Microsoft

Cloud optimize your business

Windows Server 2012 R2

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Contents

1 Trends

3 Windows Server: cloud optimize your business

5 Windows Server 2012 R2 capability overview

- 5 Server virtualization
- 9 Storage
- 13 Networking
- 18 Server management and automation
- 20 Web and application platform
- 22 Access and information protection
- 26 Virtual Desktop Infrastructure

30 Summary

31 Next steps with Windows Server 2012 R2

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Trends

The rapidly changing world of information technology (IT) has transformed how we do business, rendering many traditional management approaches and methodologies obsolete.

Several key IT trends have reshaped the industry, creating new opportunities for enterprises and service providers. These trends include the following:

New applications: Business innovation and agility drive the need for enhanced deployment, system, and integration flexibility. Such flexibility demands new application and service architectures that promote greater connectivity for the end user from virtually anywhere, anytime, on any device. These applications, built on new frameworks with richer sets of common services, empower the end user to take advantage of familiar productivity, collaboration, and social networking tools. Organizations deploy these frameworks on-premises, in the cloud, and in hybrid environments.

Device proliferation: Innovations in consumer computing devices enable end users to work from almost anywhere, making them more productive. Highly mobile device form factors now provide instant connectivity and powerful features such as touch screens, cameras, and GPS. These enhanced capabilities have created rich user experiences and preferences that carry with them certain expectations of enterprise computing. This "consumerization of IT" trend offers enterprise IT teams opportunities to support and incorporate these experiences and devices, enabling whole new work scenarios such as convenient access to data and applications in the field and new contextually relevant device applications.

Data explosion: The exponential growth of available data creates significant challenges for IT. The data often comes from a variety of internal and external sources, not to mention business and personal computing devices, and different structured and unstructured formats. As a result, relevant and useful data insights remain hidden in combinations of multiple data sources. In many cases, the sheer volume of data prevents organizations from capturing and analyzing information with traditional methods such as storage in a database for query and analysis. In certain cases, the data streams at a rate and volume that prevents any data capture or process beyond a limited window of time.

Cloud computing: To address the challenges of new applications, device proliferation, and data explosion, organizations need to find effective and efficient ways to harness the latest IT innovations in their environments. The ability to abstract resources from individual hardware components into a pooled set of resources while maintaining workload isolation enables organizations to achieve highly agile workload provisioning, continuous availability, elastic scaling, and optimal use of

resources. The 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 today have recast their datacenter services into private cloud computing models. This transformation includes automation of their delivery model with self-service provisioning and administration portals, plus instituting charge-back or report-back capabilities based on resource usage.

Datacenter service providers have also transformed their service delivery to cloud-computing models, enabling them to offer more attractive economics due to resource pooling, often at higher levels of IT service maturity.

The Microsoft vision for this new era of IT provides one consistent platform for infrastructure, applications, and data: the Cloud OS. The Cloud OS spans customer datacenters, service provider datacenters, and the Microsoft public cloud, enabling you to easily and cost-effectively cloud-optimize your business. The consistency helps IT organizations, large and small, take the most advantage of cloud computing and extend the boundaries of their datacenter to further improve service scale, elasticity, and availability.

At the heart of the Cloud OS is Windows Server 2012 R2.

Windows Server: cloud-optimize your business

For years now, Microsoft has been building and operating some of the largest cloud applications in the world. The expertise culled from these experiences along with our established history of delivering market-leading enterprise operating systems, platforms, and applications has led us to develop a new approach for the modern era: the Microsoft Cloud OS.

The Cloud OS vision combines Microsoft knowledge and experiences with today's trends and technology innovations to deliver a modern platform of products and services that helps organizations transform their current server environment into a highly elastic, scalable, and reliable cloud infrastructure. Utilizing the software that powers the Cloud OS vision, organizations can quickly and flexibly build and manage modern applications across platforms, locations, and devices, unlock insights from volumes of existing and new data, and support end-user productivity wherever and on whatever device they choose.

At the heart of Cloud OS is Windows Server 2012 R2. Delivering on the promise of a modern datacenter, modern applications, and people-centric IT, Windows Server 2012 R2 provides a best-in-class server experience that cost-effectively cloud-optimizes your business. Windows Server 2012 R2 includes the following types of new and enhanced features:

- **Enterprise-class:** Windows Server 2012 R2 offers a proven, enterprise-class virtualization and datacenter platform that can scale to run the largest workloads while enabling rich recovery options to protect against service outages. With Windows Server 2012 R2, you can achieve automated protection, recovery of assets, and cost-effective business continuity on-premises and in the cloud, enabling you to improve your workload service level agreements (SLAs) while reducing downtime risks. Because many customers have heterogeneous environments, Windows Server 2012 R2 offers high levels of interoperability with cross-platform technologies.

