Managing the Storage Infrastructure
Storage Infrastructure Management

- Managing storage infrastructure is a key to ensure continuity of business
- Establishing management processes and implementing appropriate tools is essential to meeting service levels proactively
- Management activities include availability, capacity, performance, and security management
- Monitoring is the most important aspect that forms the basis for storage management
- Continuous monitoring enables availability and scalability by taking proactive measures
Monitoring the Storage Infrastructure

Upon completion of this lesson, you will be able to:

- Discuss the major storage infrastructure components that should be monitored
- Describe what is to be monitored for the various storage infrastructure components
- Discuss alerting of events
Monitoring Storage Infrastructure

- Accessibility
- Capacity
- Performance
- Security

Network

Hosts/Servers with Applications

SAN

Storage Arrays

Client

Cluster

Port

HBA

Port

Keep Alive

IP

IP
Parameters Monitored – Accessibility

- Accessibility refers to the availability of a component to perform a desired operation.
- Why monitor accessibility of different components?
  - Failure of any hardware/software component can lead to outage of a number of different components.
    - Example: HBA failure could cause degraded access to a number of devices in multi-path environment or loss of data access in single path environment.
- Monitoring accessibility involves:
  - Checking availability status of the hardware or software components through predefined alerts.
Parameters Monitored – Capacity

- Capacity refers to the amount of storage infrastructure resources available

Why monitor capacity?

- Capacity monitoring prevents outages before they can occur
  - Inadequate capacity may lead to degraded performance or affect application/service availability
- More preventive and predictive in nature
  - Report indicates 90% of all the ports have been utilized in SAN, a new switch must be added if more arrays/servers are to be added
Parameters Monitored – Performance

• Performance monitoring evaluates how efficiently different components are performing
• Why monitor Performance metrics?
  • Want all data center components to work efficiently/optimally
  • Helps to identify performance bottlenecks
  • Measures and analyzes the ability to perform at a certain predefined level
• Examples
  • Number of I/Os to disks
  • Application response time
  • Network utilization
  • Server CPU utilization
Parameters Monitored – Security

- Monitoring security helps to track and prevent unauthorized access
- Why monitor security?
  - Need to be protected for confidentiality, integrity and availability
  - To meet regulatory compliance
- Examples
  - Tracking and reporting changes made to zoning configurations
  - Physical security through badge readers, scanners and cameras

- Monitoring Environmental parameters
  - Temperature, humidity, airflow, hazards (water, smoke, etc.)
  - Voltage – power supply
Monitoring Hosts

- **Accessibility**
  - Hardware components: HBA, NIC, graphic card, internal disk
  - Status of various processes/applications

- **Capacity**
  - File system utilization
  - Database: Table space/log space utilization
  - User quota

- **Performance**
  - CPU and memory utilization
  - Transaction response times

- **Security**
  - Login and authorization
  - Physical security (Data center access)
Monitoring the SAN

- **Accessibility**
  - Fabric errors, zoning errors, GBIC failure
  - Device status/attribute change
  - Processor cards, fans, power supplies
- **Capacity**
  - ISL (inter-switch link) and port utilization
- **Performance**
  - Connectivity ports
    - Link failures, loss of signal, link utilization
  - Connectivity devices
    - Port statistics
- **Security**
  - Zoning and LUN Masking
  - Administrative tasks and physical security
    - Authorized access, strict passwords
Monitoring Storage Arrays

- **Accessibility**
  - All Hardware components
  - Array Operating Environment
    - RAID processes
    - Environmental sensors
    - Replication processes

- **Capacity**
  - Configured/un-configured capacity
  - Allocated/unallocated storage
  - Fan-in/fan-out ratios

- **Performance**
  - FE (front-end) and BE (back-end) utilization/throughput
  - I/O profile, response time, cache metrics

- **Security**
  - Physical and administrative security
Accessibility Monitoring Example: Array Port Failure

Hosts/Servers with Applications

H1
H2
H3

Degraded

HBA

SW1

SW2

Storage Arrays
Accessibility Monitoring Example: HBA Failure

H1

H2

H3

Hosts/Servers with Applications

SW1

SW2

Storage Arrays

Degraded
Accessibility Monitoring Example: Switch Failure

Hosts/Servers with Applications

Storage Arrays
Capacity Monitoring Example: Storage Array

Can the Array provide the required storage to the new server?

