



Cloud optimize your business with

Windows Server 2012 R2 Preview

Product Overview White Paper

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Trends

The world of IT is changing rapidly, and traditional approaches are often no longer adequate. Microsoft's vision for this new era of IT is to provide you with one consistent platform for infrastructure, apps and data – called the Cloud OS – that spans customer datacenters, service provider datacenters and the Microsoft public cloud.

Windows Server 2012 R2 is at the heart of the Microsoft Cloud OS and provides a unique server and datacenter platform that allows you to easily and cost-effectively cloud optimize your business.

There are several key IT trends that are shaping the industry, are creating opportunities, and are being driven across enterprise and service provider organizations:

New Applications: Business innovation and agility drive the need for more deployment, 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 can create 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. It is through the consistency between private cloud, service provider cloud and public cloud environments that IT organizations, large and small, can take the most advantage of cloud computing and extend the boundaries of their datacenter to further improve service scale, elasticity, and availability.

Converging needs and innovations

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.

IT is under increasing pressure to deliver more capacity – on demand, both for short term projects and longer term initiatives – at a lower cost. In order to meet the SLAs that the business requires, IT must reduce or eliminate planned and unplanned downtime. Also, high barriers to hybrid cloud deployments make it difficult to extend a production environment into the cloud to leverage its resources. The complexity of a modern datacenter environment is already high, with expensive storage and networking solutions often being managed separately from core infrastructure. Finally, the demands of business users for services are increasing, and so are their options to circumvent IT. At the same time, end user requirements for anywhere anytime access to corporate resources increase along with challenges of compliance and governance as end-user requirements increase

Fortunately, business needs and technology innovations are converging, offering IT professionals a unique opportunity to take advantage of new innovations to meet business requirements. To support these business needs, IT professionals are looking for an infrastructure that can take advantage of shared resources, is elastic so it can scale up and down quickly to meet changing business needs, and minimizes downtime and failures while maximizing cost efficiencies.

As you will learn in this overview white paper, the latest release of Windows Server, Windows Server 2012 R2, is extremely well positioned to address these needs.

Windows Server: At the heart of the Cloud OS

Microsoft has gained expertise from years of building and operating some of the largest cloud applications in the world. Microsoft has combined this expertise with its experiences in delivering market leading enterprise operating systems, platforms, and applications to develop a new approach for the modern era: the Cloud OS.

The Microsoft Cloud OS delivers a modern platform of products and services that helps organizations transform their current server infrastructure into a highly elastic, scalable, and reliable cloud 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 users choose.

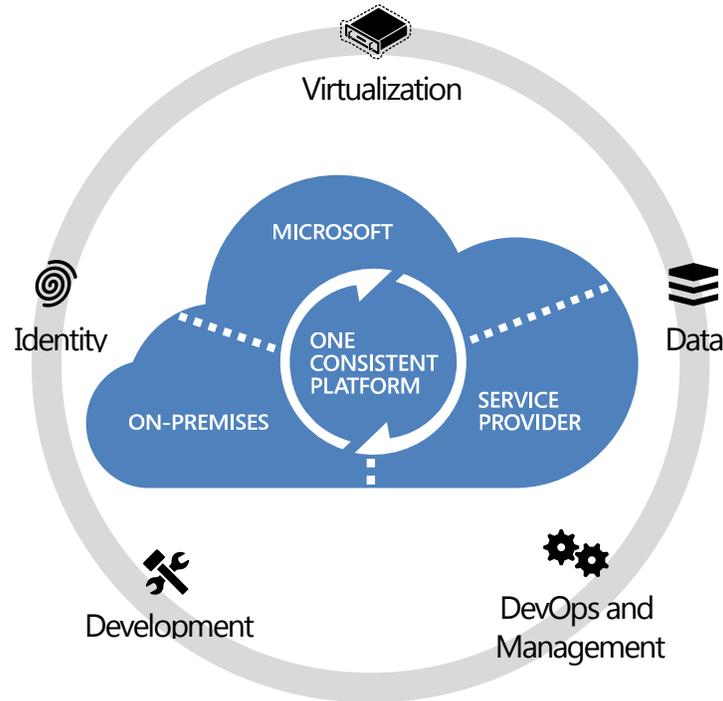
The Microsoft Cloud OS provides enterprises with infrastructure and solutions for always-on, always-up services. Automated management, robust multitenant support, and self-service provisioning help enterprises **transform their datacenters** to support the coordination and management of pooled sets of 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 data** – including unstructured, streaming, and/or voluminous data – from existing and new sources, and delivering this data to more users with the right IT oversight.

And finally, 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 Virtualization:** 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 R2, 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.

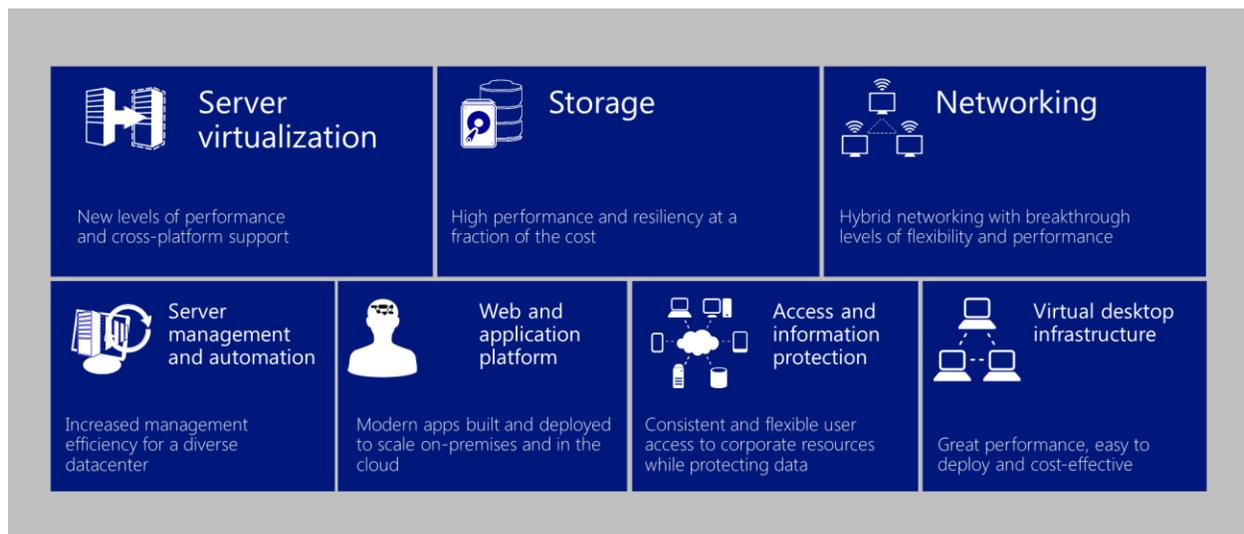
At the heart of the Microsoft Cloud OS is Windows Server 2012 R2, which delivers with a great set of qualities upon the promises of a modern datacenter, modern applications and people-centric IT, setting Windows Server 2012 R2 apart from the competition. These qualities are:

