

CompTIA Server+ SK0-005 Notes

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1 Server Hardware Installation and Management

1.1 Physical Hardware

1.1.1 Racking

- **1 Rack Unit (RU):** 1.75 in (44.45 mm)
- Standard server racks are 19 inches wide

1.1.2 Power

- **PDU:** Power Distribution Unit
- **UPS:** Uninterruptable Power Supply

Measuring Capacity

Capacity is measured in volt-amperes (VA)

The ratio between the VA and the watts is called the power factor (PF)

$$VA \times PF = W$$

1.1.3 Network Cabling

Fiber Connectors

- **LC:** Little Connector or Lucent Connector
- **SC:** Standard Connector or Subscriber Connector

Copper Connectors

- **RJ-45:** Registered Jack 45

SFP

Definition

Small **F**orm-**F**actor **P**luggable

SFP is a compact, hot-pluggable interface module used for network communications. It is the successor to GBIC and is sometimes referred to as mini-GBIC.

SFP Type	Maximum Speed	Connector
SFP	1 Gbps	SFP
QSFP	4 Gbps	QSFP
SFP+	10 Gbps	SFP
SFP28	25 Gbps	SFP
QSFP+	40 Gbps	QSFP
QSFP28	100 Gbps	QSFP

1.1.4 Server Chassis Types

- **Rack Server:**
 - Self-contained
 - Space-efficient
 - Cost-effective
 - Densely populated racks require more cooling, which raises energy costs

- **Blade Server:**
 - Server enclosure that houses several modular blades
 - Typically fits in a rack
 - Energy efficient
 - High processing power in a small space
- **Tower Server:**
 - Stand-alone server chassis
 - Not rack-mountable
 - Resembles a desktop computer
 - Low cooling costs
 - Large footprint

1.1.5 Server Components

- **ECC:** Error Checking and Correction
- **PCI:** Peripheral Component Interconnect
- **HBA:** Host Bus Adapter - circuit board or IC that connects a host system to a storage or network device
- **CMOS:** Complimentary Metal Oxide Semiconductor

Memory Types

Memory Type	DIMM Pins	SO-DIMM Pins
DDR	184	200
DDR2	240	200
DDR3	240	204
DDR4	288	260
DDR5	288	262

Bus Types

Type	Width	Speed	Bandwidth
8-bit ISA	8 bits	8.3 MHz	7.9 Mbps
ISA	16 bits	8.3 MHz	15.9 Mbps
EISA	32 bits	8.3 MHz	31.8 Mbps
VESA/VL	32 bits	33 MHz	127.2 Mbps
PCI	32 bits	33 MHz	127.2 Mbps
64-bit PCI	64 bits	66 MHz	508.6 Mbps
PCMCIA	32 bits	33 MHz	
AGP	32-bit	Speed of Processor	

1.2 Storage

- **DAS:** Direct Attached Storage
- **VSS:** Volume Shadow Service - Microsoft technology that can create snapshots of files or volumes, even when they are in use. Requires NTFS or ReFS.