New Server

Hosts/Servers with Applications
Capacity Monitoring Example: File System Space

No Monitoring

**Warning:** FS is 66% Full

FS Monitoring

**Critical:** FS is 80% Full

Extend FS
Performance Monitoring Example: Array Port Utilization

New Server

H4

H1

H2

H3

Hosts/Servers with Applications

Storage Arrays

Port Util. %

100%

H1 + H2 + H3
Critical: CPU Usage above 90% for the last 90 minutes
Security Monitoring Example: Storage Array

Warning: Attempted replication of WG2 devices by WG1 user – Access denied
Alerting of Events

- Alerting is an integral part of monitoring.
- Monitoring tools enables administrators to assign different severity levels for different events.
- Level of alerts based on severity:
  - **Information alert**: Provide useful information and may not require administrator intervention.
    - Creation of zone or LUN.
  - **Warning alerts**: Require administrative attention.
    - File systems becoming full/Soft media errors.
  - **Fatal alert**: Require immediate administrative attention.
    - Power failures/Disk failures/Memory failures/Switch failures.
Lesson Summary

Key concepts covered in this module are:

- Storage infrastructure components that should be monitored

- Parameters of monitoring:
  - Accessibility
  - Capacity
  - Performance
  - Security

- Monitoring examples
Storage Management Activities

- All the management tasks in a storage infrastructure can be broadly categorized into:
  - Availability management
  - Capacity management
  - Performance management
  - Security management
  - Reporting
Availability Management

- Establishing a proper guideline for all configurations to ensure availability based on service levels.
- Example: When a server is deployed to support a critical business function, the highest availability standard is required. This involved deploying the following components:
  - Two or more HBAs
  - Multipathing software
  - Server clustering
  - Two independent fibre channel switches
  - RAID protection
  - Backup
  - Local and remove replication
Capacity Management

- Ensure adequate availability of resources for all services based on their service level requirements

- Capacity management provides:
  - Capacity analysis – compare allocated storage to forecasted storage on a regular basis
  - Trend analysis – actual utilization of allocated storage and rate of consumption

- Example 1: Storage provisioning
  - Device configuration and LUN masking on storage arrays
  - Zoning configuration on SAN and HBA components

- Example 2: Estimating future needs of resources
  - Gather and analyze related information to come up with estimates
Performance Management

- Ensures the optimal operational efficiencies of all components
- Performance analysis is performed on existing storage infrastructure components
  - Provides information whether a component is meeting expected performance levels
- When a new application or server is to be deployed, every component involved must be validated for adequate performance capabilities as defined by the service levels.
  - Server: volume configuration, database design, application layout on multiple HBAs, multipathing software
  - SAN: designing sufficient ISLs in a multi-switch fabric with adequate bandwidth
  - Storage arrays: selecting appropriate RAID type and LUN layout, front-end and back-end ports, LUN masking
Security Management

- Prevents unauthorized access and configuration of storage infrastructure components
- Example: When deploying a new application or server
  - Managing user accounts and access policies
  - Zoning configuration in the SAN
  - LUN masking
Reporting

• Keeping track and gathering information from various components / processes
• This information is compiled to generate reports for:
  • Trend analysis and capacity planning – current and historic information about utilization of storage, file system, database tablespace, ports
  • Configuration or asset management – device allocation, local and remote replicas, fabric configuration, list of equipment with details such as their value, purchase date, lease status and maintenance record
  • Chargeback – allocation and utilization of storage infrastructure components by various departments / user groups.
  • Performance – performance of various storage infrastructure components
Storage Infrastructure Management Challenges

- Large number and variety of storage arrays, networks, servers, databases and applications
- Variety of storage devices varying in capacity, performance and protection methodologies
- Deployment of both SAN and IP networks for storage devices
- Servers with different operating systems: UNIX, LINUX, Windows, mainframe
- Interoperability issues between devices from multiple vendors
- Multiple vendor-specific tools to monitor devices from different vendors