- **Enterprise-class:** Windows Server 2012 R2 offers a proven, enterprise-class datacenter and cloud platform that can scale up to run the largest workloads while enabling robust recovery options to protect against service outages. It offers automated protection and recovery of assets and cost-effective business continuity on-premises and in the cloud, allowing you to improve your workload SLAs while reducing downtime risks. Because many customer environments are often heterogeneous, Windows Server 2012 R2 offers high levels of interoperability with cross-platform technologies.
- **Simple and cost-effective:** Windows Server 2012 R2 gives you resilient, multi-tenant-aware storage and networking capabilities for a wide range of workloads. It delivers these capabilities at a fraction of the cost of other solutions, through the use of cost-effective, industry-standard hardware. With automation of a broad set of management tasks built-in, Windows Server 2012 R2 simplifies the deployment of major workloads and increases operational efficiencies.
- **Application focused:** Windows Server 2012 R2 helps you build, deploy, and scale applications and web sites quickly, and with more flexibility than ever before. In concert with Windows Azure and System Center 2012 R2, it unlocks improved application portability between on-premises environments and public and service provider clouds, increasing flexibility and elasticity of your IT services. Windows Server 2012 R2 enables mission-critical applications and provides enhanced support for open standards, open source applications and various development languages.
- **User centric:** Windows Server 2012 R2 allows you to empower your end users by granting them access to corporate resources on the devices they choose while protecting your information. You can manage a user's identity across the datacenter and federated into the cloud, provide secure remote access, and define the resources and level of access users have to information based on who they are, what they are accessing and from what device. You can manage both corporate- and personally-owned devices with a unified infrastructure, making it easier for administrators to identify and help achieve compliance.

Windows Server 2012 R2 capability overview

When you optimize your business for the cloud with Windows Server 2012 R2, you take advantage of the skills and investments you've already made in building a familiar and consistent platform. Windows Server 2012 R2 builds on that familiarity. With Windows Server 2012 R2, you gain all the Microsoft experience behind building and operating private and public clouds, delivered as an enterprise-class, simple and cost-effective server and cloud platform. Windows Server 2012 R2 delivers significant value around seven key capabilities:

Figure 2: Windows Server 2012 R2 capabilities



Server Virtualization

Windows Server Hyper-V is a sophisticated and feature-rich virtualization platform that has helped organizations of all sizes realize considerable cost savings and operational efficiencies. With Windows Server 2012 R2, server virtualization with Hyper-V is pulling ahead of the competition with industry leading size and scale, making Hyper-V the platform of choice for you to run your mission critical workloads. Using Windows Server 2012 R2, you can take advantage of new hardware technology, while still utilizing the servers you already have. This way you can virtualize today, and be ready for the future.

Whether you are looking to expand VM mobility, increase VM availability, handle multi-tenant environments, gain bigger scale, or gain more flexibility, Windows Server 2012 R2 with Hyper-V gives you the platform and tools you need to increase business agility with confidence. And you can benefit from

complete workload portability as you extend your on-premises datacenter into the cloud to a service provider cloud or Windows Azure.

Enterprise-class scale and performance

Windows Server 2012 R2 provides you with massive scale to transform your datacenter into an elastic, always-on cloud. For example, Hyper-V in Windows Server 2012 R2 provides industry-leading virtualization host support for 320 logical processors, 4TB of physical memory and 1,024 active virtual machines per host. Hyper-V supports 64-node clusters and 8,000 VMs per cluster. And it supports a **64 TB virtual disk** format with the ability for online resize, i.e. the ability to grow or shrink a VHDX virtual disk dynamically while it is running, and with no downtime.

Live migration is an important VM mobility feature that has kept getting better and better with Hyper-V since it was introduced with Windows Server 2008 R2. Improving the performance of live migrating a VM from the source host to the target host has been a constant focus for Windows Server, and in Windows Server 2012 R2 these performance improvements have been taken to the next level: **Live migration compression** is a new feature that accelerates live migration transfer speed by compressing the VHD/VHDX file, improving performance roughly by 2x for most workloads. And **live migration with RDMA** is another new feature in Windows Server 2012 R2; it delivers the highest performance for live migrations over >10 Gbit network connections, supporting transfer speeds of up to 56 GB/s, by offloading the transfer to hardware and harnessing the power of remote direct memory access (RDMA) technologies.

Virtualized Microsoft workloads (such as Exchange, SQL, and SharePoint) run **best on Hyper-V infrastructure**. For example, independent third party testing by The Enterprise Strategy Group, Inc. (“ESG Lab”) showed that a Microsoft Exchange Server 2013 infrastructure deployed within twelve Hyper-V virtual machines, running on a single physical server, supported the I/O requirements of up to 48,000 simulated users, while average database read response times ranged between 5.02 and 15.31 milliseconds, well below the Microsoft recommended limit of 20 milliseconds. In another test case, ESG Lab took an existing Microsoft SQL Server 2012 OLTP workload that was vCPU limited by the maximum allowed configuration of four vCPUs imposed by Windows Server 2008 and increased the performance by six times taking advantage of 64 vCPUs in Windows Server 2012. The average transaction response times also improved by five times from four vCPUs to 64 vCPUs.

These features help ensure that your virtualization infrastructure can support the configuration of large, high-performance virtual machines for sustaining Microsoft or other, mission-critical workloads that you might need to scale up significantly.

Virtual machine mobility

Windows Server 2012 R2 allows you to manage virtual machines independently of their underlying physical infrastructure. It also enables you to handle changes in resource demand as they occur and gives you the ability to rebalance running virtual machines either through the servers which the VMs reside on, or the storage resources used by the virtual machines.

Introduced with Windows Server 2012 as an industry-first capability, **shared-nothing live migration** allows you to move a virtual machine, live with no downtime, from one physical system to another even if they are not in the same cluster or connected to the same shared storage. This capability means you can live migrate a virtual machine from one cluster to a different cluster without setting up complex storage mappings. This is useful, for example, in a branch office where you may be storing the virtual machines on local disk, and you want to move a VM from one node to another. This is also especially useful when you have two independent clusters and you want to move a virtual machine, live, between them, without

having to expose their shared storage to one another. You can also use shared-nothing live migration to migrate a virtual machine from one datacenter to another provided your bandwidth is large enough to transfer all of the data between the two datacenters.

In multi-tenant environments of service providers, tenants are more and more asking for application-level, high availability for their workloads. To address this need, Windows Server 2012 R2 provides complete flexibility with multiple options for guest clustering, without making you sacrifice agility and density in your environment. In addition to Fibre Channel, iSCSI and SMB, Windows Server 2012 R2 now also offers **shared VHDX files**. Supporting both storage options, shared VHDX files can be stored either on a scale-out file server cluster or on Cluster-shared Volumes (CSV) on block storage. Shared VHDX clustering also preserves dynamic memory, live migration and storage live migration for a virtual machine that is part of the guest cluster.