1.2.1 RAID

Definition

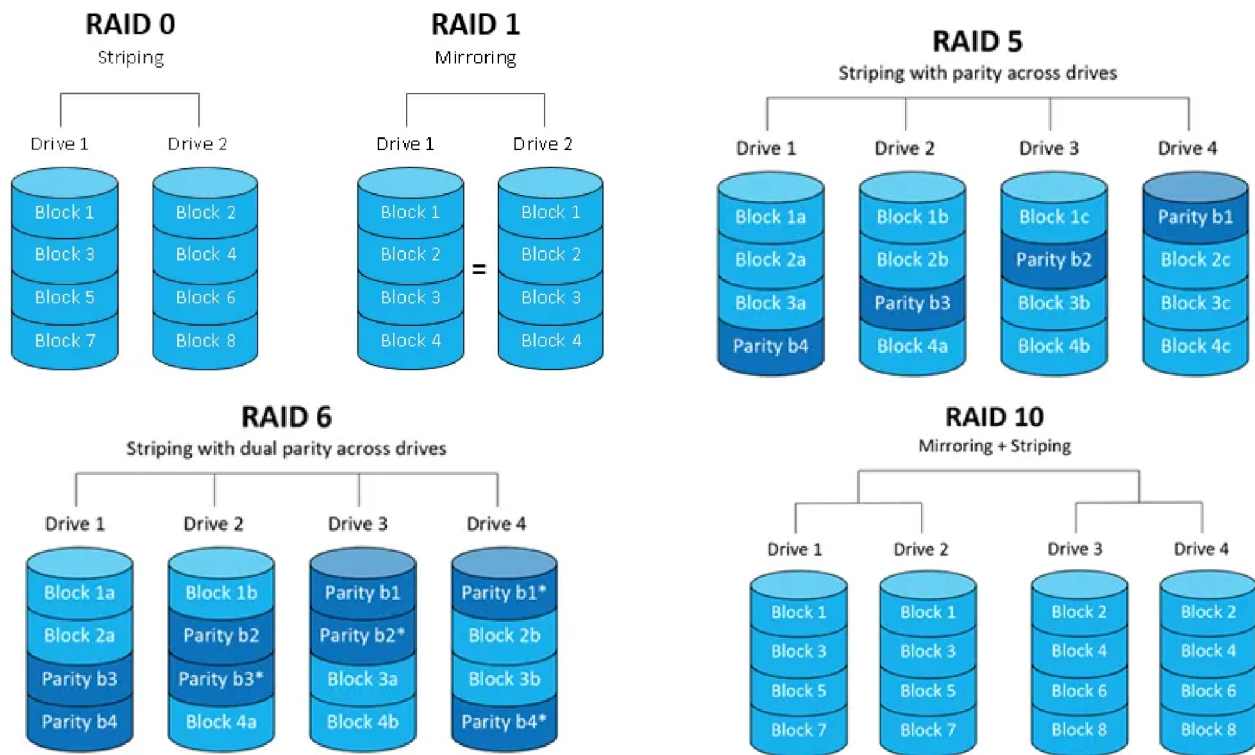
Redundant Array of Independant Disks

RAID is a data storage virtualization technology that combines multiple drives into one or more logical units for the purposes of data redundancy, performance improvement, or both.

RAID Level Comparison

Type	Min Drives	Fault Tolerance	Read Perf.	Write Perf.	Capacity Util.
RAID 0	2	None	Very good	Excellent	100%
RAID 1	2	1 drive	Very good	Good	50%
RAID 3	3	1 drive	Very good	Good	67-96%
RAID 5	3	1 drive	Very good	Good	67-96%
RAID 6	4	2 drives	Very good	Fair	50-92%

RAID Level Diagrams



JBOD

Definition

Just a Bunch of Disks

The term JBOD is sometimes used to refer to a collection of drives in one single storage enclosure that are *not* configured in a RAID array.

1.2.2 Capacity planning

- **Thin provisioning:** Using virtualization technology to trick applications into thinking you have more storage than is actually available

1.2.3 Hard Drive Media

- **RPM:** Rotations per Minute

1.2.4 Interface Types

- **SCSI:** Small Computer System Interface - used for transferring data between computer and peripherals over a parallel connection
 - **LUN:** Logical Unit Number - used to identify a SCSI device
 - **LUN Masking:** An authorization mechanism used in SANs to make LUNs available to some hosts but not others
- **ATA:** Advanced Technology Attachment
- **SATA:** Serial ATA
- **eSATA:** External SATA
- **iSCSI:** Internetworking SCSI
- **SAS:** Serial Attached SCSI

1.2.5 Shared Storage

- **NFS:** Network File System
- **SMB:** Server Message Block
- **CIFS:** Common Internet File System - a dialect of SMB

Fibre Channel

Definition

Fibre Channel is a high-speed data transfer protocol that provides in-order, lossless delivery of data

- **FCoE:** Fibre Channel over Ethernet - allows the Fibre Channel protocol to be transmitted over an Ethernet link
- **WWNN:** World Wide Node Name - universally unique identifier assigned to a device on a fibre channel network - similar to a MAC address
- **WWN/WWPN:** World Wide (Port) Name - WWNN for a specific port of a device on a fibre channel network

1.3 Server Hardware Maintenance

- **BIOS:** Basic Input/Output System
- **UEFI:** Unified Extensible Firmware Interface

1.3.1 In-Band Management

- **VNC:** Virtual Network Computing - an open-source protocol for remote GUI access
- **RDP:** Remote Desktop Protocol - a Microsoft proprietary protocol for remote GUI access
- **RAS:** Remote Access Server - provides a suite of services used for remote access

