of a resource pool can be a very economical and low risk approach to handling growth and/or peak loads, as well as the implementation of continuously available, geo-redundant architectures.

When workloads are dynamically moved to and between on-premises cloud environments and outsourced datacenter or public cloud computing environments, it is critical for organizations to maintain compliance with security policies for data in transit and data access, continuity of common application services, and integration between applications. Managing and maintaining this continuity at the infrastructure level helps provide flexibility and simplicity at the application level. This reduces implementation and integration times, which further enables business agility in changing and integrating business processes.

Windows Server 2012 enhances the security for connecting to cloud services by using a common identity and management framework. With Identity Federation, Windows Server 2012 maintains security for applications that reside either on-premises or in the cloud with consistent, centrally managed authentication and authorization services. Virtual private network (VPN) site-to-site functionality provides cross-premises connectivity between enterprises and hosting service providers. With cross-premises connectivity, enterprises can use their existing networking equipment to connect to hosting providers using the industry-standard IKEv2-IPsec protocol.

The power of many servers, the simplicity of one

Whether IT organizations are ready to move to a cloud computing model now or later, with Windows Server 2012 they can immediately benefit from enhancements that offer new levels of support to traditional datacenter and cloud environments alike. IT organizations can evolve their datacenters to improve service availability while reducing costs through the use of lower cost assets. They can also use assets more effectively and improve the efficiency of IT management tasks.

Windows Server 2012 is efficient, continuously available, and manageable. It integrates a continuously available and easy-to-manage multiserver platform

with breakthrough efficiency and ubiquitous automation. Windows Server 2012 makes it nearly as easy to manage many servers across multiple sites as it is to manage a single server, while delivering the reliability and scalability of multiple servers. With new advanced features and capabilities designed to improve manageability, performance, and reliability at the individual server level, within clusters, and across multiple datacenters, Windows Server 2012 offers the power of many servers with the simplicity of one, regardless of the size of an organization's environment.

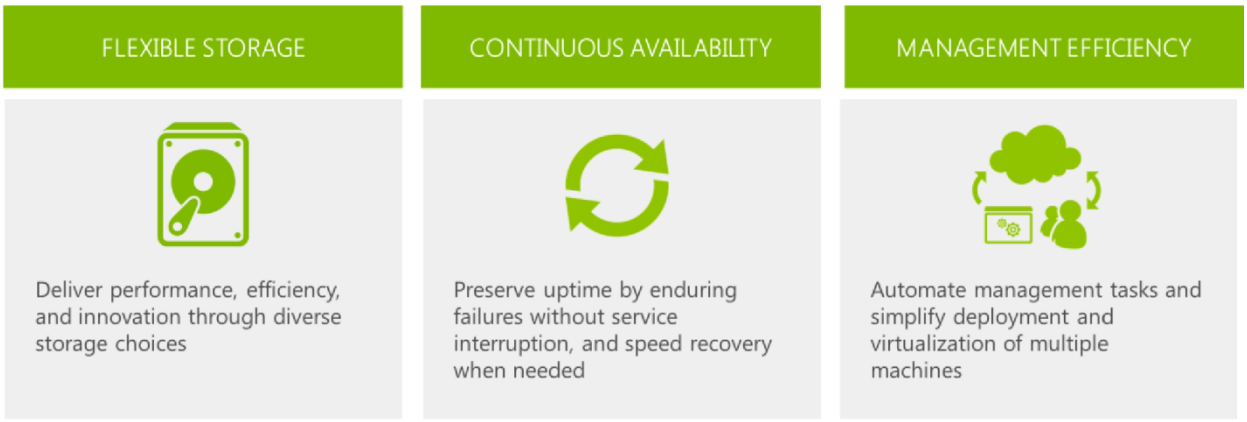

Figure 3 – The power of many servers, the simplicity of one – key Windows Server 2012 capabilities

Flexible storage

In most organizations, IT is perceived as a cost center and often experiences pressure to reduce its costs. Through virtualization with resource pooling, organizations can consolidate applications and services onto less hardware and potentially even fewer datacenters, which ultimately can help reduce space and power requirements. This drastically reduces datacenter operating expenses and minimizes capital expenditure for new applications and services.

