**Microsoft server Assignment Module 12 Installation, Storage, and Compute with Windows Server**

**Install Windows Servers 2016**

1. Windows Server 2016 installation requirements

CPU Socket minimum 1.4 GHz (64-bit Processor)

RAM Memory minimum is 512 MB, but Microsoft recommenced 8 GB

Minimum 32 GB Disk Space Requirement

Network: Gigabit (10/100/1000baseT) Ethernet adapter

Optical Storage: DVD drive (if installing the OS from DVD media)

Video: Super VGA (1024 x 768) or higher-resolution

Internet: Broadband access

2. Describe Windows Server 2016 editions

Windows Server 2016 is available in three editions — (Standard, Datacenter and Essentials)

3.From which menu we can add and remove server roles?

Add Roles and Features

4. What is workgroup?

A workgroup is a peer-to-peer windows computer network, where users can use their login credentials only on or her system and not others. It holds a distributed administration wherein each user can manage his machine independently. Most storage is distributed. Each device has its own dedicated storage.

5. What is domain?

A domain is a network of computers and devices that are controlled by one set authority and have specific guidelines. More specifically, a domain is controlled by one particular company that has its own internet presence and IP address. The domain is labeled by its domain name, such as TOPS or www.tops.com.

6. What is powershell ?

PowerShell is a powerful scripting language and command-line shell that you can use to automate tasks, manage systems, and perform various operations.

1. **Command-line shell :**

PowerShell is a modern command shell that includes the best features of other popular shells. Unlike most shells that only accept and return text, PowerShell accepts and returns .NET objects.

1. **Scripting language :**

As a scripting language, PowerShell is commonly used for automating the management of systems. It is also used to build, test, and deploy solutions, often in CI/CD environments. PowerShell is built on the .NET Common Language Runtime (CLR). All inputs and outputs are .NET objects. No need to parse text output to extract information from output.

1. **Automation platform :**

The extensible nature of PowerShell has enabled an ecosystem of PowerShell modules to deploy and manage almost any technology you work with.

1. **Configuration management :**

PowerShell Desired State Configuration (DSC)is a management framework in PowerShell that enables you to manage your enterprise infrastructure with configuration as code.

7. upgradation v/s migration

**Upgradation:**

Process of changing version of database from lower release to major release is called

UPGRADE. For example, moving from 10.2.0.1 to 11.2.0.1. 10.2.0.4 to 11.2.0.3, 9.2.0.8 to 10.2.0.5 etc. Usually, upgrading the database without changing the physical server. Means, in the existing server itself the DB will upgrade to new release.

**Migration:**

Process of changing OS platform for a database server. For example, moving a database from Solaris server to Linux server, windows to Solaris etc. Ideally in most of the migration projects, there will be a change in physical server i.e If there is a server with Solaris 5.10 and now client decided to move to latest server with RHEL 6, it is called as migration.

Upgrade simply means upgrading the old version of a product to a new version. While migration migrating data from the old system to a new system.

8. license and activation model

Licensing is the process of checking whether a software application or feature has a valid license available to it at runtime. Licenses are usually stored on disk as text files (with a

.lic extension) with an encoded digital signature to prevent tampering with the parameters that describe the licensees rights. A single license file may contain multiple features and product licenses. A license consists of at least the following parameters:

* Product or feature name
* Version number, the maximum version this license can support
* Date for expiring licenses, could be permanent
* License count (“uncounted” for single-seat licenses)
* Machine ID or “host ID” to which the license is “locked”
* Encoded digital signature (sig) to prevent tampering with the license

**License Activation:** It is the process of successfully obtaining and installing a valid license file for a licensed application. A simple approach might be the following:

* End user installs the licensed application (from media or via an Internet download)
* End user runs the licensed application for the first time, no valid license is found (not yet activated)
* The licensed application pops up an “activation dialog box” to prompt the user to enter the “activation key” which was sent to him as a result of the ordering process.
* The licensed application connects to a pre-determined activation server URL using an API call (via standard http)

9. Precaution of up gradation

Precautions of upgradation are as follow:

* Check Hardware requirements
* Clear Excess Data
* Backup Files and Image Drive
* Uninstall Firewalls and Antivirus
* Download Latest Drivers
* Note Install Keys

10. Migration limitation

Most configuration content can be migrated in most environment, some configuration cannot be migrated. Extra steps are required in some circumstances. Such limitations are :

* **Actions :** To migrate a WFINITIATE action, which initiates a workflow process, the workflow process must be active. Therefore, two deployments are required. Migrate the workflow process and activate it in the target environment first, and then migrate the action.
* **Action groups :** To migrate action groups that are created in the Actions application, you must also migrate all the actions that are in each action group. If you do not migrate the actions, the action groups cannot be used in the target environment.
* **Base language :** A target environment must have the same base language as the source environment. If the target base language is different from the source base language, packages cannot be deployed.
* **Charts of accounts :** Migration Manager does not migrate charts of accounts (GLs)
* **Classifications :** Data that is related to the CLASSIFICATION table is not migrated. Cannot migrate a classification hierarchy in which a parent classification was changed to alter the parent-child classification relationship. Cannot migrate two or more different classifications that have the same hierarchy path.
* **Collection restrictions :** Data restrictions for objects and attributes are migrated, but collection restrictions are only partially migrated. Data in the SECURITYRESTRICT table is migrated. Data in the COLLECTIONAUTH table is not migrated.
* **Conditions on security groups :** In some situations might need to create and deploy two separate Change packages
* **Crossover domains :** To migrate a crossover domain to which an attribute has been added, must create and deploy two packages. The first package to deploy must contain the attribute but not the domain. The second package to deploy must contain the domain.
* **Database indexes :** If a package is deployed and an index exists in the target environment, the index in the package is not deployed. If an index does not exist in the target environment, the index is created. If the index in the package is marked to be deleted, the index in the target with the same table and attribute combination is marked to be deleted.
* **Discarded configuration changes :** A migration user might not be aware that the events remain in the tracking table and might proceed to create, distribute, and deploy a package. During deployment, the Database Configuration application can determine that the data provided by the package does not contain changes and does not configure the database. The deployment of such a package does not harm the target environment, but the event tracking entries might be confusing to a user.