- **Simple and cost-effective:** Windows Server 2012 R2 provides resilient, multi-tenant-aware storage and networking capabilities for a wide range of workloads. The use of cost-effective, industry-standard hardware makes these capabilities available at a fraction of the cost of other solutions. 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 websites quickly, easily, and flexibly. In concert with Windows Azure and System Center 2012 R2, Windows Server 2012 R2 provides improved application portability between on-premises environments and public- and service-

provider clouds, increasing the elasticity of your IT services. Windows Server 2012 R2 also enables mission-critical applications and provides enhanced support for open standards, open source applications, and various development languages.

- **User centric**: Windows Server 2012 R2 empowers your end users by giving them access to corporate resources on the devices they choose while protecting your organization's information. You can manage an end user's identity across the datacenter and into the cloud, providing secure remote access and defining the resources and level of access they have based on who they are, what information they are accessing, and what device they are using. Having the capability to manage corporate- and personally owned devices within a unified infrastructure helps administrators easily identify and 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 your existing skillsets and technology investments. You also gain all the Microsoft experience behind building and operating private and public clouds – right in the box.

Delivered as an enterprise-class, the simple and cost-effective server and cloud platform Windows Server 2012 R2 delivers significant value around seven key capabilities:

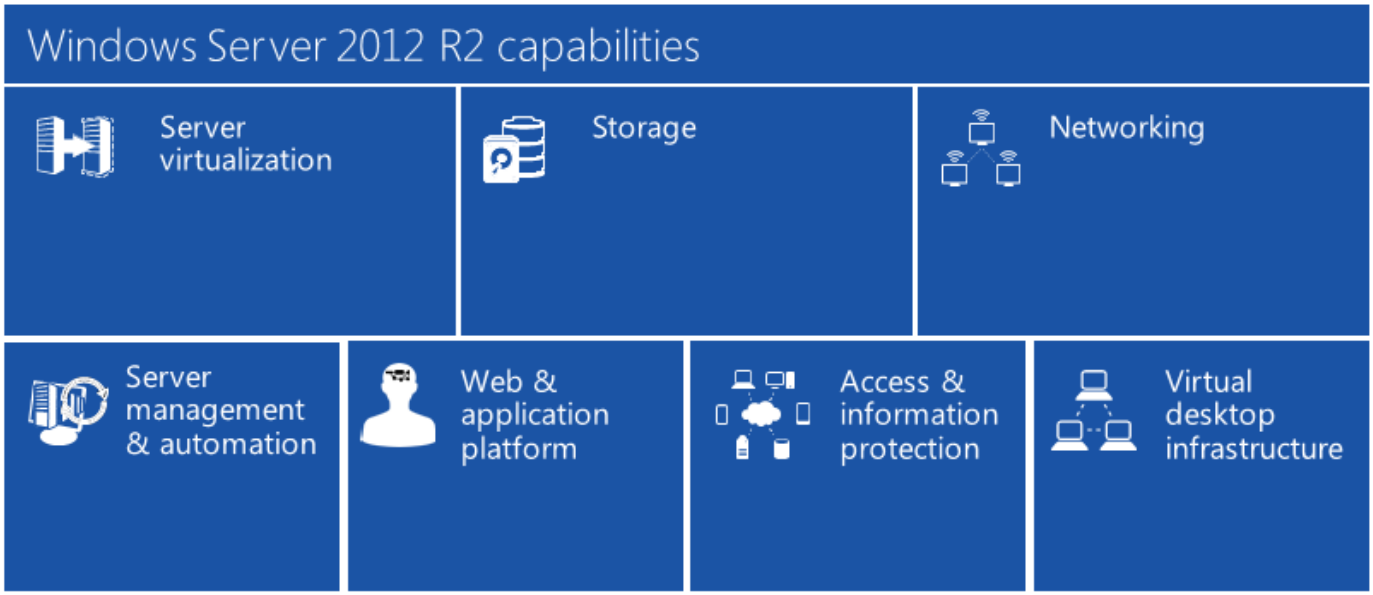

Figure 1: Windows Server 2012 R2 capabilities.

Server virtualization

Windows Server Hyper-V offers a scalable and feature-rich virtualization platform that helps organizations of all sizes realize considerable cost savings and operational efficiencies. With Windows Server 2012 R2, server virtualization with Hyper-V pulls ahead of the competition by offering industry-leading size and scale that makes it the platform of choice for running 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 functionality enables you to virtualize today and be ready for the future tomorrow.

Whether you are looking to expand virtual machine mobility, increase virtual machine 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. Plus, you can also benefit from workload

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

Enterprise-class scale and performance

Windows Server 2012 R2 offers massive scale to help 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 also supports 64-node clusters and 8,000 virtual machines per cluster as well as a 64 TB virtual disk format with the ability for *online resize* – the ability to grow or shrink a VHDX-formatted virtual disk dynamically while it is running, without downtime.

