**IT Infrastructure Management**

**Week 7 Assignment**

1. List the various uses of Hierarchical Storage Management.

Answer 1: Hierarchical storage management (HSM) is a system for storing data in a secure, cost-efficient manner. [The basic idea behind HSM is to store data on the most appropriate type of storage media, depending on how frequently the data is accessed1](https://geo-viz.com/blog/benefits-hierarchical-storage-management/)[2](https://en.wikipedia.org/wiki/Hierarchical_storage_management)[3](https://www.techtarget.com/searchstorage/definition/HSM).

Some of the uses of HSM are:

* [**Reducing storage costs**: HSM can help reduce the total cost of ownership (TCO) of storage by moving less frequently accessed data to lower-cost storage media, such as tape or cloud, while keeping more frequently accessed data on higher-cost media, such as solid state drives (SSDs) or hard disk drives (HDDs)1](https://geo-viz.com/blog/benefits-hierarchical-storage-management/)[2](https://en.wikipedia.org/wiki/Hierarchical_storage_management)[3](https://www.techtarget.com/searchstorage/definition/HSM). This way, HSM can optimize the use of storage resources and lower the capital and operational expenses associated with storage.
* **Improving performance and availability**: HSM can help improve the performance and availability of data by ensuring that the most critical and frequently accessed data is stored on the fastest and most reliable storage media, while the less critical and infrequently accessed data is stored on slower and less reliable media[1](https://geo-viz.com/blog/benefits-hierarchical-storage-management/)[2](https://en.wikipedia.org/wiki/Hierarchical_storage_management)[3](https://www.techtarget.com/searchstorage/definition/HSM). This way, HSM can enhance the user experience and service level agreements (SLAs) for data access and delivery.
* **Simplifying data management**: HSM can help simplify data management by automating the movement of data between different storage tiers based on predefined policies and rules[1](https://geo-viz.com/blog/benefits-hierarchical-storage-management/)[2](https://en.wikipedia.org/wiki/Hierarchical_storage_management)[3](https://www.techtarget.com/searchstorage/definition/HSM). This way, HSM can reduce the manual effort and complexity involved in managing data across heterogeneous storage environments. HSM can also provide transparent access to data regardless of its location, using stub files or pointers to indicate the actual location of the data[2](https://en.wikipedia.org/wiki/Hierarchical_storage_management)[4](https://www.ibm.com/docs/en/ssw_ibm_i_72/rzai8/rzai8_adv_hsm.htm).
* **Supporting data retention and compliance**: HSM can help support data retention and compliance requirements by moving data to appropriate storage media based on its lifecycle, value and legal obligations[1](https://geo-viz.com/blog/benefits-hierarchical-storage-management/)[2](https://en.wikipedia.org/wiki/Hierarchical_storage_management)[3](https://www.techtarget.com/searchstorage/definition/HSM). This way, HSM can ensure that data is preserved, protected and disposed of according to the business needs and regulatory standards. HSM can also provide audit trails and reports to demonstrate compliance with data governance policies[2](https://en.wikipedia.org/wiki/Hierarchical_storage_management).

2. Explain about the space management techniques.

Answer 2: Space management techniques are methods or tools for optimizing the use of physical space in an organization or system. Space management can help reduce costs, improve performance, enhance user experience, and support business objectives.

Some of the commonly used space management techniques are:

* **Space planning**: This involves designing and arranging the layout of the space to suit the needs and preferences of the users, such as employees, customers, visitors, etc. [Space planning can include factors such as furniture, equipment, lighting, ventilation, accessibility, safety, aesthetics, etc1](http://www.smg.ac.uk/documents/swanspace.pdf)[2](https://envoy.com/blog/what-is-space-management/).
* **Space allocation**: This involves assigning and distributing the available space to different users or functions, based on criteria such as priority, demand, utilization, efficiency, etc. [Space allocation can help balance the supply and demand of space and ensure fair and optimal use of space resources1](http://www.smg.ac.uk/documents/swanspace.pdf)[2](https://envoy.com/blog/what-is-space-management/).
* **Space utilization**: This involves measuring and analyzing how the space is used by the users or functions, such as occupancy, frequency, duration, density, etc. [Space utilization can help identify patterns, trends, gaps, or issues in the space usage and provide insights for improvement or optimization1](http://www.smg.ac.uk/documents/swanspace.pdf)[2](https://envoy.com/blog/what-is-space-management/)[3](https://www.geeksforgeeks.org/free-space-management-in-operating-system/).
* **Space optimization**: This involves implementing actions or solutions to improve or enhance the space usage or performance, based on the findings from space planning, allocation, and utilization. [Space optimization can include actions such as rearranging, resizing, relocating, consolidating, or eliminating space or its components](http://www.smg.ac.uk/documents/swanspace.pdf)

3.Briefly explain about the hierarchy of different storage types.