11. What isthe advantages of server core

The benefits of Server Core are as follow:

* 1. **Reduced servicing :** Because Server Core installs only what is required for a manageable DHCP, File, DNS, Media Services, and Active Directory server, less servicing is required.

* 1. **Reduced management :** Because less is installed on a Server Core-based server, less management is required.

* 1. **Reduced attack surface :** Because there is less running on the server, there is less attack surface.

**Less disk space required :** Server Core requires about 3.4GB to install

12. What is Nano server

Nano Server is a remotely administered server operating system optimized for private clouds and datacenters. It is similar to Windows Server in Server Core mode, but significantly smaller, has no local logon capability, and only supports 64-bit applications, tools, and agents.

It takes up far less disk space, sets up significantly faster, and requires far fewer updates and restarts than Windows Server. When it does restart, it restarts much faster. The Nano Server installation option is available for Standard and Datacenter editions of Windows Server 2016.

Nano Server is ideal for a number of scenarios:

* + As a compute host for Hyper-V virtual machines, either in clusters or not
  + As a storage host for Scale-Out File Server.
  + As a DNS server
  + As a web server running Internet Information Services (IIS)
  + As a host for applications that are developed using cloud application patterns and run in a container or virtual machine guest operating system.

13. Purpose of Nano server

Nano Server is primarily designed as either a Hyper-V or Container host, or to be used in a VM running application workloads to optimized for private clouds and datacenters. The advantage of running a smaller operating system is that it boots faster, needs less servicing, and presents a smaller attach surface. Nano Server, an edition of Windows Server which is even more cut down than server core.

14. Compare GUI v/s core v/s Nano server

Nano Server is essentially a stripped-down version of the full Windows Server OS, as it is headless—it does not have a GUI—and lacks the core server components. It is like the Server Code mode in Windows Server but is even more bare-bones than the former, requiring minimal disk space and supporting only 64-bit applications, drivers and services.

As a Hyper-V host, Nano Server uses key management service to activate its guest VMs. Nano Server support is more active, with update releases expected at least two or three times yearly. Nano Server installations must not be more than two releases behind, and administrators must update servers manually to keep them current.

Compared to Server Core or Server with Desktop Experience, Nano Server cannot act as a domain controller for your Active Directory and as a proxy server. It also does not support:

* + Group Policy.
  + Load balancing and failover.
  + Microsoft Endpoint Configuration Manager and System Center Data Protection Manager.
  + Best Practices Analyzer (BPA) cmdlets and BPA integration with Server Manager.
  + Virtual host bus adapters (HBAs).

• **Practical**

1. Install server 2016 GUI

DONE

1. Install server 2016 server core

DONE

1. Assign dual IP address on Lan card

DONE

1. Upgrade server 2012 to server 2016

DONE

1. Change computer name

DONE

1. install nano server

DONE

1. manage and configure a nano server

DONE

1. configure network in nano server

DONE

1. join nano server in domain

DONE

**Storage solution**

1. compare GPT and MBR

|  |  |  |
| --- | --- | --- |
|  | **MBR (Master Boot Record)** | **GTP (GUID Partition Table)** |
|  |  |  |
| Max Partition Capacity | 2 TB | 9.4 ZB (each ZB is 1 Billion TB) |
| Max Numbers of Partitions | up to 4 primary partitions (or three primary partitions, one extended partition, and unlimited logical drives) | 128 primary partitions |
| Firmware Interface Suport | BIOS | UEFI |
| Operating System Comability | Windows 7 and even older systems like Windows 95/98, Windows XP 32-bit, Windows 2000, Windows 2003 32-bit | Newer systems like Windows 8, 8.1 64-bit, 10, 11. |
| Speed | Slower | Faster |
| More Advanced Technology | Works with more advanced technology | Works with less advanced technology and hardware |

1. different between VHD and VHDX

Allows multiple operating systems to exist on a single host machine. VHD file is commonly used by different operating systems without installing a second hard drive or re-partitioning the origin disk.

|  |  |  |  |
| --- | --- | --- | --- |
| **VHD** | **VHDX** |  | |
|  |  |  | |
| Supported by Windows, Citrix, and Oracle | Supported by Windows | |
| Fixed Size- takes complete size in single file | Variable- easy to manage and differentiate the file with size capacity | |
| Basic format | Advanced format | |
| No Data protection | Protection against data corruption | |
| Limited to 2TB size | 64TB storage capacity |  | |
| Does not support custom Meta-data | Custom meta-data is Fully supported |  | |

1. what is SMB and NFS

SMB

SMB, short for Server Message Block, is a client-server communication protocol that provides shared access to network files and resources between nodes on a network. It basically is a network file sharing protocol that enables to communicate with remote computers or servers. SMB is mainly a native file sharing protocol for computers running on Microsoft Windows. It seamlessly integrates with Windows operating systems.

NFS

NFS, short for Network File System, is a file service protocol that enables users to access files on a remote server, making it a distributed file system. It allows a computer on which the NFS server is running to export its file systems to other clients, which means it is made available to clients on different OS platforms. It uses server-client architecture to provide multiple computers access to files over a local network.

1. what is sharing permission

Share permissions manage access to folders shared over a network; they don’t apply to users who log on locally. Share permissions apply to all files and folders in the share. One cannot granularly control access to subfolders or objects on a share. It can be specified the number of users who are allowed to access the shared folder. Share permissions can be used with NTFS, FAT and FAT32 file systems. There are three types of share permissions: Full Control, Change and Read. It can be set each of them to “Deny” or “Allow” to control access to shared folders or drives:

* **Read** : Users can view file and subfolder names, read data in files, and run programs. By default, the “Everyone” group is assigned “Read” permissions.
* **Change** : Users can do everything allowed by the “Read” permission, as well as add files and subfolders, change data in files, and delete subfolders and files. This permission is not assigned by default.
* **Full Control** : Users can do everything allowed by the “Read” and “Change” permissions, and they can also change permissions for NTFS files and folders only. By default, the “Administrators” group is granted “Full Control” permissions.