Introduced in Windows Server 2012 R2, **Hyper-V Replica** provides a storage-agnostic and workload-agnostic solution that replicates efficiently, periodically, and asynchronously over IP-based networks, typically to a remote site. It also allows an administrator to easily test the replica virtual machine without disrupting the ongoing replication. If a disaster occurs at the primary site, administrators can quickly restore their business operations by bringing up the replicated virtual machine at the replica site. New in Windows Server 2012 R2, Hyper-V Replica now allows for variable (configurable) replication frequencies down to 30 seconds or up to 15 minutes. It also supports multiple nodes; this means that tertiary replica sites are supported, for example in the case of a service provider who wants to replicate a customer's workload to another (tertiary) datacenter.

First-class citizen guest support for Linux

Many enterprises and service providers are running a mix of hypervisors, operating systems and applications in their datacenter. Often times, migrating from one platform to another is not possible, not easily feasible from a technical standpoint, or a much bigger project than IT organizations are willing to take on. Designed to integrate well with heterogeneous IT environments, Windows Server 2012 R2 supports a cross-platform cloud infrastructure by adding comprehensive functional support for Linux guests running on top of Hyper-V.

Dynamic Memory is a Hyper-V feature that was introduced with Windows Server 2008 R2 SP1 and is used to automatically reallocate memory between virtual machines that are running on a Hyper-V host. Dynamic Memory helps you to allocate virtual machine memory resources more efficiently while dramatically increasing virtual machine consolidation ratios. A number of improvements were made for Windows guests in Windows Server 2012, and - new in Windows Server 2012 R2 - Hyper-V now offers **full dynamic memory support for Linux guests** including:

- Minimum memory setting – being able to set a minimum value for the memory assigned to a virtual machine that is lower than the startup memory setting
- Hyper-V smart paging – which is paging that is used to enable a virtual machine to reboot while the Hyper-V host is under extreme memory pressure
- Memory ballooning – the technique used to reclaim unused memory from a virtual machine to be given to another virtual machine that has memory needs

- Runtime configuration – the ability to adjust the minimum memory setting and the maximum memory configuration setting on the fly while the virtual machine is running without requiring a reboot.

Also, up until now, if you wanted to take advantage of Linux Integration Services (LIS) for your Hyper-V environment, you had to go to the Microsoft download center, download the correct LIS package for your Linux distribution, and then manually install it on your Hyper-V servers. New for Windows Server 2012 R2 Hyper-V hosts, key Linux vendors (such as RHEL, SUSE, CentOS and Ubuntu) are going to include LIS for Hyper-V in their standard distributions, so there is no manual step involved any longer in order for you to take advantage of the latest LIS capabilities.

Storage

With the increase in new applications, the explosion of data and the users' expectations for continuous services, storage demands continue to grow. Hence, storage solutions play a critical role in the modern datacenter. Windows Server 2012 R2 offers a wide variety of storage features and capabilities to address the storage challenges faced by your organization. Whether you intend to use cost-effective industry standard hardware for the bulk of your workloads, or Storage Area Networks for the most demanding ones, Windows Server 2012 R2 provides you with a rich set of features that can help you maximize the returns from all of your storage investments.

Windows Server 2012 R2 was designed with a strong focus on storage capabilities, from the foundation of the storage stack up, to improvements ranging from provisioning storage to how data is clustered, transferred across the network, and ultimately accessed and managed. With flexible capabilities that can be combined to meet your business needs, Windows Server 2012 R2 storage solutions deliver the efficiency, performance, resiliency, availability, and versatility you need at every level.

High-performance storage on industry-standard hardware

Windows Server 2012 R2 provides a rich set of storage features allowing you to take advantage of lower-cost industry-standard hardware rather than purpose-built storage devices, without you having to compromise on performance or availability.

For example, **Storage Spaces** provides sophisticated virtualization enhancements to the storage stack that you can use to pool multiple physical hard disk units together and provide feature-rich, highly resilient, and reliable storage arrays to your workloads. You can use Storage Spaces to create storage pools, which are virtualized administration units that are aggregates of physical disk units. With these storage pools, you can enable storage aggregation, elastic capacity expansion, and delegated administration. You can also create virtual disks with associated attributes that include a desired level of resiliency, thin or fixed provisioning, and automatic or controlled allocation on diverse storage media.

Storage tiering, a new feature in Windows Server 2012 R2, is a great example of how storage performance can be dramatically enhanced while using lower-cost industry standard hardware. With storage tiering, low cost, high capacity spinning disks are used to store less frequently used data, while high-speed solid state disks are reserved to store frequently used data. Storage tiering builds on storage virtualization with Storage Spaces by assigning solid state drives (SSD) and hard disk drives (HDD) to the same storage pool and using them as different tiers in the same tiered space. Windows Server 2012 R2 recognizes the tiers and optimizes them by moving often used "hot" data to the SSD tier. Windows Server

2012 R2 tracks data temperature and moves data at the sub-file level; only “hot” regions of a file (such as VHD or database) need to move to SSDs, the “cold” regions can reside on HDDs.

Since Windows Server 2012, with a feature referred to as **SMB Direct**, the SMB protocol has provided support for Remote Direct Memory Access (RDMA) network adapters, which allows storage performance capabilities that rival Fiber Channel. RDMA network adapters enable this performance capability by operating at full speed with very low latency due to the ability to bypass the kernel and perform write and read operations directly to and from memory. This capability is possible since reliable transport protocols are implemented on the adapter hardware and allow for zero-copy networking with kernel bypass. With this capability, applications, including SMB, can perform data transfers directly from memory, through the adapter, to the network, and then to the memory of the application requesting data from the file share.

Continuous application availability and robust recovery

Hardware fails, hardware needs to be replaced as it approaches its end of life, and software requires patches and updates - most organizations are used to this cycle. What doesn't change is the SLA they have with their internal and external customers, as application owners still require uninterrupted access to their resources or services. Windows Server 2012 R2 reduces server downtime and application disruption by letting you store server application data on file shares and obtain a similar level of reliability, availability, manageability, and high performance that would typically be expected from a high-end Storage Area Network (SAN).

Introduced in Windows Server 2012, **SMB Transparent Failover** allows you to transparently move SMB file shares between the file server cluster nodes, without noticeable interruption of service for the SMB client. This is useful for planned events (for example, when you need to perform maintenance on a node) or surprise events (for example, when a hardware failure causes a node to fail). This is achieved regardless of the kind of operation that was underway when the failure occurred.

One of the main advantages of file storage over block storage is the ease of configuration, paired with the ability to configure folders that can be shared by multiple clients. Windows Server 2012 has taken file-based storage one step further by introducing the **SMB Scale-Out** feature, which provides the ability to share the same folders from multiple nodes of the same cluster. This is made possible by the use of Cluster Shared Volumes (CSV), which since Windows Server 2012 support file sharing. New in Windows Server 2012 R2, SMB sessions can now also be managed per share (not just per file server), increasing flexibility. And SMB Scale-out now also offers finer-grained load distribution by distributing workloads from a single client across many nodes of a scale-out file server.