Answer 3: The hierarchy of different storage types is a way of organizing the storage devices or media in a system based on their speed, cost, size, and volatility. [The hierarchy reflects the trade-off between performance and capacity, as well as the frequency and importance of data access1](https://www.geeksforgeeks.org/storage-structure-in-operating-systems/)[2](https://en.wikipedia.org/wiki/Computer_data_storage).

[The hierarchy typically consists of the following levels, from top to bottom1](https://www.geeksforgeeks.org/storage-structure-in-operating-systems/)[2](https://en.wikipedia.org/wiki/Computer_data_storage)[3](https://www.cs.princeton.edu/courses/archive/spring20/cos217/lectures/20_Mem_Storage_Hierarchy.pdf):

* **Registers**: These are the smallest and fastest storage units in a system, located inside the CPU. They store temporary data and instructions that are currently being executed by the CPU. They are volatile, meaning they lose their contents when power is turned off.
* **Cache**: This is a small and fast memory unit that is located close to the CPU. It stores copies of frequently accessed data from the main memory, to reduce the access time and improve the performance of the CPU. It is also volatile and usually divided into multiple levels (L1, L2, L3) based on their speed and size.
* **Main memory**: This is also known as random access memory (RAM) or primary memory. It is a large and relatively fast memory unit that stores data and programs that are currently in use by the CPU. It is also volatile and usually implemented using dynamic RAM (DRAM) or static RAM (SRAM) technologies.
* **Secondary memory**: This is also known as external memory or auxiliary memory. It is a large and relatively slow memory unit that stores data and programs that are not currently in use by the CPU, but can be retrieved when needed. It is non-volatile, meaning it retains its contents when power is turned off. It usually includes devices such as hard disk drives (HDDs), solid state drives (SSDs), optical disks, flash drives, etc.
* **Tertiary memory**: This is also known as offline storage or archival storage. It is a very large and very slow memory unit that stores data and programs that are rarely accessed or need to be preserved for a long time. It is non-volatile and usually removable or portable. It includes devices such as magnetic tapes, optical disks, cloud storage, etc.

[The hierarchy of different storage types can vary depending on the system design and configuration, but the general principle is that higher levels are faster, smaller, more expensive, and more volatile than lower levels](https://www.geeksforgeeks.org/storage-structure-in-operating-systems/)

4.Mention the different types of disaster? And also write about the disaster recovery management.

Answer 4: They can be classified into three broad categories:

* **Natural disasters**: These are caused by natural phenomena such as earthquakes, floods, hurricanes, wildfires, etc. They can occur suddenly or gradually and affect large areas and populations.
* **Human-made or technological disasters**: These are caused by human actions or errors, such as industrial accidents, cyberattacks, terrorism, etc. They can also affect large areas and populations and disrupt critical infrastructure and services.
* **Complex emergencies**: These are situations of conflict, violence, or instability that result from a combination of natural and human-made factors. They can lead to humanitarian crises, displacement, and human rights violations.

Some examples of each type of disaster are:

| **Type** | **Examples** |
| --- | --- |
| Natural disasters | Tornadoes, hurricanes, floods, droughts, earthquakes, volcanoes, etc. |
| Human-made or technological disasters | Nuclear accidents, oil spills, chemical leaks, cyberattacks, terrorist attacks, etc. |
| Complex emergencies | Civil wars, ethnic conflicts, political unrest, refugee crises, etc. |

**Disaster Recovery Management**

According to [Invenio IT](https://invenioit.com/continuity/disaster-recovery-management/" \t "_blank), disaster recovery management is the process of creating and executing a plan to respond to disruptive events that may affect an organization’s systems and operations. It involves managing data backup systems, recovery protocols, testing, training, business continuity planning, and resource allocation. The aim of disaster recovery management is to minimize the effects of the disaster and restore normal operations as quickly as possible.

Some steps involved in disaster recovery management are:

* Conducting a business impact analysis to identify the critical functions and assets of the organization and the potential losses from a disaster.
* Developing a disaster recovery strategy that defines the objectives, roles, responsibilities, and procedures for recovering from a disaster.
* Implementing the disaster recovery plan by deploying appropriate technology, resources, and personnel to backup and restore data and systems.
* Testing and updating the disaster recovery plan regularly to ensure its effectiveness and relevance.

Some benefits of disaster recovery management are:

* Reducing the risk of data loss and downtime
* Enhancing the resilience and reputation of the organization
* Improving the compliance and security of the organization
* Providing a competitive advantage for the organization

5. Identify various storage devices and compare them based on their access speed and cost.

## Answer 5: Storage Devices

Storage devices are hardware components that store data and information for later use. They can be classified into different types based on their characteristics, such as:

* **Volatility**: Whether they retain data when the power is off or not.
* **Capacity**: How much data they can store.
* **Speed**: How fast they can read and write data.
* **Cost**: How much they cost per unit of storage.