1. what is NTFS permission

NTFS (New Technology File System) is the standard file system for Microsoft Windows NT and later operating systems; NTFS permissions are used to manage access to data stored in NTFS file systems. The main advantages of NTFS share permissions are that they affect both local users and network users and that they are based on the permissions granted to an individual user at the Windows logon, regardless of where the user is connecting from. There are both basic and advanced NTFS permissions. You can set each of the permissions to “Allow” or “Deny” to control access to NTFS objects. Here are the basic types of access permissions:

* **Full Control** : Users can add, modify, move and delete files and directories, as well as their associated properties. In addition, users can change permissions settings for all files and subdirectories.
* **Modify** : Users can view and modify files and file properties, including adding files to or deleting files from a directory, or file properties to or from a file.
* **Read & Execute** : Users can run executable files, including scripts.
* **Read** : Users can view files, file properties and directories.
* **Write** : Users can write to a file and add files to directories.

1. what is resource ownership

Resource ownership : Owner owes its name to the fact that it allows the owner of a Windows object-- such as a file, folder, registry key, or Active Directory (AD) object to set permissions on that object at their proper discretion. This means that it is the object owner who ultimately controls which users can access the object. In Windows, the user who creates an object automatically becomes the owner of anything he or she creates.

The owner owes his powers to the fact that Windows implicitly grants an object owner the read permissions and change permissions on the object. This means that the owner is always allowed to access the object, regardless of what the Access Control List (ACL) of the object says. Even if the ACL of an object includes an explicit deny Access Control Entry (ACE) for the owner’s user account, the owner can still access the object. That is, Owner can get to the object’s ACL and override or simply remove the deny ACE.

1. what is storage pool

A storage pool aggregates many physical disks into one large storage space. Disks are joined together using RAID technology to form a RAID group. Storage pools may contain more than one RAID group. Using a storage pool multiple volumes can be created on a storage pool, enabling you to divide the storage space among different users and applications.

* Disks of different sizes and types can be mixed into one large storage space.
* Disks from connected expansion units can be mixed with disks in the NAS to form a storage pool.
* Extra disks can be added while the storage pool is in use, increasing storage capacity without interrupting services.

1. what is basic disk and dynamic disk

**Basic Disk:**

* 1. basic disk is a type of hard drive configuration, available with the Windows operating system. To manage all partitions and data on the hard disk, normal partition tables or logical drives are used. They are the storage types most often used with Windows. It can contain up to four primary partitions, or three primary partitions and an extended partition with multiple logical drives. It allows operation to**:**
  + Create and delete primary and extended partitions.
  + Create and delete logical drives within an extended partition.
  + Format a partition and mark it as active.

**Dynamic Disk:**

* 1. disk that has been initialized for dynamic storage is called a dynamic disk. It gives more flexibility than a basic disk because it does not use a partition table to keep track of all partitions. The partition can be extended with dynamic disk configuration. It uses dynamic volumes to manage data. It allows operation to**:**
  + Create and delete simple, spanned, stripped, mirrored, and RAID-5 volumes.
  + Extend a simple or spanned volume.
  + Repair mirrored or RAID-5 volumes.
  + Reactivate a missing or offline disk.

1. what is simple volume ,spanned volume

Simple volume :

* 1. simple volume is a portion of a physical disk that functions as though it were a physically separate unit. A simple volume can consist of a single region on a disk or multiple regions of the same disk that are linked together.

Spanned volume :

spanned volume combines areas of unallocated space from multiple disks into one logical volume, allowing you to more efficiently use all of the space and all the drive letters on a multiple-disk system.

1. describe RAID 0 , RAID 1 , RAID 5, RAID 6 , RAID 10

**RAID 0 (Striping) :**

RAID 0 is taking any number of disks and merging them into one large volume. This will greatly increase speeds while reading and writing from multiple disks at a time. An individual file can then use the speed and capacity of all the drives of the array.

• The downside to RAID 0 though is that it is NOT redundant. The loss of any individual disk will cause complete data loss. This RAID type is very much less reliable than having a single disk.

**RAID 1 (Mirroring) :**

RAID 1 is where a pair of identical disks identically mirror/copy the data equally across the drives in the array. The point of RAID 1 is primarily for redundancy. If you completely lose a drive, still can stay up and running off the additional drive.

* RAID 1 also gives you the additional benefit of increased read performance, as data can be read off any of the drives in the array.
* The downsides are that you will have slightly higher write latency. Since the data needs to be written to both drives in the array, you'll only have the available capacity of a single drive while needing two drives.

**RAID 5 :**

RAID 5 requires at least three drives. A checksum parity is created. This is a calculated value that can be used to rebuild data mathematically. The data and the checksum parity of the data are then written across all drives. If any one of the drives fail, the missing data can then be recovered using the checksum.

* RAID 5 offers fast read speeds but is slower at writing. It protects against drive failure without requiring data duplication.
* Repairing a failed drive is a complicated process that takes time. In addition, if more than one drive fails, data will be lost. This makes a RAID 5 system vulnerable to data loss during the time it takes to replace a failed drive.

**RAID 6 :**

RAID 6 is identical to RAID 5, except parity data is written on two drives instead of one. This requires a minimum of four drives, but the advantage is that two drives can now fail without data loss. The idea behind RAID 6 is that if one drive fails, it's highly unlikely that more than one additional drive will fail before the first failed drive is repaired. This means that by accounting for a situation where two drives have failed simultaneously, data is protected in almost all cases.

* RAID 6 is just as fast at reading as RAID 5 but it is much better at protecting against data loss.
* RAID 6 is slower at writing than RAID 5. The process for replacing a drive is still timeintensive.

**RAID 10 :**

RAID 10 combines RAID 1 and RAID 0. Data is mirrored across multiple drives to protect against data loss, and striping is added to increase read speeds.

* RAID 10 allows the data from a failed drive to be recovered faster than in a comparable RAID 5 or RAID 6 system.
* RAID 10 requires the same amount of data duplication as RAID 1. This means that it requires far more storage space than RAID 5 or RAID 6.

1. describe DAS, NAS and SAN

**DAS (Direct Attached Storage) :**

Direct attached storage is a fairly basic, low-maintenance, low-cost solution where the storage system is a part of the actual host computer or connected directly to the host computer. It can through HBA (Host Bus Adaptor) to DAS box, to which it allows to connect multiple storage devices.