Another innovation around Windows Server 2012 R2 is the **Windows Azure Hyper-V Recovery Manager** offering, a related service which offers a robust recovery solution that takes advantage of Hyper-V Replica. For organizations with two or more datacenters looking to protect vital workloads running in their datacenter, Windows Azure Hyper-V Recovery Manager enables them to combine Windows Azure, System Center Virtual Machine Manager, and Hyper-V Replica to deliver planned and cost-effective business continuity of workloads. With Windows Azure Hyper-V Recovery Manager, datacenters can be protected by automating the replication of the virtual machines that compose them at a secondary location. Windows Azure Hyper-V Recovery Manager also provides continuous health monitoring of the primary datacenter, and it helps automate the orderly recovery of services in the event of a site outage at the primary datacenter. Virtual machines are started in an orchestrated fashion to help restore service quickly. This process can also be used for testing recovery without disruption to services, or temporarily transferring services to the secondary location.

Comprehensive storage management and backup

Whether you use purpose-built or industry-standard storage solutions, efficient use and management of your valuable storage resources is critical. Not surprisingly, therefore, one of the most important focal areas is around managing the storage infrastructure both from a capacity and data protection perspective. Windows Server 2012 R2 provides great management and backup capabilities that help you better manage your storage capacity whether you have a single server or multiple servers, whether you have one class of storage or a variety of storage solutions, and whether you have a Windows only or a heterogeneous environment.

Storage QoS is a new feature in Windows Server 2012 R2 that allows you to restrict disk throughput for overactive or disruptive virtual machines and can be configured dynamically while the virtual machine is running. For maximum bandwidth applications, it provides strict policies to throttle IO to a given virtual machine to a maximum IO threshold. For minimum bandwidth applications, it provides policies for threshold warnings that alert of an IO starved VM when the bandwidth does not meet the minimum threshold.

Also, to help improve storage management efficiency and offset that cost, Windows Server 2012 R2 comes with a **set of storage management APIs and provider interfaces** that enables administrators to centrally manage disparate storage resources and solutions, such as SANs and storage arrays, from a centralized “single pane of glass” interface. Manageable resources can include SANs that are SMI-S compliant, storage devices with proprietary hardware that has compatible third-party storage management providers, or storage devices that are already being allocated through the use of Storage Spaces. This storage management capability will allow administrators to configure and manage all of the storage devices throughout their organization or management sphere through an easy-to-use management interface that they are already familiar with, the Server Manager in Windows Server. By using Server Manager, administrators can populate server groups with file servers or storage clusters that leverage Storage Spaces, or reach out to populate manageable devices that have SMI-S agents enabled.

If you have a small number of servers to protect and you currently have no backup solution or you are using the inbox Windows Server Backup tool on these servers, **Windows Azure Backup** is a separate offering that extends the capabilities of Windows Server Backup and System Center Data Protection Manager to deliver simple and reliable off-site data protection at the cost of cloud storage. It is suitable for any workload, such as file servers, SharePoint, SQL, Exchange, and others.

Networking

New technologies, such as private and public cloud computing, mobile workforces, and widely dispersed assets have transformed the business landscape and altered how you manage networking and network assets. Still, your main goal remains the same: keep all networking components connected to ensure smooth data transmission and reliable access by users and customers to the services they need when they need them.

Windows Server 2012 R2 makes it as straightforward to manage an entire network as a single server, giving you the reliability and scalability of multiple servers at a lower cost. Automatic rerouting around storage, server, and network failures enables file services to remain online with minimal noticeable downtime. In addition, Windows Server 2012 R2 provides the foundation for software-defined networking out-of-the-box – enabling seamless connectivity across public, private, and hybrid cloud implementations.

Whatever your organization's needs, from administering network assets to managing an extensive private and public cloud network infrastructure, Windows Server 2012 R2 offers you solutions to today's changing business landscape. It offers several new and enhanced features that can help reduce networking complexity while lowering costs, simplifying management tasks, and delivering services reliably and efficiently. You can use these new tools to automate and consolidate networking processes and resources, more easily connect private clouds with public cloud services, and more easily connect users to IT resources and services across physical boundaries.

Software-defined networking

Software-defined networking (SDN) enhances the management of modern networks by providing the ability for applications to control access to network resources dynamically. A key enabler of SDN is that it uses networking functionality that has been moved to a virtual switch, providing the ability to modify packets in transit and enabling integration of more advanced switch extensions. Finally, SDN also brings the benefit of unifying the management of both the physical and virtual infrastructure.

Hyper-V Network Virtualization and the **Hyper-V Extensible Switch** are the foundations of SDN in Windows Server 2012 R2. You can isolate network traffic from different business units or customers on a shared infrastructure and not be required to use VLANs. Hyper-V Network Virtualization also lets you move virtual machines as needed within your virtual infrastructure while preserving their virtual network assignments. You can even use Hyper-V Network Virtualization to transparently integrate these private networks into a preexisting infrastructure on another site.

Hyper-V Network Virtualization extends the concept of server virtualization to allow multiple virtual networks, potentially with overlapping IP addresses, to be deployed on the same physical network. With Hyper-V Network Virtualization, you can set policies that isolate traffic in your dedicated virtual network independently of the physical infrastructure.

The Hyper-V Extensible Switch in Windows Server 2012 R2 is a layer-2 virtual network switch that provides programmatically managed and extensible capabilities to connect virtual machines to the physical network. It is an open platform that makes it possible for multiple vendors to provide extensions that are written to standard Windows API frameworks, the reliability of which are strengthened through the Windows standard framework.

On the same physical network, with Hyper-V Network Virtualization and the Hyper-V Extensible Switch, you can run multiple virtual network infrastructures and you can have overlapping IP addresses with each virtual network infrastructure acting as if it was the only one running on the shared physical network infrastructure.

In Windows Server 2012, we also introduced a feature called cross-premises connectivity, which provides VPN site-to-site functionality to help establish cross-premises connectivity between enterprises and hosting service providers. Cross-premises connectivity enables enterprises to connect to private subnets in a hosted cloud network. It also enables connectivity between geographically separate enterprise locations. However, some of the limitations of this feature were that you needed one gateway per tenant. Windows Server 2012 R2 now includes a **multi-tenant VPN gateway** built right into the operating system. This function can provide a seamless connection over a site-to-site VPN link between multiple external organizations and the resources that those organizations own in a hosted cloud. It also enables connectivity between physical and virtual networks, enterprise datacenters, and hosting organizations, and between enterprise networks and Windows Azure.

Another challenge on the path to a software-defined datacenter has been the fact that today's datacenters are made up of different classes of devices – such as load balancers, power distribution units,

baseboard management controllers (BMCs), top-of-rack (TOR) switches, and routers – from a variety of device manufacturers. With the explosion of datacenters the need to automate the management of such devices in a consistent way is more important than ever as most of these devices are managed via different protocols and schemas, and in some instances, via proprietary solutions. Windows Server 2012 R2 includes **standards-based switch configuration** as a device management abstraction layer that further reduces the complexity of heterogeneous device management with the goal that devices can be easily managed and configured using standards technologies. Windows Server 2012 R2 allows you to enable device management using a common abstraction layer, working over standard protocol and schema; as a consequence, it allows you to move from a complex datacenter device world into a world of well-defined, standard based components; and build a ready to use solution for device management right in Windows.

High-performance networking

Modern SLA requirements for the datacenter require IT to help ensure that services are running continuously without any interruption. Poor network performance – usually caused by limitations in network bandwidth or limitations in the processing power -, can impact availability and resiliency of the network infrastructure and hence affect service availability directly. A considerable amount of work has been done in Windows Server 2012 R2 to extract great and predictable network performance inbox, as well as to make the most out of next generation hardware.