System	Resource	Maximum number		Improvement factor
		Windows 2008 R2	Windows Server 2012 R2	
Host	Logical processors on hardware	64	**320**	5×
	Physical memory	1 TB	**4 TB**	4×
	Virtual processors per host	512	**2,048**	4×
Virtual machine	Virtual processors per virtual machine	4	**64**	16×
	Memory per virtual machine	64 GB	**1 TB**	16×
	Virtual disk capacity	2 TB	**64 TB**	32x
	Active virtual machines	384	**1,024**	2.7×
Cluster	Nodes	16	**64**	4×
	Virtual machines	1,000	**8,000**	8×

Figure 2: Windows Server 2012 R2 offers industry-leading scalability for server virtualization.

Live migration is an important virtual machine mobility feature that has continued to improve since it was introduced with Windows Server 2008 R2. In Windows Server 2012 R2, these performance improvements have been taken to the next level. Live migration compression accelerates live migration transfer speed by compressing the VHD/VHDX file, improving performance by roughly 2x for most workloads. Live migration with remote direct memory access (RDMA), another new feature in Windows Server 2012 R2, delivers the highest performance for live migrations over >10 GB network connections, supporting transfer speeds of up to 56 Gigabytes, by offloading the transfer to hardware and harnessing the power of RDMA technologies.

Virtualized Microsoft workloads, such as Exchange, SQL, and SharePoint, run best on a Hyper-V infrastructure. For example, independent third-party testing by The Enterprise Strategy Group, Inc. (ESG Lab) showed that an 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. The average database read-response times ranged between 5.02 and 15.31

milliseconds, well below the Microsoft recommended limit of 20 milliseconds. In another ESG Lab test case, an existing SQL Server 2012 online transaction processing (OLTP) workload, virtual processor (vCPU)-limited by the maximum allowed configuration of four vCPUs imposed by Windows Server 2008, increased performance by six times by taking advantage of 64 vCPUs in Windows Server 2012. The average transaction response times also improved five times, from four vCPUs to 64 vCPUs.

Windows Server 2012 R2 also introduces generation 2 virtual machines to Hyper-V. These virtual machines provide Unified Extensible Firmware Interface (UEFI)firmware support, Pre-Boot Execution Environment (PXE) boot, secure boot, and boot from a Small Computer System Interface (SCSI) virtual hard disk VHD. Some older virtual hardware such as Integrated Drive Electronics (IDE) controllers has been removed. This change can help contribute to faster boot times and more flexible configurations. However, Windows Server 2012 R2 only supports more recent operating systems and does not support conversion between generation 1 and generation 2.

These enterprise-class 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 significantly scale.

Virtual machine mobility

Windows Server 2012 R2 enables you to manage virtual machines independently of their underlying physical infrastructure. In addition, Windows Server 2012 R2 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 on which the virtual machines reside or the storage resources used by the virtual machines.

Introduced with Windows Server 2012 as an industry-first capability, shared-nothing live migration enables you to move a virtual machine, live without downtime, from one physical system to another, even if the systems are in different clusters or not 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. Such functionality can prove beneficial in many different situations, such as in a branch office where you may be storing the virtual machines on a local disk, and you want to move a virtual machine from one node to another. This feature also can prove 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. Windows Server 2012 R2 also introduces cross-version live migration that enables you to move virtual machines from a server or cluster running Windows Server 2012 to a server or cluster running Windows Server 2012 R2 with no downtime.

In multi-tenant environments of service providers, tenants are frequently 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 server message block (SMB) protocol support, Windows Server 2012 R2 now also offers shared VHDX files. 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.

First introduced in Windows Server 2012, Hyper-V Replica provides a storage- and workload-agnostic solution that replicates efficiently, periodically, and asynchronously over IP-based networks, typically to a remote site. Hyper-V Replica also enables 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 enables configurable, replication frequencies down to 30 seconds or up to 15 minutes. Furthermore, Hyper-V Replica now supports multiple nodes, meaning tertiary replica sites for example, such as in the case of a service provider who wants to replicate a customer's workload to another datacenter.

Another innovation around Windows Server 2012 R2 is Windows Azure Hyper-V Recovery Manager. Hyper-V Recovery Manager combines 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, you can protect services by automating the replication of the virtual machines that composes them at a secondary location. Hyper-V Recovery Manager also provides continuous health monitoring of the primary site and coordinates the orderly recovery of services in the event of a site outage.

First-class citizen support for Linux as a guest

Many enterprise IT departments and service providers today run a mix of hypervisors, operating systems, and applications in their datacenter. Oftentimes, migrating from one platform to another is not possible or even feasible from a technical standpoint due to the size and scope involved. 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, a Hyper-V feature first introduced in Windows Server 2008 R2 SP1, automatically reallocates memory between virtual

machines running on a Hyper-V host. This results in a more efficient allocation of virtual machine memory while dramatically increasing virtual machine consolidation ratios. In Windows Server 2012 R2, Hyper-V now offers full dynamic memory support for Linux guests including:

- **Minimum memory setting** — ability to set a minimum value for the memory assigned to a virtual machine lower than the startup memory setting.
- **Hyper-V smart paging** — paging used to enable a virtual machine to reboot while the Hyper-V host is under extreme memory pressure.
- **Memory ballooning** — reclaiming unused memory from a virtual machine for another virtual machine with memory needs.
- **Runtime configuration** — adjusting the minimum memory and maximum memory configuration setting on the fly, without requiring a reboot, while the virtual machine continues to run.