1.3.2 Out-of-Band Management

- **Crash cart:** Mobile cart with a secured laptop that is used to provide a direct connection to malfunctioning servers
 - **iDRAC:** Integrated Dell Remote Access Controller - allows for local and remote management of PowerEdge servers
 - **iLO:** Integrated Lights Out - HP out of band server management technology
 - **IPMI:** Intelligent Platform Management Interface - set of specifications for an autonomous computer subsystem that provides management and monitoring capabilities independently of the host system's operating system and hardware. Commonly used for out of band management.
-

2 Server Administration

2.1 Server Operating Systems

- **HCL:** Hardware Compatibility List
- **PXE:** Preboot Execution Environment - client boots an OS over the network
- **P2V:** Physical to Virtual

2.1.1 Microsoft Windows

- **AD:** Active Directory
 - **OU:** Organizational Unit - container within an Active Directory domain
- **SCCM:** System Center Configuration Management - also known as Microsoft Endpoint Configuration Manager. Used to manage, control, inventory, and patch large groups of computers.
- **WSUS:** Windows Software Update Services
- **WDS:** Windows Deployment Services - allows you to deploy Windows operating systems over the network
- **RIS:** Remote Installation Services - Microsoft PXE server used to remotely execute boot environment variables
- **WMI:** Windows Management Instrumentation - extensions to the Windows driver model that allow scripting languages to manage Windows computers and servers

2.1.2 Partitioning

- **GPT:** GUID Partition Table
- **MBR:** Master Boot Record

2.1.3 File System Types

- **NTFS:** New Technology File System
 - Microsoft proprietary file system used in Windows
 - When using an NTFS file system, a user must have the Modify permission to delete files
- **ZFS:** Z File System
- **EFS:** Encrypting File System
- **ReFS:** Resilient File System - Microsoft proprietary file system designed to maximize data availability and scale efficiently

2.2 Network Infrastructure Services

- **RFC:** Request for Comments
- **SNMP:** Simple Network Management Protocol
 - **OID:** Object Identifier
 - **MIB:** Management Information Base

2.3 Server Functions and Features

2.3.1 Monitoring

- **IOPS:** Input/Output Operations per Second

2.4 High Availability

2.4.1 Clustering

Definition

A server cluster consists of a group of servers working simultaneously under a single IP address.

- **Active-active:** Client workloads are distributed across two or more nodes
- **Active-passive:** One node is used to handle all requests, while one or more additional nodes are designated as backups in case the active node goes down.

2.5 Virtualization

- **Intel-VT:** Intel Virtualization Technology - provides hardware assistance to virtualization software
- **Type 1 Hypervisor:** Runs directly on the hardware (e.g. Proxmox)
- **Type 2 Hypervisor:** Runs on a conventional operating system (e.g. VirtualBox)

2.6 Scripting

- **Bootstrap:** The process of loading a set of instructions when a computer is first powered on

2.7 Asset Management and Documentation

2.7.1 Company Policies and Procedures

- **BCP:** Business Continuity Plan
- **DRP:** Disaster Recovery Plan
- **BIA:** Business Impact Analysis
- **COOP:** Continuity of Operations
- **MTTR:** Mean Time to Repair
- **MTBF:** Mean Time Between Failures
- **RTO:** Recovery Time Objective - targeted duration of time between failure and resuming normal operations
- **RPO:** Recovery Point Objective - maximum length of time permitted that data can be restored from - maximum tolerable amount of data loss

Service Level Agreements (SLA)

Availability %	Downtime per year	Downtime per month	Downtime per week
99%	3.65 days	7.2 hours	1.68 hours
99.9%	8.76 hours	43.2 minutes	10.1 minutes
99.99%	52.56 minutes	4.32 minutes	1.01 minutes
99.999%	5.26 minutes	25.9 seconds	6.05 seconds
99.9999%	31.5 seconds	2.59 seconds	0.605 seconds

2.8 Licensing

2.8.1 Licensing Models

- **Per-socket:** Licence costs are determined using the number of CPU cores
- **Site-based:** A software package can be installed on multiple computers at the same physical location
- **Node-locked:** A license for a software application is assigned to one or more specific hardware devices

2.8.2 License Count Validation

- **True-up:** A company compares the number of actual software license users to the good faith estimate of the initial contract

3 Security and Disaster Recovery

3.1 Data Security

- The cost of protecting yourself against a threat should be less than the cost of recovering from the threat
- **PKI:** Public Key Infrastructure - a set of roles, policies, hardware, software, and procedures needed to create, manage, distribute, use, store, and revoke certificates and keys
- **XD:** Execute Disable Bit - allows a processor to distinguish between bits of code that should and should not be executed