Some common types of storage devices are:

* **Registers**: These are the smallest and fastest storage units in a computer. They are located inside the CPU and store temporary data for processing. They are volatile and have very limited capacity (usually a few bytes).
* **Cache**: This is a small and fast memory that stores frequently used data from the main memory. It is also located inside the CPU and improves the performance of the computer. It is volatile and has low to medium capacity (usually a few megabytes).
* **Main memory**: This is the primary memory of the computer that stores data and instructions for running programs. It is also known as RAM (Random Access Memory). It is volatile and has medium to high capacity (usually a few gigabytes).
* **Secondary storage**: This is the non-volatile storage that stores data permanently. It is also known as external or auxiliary memory. It has high to very high capacity (usually a few terabytes or more). Some examples of secondary storage devices are hard disks, solid state drives, optical disks, flash drives, etc.
* **Tertiary storage**: This is the non-volatile storage that stores large amounts of data for long-term archiving or backup. It has very high to extremely high capacity (usually a few petabytes or more). Some examples of tertiary storage devices are magnetic tapes, cloud storage, etc.

## Access Speed and Cost

The access speed and cost of different storage devices vary depending on their technology, design, and market factors. The following table shows some approximate values for comparison purposes only. The actual values may differ depending on the specific models and brands of the devices.

| **Storage Device** | **Access Speed** | **Cost** |
| --- | --- | --- |
| Registers | 0.1 ns | $1000/MB |
| Cache | 0.5 ns | $100/MB |
| Main memory | 10 ns | $10/GB |
| Solid state drive | 0.1 ms | $0.1/GB |
| Hard disk drive | 10 ms | $0.05/GB |
| Optical disk drive | 100 ms | $0.01/GB |
| Flash drive | 1 ms | $0.1/GB |
| Magnetic tape drive | 10 s | $0.001/GB |
| Cloud storage | Varies | Varies |

Note: ns = nanosecond, ms = millisecond, s = second, MB = megabyte, GB = gigabyte

6. List any four natural disaster and suggest some ideas on how to overcome those effects when you setup an IT based office.

## Answer 6: Natural Disasters

Natural disasters are extreme events that occur due to natural forces and cause widespread damage, disruption, and loss of life. Some examples of natural disasters are:

* **Earthquakes**: These are sudden movements of the earth’s crust that release energy and create seismic waves. They can cause buildings to collapse, roads to crack, fires to break out, and tsunamis to form.
* **Floods**: These are overflow of water that submerge land that is usually dry. They can result from heavy rainfall, snowmelt, storm surges, or dam failures. They can damage infrastructure, crops, property, and health.
* **Cyclones**: These are rotating storms that form over warm ocean waters. They can have strong winds, heavy rain, thunderstorms, and storm surges. They can destroy coastal areas, power lines, communication networks, and livelihoods.
* **Droughts**: These are prolonged periods of abnormally low rainfall that cause water shortages. They can affect agriculture, wildlife, health, and economy.

## Disaster Recovery Management for IT Based Office

Disaster recovery management is the process of planning and implementing measures to restore the normal functioning of an IT based office after a disaster. Some steps involved in disaster recovery management are:

* **Risk assessment**: This involves identifying the potential hazards that can affect the IT based office and the impact they can have on the business operations, data, and assets.
* **Disaster recovery plan**: This involves developing a document that outlines the objectives, roles, responsibilities, and procedures for recovering from a disaster. It should include details such as backup systems, recovery sites, communication channels, and testing methods.
* **Disaster recovery implementation**: This involves executing the disaster recovery plan by activating the backup systems, transferring the data and operations to the recovery sites, restoring the communication networks, and resuming the business activities.
* **Disaster recovery evaluation**: This involves reviewing the disaster recovery process and identifying the strengths, weaknesses, opportunities, and challenges. It should also include updating the disaster recovery plan based on the lessons learned and feedback received.

Some tips for overcoming the effects of natural disasters when setting up an IT based office are:

* **Choose a location that is less prone to natural disasters or has adequate mitigation measures in place.**
* **Install fire alarms, smoke detectors, sprinklers, and extinguishers in the office premises.**
* **Use surge protectors, uninterruptible power supplies (UPS), and generators to protect the IT equipment from power fluctuations and outages.**
* **Use cloud storage, online backup services, or offsite storage facilities to store the data and applications securely and remotely.**
* **Use encryption, passwords, firewalls, antivirus software, and VPNs to secure the data and networks from unauthorized access or cyberattacks.**
* **Train the staff on how to respond to different types of disasters and how to use the disaster recovery plan.**
* **Conduct regular drills and tests to ensure the readiness and effectiveness of the disaster recovery plan.**