Single Root I/O Virtualization (SR-IOV) is a standard introduced by the PCI-SIG, the special-interest group that owns and manages PCI specifications as open industry standards. SR-IOV works in conjunction with system chipset support for virtualization technologies that provide remapping of interrupts and Direct Memory Access, and allows SR-IOV-capable devices to be assigned directly to a virtual machine.

Introduced with Windows Server 2012, Hyper-V enables support for SR-IOV-capable network devices and allows a SR-IOV virtual function of a physical network adapter to be assigned directly to a virtual machine. This increases network throughput and reduces network latency while also reducing the host CPU overhead required for processing network traffic. You can configure your systems to maximize the use of host system processors and memory to effectively handle the most demanding workloads. These Hyper-V features let you take full advantage of the largest available host systems to deploy mission-critical, tier-1 business applications with large, demanding workloads.

Windows Server 2012 R2 also helps you provide fault tolerance on your network adapters without having to buy additional hardware and software. Windows Server 2012 R2 includes **NIC Teaming** which allows multiple network interfaces to work together as a team, preventing connectivity loss if one network adapter fails. NIC Teaming also allows you to aggregate bandwidth from multiple network adapters, so for example, four 1-gigabyte (GB) network adapters can provide an aggregate of 4 GB/second of throughput. In Windows Server 2012 R2, the load-balancing algorithms have been further enhanced with the goal to better utilize all NICs in the team, significantly improving performance.

The advantages of a Windows NIC Teaming solution are that it works with all network adapter vendors, spares you from most potential problems that proprietary solutions cause, provides a common set of management tools for all adapter types, and is fully supported by Microsoft.

Improved manageability and diagnostics

Better insight into your network as well as improved manageability and control over your network assets are important challenges that IT Professionals face. This spans all the way from the ability to automate regular tasks to having the control over the entire IP address infrastructure, no matter what the size of

your organization is, to having the ability to get the best performance on a multi-site environment, and finally to providing enterprises and hosting providers with a way to track resource usage and build chargeback/show-back solutions. Windows Server 2012 R2 builds on the networking advances in Windows Server 2012 with an array of new and enhanced features that help reduce networking complexity while lowering costs and simplifying management tasks. With Windows Server 2012 R2, you now have the tools to automate and consolidate networking processes and resources.

IP Address Management (IPAM), introduced in Windows Server 2012, is an out-of-the-box framework for discovering, monitoring, auditing, and managing the IP address space and the associated infrastructure servers on a corporate network. IPAM provides automatic IP address infrastructure discovery, migration of IP address data from spreadsheets or other tools, custom IP address space display, reporting and management, audit of server configuration changes and tracking of IP address usage, and monitoring and specific scenario-based management of DHCP and Domain Name System services. Windows Server 2012 R2 adds **virtual IP address space management**, which means that IPAM in Windows Server 2012 R2 now can show both the physical and the virtual address space in a single view, including tenant IP subnets and address spaces as well as the provider IP address space.

Since Windows Server 2012, you have been able to manage Quality of Service (QoS) policies and settings dynamically with Windows PowerShell. Most hosting providers and enterprises today use a dedicated network adapter and a dedicated network for a specific type of workload such as storage or live migration to help achieve network performance isolation on a server running Hyper-V. QoS minimum bandwidth benefits vary between service providers to enterprises. For service providers, **QoS management** allows them to host customers on a server running Hyper-V and still be able to provide a certain level of performance based on SLAs. It also helps them to ensure that customers won't be affected or compromised by other customers on their shared infrastructure, which includes computing, storage, and network resources. For enterprises, QoS management allows them to run multiple application servers on a server running Hyper-V and be confident that each application server will deliver predictable performance.

Hyper-V in Windows Server 2012 R2 helps providers build a multitenant environment in which virtual machines can be served to multiple clients in a more isolated way. Because a single client may have many virtual machines, aggregation of resource use data can be a challenging task. However, Windows Server 2012 R2 simplifies this task by using resource pools, a Hyper-V feature that allows for **resource metering**. Resource pools are logical containers that collect the resources of the virtual machines that belong to one client, permitting single-point querying of the client's overall resource use. Resource Metering in Windows Server 2012 R2 can measure and track a series of important data points, including the following:

- The average CPU, in megahertz, used by a virtual machine over a period of time.
- The average physical memory, in megabytes, used by a virtual machine over a period of time.
- The lowest amount of physical memory, in megabytes, assigned to a virtual machine over a period of time.
- The highest amount of physical memory, in megabytes, assigned to a virtual machine over a period of time.
- The highest amount of disk space capacity, in megabytes, allocated to a virtual machine over a period of time.
- The total incoming network traffic, in megabytes, for a virtual network adapter over a period of time.

- The total outgoing network traffic, in megabytes, for a virtual network adapter over a period of time.

Server management and automation

Datacenter infrastructure has become complex: Multiple industry standards are confusing hardware vendors, and customers are looking for guidance on how to best automate their datacenter while adopting a standards-based management approach supporting their multi-vendor investments. Windows Server 2012 R2 enables IT professionals to meet this need by offering an integrated platform to automate and manage the increasing datacenter ecosystem. Windows Server 2012 R2 delivers capabilities to manage many servers and the devices connecting them, whether they are physical or virtual, on-premises or in the cloud.

Standards-based management

Windows Server 2012 R2 enhances the manageability of datacenters through significant improvements in the standards-based infrastructure. It does this by delivering application programming interfaces (APIs) that are easier for developers and IT Pros to use. These APIs provide support for recent standards and add new kinds of Windows PowerShell commands (cmdlets) that make it simpler and more cost-effective to connect to and manage multiple servers and devices in the datacenter.

Another challenge in standards-based management is the definition and availability of a standard management protocol. With multiple vendors creating multiple management tools and interfaces on multiple platforms, the complexity of managing these environments continues to grow.

WMI is a standard Common Information Model Object Manager (CIMOM) that hosts many standard class providers; however, early on, there was not an interoperable management protocol, so WMI used the Distributed Component Object Model (DCOM). This made it an “island of management” for Windows managing Windows.

This situation changed with the DMTF’s definition and approval of WS-Man, a SOAP-based, firewall-friendly protocol that allows a client on any operating system to invoke operations on a standards-compliant CIMOM running on any platform. Microsoft shipped the first partial implementation of WS-Man in Windows Server 2003 and named it Windows Remote Management (WinRM).

Since Windows Server 2012, WinRM has become the default protocol for management. This provides interoperability with a number of CIMOM and WS-Man stacks available on other platforms, including Opensman (Perl, Python, Java, and Ruby Bindings), Wiseman, and OpenPegasus.

Simplified multi-server management

Since Windows Server 2012, the capabilities of **Server Manager** have expanded considerably to facilitate multi-server tasks, such as remote role and feature deployment to both physical and virtual servers, remote role and feature management, and custom server group creation.