If capital expenditure is required to expand capacity, organizations should employ industry-standard hardware as much as possible. In most cases, an architecture that supports resource pooling with continuous availability and failure recovery reduces the need for hardware with higher than average reliability. Failed hardware can simply be replaced, with virtually no service interruption or loss of data.

In addition, organizations should consider industry-standard server technologies as an alternative to specialty virtualization and resource pooling of hardware technologies for storage and networking. These technologies have advanced to the point where they offer many of the capabilities and the performance of specialty hardware, for a fraction of the price.

With Windows Server 2012 organizations can take advantage of industry-standard hardware for continuously available, high-performance storage solutions. For example, with Windows Server 2012 administrators can store application data on inexpensive, yet continuously available Server Message Block 3.0 (SMB 3.0) file shares, alleviating the need for expensive SAN devices in many cases. Storage Spaces, another new feature in Windows Server 2012, delivers a cost-effective solution for storage virtualization capabilities, which empower customers to use industry-standard storage for both single-node and scalable multinode deployments.

Continuous availability

The value of IT is rapidly undermined if its systems are not accessible when they are needed. To maximize business productivity, efficiency, and service levels, IT should make applications, services, and information continuously available and resilient to faults.

Resource pooling of compute, storage, and network resources into virtualized private cloud environments can provide resiliency against hardware failures since virtual machines can be migrated freely across hardware. Resiliency can be improved to the point of fault tolerance with no perceived service interruption in a continuous availability, failure recovery architecture that is supported by appropriate automation in a virtualized infrastructure. Continuous availability, failure recovery automation requires high performance (for example, in terms of throughput and latency) of network and storage to attain true transparency of failover without interruption or reduced application performance levels.

In addition to supporting resiliency of applications to maximize their availability, it is also important for organizations to protect their application data against loss or corruption in the event of a hardware fault. Even if a continuous availability and failure recovery architecture ensures that redundant copies of data are engaged to prevent data loss and service interruption in the event of a

storage fault, the faulty storage volume must be repaired and the data restored as soon as possible after fault detection to restore the architecture back to its full effectiveness against future faults.

Windows Server 2012 supports continuous availability by providing high IT service uptime and transparent recovery assistance from a wide range of failure scenarios for individual servers, server clusters, and servers across datacenters. For example, at the individual server level, Windows NIC Teaming provides transparent NIC failover, and Online Corruption Repairs isolates and repairs file system corruption while the volume is online and unaffected portions of the file system remain available. Active File Server Clusters provides transparent failover across server clusters by moving file server clients without any service interruption. Hyper-V Replica provides active-active clustering of any workload across datacenters by replicating a virtual machine from one location to another and then keeping the virtual machines synchronized. Hyper-V Replica works with virtually any server vendor, any network vendor, and any storage vendor. If a failure occurs at the primary site, administrators can quickly restore their business operations by bringing up the replicated virtual machine at the replica site. Hyper-V Replica provides a virtual machine-level, affordable, reliable, and manageable replication solution that is tightly integrated with Hyper-V Manager and the failover clustering feature in Windows Server 2012.

Management efficiency

Enterprises must rationalize the portfolio of enterprise applications to consolidate systems, remove wasteful redundancies, and drive consistency. This in turn will simplify and streamline dependent business processes, simultaneously improving their efficiency, performance, and agility. User productivity will improve due to use of fewer, more integrated applications, and more consistency in system UIs. In addition, the resulting simplification of business processes and systems will help provide a crisper definition and documentation of processes, as well as cleaner system architecture that can simplify system integration tasks – both of which are essential for supporting agility.

This simplified set of enterprise applications should run on a modern IT platform, with uniformity of IT services and consistency across environments to simplify and allow automation of management tasks. IT employee labor costs are a significant line item in the IT budget. Employing technologies and architectures

that are more automated, reliable, and resilient can reduce required technology management efforts, and increase the server to administrator ratio. These technologies have the effect of reducing IT complexity by increasing consistency across and simplifying the architecture of the platform. This reduction in complexity, combined with the integration and/or consolidation of platform management tools, enables organizations to centralize control and automate tasks across environments that can further reduce required management efforts.