**NAS (Network-Attached Storage) :**

Network-attached storage offers dedicated file serving and sharing through a network. It increases performance and reliability with features like RAID and swappable drives designed for higher multi-drive workloads. NAS storage is also a good solution for consolidating storage systems from DAS – plus, having one centralized, shared storage system will save money in the long run, eliminate confusion and increase reliability in case of system failure or an outage. NAS is known as a top choice for SMBs.

**SAN (Storage Area Network) :**

A storage area network is a dedicated, high-performance storage system that transfers block-level data between servers and storage devices. SAN is typically used in data centers, enterprises or virtual computing environments. It offers the speed of DAS with the sharing, flexibility and reliability of NAS. SAN storage is a very sophisticated option that’s meant to support complex, mission-critical applications.

1. what is iscsi initiator and target?

iSCSI (internet Small Computer System Interface) is an IP based storage networking protocol that’s designed for sharing block storage over the internet. iSCSI follows the Server-Client model. The Server makes storage available for Clients to use. A Network Interface Controller (NIC) on System attached to an IP (TCP/IP) network acts as an iSCSI initiator which initiates I/O requests to and receives responses from iSCSI target.

iSCSI targets are the devices, which provide the response to iSCSI commands received from the iSCSI initiators over the IP (TCP/IP) Network.

Initiators and targets are given a unique ASCII name with a size of 233 bytes known as iSCSI Qualified Name (IQN). IQN is worldwide unique name which is used to identify each initiator and target.

The Target makes the storage available in the form of a block device. As a result the Initiators views the remote storage as a locally attached block device, and therefore treats the remote block device like an ordinary block device, This means that when Initiator successfully establish a session with a Target, one or more block devices in the /dev folder will suddenly appear and be ready for use.

1. what is data duplication?

Data deduplication is a process that eliminates excessive copies of data and significantly decreases storage capacity requirements.

Deduplication can be run as an inline process as the data is being written into the storage system and/or as a background process to eliminate duplicates after the data is written to disk. That is, extra copies of the same data are deleted, leaving only one copy to be stored. The data is analysed to identify duplicate byte patterns and ensure the single instance is indeed the only file. Then, duplicates are replaced with a reference that points to the stored chunk.

• **Practical**

1. share “data” a folder and give read / write permission to first user

DONE

1. share “data” folder and give read permission to another user

DONE

1. share a “data” folder create a file in that folder and remove

DONE

1. inheritance permission and give different ntfs permission to different user

DONE

1. configure RAID 1 and check redundancy

DONE

1. configure RAID 5 and check redundancy
2. DONE

6. configure iscsi target and iscsi initiator and allocate remote

Storage

DONE

1. configure data deduplication

DONE

**Implement Hyper-V**

1. what is virtualization

Virtualization uses software to create an abstraction layer over computer hardware that allows the hardware elements of a single computer—processors, memory, storage and more—to be divided into multiple virtual computers, commonly called virtual machines (VMs). Each VM runs its own operating system (OS) and behaves like an independent computer, even though it is running on just a portion of the actual underlying computer hardware.

It follows that virtualization enables more efficient utilization of physical computer hardware and allows a greater return on an organization’s hardware investment.

1. type of virtualization and compare it

Virtualization falls into four main categories – desktop virtualization, network virtualization, software virtualization, and storage virtualization. Each serves a different purpose.

1. **Desktop virtualization** : It allows for one centralized server to deliver and manage multiple individualized desktops, that is run multiple desktop operating systems, each in its own VM on the same computer.

1. **Network virtualization** : It splits network bandwidth into independent channels which are then assigned to specific devices or servers. Network virtualization uses software to create a “view” of the network that an administrator can use to manage the network from a single console. It abstracts hardware elements and functions. Such as, connections, switches, routers, etc. and abstracts them into software running on a hypervisor. The network administrator can modify and control these elements without touching the underlying physical components, which dramatically simplifies network management.

1. **Software virtualization** : It separates applications from the hardware and operating system.

1. **Storage virtualization :** It combines multiple network storage resources into one storage device, which numerous users can access. Storage virtualization enables all the storage devices on the network whether they’re installed on individual servers or standalone storage units to be accessed and managed as a single storage device.

1. Describe hyper v

A hypervisor is the software layer that coordinates VMs. It serves as an interface between the VM and the underlying physical hardware, ensuring that each has access to the physical resources it needs to execute. It also ensures that the VMs don’t interfere with each other by impinging on each other’s memory space or compute cycles.

There are two types of hypervisors:

* 1. **Bare-metal hypervisors** : Interact with the underlying physical resources, replacing the traditional operating system altogether. They most commonly appear in virtual server scenarios.
  2. **Type 2 hypervisors :** run as an application on an existing OS. Most commonly used on endpoint devices to run alternative operating systems, they carry a performance overhead because they must use the host OS to access and coordinate the underlying hardware resources.

1. what is remote management of hyper v

Remote server management is a segment that includes products and services that enable IT professionals to monitor and control data centers from offsite. These offerings include various solutions spanning over network support, off-hours server support, remote monitoring and management software and services and hardware-based tools. Data center managers rely on these remote server management technologies and services to extend their reach by controlling servers and systems without physical access to them.

1. what is hyper v manager

Hyper-V Manager is a GUI management tool used for administration and configuration of Hyper-V hosts and virtual machines, both locally and remotely. Hyper-V Manager allows to create, modify, and delete virtual machines, VM checkpoints, virtual switches, and virtual hard disks in addition to letting manage Hyper-V hosts both locally and remotely.

Hyper-V Manager provides a graphical user interface (GUI) for centralized management of Hyper-V virtual environments. Basically, Hyper-V Manager is Microsoft's Management Console snap-in (.msc file), which is used by Microsoft Windows to simplify the configuration and administration of Hyper-V systems.

1. what is virtual machine and nested virtualization

**Virtual machine :** A virtual machine is the emulated equivalent of a computer system that runs on top of another system. Virtual machines may have access to any number of resources: computing power, through hardware-assisted but limited access to the host machine's CPU and memory; one or more physical or virtual disk devices for storage, a virtual or real network inferface; as well as any devices such as video cards, USB devices, or other hardware that are shared with the virtual machine. If the virtual machine is stored on a virtual disk, this is often referred to as a disk image. A disk image may contain the files for a virtual machine to boot, or, it can contain any other specific storage needs.