By using Server Manager in Windows Server 2012 R2, you can provision servers and offline virtual hard disks from your desktop without requiring either physical access to the system or Remote Desktop Protocol (RDP) connections to each server. Server Manager also helps administrators manage groups of servers collectively from a single, integrated console, allowing them respond to business-critical problems with greater speed and agility.

Robust automation

Increasing business agility by more efficiently managing infrastructure and applications must come in a cost-effective manner. IT budgets historically spend 60 to 80% of the overall budget just to keep IT services running smoothly which means that the greater the efficiency of datacenter operations, the more money there is to focus on new services. In addressing these needs, IT Professionals need to work within budget limitations by developing a standardized approach to managing server environments and look for opportunities to automate as much of the datacenter operations as possible.

Windows PowerShell offers comprehensive, resilient, and simple automation of your Windows Servers to help you manage most server roles and aspects of the datacenter. PowerShell sessions to remote servers are resilient and can withstand various types of interruptions. In addition, learning Windows PowerShell has become much easier than ever through improved cmdlet discovery, simplified, consistent syntax across all cmdlets and an integrated scripting environment. In Windows Server 2012 R2, Windows **PowerShell 4.0** delivers over 3,000 cmdlets to enable you to manage server roles and automate management tasks quickly. You can also execute and monitor scripts more efficiently through more robust session connectivity, workflow capabilities, enhanced job scheduling, and Windows PowerShell Web Access. Last not least, you can write Windows PowerShell scripts more quickly and intuitively through the built-in Integrated Scripting Environment (ISE) that enables script sharing, which connects IT Professionals to a larger Windows PowerShell user community.

In addition to the enhanced functionality of Windows PowerShell, you can also rely on new management capabilities in Windows Server 2012 R2 for deploying resources in a repeatable, reliable and standardized manner. For example, **Desired State Configuration** provides the ability to help standardize deployments by enabling you to ensure that the components of your datacenter have the correct configuration. To that effect, Windows Server 2012 R2 has PowerShell language extensions and providers which enable declarative, autonomous and repeatable deployment, configuration and conformance of standards-based managed elements. This provides the ability to define the exact configuration of target nodes (computers or devices) and prevent "configuration drift", thereby providing stable, reliable, standardized deployments.

Web and application platform

It is likely your organization uses or is planning to use a combination of on-premises and off-premises IT resources and tools for building a hybrid environment. To protect your existing investment in on-premises applications as you begin to migrate to the cloud, you need a scalable application and web platform and the means to manage your applications and websites in a unified way.

Windows Server 2012 R2 builds on the tradition of the Windows Server family as a proven application platform, with thousands of applications already built and deployed and a community of millions of knowledgeable and skilled developers already in place. The capabilities included in Windows Server 2012 R2 can offer your organization even greater application flexibility. You can build and deploy applications either on-premises or in the cloud—or both at once, with hybrid solutions that can work in both environments.

As your organization plans for and moves to a hybrid or cloud-based environment, Windows Server 2012 R2 provides the tools you need to build, provision, and manage multitenant environments while still supporting your large enterprise or the many customers hosted within your service provider infrastructure.

Flexibility to build on-premises and in the cloud

Windows Server 2012 R2 supports both hybrid and portable applications across premises - private, hosted and Windows Azure public clouds.

This is important as developers need to think about how to build and deploy next-generation applications, many of which will be cloud applications. For example, developers may want to run applications that they developed for Windows Azure on premises and vice versa, which is where programming symmetry, common development tools between Windows Server 2012 R2 and Windows Azure, and virtual machine portability can help achieve this goal.

Windows Server is a proven application platform with thousands of applications already built and deployed and a community of millions of knowledgeable and skilled developers already in place. Windows Server 2012 R2 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 R2 and Windows Azure. This **programming symmetry** is complemented by the rich and comprehensive experience of working in Visual Studio. Whether developers work in house or as third-party solution providers, they can write code and use common workflows and rules to create on-premises, cloud-based, or hybrid applications from within a unified Windows development environment.

With **virtual machine portability** between Windows Server 2012 R2 and Windows Azure, you gain the ability to leverage infrastructure on your terms: You can easily bring your own customized Windows Server images without changing existing code, retain full control of your images, and maintain them as your business requires, saving you time and money.

Scalable and elastic application and web platform

Windows Server 2012 R2 provides frameworks, services, and tools to increase scalability and elasticity for applications that support multi-tenancy and that improve website density and efficiency. This is important not only for enterprise IT Professionals, but also to enable service providers to more effectively build, provision, and manage a hosting environment.

In previous versions of Windows Server, there were ways to manage the memory, network, and disk size—but not input and output—per Internet Information Services (IIS) application pool. With Windows Server 2012, Internet Information Services introduced CPU throttling. **IIS CPU throttling** can be used to set the maximum CPU consumption allowed per application pool. Because the recommended setup is to create a separate application pool (sandbox) for each tenant, administrators can use CPU throttling to prevent one tenant's application from monopolizing CPU resources needed by other tenants.

Another way how Windows Server 2012 R2 provides an ideal platform to run high-density web servers is through a **centralized SSL certificate store** that dynamically maps sites to certificates: SSL certificates can be stored centrally on a file share in Windows Server 2012 R2, which helps to simplify certificate management and lower the total cost of ownership. Centralized SSL certificate support in Windows Server 2012 R2 is used to store all SSL certificates centrally in a file server, where they are shared by all servers in the server farm. Hence, SSL binding is much simplified, further reducing the cost of manageability.

Open web platform

Windows Server 2012 R2 enables business-critical applications and enhanced support for open frameworks, open source applications and various development languages. This is important as the latest .NET Framework offers core new features and improvements, such as support for asynchronous file operations, and enhancements around web, networking, WPF and others. Also, with Windows Server 2012, web standards “just work”.

Windows Server 2012 R2 offers **support for multiple languages** which enables developers to choose from supported programming languages such as .NET, PHP, Node.js and Python. Enhanced support for PHP and MySQL is available through Internet Information Services extensions.

Windows Server 2012 R2 also offers **support for open source software**: The Windows Web App Gallery provides simple ways for millions of users worldwide to explore, discover, install, and deploy web applications on the Windows platform. Users have a great place to go to discover and install the web apps they want, and to share and learn from user ratings and reviews. Service providers have a simple way to offer and deploy the best free web applications to their customers. And developers benefit from an easy way to distribute their latest apps.

Access and information protection

Information exists almost everywhere in your organization: on servers, laptops, desktops, removable devices, and in emails. Users need to be able to access this information from anywhere, share it where appropriate, and achieve maximum productivity with the assets they have. To further complicate matters, the move to cloud computing means you need to be able to secure enterprise applications that no longer live in your datacenter.

Microsoft assists you in supporting consumerization of IT, and in retaining effective management, security, and compliance capabilities. The enterprise tools and technologies that Microsoft provides can help with key enterprise tasks—for example, identifying non-corporate devices, delivering applications and data to those devices with the best possible user experience, and establishing and enforcing policies on devices, based on the user’s role within the organization. Microsoft enterprise tools and technologies can help IT maintain a high level of security across all device types, whether the devices are corporate or personal assets, and establish security measures that protect their organization’s systems, data, and network.