Reducing the costs and efforts required to operate IT infrastructure frees resources that can be redirected to work more closely with the business to support business agility, increase the velocity of new application deployment and system integration, and improve service levels. This heightened focus on the immediate needs of the business enables IT to deliver and support innovations to users, partners, and customers faster than they have ever been able to do in the past.

Windows Server 2012 delivers significant management efficiency with broader automation of common management tasks and a path toward full "lights-out" automation. For example, Server Manager in Windows Server 2012 enables multiple servers on the network to be managed effectively from a single pane of glass. With the Windows PowerShell 3.0 command-line interface, Windows Server 2012 provides a platform for robust, multi-machine automation for all elements of a datacenter, including servers, Windows operating systems, storage, and networking. It also provides centralized administration and management capabilities like deploying roles and features remotely to both physical and virtual servers, and deploying roles and features to virtual hard disks even when they are offline.

Every app, any cloud

To increase business agility and take advantage of the increased service levels a modern datacenter can offer, IT needs to think about ways to build and deploy new, mission-critical and web-enabled applications that can run on-premises, off-premises, and in a hybrid environment.

Windows Server is a proven application and web platform – with thousands of applications already built and deployed on the Windows platform, and a community of millions of knowledgeable and skilled developers already in place. The new version of Windows Server will keep bringing innovations to developers

and end customers. On Windows Server 2012, applications can run well in virtually any application environment developers choose (for example, .NET languages, Java, PHP, or Python). Windows Server 2012 also offers the flexibility to build and deploy applications and websites across premises on a scalable, elastic, and open web and application platform.

Figure 4 – Every app, any cloud – key capabilities

Flexible

By connecting a private cloud to a compatible public cloud, resource pooling can provide access to a practically limitless level of application scalability. This is accomplished with virtual machine portability between private and public clouds, enabling applications and services needing additional scale to be dynamically moved. Access and movement to public cloud resources can be automated with configuration through centralized management tools to create a dynamic, optimal cloud environment.

This "hybrid cloud" architecture is very useful for cost-effectively handling bursts of application demand, since public cloud providers typically charge only for the resources that are consumed, avoiding the need for capital expenditure to build a datacenter to handle peak loads. This allows IT to quickly scale support for increasing or bursty business process capacities, without incurring the risks of capital expenditure and time invested in expanding the private cloud capacity and the high cost of low resource utilization.

Common development environments can enable and simplify interoperability between applications and services in traditional datacenters and heterogeneous private and public cloud runtime environments. Such support enables the development of "hybrid applications" with multiple components that

can span these environments, and eases integration with common cloud services or even third-party cloud service offerings to create "next generation" cloud applications. Simplifying development environments and reducing constraints on interoperability enables faster system integration, reducing process integration risk and time. Doing this in a manner that provides programming symmetry for on-premises, private cloud, and public cloud environments simplifies application development and IT operations across these environments.

Both Windows Server 2012 and Windows Azure provide increasing flexibility for building and deploying applications in on-premises and public cloud environments. Windows Server 2012 offers programming languages and tools, such as Microsoft Visual Studio and Microsoft .NET Framework, that span on-premises and cloud environments. With these tools, developers can work in a single, unified environment to build solutions for Windows Server and Windows Azure cloud platforms. Developers can use these programming tools across web, application, and data tiers for locally deployed applications and for private and public cloud solutions. They provide the ability to use the same development model between Windows Server 2012 and Windows Azure to create on-premises, cloud-based, or hybrid applications.