**Nested virtualization** : It is a complex process that involves running virtual machines within virtual machines. This process is made possible through the use of hypervisors, which are specialized software programs that manage the operating systems needed within virtual environments. Hypervisors are responsible for allocating essential resources like processing power, memory, and other resources that your virtual environments require to function.

1. what is dynamic memory

Hyper-V Dynamic Memory is a feature that allows you to dynamically allocate memory resources to the VMs running in Hyper-V environments. This functionality reclaims a part of unused memory from VMs that don’t need it at that particular moment and then reassigns the reclaimed memory to other VMs that actually require it.

With Hyper-V Dynamic Memory, you can specify the amount of startup memory that the VM can use, set the range of available physical memory for a specific VM, and determine the VM’s priority for memory allocation. Physical memory can be efficiently and dynamically assigned to the VM on an as-needed basis and with minimal performance impact. As a result, you have more granular control over memory usage and enhanced resource optimization.

1. what is NUMA

* Non-Uniform Memory Access (NUMA) is a computer system architecture, which divides memory and processors into groups. A NUMA-aware application can schedule processor threads to access the data in the same NUMA node. This can minimize memory access latencies and reduce memory interconnect traffic.
* Each processor has a direct bus connection to the memory, where a machine with sockets will have access to less. This is known as a NUMA node. Each node haves cores and the DIMM slots on the motherboard. An operating system or hypervisor that’s installed on the physical server will do its best to schedule processes and assign memory within a NUMA node.

1. describe Virtual Machine functions

The virtual machine runs as a process in an application window, similar to any other application, on the operating system of the physical machine. Key files that make up a virtual machine include a log file, NVRAM setting file, virtual disk file and configuration file.

It creates a software-based, or virtual version of a computer, with dedicated amounts of CPU, memory, and storage that are borrowed from a physical host computer, such as personal computer and/or a remote server, such as a server in a cloud provider's data center. A virtual machine is a computer file, typically called an image, that behaves like an actual computer. It can run in a window as a separate computing environment, often to run a different operating system or even to function as the user's entire computer experience is common on many people's work computers. The virtual machine is partitioned from the rest of the system, meaning that the software inside a VM can't interfere with the host computer's primary operating system.

1. describe Hyper v functions

* A hypervisor, or virtual machine manager runs different operating systems on different virtual machines at the same time. This makes it possible to run Linux VMs, for example, on a Windows OS, or to run an earlier version of Windows on more current Windows

OS. And, because VMs are independent of each other, they're also extremely portable.

* It can be moved a VM on a hypervisor to another hypervisor on a completely different machine almost instantaneously.

1. what is check point

* Hyper-V checkpoints allow IT administrators to easily save the existing state of a virtual machine before any changes are made so that if a problem crops up due to the changes, the VM can revert to its previous state.
* Checkpoints add a great range of use saved state technology to create a point-in-time and knowing which option to rely on in different scenarios will ensure that VMs can be quickly reverted to a saved state technology in the event of corruption or another undesirable state.

1. hyper v networking—virtual nic , hyper v switch

* **virtual nic :** A virtual network interface card (vNIC) represents the configuration of a VM connected to a network. A VM can be configured to have multiple vNICs. When a VM is provisioned, each of its associated vNICs can be attached to a virtual network bridge in order to gain connectivity to a specified network. A virtual NIC is a type of virtual adapter that can be configured on logical partitions to provide a network interface. Each virtual NIC client adapter is backed by an SR-IOV logical port that is owned by the hosting partition.
* A virtual NIC can have one or more backing devices. The maximum number of backing devices per virtual NIC depends on the system. If the virtual NIC has more than one backing device, nodes can be expanded to view all the backing devices. If the virtual NIC has only one backing device, that active backing device is the one that is in use by the virtual NIC. If the managed system is not failover capable, the table displays virtual NICs that have a single backing device.
  + **Virtual Switch :** Hyper-V Virtual Switch is a software-based layer-2 Ethernet network switch that is available in Hyper-V Manager while installing the Hyper-V server role.
* Hyper-V Virtual Switch includes programmatically managed and extensible capabilities to connect VMs to both virtual networks and the physical network. In addition, Hyper-V Virtual Switch provides policy enforcement for security, isolation, and service levels. Hyper-V Virtual Switch includes tenant isolation capabilities, traffic shaping, protection against malicious virtual machines, and simplified troubleshooting.

1. hyper v storage---vhd ,vhdx , fixed size, dynamic expanding

VHD and VHDX are two virtual hard disk file formats used by Microsoft’s Hyper-V.

**VHD file :** is a virtual machine disk image file with the “.vhd” extension. VHD files are a new shared Virtual Disk model for guest clusters in Windows Server 2016. VHD files support online resizing of shared virtual disks, support Hyper-V Replica, and can be included in application-consistent checkpoints. VHD Set files use a new VHD file type, .VHDS. This file is designed with the following features:

* 1. Allows multiple operating systems to exist on a single host machine**.**
  2. Allows users to move files between a VHD file and the host file system**.**
  3. Allows users to modify the virtual machines by the host servers,including file recovery, a full backup of the machine, transfer of VHD file, image disk conversion, etc.

**VHDX file** : is the file followed by “.vhdx” extension. Besides Hyper-V virtual machine, it is often used by Vmware workstation. VHDX format was introduced as the successor format to VHD to add features and flexibility that VHD lacks. The added features are:

* + Protecting your data against failure by logging updates to the VHDX metadata structure.
  + Having increased performance as VHDX is designed as a 4KB logical sector virtual disk.
  + VHDX is a semi-open file format that describes a virtual hard disk.
  + A VHDX mimics a hard disk. It is not related to formats, such as NTFS or FAT or EXT3. It is also not concerned with partitions. VHDX presents the same characteristics as a physical hard drive, or SSD, or SAN LUN, or any other block storage. It is up to some other component, such as the guest operating system, to define how the blocks are used.