To address these information needs and challenges, organizations have to make fundamental shifts in how they approach identity and security. Windows Server 2012 R2 helps you to accommodate these changes through exciting new remote access options, significant improvements to Active Directory and Active Directory Federation Services, and the introduction of policy-based information access and audits with Dynamic Access Control. With the new capabilities in Windows Server 2012 R2, you will be able to better manage and protect data access, simplify deployment and management of your identity infrastructure, and provide more secure access to data from virtually anywhere.

Always-on remote access from trusted devices

In a world of consumerized devices and mobility, users want to use the device of their choice and have access to both their personal and work related applications, data and resources; they also want an easy way to be able to access their corporate applications from anywhere. IT organizations are increasingly

open to empower users to work this way, but they also see the need to control access to sensitive information and remain in compliance with regulatory policies.

Windows Server 2012 R2 provides flexible remote access based, on user identity, to keep users productive virtually anywhere, on any device. For example, Windows Server 2012 R2 introduces a new concept known as device registration or **Workplace Join**. With Workplace Join, users can register their BYO devices for single sign-on and access to corporate data. As part of this registration process, a certificate is installed on the device, and a new device object is created in Active Directory. This device object establishes a link between the user and their device, making it known to IT, and allowing the device to be authenticated, effectively establishing a seamless 2nd factor authentication. In return for registering their device and making it known to IT, the user gains access to corporate resources that were previously not available outside of their domain joined PC.

Also new in Windows Server 2012 R2 is a feature called **Work Folders**, which allows users to synchronize files, originating from corporate file servers to their devices anywhere through a synchronization service. IT administrators can configure a file server to provide Work Folder sync shares for each user to store data that syncs to their devices, and even take advantage of the integration with Active Directory Rights Management Services to better protect the user's files.

Another new feature in Windows Server 2012 R2 provides the ability for applications to trigger a VPN connection on the user's behalf as they are launched. Traditional VPNs are user-initiated and provide on-demand connectivity to corporate resources: The user launches the VPN connection, typically enters credentials, and often two-factor authentication and a connection is established from the user's machine to the corporate environment. In Windows Server 2012 R2, however, **automatic VPN connections** provide automated starting of the VPN when a user launches an application that requires access to corporate resources. The user may still be prompted for two-factor credentials, but the requirement to initiate the connection before starting the application is removed; it will start whenever an application requires it.

Seamless, single sign-on to applications and data

When users are accessing resources that are located both on-premises in a corporate environment and in the cloud, IT is often challenged to provide users with a common identity. In addition, managing multiple identities and keeping the information in sync across environments can be an unwelcome drain on IT resources. Windows Server 2012 R2 provides a single view of all user information, allowing organizations to reduce security risk and lower the burden of managing multiple credentials.

In Windows Server 2012 R2, Microsoft has enhanced **Active Directory** in a number of ways: You can run Active Directory at scale with support for virtualization and rapid deployment through domain controller cloning. Virtualizing Active Directory in the past has been challenging, and was fraught with potential issues when administrators used common virtualization platform management tasks such as snapshots. Active Directory has been updated to be "virtualization aware" and to respond accordingly.

When it comes to extending on-premises identities into the cloud, you can take advantage of **Active Directory Federation Services (AD FS)** which enables the corporate Active Directory to communicate with heterogeneous identity stores, and allows for a seamless single sign-on experience for end users. It also allows IT organizations to authenticate users from partner organizations and grant them access to internal domain resources.

Microsoft supports running domain controllers and AD FS on Windows Azure IaaS, connected back on premises via the Azure Connect bridge, making it easier and faster for customers to connect and authenticate cloud based users, devices and applications. And if you are a developer, you can integrate

applications for single sign-on across on-premises and cloud-based applications, providing a more productive experience for users and an easier way for customers to manage the identity of users within these applications.

Windows Azure Active Directory (WAAD) works fluidly with Windows Server Active Directory to easily extend an organization's Active Directory into the Windows Azure cloud. Providing cloud based identity through Windows Azure AD enables customers to use WAAD as the central authentication endpoint for all users and devices outside of the corporate environment, including cloud or hybrid applications. In that case, WAAD may be the authoritative authentication directory, or the user validation and device verification can be checked through federated connections to other directories such as on-premises AD, partners or other cloud based identity repositories.

Policy-based access and audit of corporate information

As users bring their own devices to their workplace, they will also want to access sensitive information and have access to this information locally on the device. A significant amount of corporate data can only be found locally on user devices, which means it is typically not backed up or available for compliance classification, and it is unprotected in the event a device is lost, stolen or sold. IT needs to be able to secure, classify and protect data based on the content it contains, not just where it resides, and to maintain regulatory compliance. Windows Server 2012 R2 helps organizations keep corporate intellectual property secure and simplifies regulatory compliance.

Dynamic Access Control, introduced in Windows Server 2012, provides a holistic data classification and protection system integrated with centralized access control. You can use Dynamic Access Control in Windows Server 2012 R2 to classify data on organizational file servers based on their contents, location, and other criteria. The classification data can be used for audit information, access control, and automatic classification tasks. You can also use this feature to achieve central access control by enabling access control policies in Active Directory and distributing them to file servers. These policies can be based on classification information in the data and paired with user information from Active Directory for fine-grain access policies. Finally, Dynamic Access Control allows you to automatically protect sensitive information through integration with **Active Directory Rights Management Services (AD RMS)**. With an existing AD RMS implementation, properly classified data can be automatically sent to AD RMS for protection in near-real time. AD RMS protects Office documents and email by identifying the rights that a user has to the file. Rights can be configured to allow a user to open, modify, print, forward, or take other action with rights-managed information, allowing organizations to safeguard data when it is distributed outside the corporate network.

Virtual Desktop Infrastructure (VDI)

Most IT departments are currently facing the challenge of enabling worker productivity on a growing number of mobile devices in the workplace. Virtual Desktop Infrastructure (VDI) is a key technology that helps you to accommodate these new devices by allowing them to access a centralized instance of the Windows desktop in the datacenter. By virtualizing these desktop resources, you can alleviate device compatibility and security issues while still delivering a consistent, familiar experience that enhances user productivity. With Windows Server 2012 R2, Microsoft is making it easier and more cost-effective to deploy and deliver virtual desktop resources across workers' devices.

VDI technologies in Windows Server 2012 R2 offer easy access to a rich, full-fidelity Windows environment running in the datacenter, from virtually any device. Through Hyper-V and Remote Desktop Services (RDS), Microsoft offers three flexible VDI deployment options in a single solution: Pooled Desktops, Personal Desktops, and Remote Desktop Sessions (formerly Terminal Services).

With Windows Server 2012 R2, you get a complete VDI toolset for delivering flexible access to data and applications from virtually anywhere on popular devices, while also helping to maintain security and compliance.

Efficient VDI management

For IT Professionals looking at deploying a VDI infrastructure, many questions arise quickly: Can you reduce your management costs with VDI? Can you deploy and update applications in a faster and less expensive way? How can you centrally administer and manage those remote desktops running in the datacenter, and how do you make sure that they are adhering to the right corporate policies?

