**Question 1(a)v PAST PAPER (19)**

**What are the required skills of a System Administrator? How configuring and troubleshooting are included in basic tasks of System Administration?**

**Required skills of a System Administrator:**

1. **Technical Proficiency:**
   * Understanding of various operating systems (e.g., Linux, Windows).
   * Knowledge of networking principles and protocols.
   * Familiarity with hardware and software installation and configuration.
2. **Problem-Solving Skills:**
   * Ability to diagnose and resolve hardware, software, and network issues.
   * Capacity to perform root cause analysis and implement effective solutions.
3. **Security Awareness:**
   * Knowledge of security best practices and protocols.
   * Ability to implement and manage security measures like firewalls, anti-virus, and encryption.
4. **Scripting and Automation:**
   * Proficiency in scripting languages (e.g., Bash, PowerShell, Python) to automate repetitive tasks.
   * Understanding of automation tools (e.g., Ansible, Puppet).
5. **Communication Skills:**
   * Ability to communicate technical information to non-technical stakeholders.
   * Good documentation practices for processes, procedures, and configurations.
6. **Project Management:**
   * Ability to manage projects, timelines, and resources effectively.
   * Familiarity with project management tools and methodologies.

**Configuring and Troubleshooting in System Administration:**

* **Configuring:** Involves setting up hardware, software, and network components to ensure they work together efficiently. This includes installing and configuring operating systems, network devices, servers, and applications.
* **Troubleshooting:** Involves identifying, diagnosing, and resolving issues that arise in the IT infrastructure. This could range from hardware failures and software bugs to network connectivity problems. Effective troubleshooting ensures minimal downtime and optimal performance.

**Question 1(b)**

**Explain the following in terms of system administration:**

1. **Managing Desktops**
   * Installation and configuration of operating systems and applications.
   * Ensuring user access and permissions are correctly set up.
   * Regular updates and patch management to keep systems secure.
2. **System Monitoring**
   * Continuously checking system performance and health.
   * Using tools like Nagios, Zabbix, or SolarWinds to monitor metrics like CPU usage, memory utilization, and network traffic.
   * Setting up alerts to notify administrators of potential issues before they escalate.
3. **Troubleshooting**
   * Identifying and resolving hardware and software issues.
   * Using diagnostic tools and logs to pinpoint problems.
   * Applying fixes or workarounds to restore system functionality.
4. **Basic Linux Commands**
   * **File Operations:** ls, cp, mv, rm.
   * **System Information:** uname, df, top.
   * **User Management:** useradd, passwd, usermod.
   * **Networking:** ifconfig, ping, netstat.

**Question 2(a)**

**Carry out differences between Linux Kernel & Windows Kernel. Which one is better in terms of file permissions and security?**

**Differences between Linux Kernel & Windows Kernel:**

* **Architecture:**
  + Linux Kernel: Monolithic kernel, where the entire OS runs in a single address space for efficiency.
  + Windows Kernel: Hybrid kernel, combining features of microkernel and monolithic kernel architectures.
* **File System:**
  + Linux Kernel: Supports multiple file systems like ext4, XFS, Btrfs, and NTFS.
  + Windows Kernel: Primarily uses NTFS and FAT32 file systems.
* **Security:**
  + Linux Kernel: Uses a permissions model based on user, group, and others with read, write, and execute permissions. Also supports SELinux and AppArmor for enhanced security.
  + Windows Kernel: Uses ACLs (Access Control Lists) for fine-grained control over file permissions. Includes features like BitLocker and Windows Defender for security.

**Better in terms of file permissions and security:**

* **File Permissions:** Linux is generally considered better due to its clear and straightforward permissions model and support for additional security modules like SELinux and AppArmor.
* **Security:** Both have robust security features, but Linux is often preferred in environments requiring high security due to its open-source nature, allowing for more customization and control over security implementations.

**Question 2(b)**

**Discuss some famous Linux distributions. Why is Red Hat Enterprise Linux widely chosen by System Administrators?**

**Famous Linux Distributions:**

1. **Ubuntu:**
   * User-friendly and widely used for desktops and servers.
   * Regular updates and strong community support.
2. **Debian:**
   * Known for its stability and vast repository of software packages.
   * Basis for many other distributions like Ubuntu.
3. **Fedora:**
   * Cutting-edge features and technologies.
   * Often used by developers and tech enthusiasts.
4. **CentOS:**
   * Community-supported distribution derived from Red Hat Enterprise Linux (RHEL).
   * Known for its stability and long-term support.

**Why Red Hat Enterprise Linux (RHEL) is widely chosen by System Administrators:**

* **Enterprise Support:** Offers professional support and services, which is crucial for enterprise environments.
* **Stability and Reliability:** Known for its stability, making it a preferred choice for mission-critical applications.
* **Security:** Provides regular security updates and compliance certifications, ensuring robust security.
* **Ecosystem:** Integrates well with other Red Hat products and solutions, offering a comprehensive ecosystem for enterprise IT infrastructure.
* **Certification and Training:** Offers extensive training and certification programs, ensuring administrators are well-equipped to manage the systems.

**Question 3(a)**

**Explain Cloud Computing. Write a few service models of Cloud Computing.**

**Cloud Computing:**

* **Definition:** Delivery of computing services like servers, storage, databases, networking, software, and analytics over the internet (the cloud) to offer faster innovation, flexible resources, and economies of scale.
* **Characteristics:**
  + On-demand self-service.
  + Broad network access.
  + Resource pooling.
  + Rapid elasticity.
  + Measured service.

**Service Models of Cloud Computing:**

1. **Infrastructure as a Service (IaaS):**
   * Provides virtualized computing resources over the internet.
   * Examples: Amazon Web Services (AWS) EC2, Microsoft Azure, Google Compute Engine.
2. **Platform as a Service (PaaS):**
   * Provides a platform allowing customers to develop, run, and manage applications without dealing with the underlying infrastructure.
   * Examples: Google App Engine, Microsoft Azure App Services, Heroku.
3. **Software as a Service (SaaS):**
   * Delivers software applications over the internet on a subscription basis.
   * Examples: Google Workspace, Microsoft Office 365, Salesforce.

**Question 3(b)**

**Discuss Virtualization. How it manages memory while working with separate virtual environments.**

**Virtualization:**

* **Definition:** The creation of a virtual version of something, such as hardware platforms, storage devices, or network resources.
* **Types:**
  + Hardware Virtualization (e.g., VMware, Hyper-V).
  + Software Virtualization (e.g., Docker, Kubernetes).
  + Network Virtualization (e.g., VLAN, SDN).

**Memory Management in Virtualization:**

* **Memory Overcommitment:** Allows the allocation of more virtual memory to VMs than the physical memory available, based on the understanding that not all VMs will use their allocated memory simultaneously.
* **Ballooning:** A technique where the hypervisor reclaims memory from VMs that are underutilizing their allocated memory and redistributes it to VMs that need more.
* **Swapping:** Involves moving inactive memory pages from RAM to disk storage to free up physical memory for active VMs.
* **Memory Deduplication:** Identifies and eliminates duplicate memory pages, reducing the overall memory footprint and improving efficiency.