Both Hyper-V VHD and VHDX files can be of different types:

* **Fixed size :** Space for the virtual disk is assigned when the VHD file is created. The virtual hard disk file has the same size as the virtual hard disk. Its size remains constant, regardless of data being added or deleted.
* **Dynamically expanding**. Space for the virtual disk is assigned on demand. The virtual hard disk has a specified amount of physical storage space that can potentially be used, but the space is allocated as and when needed. Thus, the size of the VHD or VHDX file increases when new data is added.

• **Practical**

1. install hyper v and configure a virtualswitch

DONE

1. install virtual machine and install windows 10

DONE

1. create a checkpoint

DONE

1. P4 create a virtual hdd (vhd) and attach to virtual machine

DONE

**Windows containers**

1. describe containers

Containers are a technology for packaging and running Windows and Linux applications across diverse environments on-premises and in the cloud. Containers provide a lightweight, isolated environment that makes apps easier to develop, deploy, and manage. Containers start and stop quickly, making them ideal for apps that need to rapidly adapt to changing demand. The lightweight nature of containers also make them a useful tool for increasing the density and utilization of your infrastructure.

1. what is docker?

Docker is an open source project for automating the deployment of applications as portable, self-sufficient containers that can run on the cloud or on-premises. Docker is also a company that promotes and evolves this technology, working in collaboration with cloud, Linux, and Windows vendors, including Microsoft.

Docker containers can run anywhere, on-premises in the customer datacenter, in an external service provider or in the cloud. Docker image containers can run natively on Linux and Windows. However, Windows images can run only on Windows hosts and Linux images can run on Linux hosts and Windows hosts (using a Hyper-V Linux VM, so far), where host means a server or a VM.

1. hyper v containers and windows containers

**Hyper V containers :** In Hyper-V containers, Hyper-V assigns memory to the specialized Hyper-V VM running the container. Hyper-V containers and their dependencies reside in Hyper-V VMs and provide an additional layer of isolation. For reference, Hyper-V containers and Hyper-V VMs have different use cases. Containers are typically used for microservices and stateless applications because they are deposable by design and, as such, don't store persistent data. Hyper-V VMs, typically equipped with virtual hard disks, are better suited to mission-critical applications.

**Windows containers :** Windows Server containers and Hyper-V containers do the same thing and are managed the same way, the level of isolation they provide is different. In Windows Server containers, memory is shared between the container(s) and the Windows Server host. Windows Server containers share the underlying OS kernel, which makes them smaller than VMs because they don't each need a copy of the OS. Security can be a concern, however, because if one container is compromised, the OS and all of the other containers could be at risk.

• **Practical**

1. install windows container

DONE

1. install container in core server

DONE

1. install container in nano server

DONE

**High availability**

1. hyper v live migration

Live migration is a Hyper-V feature in Windows Server. It allows to transparently move running Virtual Machines from one Hyper-V host to another without perceived downtime. The primary benefit of live migration is flexibility; running Virtual Machines are not tied to a single host machine. This allows actions like draining a specific host of Virtual Machines before decommissioning or upgrading it. When paired with Windows Failover Clustering, live migration allows the creation of highly available and fault tolerant systems.

1. what is high availibilty?

High availability refers to computing infrastructure that gives access to continue functioning, even when some of its components fail. However, this is essential for mission-critical systems that cannot tolerate interruption in service and any downtime can cause damage. Elements of high availability. There are three elements that are essential to a highly available system:

* **Redundancy**: This ensures that any elements critical to system operations have an additional, redundant component that can take over in case of failure.
* **Monitoring**: this is for collecting data from a running system and detecting when a component fails or stops responding.
* **Failover**: It is a mechanism that can switch automatically from the currently active component to a redundant component.

Technical components enabling high availability. The following systems are used in highly available systems for implementing the concepts of redundancy, monitoring and failover:

* **Data backup and recovery** : that automatically backs up data to a secondary location and recovers it to the source.
* **Load balancing :** that manages traffic, routing it between more than one system that can serve that traffic. The load balancer can be aware that one of the target systems has failed.
* **Clustering :** this contains several nodes that serve a similar purpose, and users typically access. And, it also views the entire cluster as one unit. Each node in the cluster can potentially failover to another node if a failure occurs.

1. what is cluster, quorum and witness?

* **Windows Clustering** **:** To mitigate system downtime and ensure high availability for Windows, IT best practice recommends that you cluster servers (or nodes) so that if one node fails, one or more other nodes automatically take over-processing. This is also referred to as Windows clustering. Clustering software is required that monitors the health of the primary node and initiates recovery actions if it detects an issue. HA clustering also requires a way to ensure that, in the event of a failure, the secondary node is accessing the most current versions of data in storage.
* provides high availability for workloads running on Azure Stack HCI and Windows Server clusters. These resources are considered highly available if the nodes that host resources
* are up; however, the cluster generally requires more than half the nodes to be running, which is known as having quorum.
* **Quorum :** It is designed to prevent split-brain scenarios which can happen when there is a partition in the network and subsets of nodes cannot communicate with each other. This can cause both subsets of nodes to try to own the workload and write to the same disk which can lead to numerous problems. However, this is prevented with Failover Clustering's concept of quorum which forces only one of these groups of nodes to continue running, so only one of these groups will stay online.
* **Witness :** Dynamic witness toggles the vote of the witness to make sure that the total number of votes is odd. If there are an odd number of votes, the witness doesn't have a vote. If there is an even number of votes, the witness has a vote. Dynamic witness significantly reduces the risk that the cluster will go down because of witness failure. The cluster decides whether to use the witness vote based on the number of voting nodes that are available in the cluster. Dynamic quorum works with dynamic witness in the way described below.

1. describe clusterstorage

* Clustered storage is the use of two or more storage server working together to increase performance, capacity, or reliability. Clustering distributes workloads to each server, manages the transfer of workloads between servers, and provides access to all files from any server regardless of the physical location of the file. Two basic clustered storage architectures exist, known as tightly coupled and loosely coupled.

1. what is NLB?