Furthermore, virtual machine portability between Windows Server 2012 and Windows Azure enables the provisioning, management, and movement of virtual machines across on-premises environments and Windows Azure, with a common set of tools to configure virtual machines and support of the Open Virtualization Format (OVF), a Distributed Management Task Force (DMTF) standard for packaging and distributing virtual machines. VM portability increases the flexibility of IT departments by giving them the ability to leverage infrastructure at their terms

Scalable and elastic

To get the most scale out of hardware investments, it is important to make optimal use of hardware capabilities to maximize the utilization of resources, and hence the density of workloads such as applications, websites, or services. Higher density allows more workloads to be hosted on the same set of hardware, resulting in lower hosting cost per workload. The multiprocessor hardware commonly used to host cloud environments today often makes use of a memory design known as Non-Uniform Memory Access (NUMA), which allows more

effective memory access by processors. NUMA enables the time required for a processor to access memory to vary depending on the memory's location relative to the processor, reducing the wait times for its own memory vs. shared memory or another processor's memory. It also includes facilities for moving data between memory banks as needed to bring relevant data closer to the processor that is using it. To make optimal use of NUMA hardware, multiprocessor applications must understand the processor and memory topology as well as the NUMA capabilities of the hardware to optimally control the allocation of memory and movement of data. In a virtualized cloud environment, this can only be achieved if the NUMA topology is effectively projected to the virtual machines and relayed to these NUMA-aware applications.

Cloud providers as well as internal IT departments are expected to meet aggressive SLAs by their tenants, both for the performance of the application as well as the provisioning and scaling of applications. In order to maintain performance levels in a multitenant environment, the allocation of resources to an application or service must be controlled to prevent one tenant's application from monopolizing resources at the expense of the performance of another tenant's application. When scaling of an application is needed, it is important to simplify and minimize the time required for the process of adding and managing new servers in the cloud environment.

Windows Server 2012 offers new and enhanced features that provide extensive support for improving website and application density that enables enterprises and hosting providers to increase the number of sites and applications supported with the same amount of computer hardware. This enables Windows Server 2012 to significantly enhance cloud performance and scalability. Windows Server 2012 supports NUMA-aware scalability for NUMA-aware applications, and the new Internet Information Services (IIS) feature in Windows Server 2012 is NUMA-aware. Windows Server 2012 can deliver robust multitenant website and application support, including virtual isolation of information across compute, storage, and network resources among tenants; IIS CPU throttling, which limits the CPU consumption allowed per application pool based on the tenant's SLA; and features that simplify management across tenants such as Centralized SSL Certificate Support, which allows SSL certificates to be centrally stored on a file share and shared by all servers in the server farm, instead of having to copy them to each server.

Open

To maximize the flexibility of the cloud platforms and interoperability of applications they host, private and public cloud application services should support a variety of environments and open standards. These include commonly available server operating systems, directory services for authentication and authorization, and application frameworks of various development languages.

In addition to runtime support, organizations should support application development environments that integrate use of cloud application services and containers into the development tools and environments of a variety of common programming languages.

Reducing restrictions on application development and runtime requirements enables more flexibility to implement new applications in less time and with less risk. This, combined with improvements in interoperability, enables quicker implementation of new processes and integration of existing processes.

Always on, accessible anywhere, high scale data management, and constantly evolving are defining traits of modern applications. Enabling these traits without the right application platform and tools is a tough scale and complexity challenge. Microsoft offers a comprehensive solution to address these challenges in realizing your modern application investments and to take your business forward with agility and quality. The Microsoft components for a modern application solution include:

- Modern application development platform and tools to build connected device (phone, tablet, browser, PC, device console), web, and cloud applications and services that are accessible anywhere while being internet reach and scale capable
- Modern application lifecycle management tools and services to enable a continuous delivery cadence for constantly evolving modern app investments
- Modern data and BI services and development tools spanning Big Data , RDBMS, and OLAP data/information models to address the volume, variety, and velocity challenges of modern application data requirements.
- Modern datacenter solutions spanning on-premise, private cloud, and public cloud infrastructure to meet the always on and elastic scalability requirements of modern applications.

Windows Server 2012 and Windows Azure road maps address the requirements for a modern application development platform by offering an

excellent environment to develop cloud applications spawning the private datacenter and the public cloud, and by providing the capabilities and framework to enable developers to create next generation application solutions. Together with Microsoft Visual Studio, the .NET 4.5 framework enables developers to manage all their development tasks in a very productive way.

For example, innovations in .NET 4.5 include new Async language and runtime support: which enables easy development of highly scalable solutions, as it allows to handle high volumes of transactions with Async HTTP. Additional enhancements include increased application speed and startup via background JIT compilation, as well as many new features across ASP.NET, Windows Presentation Foundation (WPF), Windows Communication Foundation (WCF) and Windows Workflow Foundation (WF).