3.2 Access Management

- **RADIUS:** Remote Authentication Dial-In User Service
- **TACACS:** Terminal Access Controller Access Control System

3.3 Mitigation Strategies

3.3.1 Regulatory Constraints

- **PCI DSS:** Payment Card Industry Data Security Standard

3.4 Backups and Restores

- **DLT:** Digital Linear Tape
- **LTO:** Linear Tape-Open - magnetic data storage technology
- **Archive bit:** A file attribute used to indicate whether or not the file has been backed up
- **Snapshot:** A type of backup copy used to create an exact copy of an entire application, disk, or system.
- **Image:** Another term for a snapshot

3.4.1 Backup Methods

- **Incremental backup**
 - Includes the data that has changed since the *previous* backup
 - Storage efficient and has the fastest backup time
 - Slow recovery
 - A single corrupted incremental backup file would ruin the entire backup
- **Differential backup**
 - Includes the data that has changed since the *last full* backup
 - Fast recovery
 - Not storage efficient and requires regular full backups
 - **Does not clear the archive bit**
- **Full backup**
 - Complete copy of the data
 - Takes the longest amount of time and uses the most storage space
 - Fastest recovery
- **Synthetic backup**
 - Combines the last full backup and all the incremental backups into one single backup file that contains the same data as the full backup
 - Takes less time than a full backup and is more storage efficient
 - Not as effective if lots of changes are made and still relies on incremental backups

3.4.2 Backup Rotation Schemes

- **First in, first out (FIFO)**
 - New backups are saved over the oldest backups
 - The backup depth would be the number of days a backup is kept
- **Grandfather-father-son (GFS)**
 - 3 or more FIFO cycles
 - For example, one daily rotation, one weekly rotation, and one monthly rotation
 - Protects against an issue that could have corrupted backups and gone unnoticed
- **Tower of Hanoi**
 - First tape is used every other day (1, 3, 5, 7, 9)
 - Second tape is used every fourth day (2, 6, 10)
 - Third tape is used every eighth day (4, 12, 20)
 - Provides the most optimal usage of a limited number of tapes

3.5 Disaster Recovery

- **Failover:** The process of switching production to a backup facility
- **Failback:** The process of returning production to its original location after a disaster or maintenance period has been resolved
- **Heartbeat:** A periodic signal generated by hardware or software to indicate normal operation

3.5.1 Site Types

- **Hot site:** A mirror of an existing data center. Populated with servers, cooling, power, and offices. Files, applications, and databases are synchronized with the primary site.
- **Warm site:** The middle ground between a hot and cold site. Populated with some pre-installed hardware, but applications are not deployed and the data is not stored here. Also known as a standby site.
- **Cold site:** Office or datacenter space without any existing equipment installed. Populated with power, cooling, and office space. Requires extensive work to bring up and running.
- **Cloud site**

3.5.2 Replication

Definition

Replication is the process of making multiple copies of data and storing them at different locations for the purposes of backups, fault tolerance, and improving accessibility.

Replication Types

- **Full:** All data is stored in multiple locations
- **Partial:** Some data is stored in multiple locations while other data is only stored in a single location
- **Asynchronous:** Data is written to the primary storage and then copied to the replica
- **Synchronous:** Data is written to the primary and secondary storages at the same time

4 Miscellaneous

4.1 Troubleshooting

4.1.1 Troubleshooting Steps

1. Identify the problem
2. Establish a theory of probable cause
3. Test the theory to determine the cause
4. Establish a plan of action to resolve the problem
5. Implement the solution or escalate as necessary
6. Verify full system functionality and implement preventive measures
7. Perform a root cause analysis
8. Document your findings

4.2 Web and Networking

- **NOS:** Network Operating System - operating system that allows multiple computers to communicate and share files and hardware devices with each other
- **IIS:** Internet Information Services - Microsoft web server software
- **URL:** Uniform/Universal Resource Locator
- **WINS:** Windows Internet Naming Service - legacy service that maps NetBIOS names to IP addresses
- **MDI:** Medium Dependent Interface - uses a crossover cable to connect
- **MDI-X:** Medium Dependent Interface Crossover - uses a straight-through cable rather than a crossover cable
- **Auto MDI/MDIX:** Automatically chooses between MDI and MDI-X
- DHCP uses UDP port 68

4.3 Hardware

- **CRU:** Customer Replaceable Unit
- **FRU:** Field Replaceable Unit
- **HID:** Human Interface Device