* The Network Load Balancing (NLB) feature distributes traffic across several servers by using the TCP/IP networking protocol. By combining two or more computers that are running applications into a single virtual cluster, NLB provides reliability and performance for web servers and other mission-critical servers.
* The servers in an NLB cluster are called host, and each host runs a separate copy of the server applications. NLB distributes incoming client requests across the hosts in the cluster. You can configure the load that is to be handled by each host. You can also add hosts dynamically to the cluster to handle increased load. NLB can also direct all traffic to a designated single host, which is called the default host.

1. importance of network in Failover and NLB

* Having a failover solution in place will allow you the proper time to fix your issue, without needing to rush to find a ‘Band-Aid’ fix. Network also effects to the potential cost of the downtime, lost business, and damaged reputation caused by a system failure.
* A high availability system reliably provides an acceptable level of service with minimal downtime. To provide high availability, NLB includes built-in features that can automatically Detect, Balance, Recover and redistribute the workload within ten seconds.
* Scalability is the measure of how well a computer, service, or application can grow to meet increasing performance demands. For NLB clusters, scalability is the ability to incrementally add one or more systems to an existing cluster when the overall load of the cluster exceeds its capabilities.

1. describe node in cluster and its operation

* An active node can act as host to cluster groups. When the Cluster service is installed, the administrator must choose whether the node should form its own cluster or join an existing cluster. After installation is complete, the node always attempts to join an existing cluster whenever it is restarted. A node locates an existing cluster by searching for active nodes along the networks designated for internal communication.
* When a node attempts to join an existing cluster, the cluster validates the node's name and verifies version compatibility. If the validation process succeeds, the cluster allows the node to join. The node updates its copy of the cluster database from the cluster database on the other active nodes.
* If a node cannot join an existing cluster because it cannot locate another active node, it attempts to form its own cluster by gaining access to the quorum resource. If access is granted, the node uses the recovery logs to update its cluster database and becomes active as a new cluster.

• **Practical**

1. Install and configure failover cluster for hyper v

DONE

1. install and configure NLB for web server

DONE

**Maintain and monitorserver**

1. need of updates

Updates are important to meet following requirements:

1. **Business Continuity Value**

Servers are arguably the most critical component of any organization. As the engines that store data, maintain performance, connect, and protect, their continued performance is essential to Business Continuity**.** If any high-priority server seems at risk of malfunctioning, plan accordingly, knowing the consequences can mean extended downtime, security vulnerabilities, and more.

1. **Up-To-Date Technology**

A popular reason for organizations and firms to upgrade is the demand for the newest features servers can offer. The practice by manufacturers of releasing hardware and software in unique cycles presents a struggle no organization can fully control.

1. **Server Speed**

On the client-side, slow performance can mean lagging operating systems that upend staff and customer expectations. There are ways of improving server speed like enabling caching, HTTP/2, a reverse proxy, and more, but doing so could take time and resources that administrators don’t have.

1. **Disk Space**

Insufficient free disk space directly affects the server performance and can lead to instability, degradation of the server, or shutdown. As disk space fills, it’s essential to take steps to remove shadow copies, full backups, and logs that aren’t business-critical.

1. **Server Noise**

From the rack’s frame to servers and their complementary parts. Finding the noise source can inform the following steps to replace a damaged or malfunctioning server or other server rack component.

**(vii) Cost-Benefit Analysis**

If the price weren’t a factor, organizations wouldn’t hesitate to upgrade. Because the cost is essential, organizations try to maximize the lives of servers and, when needed, upgrade accordingly.

**2) Synchronization of update, product and classification 5 wsus group**

* **Synchronization of update :** Software update synchronization in Configuration Manager is the process of retrieving the software update metadata that meets the criteria configured. This includes specific products, classifications, and languages. Typically, the software update point on the central administration site, or on a stand-alone primary site, retrieves the metadata from Microsoft Update. Then, the top-level site will send a synchronization request to other sites. When a site receives the synchronization request from the parent site, the software update point for the site retrieves software updates metadata from its upstream synchronization source.
* After the software update point successfully synchronizes, it sends a synchronization request to child sites. If there is additional software update points at a primary site, it sends a synchronization request to each software update point. This process is repeated on every site in the hierarchy.
* **Update classifications :** Every software update is defined with an update classification that helps to organize the different types of updates. During the synchronization process, the site synchronizes the metadata for the specified classifications.
* Configuration Manager supports synchronization of the following update classifications:
  + **Critical Updates**: A broadly released update for a specific problem that addresses a critical, non-security-related bug.
  + **Definition Updates**: An update to virus or other definition files.
  + **Feature Packs**: New product features that are distributed outside of a product release and are typically included in the next full product release.
  + **Security Updates**: A broadly released update for a product-specific, security-related issue.
  + **Service Packs**: A cumulative set of hotfixes that is applied to an OS or application. These hotfixes include security updates, critical updates, and software updates.
  + **Tools**: A utility or feature that helps to complete one or more tasks.
  + **Update Rollups**: A cumulative set of hotfixes that is packaged together for easy deployment. These hotfixes include security updates, critical updates, and software updates. An update rollup generally addresses a specific area, such as security or a product component.
  + **Updates**: An update to an application or file that's currently installed.
  + **Upgrades**: A feature update to a new version of Windows.
* **Products :**
* The metadata for each software update defines one or more products for which the update is applicable. A product is a specific edition of an OS or application. An example of a product is Microsoft Windows 10. A product family is the base OS or application from which the individual products are derived. An example of a product family is Microsoft Windows, of which Windows 10 and Windows Server 2016 are members. Select a product family or individual products within a product family.
* When software updates are applicable to multiple products, and at least one of the products is selected for synchronization, all of the products appear in the Configuration Manager console even if some products weren't selected. For example, One have only selected the Windows Server 2012 product. If a software update applies to Windows Server 2012 and Windows Server 2012 Datacenter Edition, both products are in the site database.

**WSUS Group :**

* WSUS allows to target updates to groups of client computers and ensures that specific computers always get the right updates at the most convenient times. Computers are always assigned to the all computers group, and remain assigned to the Unassigned computers group until one assign them to another group. Computers can belong to more than one group.
* Computer groups can be set up in hierarchies Updates that are approved for a higher group will automatically be deployed to lower groups, as well as to the higher group itself.