Also, previously, 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. With Windows Server 2012 R2 Hyper-V hosts, key Linux vendors have included LIS for Hyper-V in their standard distributions, eliminating the manual step required to take advantage of the latest LIS capabilities.

Storage

With the increase in new applications, the explosion of data, and growing end-user expectations for continuous services, there has come a significant increase in storage demands. Windows Server 2012 R2 offers a wide variety of storage features and capabilities to address the storage challenges faced by organizations. 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.

Microsoft designed Windows Server 2012 R2 with a strong focus on storage capabilities, including improvements in the provisioning, accessing, and managing of storage and the transfer of data across the network that resides on that storage. The end result is a storage solution that delivers 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 that enable you to take advantage of lower-cost industry-standard hardware—rather than investing in purpose-built storage devices—without having to compromise performance or availability.

Storage Spaces, for example, 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. These virtual disks can make use of striping, mirroring, and parity across physical disks for improved availability and performance.

Storage tiering, a new feature in Windows Server 2012 R2, relies on low cost, high-capacity spinning disks to store less-frequently used data, while high-speed solid-state disks store more-frequently used data. Storage tiering accomplishes this by building on storage virtualization with Storage Spaces, 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. By tracking data temperature, Windows Server 2012 R2 can move data at the sub-file level, resulting in only "hot" regions of a file (such as VHD or database) moving to SSDs, with the "cold" regions residing on HDDs.

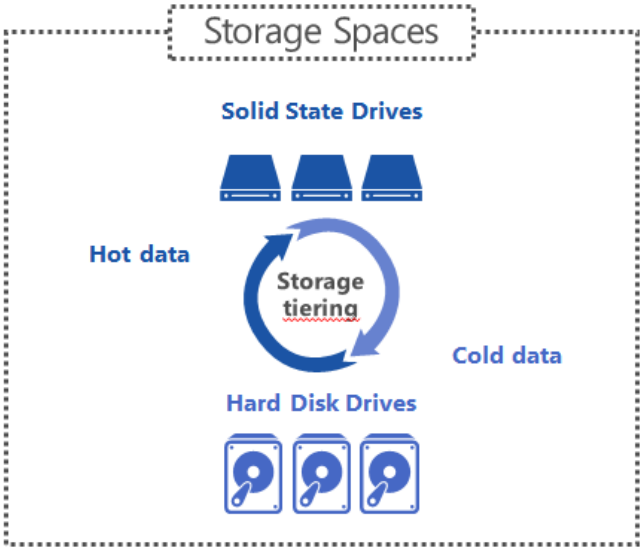

Figure 3: Storage tiering in Windows Server uses solid-state drives (SSD) and hard-disk drives (HDD) in tiered storage space.

Since Windows Server 2012, SMB Direct has provided support for remote direct memory access (RDMA) network adapters, enabling storage performance capabilities that rival Fibre Channel. RDMA network adapters provide 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 made possible by implementing reliable transport protocols on the adapter hardware that enable zero-copy networking with kernel bypass. As a result, 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

Windows Server 2012 R2 reduces server downtime and application disruption by letting you store server application data on file shares while obtaining a similar level of reliability, availability, manageability, and high performance typically expected from a high-end storage area network (SAN).

Introduced in Windows Server 2012, Transparent Failover enables you to transparently move SMB file shares between file server cluster nodes, without noticeable interruption of access for end users or servers depending on the storage. This feature proves useful for planned events, such as performing maintenance on a node, or surprise events, such as when a hardware failure causes a server to fail. Transparent Failover occurs regardless of the kind of operation underway when the failure occurred.

One of the main advantages of file storage over block storage is the ease of configuration and the ability to configure folders that can be shared by multiple clients. Windows Server 2012 first introduced the ability to share the same folders from multiple nodes of the same cluster with cluster shared volumes (CSV). New in Windows Server 2012 R2 is the ability to manage SMB sessions per share (not just per file server), increasing flexibility. Workloads from a single client can be distributed across many nodes of a scale-out file server.

The combination of performance improvements and enhancements to availability through features such as transparent failover means you can now use File and Storage Services clusters as network storage for application data, especially workloads such as SQL Server and Hyper-V. In fact, for Windows Server 2012 R2 a file share cluster storage back end becomes the recommended deployment model for Hyper-V deployments.

Comprehensive storage management and backup

Whether you use purpose-built or industry-standard storage solutions, efficient use and management of valuable storage resources is critical. Windows Server 2012 R2 provides great management and backup capabilities that help you better manage your storage capacity for a single server or multiple servers, one class of storage or a variety of storage solutions, for a Windows-only or a heterogeneous environment.