Cloud applications are a new type of application that depends on loosely coupled, asynchronous, and data centric capabilities. These typically run on scalable, highly available, and utility designed runtimes and infrastructure that provide higher levels of abstraction from the metal than those previously available. .NET 4.5 is targeted to provide great capabilities for developers working on mobile apps, web apps, and cloud services – while giving rapid scalability support, fast time to market, and handling a gamut of PCs, browsers, and mobiles.

In addition to being the best platform for the .NET framework, Windows Server 2012 provides a single, agile platform for both open-source software and ASP.NET, which allows developers to freely choose from multiple programming stacks and languages, including .NET, PHP, Node.js, and Python. Windows Server 2012 also offers enhanced support for PHP and MySQL through IIS 8.0 extensions. IIS can support running both ASP.NET 3.5 and ASP.NET 4.5 applications, and provides support for the latest HTML5 standards and for writing managed WebSocket protocol applications that provide real-time bidirectional client-server communications.

Modern workstyle, enabled

New and significant trends in the work styles and preferences of employees present new business scenarios that offer better customer service; provide integration across partners, customers, and the value chain; and support new levels of employee productivity.

New business scenarios and the processes that define their implementation should not be constrained by the user's location or device. Enabling connection and productivity from virtually anywhere and from virtually any device unlocks new possibilities for innovations in the depth and fidelity of how organizations interact with and service customers, optimize the partner and supplier value chain, and more easily connect with workers when they are away from the office.

A new breed of inexpensive, commercially available mobile phone and tablet devices targeting consumers has revolutionized device and application UIs, the form factors upon which these applications run, and the way people stay connected and communicate across social networks. These new, always-on devices – armed with cellular and Wi-Fi connectivity, cameras, and touch interfaces – present new opportunities for creating new and more fit-for-purpose field applications that are more fluidly integrated with worker activities.

Employees expect connectivity and access to enterprise applications, information, and resources from their personally owned devices. However, immature security controls, lack of manageability, and the sheer variety of available devices present significant challenges. Overcoming these hurdles and enabling a rich connection to the enterprise promises new levels of productivity as people will be more connected to applications, information, and their colleagues, enabling them to contribute when away from the office, or even just away from their desk.

Effectively supporting these work styles and devices promotes business agility by enabling new business scenarios and processes that are less constrained by location while simultaneously improving worker productivity.

In this new world of continuously available services and connected devices, IT is often tasked with supporting a variety of company and personally-owned devices for remote and mobile workers who want to access corporate resources over managed and unmanaged networks.

Windows Server 2012 gives users more secure access to their personalized work environment from virtually anywhere, on virtually any device.