Since Windows Server 2012, an important goal for the enhancements of RDS has been to help ensure that VDI is simple to deploy and easy to manage. A simple, intuitive **setup wizard** takes customers through the steps required to setup a VM or session based VDI environment. Selecting between one of the deployment modes has been simplified to checking an option during the setup process. Additional settings can easily be configured during the wizard based setup, thereby not sacrificing functionality at the expense of simplification. RDS creates and deploys the VMs for you as part of the setup process, thereby reducing the dependency for additional tools during the setup process. The VMs and sessions are also automatically configured with optimal settings, so users can start connecting to their desktops fairly quickly.

The **RDS administration console** has been greatly simplified in order to unify the administration of published applications and desktops, so that you have plenty of options to setup and manage users, sessions and VMs from a single console. In addition to entire desktops, you can also publish virtual applications, called RemoteApp, to both VMs and session desktops using the RDS administration console. You can manage user permissions, including their settings and other properties from the same console that you use to manage desktops, thereby ensuring complete in-box management for a simplified VDI deployment experience.

Best value for VDI

Storage is a key part of any VDI roll-out, and one that has a significant impact on the cost of the deployment. Customer experience indicates that VDI is easily the most challenging workload for storage infrastructure, both in terms of IOPS and storage volume. Thus, it is critical to have a wide range of options with which you can optimize the output from your storage investment.

Remote Desktop Services (RDS) in Windows Server 2012 R2 supports various **lower cost storage options**, such as SMB based file shares, or Direct Attached Storage (DAS), in addition to SAN. RDS can separately configure storage location for the parent VHD and individual guest VMs, and use different storage tiers for each to optimize. High-performance, lower-cost storage options for VDI have become more plentiful, which means that customers do not have to rely on SANs anymore as the only option.

New in Windows Server 2012 R2, **storage de-duplication for VDI** now supports live VHDs, which means that data de-duplication can now be performed on open VHD/VHDX files on remote VDI storage with cluster-shared-volume (CSV) support. This allows for faster read/write times of optimized files, increased VDI storage density and hence reduced storage cost.

Rich user experiences

Users demand access to their corporate applications and data from anywhere they go, and on any device they choose. However, they still expect a familiar, consistent, rich and responsive desktop and application experience whether they are on the LAN or on the WAN, and no matter what the display capabilities of the device are.

With Windows Server 2008 R2 SP1, Microsoft introduced RemoteFX, a set of user experience technologies that enable the delivery of a full-fidelity Windows user experience to a broad range of remote client devices. Windows Server 2012 and Windows Server 2012 R2 build on this platform to more easily enable a far richer experience on many types of networks and devices. Specifically, the RDP protocol in Windows Server 2012 R2 enables a more consistent user experience when connecting to centralized desktops and applications, even on networks where bandwidth is limited and end-to-end latency is increasing.

Microsoft RemoteFX enables the delivery of a robust Windows user experience across a range of scenarios. In Windows Server 2012 R2, enhancements provide a richer and more seamless experience on all types of networks and devices. For example, **RemoteFX over WAN** helps maintain a consistent user experience over highly variable WANs. RemoteFX over WAN enables an automatic choice of TCP or security-enhanced UDP transport, and it detects and tunes graphics output to network capabilities dynamically and automatically.

RemoteFX Adaptive Graphics provides improved graphics processing that enables higher fidelity delivery of rich virtual desktops and RemoteApp programs, such as video and 3D content, across various networks. The RemoteFX graphics processing pipeline and codecs and RemoteFX Progressive Rendering are some of the key components that enable RemoteFX Adaptive Graphics.

To further enhance the user experience, RemoteFX includes a CPU-based graphics accelerator that allows applications running in a virtual machine to access graphics processing unit (GPU) resources, even if there is no GPU in the server, in order to provide a great graphics experience. It also supports virtualizing a GPU in the host server in virtual machines, providing an accelerated DirectX graphics experience for 3D or other graphics-intensive applications. Last not least, RemoteFX fully supports touch-enabled devices and applications in a VDI environment.

Summary

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.

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. Microsoft calls this vision “the Cloud OS”.

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.

At the heart of the Microsoft Cloud OS is Windows Server 2012 R2, which delivers with a great set of qualities upon the promises of a modern datacenter, modern applications and people-centric IT. Whether you are an enterprise building out your own private cloud environment, or a service provider offering large-scale cloud services, here is why you should choose Windows Server 2012 R2 for your infrastructure:

- **Enterprise-class:** Windows Server 2012 R2 offers a proven, enterprise-class cloud and datacenter platform that can scale up to continuously run the largest workloads while enabling robust recovery options to protect against service outages. Because large datacenters can be heterogeneous, Windows Server 2012 R2 offers high levels of interoperability with cross-platform technologies.
- **Simple and cost-effective:** Windows Server 2012 R2 gives you resilient, multi-tenant-aware storage and networking capabilities for a wide range of workloads. It delivers these capabilities at a fraction of the cost of other solutions, through the use of cost-effective, industry-standard hardware. With automation of a broad set of management tasks built-in, Windows Server 2012 R2 simplifies the deployment of major workloads and increases operational efficiencies.
- **Application focused:** Windows Server 2012 R2 helps you build, deploy and scale applications and web sites quickly, and with more flexibility than ever before. In concert with Windows Azure and System Center 2012 R2, it unlocks improved application portability between on-premises environments and public and service provider clouds, increasing flexibility and elasticity of your IT services. Windows Server 2012 R2 enables mission-critical applications and provides enhanced support for open standards, open source applications and various development languages.

- **User centric:** Windows Server 2012 R2 enables you to provide access to corporate resources and helps protect critical business information. With Windows Server 2012 R2, you can manage identities across your datacenter and federated into the cloud, provide flexible remote access to applications and resources, and define the resources and level of access users have to information based on who they are, what they are accessing, and what device they are using.

Next Steps with Windows Server 2012 R2

As the foundation of Microsoft's Cloud OS platform, Windows Server 2012 R2 provides powerful new technologies that help enable the transformation to a modern datacenter. It allows you to effectively address opportunities created by the latest IT trends and to better meet today's business needs with agility and efficiency.

These technologies allow you to offer new levels of datacenter support for existing and new, lower cost hardware, offer private cloud services, extend private clouds to hybrid cloud architectures more easily, and improve support for remote and mobile workers and devices. They enable enterprise and service provider IT organizations to simplify the roll-out and management of IT services, to quickly support process and workload deployment, and to improve availability and access to applications, while simultaneously reducing costs, capital investment, and risk.

By adopting Windows Server 2012 R2, enterprise and service provider IT is better equipped to support business agility, efficiency, and innovation—to ultimately create competitive advantage for the business. To take a deeper look at how Windows Server 2012 R2 can help your organization attain new levels of agility and efficiency, download a trial version of the software and begin evaluating the capabilities most relevant to your business and IT strategy.

- Refer to additional Windows Server 2012 R2 resources
<http://www.microsoft.com/en-us/server-cloud/windows-server/windows-server-2012-r2.aspx>
- Windows Server 2012 R2 on TechNet
<http://www.microsoft.com/technet>
- Download and evaluate Windows Server 2012 R2
<http://www.microsoft.com/en-us/server-cloud/evaluate/trial-software.aspx>
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