Storage QoS, a new quality of service feature in Windows Server 2012 R2, enables you to restrict disk throughput for overactive or disruptive virtual machines. You can configure Storage QoS dynamically while the virtual machine is running. For maximum bandwidth applications, Storage QoS provides strict policies to throttle IO to a given virtual machine to a maximum IO threshold. For minimum bandwidth applications, Storage QoS provides policies for threshold warnings that alert an IO-starved virtual machine 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 application programming interfaces (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 Storage Management Initiative Specification (SMI-S) compliant, storage devices with proprietary hardware that have compatible third-party storage management providers, or storage devices that are already allocated through the use of Storage Spaces. This storage management capability enables 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: Server Manager in Windows Server. By using Server

Manager, administrators can populate server groups with file servers or storage clusters that take advantage of Storage Spaces or reach out to populate manageable devices that have enabled SMI-S agents.

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 to Windows Azure. Windows Azure Backup 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 we manage networking and network assets. Still, the 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. These capabilities help reduce networking complexity while lowering costs, simplifying management tasks, and delivering services reliably and efficiently. With Windows Server 2012 R2 you can 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. 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. With both features, you can isolate network traffic from different business units or customers on a shared infrastructure without utilizing virtual local area networks (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 pre-existing infrastructure on another site.

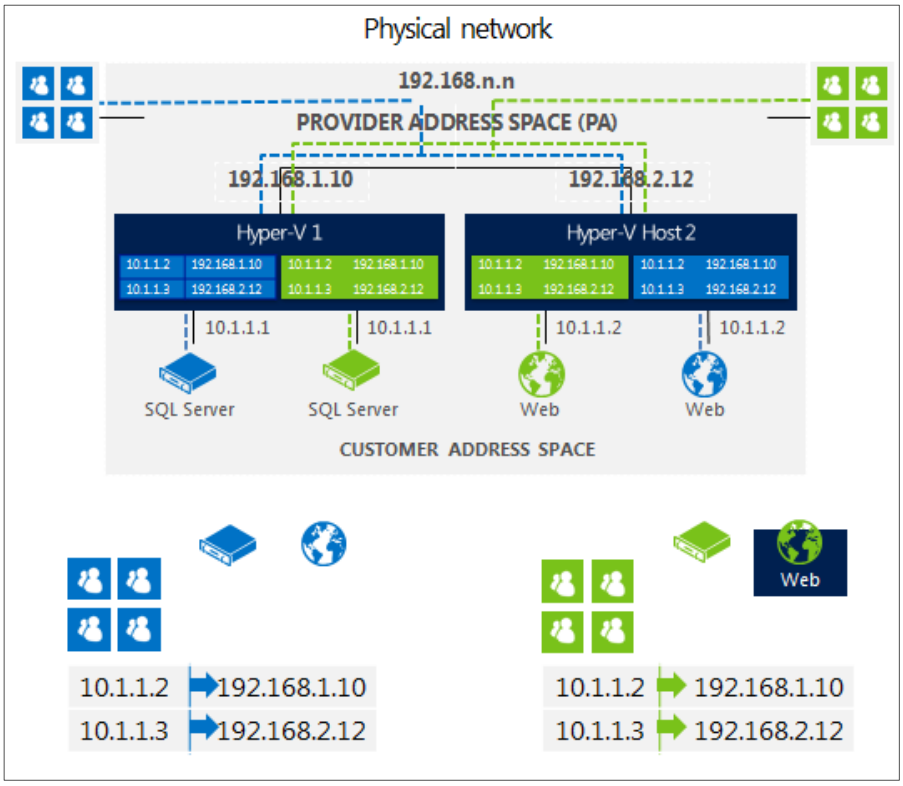

Figure 4: With Hyper-V Network Virtualization, two companies can have virtual machines and virtual networks with overlapping IP address ranges running on the same physical infrastructure. Despite the overlap, the virtual workloads and networks remain independent and secure."

Hyper-V Network Virtualization extends the concept of server virtualization to enable multiple virtual networks, 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. As an open platform, Windows Server 2012 R2 makes it possible for multiple vendors to provide extensions that are written to standard Windows API frameworks, with strengthened reliability through the Windows standard framework.

On the same physical network as Hyper-V Network Virtualization and the Hyper-V Extensible Switch, you can run multiple virtual network infrastructures and 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 introduced a feature called cross-premises connectivity, which provides virtual private network (VPN) site-to-site functionality to help establish cross-premises connectivity between enterprise operations and hosting service providers. Cross-premises connectivity enables enterprise IT departments to connect to private subnets in a hosted cloud network. In addition, cross-premises connectivity enables connectivity between geographically separate enterprise locations. However, one of the limitations of this feature was that you needed one gateway per tenant. With Windows Server 2012 R2, however, you get 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. A new in-box multi-tenant VPN gateway opens up a broad range of scenarios including the enabling of connectivity between physical and virtual networks, enterprise datacenters, hosting organizations, and enterprise networks and Windows Azure.