**3) what is WSUS and importance of WSUS 3 WSUS architecture**

**Windows Server Update Service (WSUS)** is a utility used to deploy limited updates to a server that can then distribute the updates to other machines on the network. This allows the administrators to determine what updates other machines in the organization receive, and allows them to make sure security updates are applied to all systems. WSUS also saves internet bandwidth because the updates only need to be downloaded once from the internet.

**WSUS 3 features :**

* + Auto-approval rules: Auto-approval rules now include the ability to specify the approval deadline date and time for all computers or specific computer groups.
  + Update files and languages: Improved handling of language selection for downstream servers includes a new warning dialog box that appears to decide to download updates only for specified languages.
  + Easy upgrade: WSUS can be installed as an in-place upgrade from earlier versions of WSUS and preserves all settings and approvals. The user interface is compatible between WSUS 3.0 SP1 and SP2 on the client and the server.
  + Reports: New Update and Computer Status reports let you filter on updates that are approved for installation. One can run these reports from the WSUS console or use the API to incorporate this functionality into your own reports.

**WSUS Deployment Architecture :**

In a single WSUS Server scenario, administrators can set up a single WSUS Server inside their corporate firewall which summons updates directly from Microsoft servers and then acts as a distribution server to the other client computers at the organizational level.

* + A considerably large organization is likely to maintain multiple WSUS servers. Additionally, allow to configure how many servers should be allowed to connect to Microsoft Update servers, based on which different roles can be assigned to individual WSUS servers. If there is a number of WSUS servers that are being managed independently and each server independently synchronizes its content from Microsoft Update server.

1. wsus port number and wsus policy

**Wsus port number :**

To get updates from Microsoft Update, the WSUS server uses ports 80 and 443 for the HTTP and HTTPS protocols.

**Wsus policy :**

In an Active Directory environment, Group Policy can be define how computers and users can interact with Windows Update to obtain automatic updates from Windows Server Update Services (WSUS). Group policy for WSUS client update provides prescriptive guidance and behavioural details about the Windows Update and Maintenance Scheduler settings of Group Policy that control how WSUS clients can interact with Windows Update to obtain automatic updates.

* **Accessing the Windows Update settings in Group Policy :** provides general guidance about using the Group Policy Management Editor (GPME). It also has information about accessing the policy extensions and Maintenance Scheduler settings in Group Policy for update services.
* **Changes to WSUS relevant :** gives a brief summary of key differences between the current and past versions of WSUS relevant to this guide. It's for administrators familiar with WSUS 3.2 and previous versions.
* **Term and Definition :** defines terms that pertain to WSUS and update services.

1. what is backup and restore 8 type of backup

Backup and restore refers to technologies and practices for making periodic copies of data and applications to a separate, secondary device and then using those copies to recover the data and applications—and the business operations on which they depend—in the event that the original data and applications are lost or damaged due to a power outage, cyberattack, human error, disaster, or some other unplanned event.

**Types of Backup :**

1. **Full backup :**

The full backup is the starting point for all other types of backup and contains all the data in the folders and files that are selected to be backed up. Because full backup stores all files and folders, frequent full backups result in faster and simpler restore operations.

1. **Differential backup:**

The differential backup contains all files that have changed since the last FULL backup. The advantage of a differential backup is that it shortens restore time compared to a full backup or an incremental backup. However, if you perform the differential backup too many times, the size of the differential backup might grow to be larger than the baseline full backup.

1. **Incremental backup :**

Incremental backup stores all files that have changed since the last FULL**,** DIFFERENTIAL OR INCREMENTAL backup. The advantage of an incremental backup is that it takes the least time to complete. However, during a restore operation, each incremental backup must be processed, which could result in a lengthy restore job.

1. **Mirror backup :**

The mirror backup is identical to a full backup, with the exception that the files are not compressed in zip files and they can not be protected with a password. A mirror backup is most frequently used to create an exact copy of the source data. It has the benefit that the backup files can also be readily accessed using tools like Windows Explorer.

1. **Smart backup :**

Smart backup is a backup type which combines the full, differential and incremental backup types with cleanup operations in order to efficiently manage the backups in accordance with the backup settings and the free disk space in the destination. The Smart backup type starts with a full backup.

**6) difference between incremental and differential backup**

Difference between incremental backup and differential backup :

|  |  |  |
| --- | --- | --- |
| **NO.** | **Incremental Backup** | **Differential Backup** |
| 1. | In this type of backup successive copies of data contains only the changed part since the preceding backup copy was made. | In this type of backup only the difference in the data from last full backup is saved. |
| 2. | It has more redundant data than differential backup. | Differential backup contains less redundant data. |
| 3. | Recovery is difficult in this type of backup. | Recovery is easy as compared to incremental backup. |
| 4. | It takes less time to create backup. | It takes more time to create backup than incremental backup. |
| 5. | It take less data storage space to create backup. | Memory taken to create backup is more as compared to incremental backup. |
| 6. | Incremental backup uses less bandwidth. | Differential backup uses more bandwidth than incremental backup. |

1. what is full server backup

* A full server backup is recommended to prepare for a forest recovery because it can be restored to different hardware or a different operating system instance. Using Windows Server Backup you can perform a full backup of your server.
* Full backups are usually stored in a compressed, proprietary format that requires the software that created the backup to restore the files. Full backups are commonly performed as the first backup followed by subsequent differential or incremental backups. Since full backups contain all of the files and folders that were selected for the backup job rather than just the changed files, they are usually larger in size and thus requires more storage space.

1. what is use of performance monitor

* ❖ The Microsoft Windows Performance Monitor is a tool that administrators can use to examine how programs running on their computers affect the computer's performance. The tool can be used in real time and also be used to collect information in a log to analyze the data at a later time. It monitors various activities on a computer such as CPU or memory usage. This type of application may be used to determine the cause of problems on a local or remote computer by measuring the performance of hardware, software services, and applications.

• **Practical**

1. install and configure wsusserver

DONE

1. apply update to particular client group through wsus

DONE

1. Take customize backup of data

DONE

1. restore backup original location and also another location

DONE

1. backup schedule and check it.

DONE

1. take full backup

DONE

1. performance monitor of current process

DONE

1. performance monitor of cpu, memory

DONE