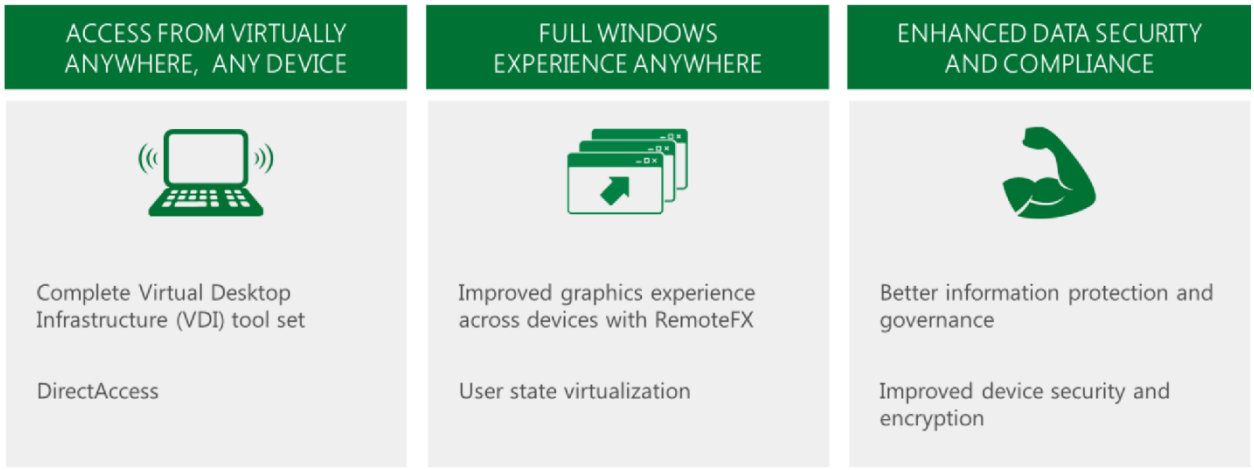

Figure 5 – Modern workstyle, enabled - key capabilities

Access from virtually anywhere, any device

To meet this demand and open up new possibilities, IT should make applications, data, information, and other IT resources uniformly available from multiple devices types, locations, and networks. This availability must support access with acceptable security and performance levels across network boundaries, including corporate networks, networks at branch locations, cellular and supporting public and private data networks, and home and public wireless access points.

Windows Server 2012 enables easier access to virtualized work environments from nearly anywhere. These environments enable modern work styles by providing users with flexible and controlled access to their data from different computers and devices and different locations. With Unified Remote Access in Windows Server 2012, employees can access corporate network resources while working remotely, and IT administrators can manage corporate computers located outside the internal network. For example, with DirectAccess in Windows Server 2012, client computers can directly connect to intranet-based resources without the complexity of establishing a VPN connection. Remote Desktop Services, which enables a virtual desktop infrastructure (VDI), comes with a multitude of innovations including simplified deployment and lower cost storage options that support a richer and smoother user experience across multiple device types.

Full Windows experience anywhere

Providing a consistent work environment experience of accessing applications and information across a variety of devices and locations can further enhance employee productivity. Providing the full Windows PC experience over multiple devices and multiple PCs – with consistent user profiles, desktop settings and files, and access to applications and resources – will provide users with a consistent, rich work environment that they are already familiar with. This experience must be rendered with acceptable performance levels over even slower connections, and should easily integrate device UIs and peripherals, such as multi-touch and USB interfaces.

Windows Server 2012 helps business users who want to roam while staying productive on different devices in different locations. Their experience needs to be the same or as close as possible to the in-office solution of using a laptop or PC. Windows Server 2012 helps maintain a rich user experience – even across Wide Area Network (WAN) connections – through a set of features referred to as RemoteFX. This includes detecting end-to-end network speed and using congestion control techniques. Windows Server 2012 allows users to connect USB-based devices, including USB flash drives and other devices, to their client device and see it within their Virtual Desktop Infrastructure (VDI) desktop, including for session-based virtual desktops. Windows Server 2012 provides a consistent user experience of VDI desktop access through a new feature called User Profile Disk, which maintains personalization and application data across user logons, enhancing user productivity.

Enhanced data security and compliance

Enabling the possibilities of access from virtually anywhere, on nearly any device can create security and compliance challenges. Those can be addressed by implementing security policy and auditable compliance controls that may be critical to control access to certain types of information (for example, financial or personal data) in a persistent and consistent manner across remote and non-remote corporate network access scenarios.

To make this happen, security and compliance controls must be centralized at the infrastructure and application services layer. These controls must discern and make use of the context of users, their role, their location, and the device

type and network currently being used. This context can then be used to determine authorization for application and information access, the types of interactions permitted, and the use of encryption, multi-factor authentication, or other security measures as warranted. In addition, this context should be surfaced to the application and device environments so that these controls can be more precisely enforced without undue restrictions.

Richer, more pervasive security controls at lower levels in the technology stack support business agility by enabling a faster rate of business and IT services change with less risk.

Dynamic Access Control, a new feature in Windows Server 2012, helps enhance data security and maintain compliance by offering granular access to data and corporate resources based on strong identity and device security status. Windows Server 2012 also offers central audit policies for file access reporting and the ability to perform forensic analysis that makes regulatory compliance much easier. With User Device Affinity, Windows Server 2012 gives administrators the option of setting primary devices and making users' roaming profiles and redirected folders immediately available when they log on to their primary devices and clear the sensitive data when they log off.