Another challenge to a software-defined datacenter is the fact that today's datacenters are made up of different classes of devices – 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 very important as most of these devices are managed with different protocols and schemas, and in some instances, with 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 by easily managing and configuring devices utilizing standards technologies. Windows Server 2012 R2 enables you to provide device management with a common abstraction layer, working over standard protocol and schema. As a consequence, you can 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 team 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 directly affect service availability. A considerable amount of work has been done in Windows Server 2012 R2 to extract predictable network performance inbox as well as to extract the most out of next-generation hardware.

Single Root I/O Virtualization (SR-IOV) is a standard introduced by the Peripheral Component Interconnect Special Interest Group (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 enables SR-IOV-capable devices to be assigned directly to a virtual machine.

Hyper-V enables support for SR-IOV-capable network devices. Hyper-V also enables 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 provide fault tolerance on your network adapters without having to buy additional hardware and software. NIC Teaming in Windows Server 2012 R2 enables multiple network interfaces to work together as a team, preventing connectivity loss if one network adapter fails. This feature also enables you to aggregate bandwidth from multiple network adapters. For example, four 1 GB network adapters can provide an aggregate of 4 GB 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 on a daily basis. No matter the size of your organization, you need to have the ability to get the best performance on a multi-site environment and provide your organization 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, offers 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, auditing of server configuration changes, tracking of IP address usage, and monitoring and specific scenario-based management of DHCP and Domain Name System services. With Windows Server 2012 R2, you also receive virtual IP address space management, which enables IPAM in Windows Server 2012 R2 to 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.

Windows Server 2012 first introduced the ability to manage quality of service policies and settings dynamically with Windows PowerShell. Most hosting providers and enterprise operations today use a dedicated network adapter and 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 and enterprise operations. For service providers, QoS management enables hosting customers on a server running Hyper-V while still providing a certain level of performance based on SLAs. QoS management also helps hosters ensure that customers won't be affected or compromised by other customers on their shared infrastructure. This functionality applies to computing, storage, and network resources. For enterprise operations, QoS management enables 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 multi-tenant 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 enables 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 more and more complex. Multiple industry standards are confusing hardware vendors. 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 offer an integrated platform to automate and manage the increasing datacenter ecosystem. Features within Windows Server 2012 R2 enable you 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 that deliver application programming interfaces (APIs), which are easier for developers and IT staff 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.

Windows management instrumentation (WMI) is a standard common information model object manager (CIMOM) that hosts many standard class providers. Early on however, there was not an interoperable management protocol, resulting in WMI using the distributed component object model (DCOM). This limitation made Windows managing Windows an "island of management."

This situation changed with the Distributed Management Task Force (DMTF) definition and approval of WS-Man, a SOAP-based, firewall-friendly protocol that enables 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 functionality provides interoperability with a number of CIMOM and WS-Man stacks available on other platforms, including Openwsman (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, enabling them to respond to business-critical problems with greater speed and agility.

Rich automation

Increasing business agility by more efficiently managing infrastructure and applications must come in a cost-effective manner. IT staffs historically spend 60 to 80 percent of their overall budget keeping IT services running smoothly. 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 for managing server

environments and looking 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. Windows PowerShell sessions to remote servers are resilient and can withstand various types of interruptions. In addition, learning Windows PowerShell has become much easier 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 more than 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 richer session connectivity, workflow capabilities, enhanced job scheduling, and Windows PowerShell Web Access. Furthermore, you can write Windows PowerShell scripts more quickly and intuitively through the built-in Integrated Scripting Environment (ISE) that enables script sharing, connecting IT professionals to a larger Windows PowerShell user community.

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

Web and application platform

Chances are your organization already 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 that enables you 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 offer your organization even greater application flexibility, helping you build and deploy applications

either on-premises, 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 multi-tenant 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. For developers thinking about how to build and deploy next-generation applications, including cloud applications, this capability can prove very important. For example, developers may want to run applications that they developed for Windows Azure on-premises or on-premises applications in the cloud environment, which is where programming symmetry, common development tools between Windows Server 2012 R2 and Windows Azure, and virtual machine portability can help them achieve their goal.

Windows Server provides 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 across 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. They can also use these programming tools across web, application, and data tiers for locally deployed applications and for private and public cloud solutions. In addition, these tools 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 use your infrastructure on your terms. That's because 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 improve website density and efficiency. This functionality is important not only for enterprise IT professionals, but also for service providers, enabling them 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 or sandbox for each tenant, administrators can use CPU throttling to prevent one tenant's application from monopolizing CPU resources needed by other tenants.

Windows Server 2012 R2 provides an ideal platform to run high-density web servers 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 helps to store all SSL certificates centrally in a file server, where they are shared by all servers in the server farm, simplifying SSL binding and 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 support is important because the latest .NET Framework offers core new features and improvements, such as support for asynchronous file operations, and enhancements around web, networking, Windows Presentation Foundation (WPF) and others. Also, with Windows Server 2012, web standards "just work."

In addition, 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 discover and install the web applications 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 applications.

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 necessitates being 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 such as 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 end user's role within the organization. Microsoft enterprise tools and technologies can help IT staff to 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 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, and new scenarios to help customers provide access to corporate resources for users from their own devices. With these new capabilities, you can better manage and protect data access, simplify deployment and management of your identity infrastructure, and provide more secure access to data from virtually anywhere across both on-premises well managed devices and new consumer orientated form factors.

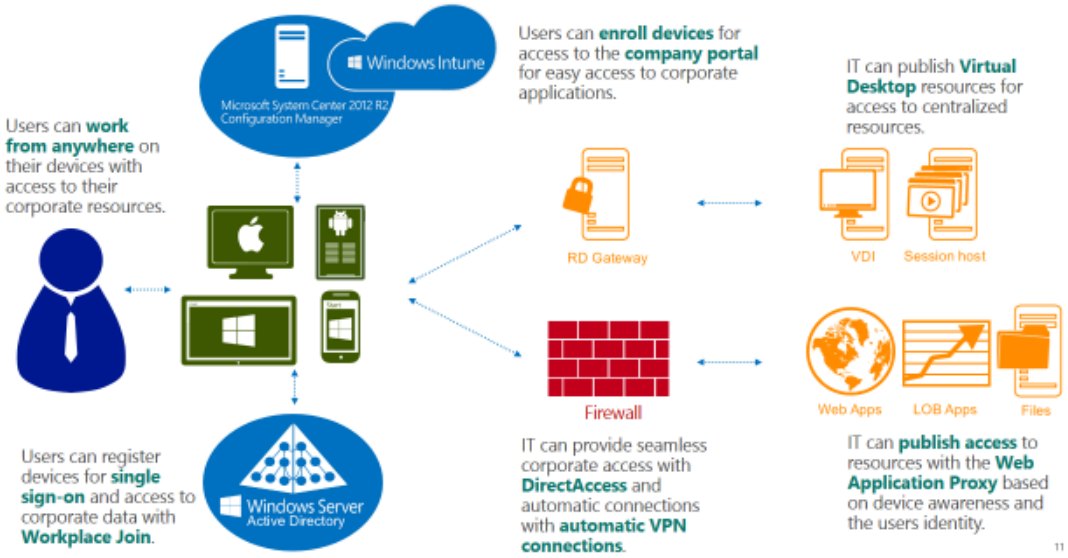

Figure 5: Windows Server Remote Access helps IT provide seamless application access and automatic VPN connections with conditional access to users based on the user's identity, the user's device, and whether the user is inside the corporate network or connecting from an external location.

Always-on remote access from trusted devices

In a world of consumerized devices and mobility, end users want to use their device of choice and have access to their personal and work-related applications, data, and resources. They also want an easy way to access their corporate applications from anywhere. IT organizations are increasingly open to empower end users to work this way, but they also 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 end 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, end users can register their own 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 record is created in Active Directory. This device record establishes a link between the end user and their device, making it known to the IT system and enabling the device to be authenticated (effectively establishing a seamless second-factor authentication). In return, the end user gains access to corporate resources that were previously not available outside of their domain-joined PC.

Another new feature in Windows Server 2012 R2 provides the ability for applications to trigger a VPN connection on the end user's behalf during launch. Traditional VPNs are user-initiated and provide on-demand connectivity to corporate resources: The end user launching the VPN

connection, typically enters credentials. Oftentimes, the end user's device establishes two-factor authentication and a connection to the corporate environment. In Windows Server 2012 R2, however, automatic VPN connections provide automated starting of the VPN when an end user launches an application that requires access to corporate resources. The end user may still be prompted for two-factor credentials, but automatic VPN connections remove the requirement to initiate the connection before starting the application. A VPN connection will start whenever an application requires it.

Seamless, single sign-on to applications and data

When end users access resources located on-premises and in the cloud, the IT team often struggles to provide end 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 end-user information, enabling organizations to reduce security risk and lower the burden of managing multiple credentials.

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

You can also extend on-premises identities into the cloud with Active Directory Federation Services (ADFS). ADFS enables the corporate Active Directory to communicate with heterogeneous identity stores and offers seamless single sign-on for end users. In addition, ADFS also enables IT organizations to authenticate end users from partner organizations and grant them access to internal domain resources. New in Windows Server 2012 R2 AD FS is the ability to enforce multi-factor authentication on a global or per-application basis, and to enforce device registration by users as part of the requirements in order to get access to corporate resources.

Microsoft supports running domain controllers and ADFS on Windows Azure Infrastructure as a Service (IaaS), connected back on premises with the Azure Connect bridge. This configuration makes it easier and faster for customers to connect and authenticate cloud-based end 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 end users and an easier way for customers to manage the identity of end 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 WAAD enables customers to use it as the central authentication endpoint for all end users and devices outside of the corporate environment, including cloud or hybrid applications. In such a case, WAAD may be the authoritative authentication directory. You can also check the end user validation and device verification through federated connections to other directories such as on-premises Active Directory, partners, or other cloud-based identity repositories.

Policy-based access and audit of corporate information

As end users bring their own devices to their workplace, they will also want to access sensitive information locally on these devices. A significant amount of corporate data can only be found locally on end-user devices, which means it is typically not backed up or available for compliance classification, leaving it unprotected in the event a device is lost, stolen, or sold. The IT team 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-grained access policies. Furthermore, Dynamic Access Control enables 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 an end user has to the file. Rights can be configured to enable an end user to open, modify, print, forward, or take other action with rights-managed information, helping organizations safeguard data when it is distributed outside the corporate network.

Virtual Desktop Infrastructure

Most IT departments currently face the challenge of enabling worker productivity on a growing number of mobile devices in the workplace. Virtual Desktop Infrastructure (VDI) helps you accommodate these new devices by enabling 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 end-user productivity. With Windows Server 2012 R2, Microsoft makes 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

IT professionals looking to deploy a VDI infrastructure have many questions they need answered. Can you reduce 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? Lastly, how do you make sure that you 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 deployment wizard takes customers through the steps required to setup a virtual machine or session-based VDI environment. Selecting between one of the deployment modes has been simplified in such a way as to only require 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 virtual machines for you as part of the setup process, reducing the dependency for additional tools during the setup process. The virtual machines 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 to unify the administration of published applications and desktops, giving you plenty

of options to setup and manage end users, sessions, and virtual machines from a single console. In addition to entire desktops, you can also publish virtual applications, called RemoteApp, to virtual machines and session desktops with the RDS administration console. You can manage end-user permissions, including their settings and other properties, from the same console, 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 input/output operations per second (IOPS) and storage volume. Thus, it is critical to have a wide range of options to optimize the output from your storage investment.

RDS in Windows Server 2012 R2 supports various lower cost storage options, such as SMB based file shares, Direct Attached Storage (DAS), and SAN. With RDS, you can separately configure storage location for the parent VHD and individual guest virtual machines, and use different storage tiers to optimize each one. High-performance, lower-cost storage options for VDI have become more plentiful, freeing customers from having to rely on SANs as their only option.

New in Windows Server 2012 R2, storage de-duplication for VDI now supports live VHDs. Such support enables data de-duplication to be performed on open VHD/VHDX files on remote VDI storage with cluster-shared-volume (CSV) support. The end result is faster read/write times of optimized files, up to a 90% reduction in storage use, and reduced storage cost.

By using storage tiering in Storage Spaces, mentioned earlier in this paper, an IT administrator doesn't need to plan and architect the storage locations for VDI gold images, differencing disks, and user data. Data will automatically be placed on higher or lower performing disks based on frequency of usage.

Rich user experiences

End users demand access to their corporate applications and data anytime, anywhere, and on any device. However, they still expect a familiar, consistent, rich and responsive desktop and application experience whether they are on the local area network (LAN) or on the wide area network (WAN), and regardless of the display capabilities of the device they are using.

With Windows Server 2008 R2 SP1, Microsoft introduced RemoteFX, a set of end-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 end 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 rich Windows user experience across a range of scenarios. In Windows Server 2012 R2, enhancements provide a more seamless experience on all types of networks and devices. For example, RemoteFX for WAN helps maintain a consistent end-user experience over highly variable WANs. RemoteFX for WAN enables an automatic choice of transmission control protocol (TCP) or security-enhanced user datagram protocol (UDP) transport, and dynamically and automatically detects and tunes graphics output to network capabilities.

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.

RemoteFX USB Redirection allows any locally connected USB device to be accessed by the remote session. This enables users to use virtually any USB device they have with their remote desktop.

To further enhance the end user experience, RemoteFX includes a CPU-based graphics accelerator that enables 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 rich graphics experience. RemoteFX 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. Furthermore, RemoteFX fully supports touch-enabled devices and applications in a VDI environment.

With the release of Windows Server 2012 R2 Microsoft are also releasing Remote Desktop App which provides easy access from iOS, Android and Mac OS X devices. These clients are available for free from the app store on the devices and take advantage of the latest RDP functionality, including the protocol improvements and support for RemoteApp and multitouch.

Summary

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

Microsoft has gained expertise from years of building and operating some of the largest cloud applications in the world. We've combined this expertise with our experiences in delivering market-leading enterprise operating systems, platforms, and applications to develop a platform for infrastructure, applications, and data: the Cloud OS.

The Microsoft Cloud OS delivers a modern platform of products and services that helps enterprise IT teams transform their current environment to a highly elastic, scalable, and reliable infrastructure. With Cloud OS, organizations can 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 Cloud OS is Windows Server 2012 R2, which delivers 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, Windows Server 2012 R2 offers an enterprise-class, simple and cost-effective solution that's application-focused and user centric. With Windows Server 2012 R2, you can utilize the capacity of your datacenter, deliver best-in-class performance for your Microsoft workloads, and receive affordable, multi-node business continuity scenarios with high service uptime and at-scale disaster recovery.

Next steps with Windows Server 2012 R2

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

These technologies enable 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. As a result, enterprise and service provider IT organizations can 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 IT teams and service providers are better equipped to support business agility, efficiency, and innovation, helping create competitive advantage. 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
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- Windows Server 2012 R2 on TechNet
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