**VAIDIK PRAJAPATI**

**Module 11 : CCNA : Automation and Programmability**

1. **Explain How Automation Impacts Network Management**

**Ans**. Automation makes network management **faster, easier, and more reliable** by reducing manual work and improving efficiency. Here’s how it helps:

**1. Saves Time & Effort**

* Routine tasks like setting up, monitoring, and fixing networks happen automatically.
* No need for manual configurations every time.

**2. Improves Security**

* Detects and fixes security issues instantly.
* Keeps networks safe by applying updates automatically.

**3. Reduces Errors**

* Humans can make mistakes, but automation ensures things are done correctly.
* Prevents network problems caused by misconfigurations.

**4. Handles Large Networks Easily**

* Can manage thousands of devices without extra effort.
* Perfect for big companies and cloud networks.

**5. Fixes Problems Faster**

* Finds and solves issues before they cause serious trouble.
* Reduces downtime and keeps everything running smoothly.

**6. Saves Money**

* Less manual work means lower costs.
* Uses resources efficiently, reducing waste.

**7. Keeps Performance High**

* Balances traffic and prevents network slowdowns.
* Ensures smooth and fast connections.

**8. Makes Compliance Easy**

* Generates reports for audits without extra work.

1. **Compare Traditional network with Controller based networking**

**Ans. Comparison: Traditional Network vs. Controller-Based Networking**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | **Feature** | **Traditional Network** | **Controller-Based Networking (SDN)** | | **Architecture** | Distributed, device-based management | Centralized, software-defined control | | **Configuration** | Manual, per-device configuration | Automated, centralized management | | **Scalability** | Limited, complex for large networks | Highly scalable, easy to expand | | **Flexibility** | Less flexible, changes require manual updates | More flexible, quick changes via controller | | **Automation** | Minimal, requires human intervention | High, uses automation and AI | | **Troubleshooting** | Manual, slow issue resolution | Automated, quick problem detection and resolution | | **Security** | Device-level security, harder to manage | Centralized security policies, better threat detection | | **Cost** | High operational costs due to manual work | Cost-efficient due to automation and optimization | | **Performance** | Slower, depends on manual optimization | Faster, dynamic traffic control for efficiency | | **Management** | Requires individual configuration on each device | Centralized control, easier management | | **Adaptability** | Difficult to integrate with modern technologies | Easily integrates with cloud, IoT, and AI | |

1. **Explain Virtualization**

**Ans.** Virtualization is a technology that allows you to create multiple virtual environments on a single physical system. It enables better resource utilization, cost savings, and flexibility by running multiple operating systems or applications on the same hardware.

**Types of Virtualization :**

1. **Server Virtualization**
   * Divides a single physical server into multiple virtual servers.
   * Each virtual server operates independently with its own OS and applications.
   * **Example:** VMware, Microsoft Hyper-V.
2. **Network Virtualization**
   * Creates multiple virtual networks on shared physical infrastructure.
   * Improves security and network performance.
   * **Example:** VLANs, SDN (Software-Defined Networking).
3. **Storage Virtualization**
   * Combines multiple physical storage devices into a single virtual storage unit.
   * Makes storage management easier and more efficient.
   * **Example:** SAN (Storage Area Network), NAS (Network Attached Storage).
4. **Desktop Virtualization**
   * Allows users to access a virtual desktop remotely from any device.
   * Increases security and reduces hardware costs.
   * **Example:** Virtual Desktop Infrastructure (VDI), Citrix.
5. **Application Virtualization**
   * Runs applications in isolated environments without installing them on a physical device.
   * Helps in software compatibility and security.
   * **Example:** Microsoft App-V, VMware ThinApp.

1. **Describe Characteristics of REST-based API.**

**Ans.** REST (Representational State Transfer) is an architectural style for designing networked applications. REST-based APIs (also called RESTful APIs) follow a set of principles that make them scalable, stateless, and easy to interact with. Here are the key characteristics:

1. **Stateless**
   * Each request from a client to a server must contain all the information needed to understand and process it.
   * The server does not store client state between requests, making REST APIs scalable and reliable.
2. **Client-Server Architecture**
   * The API follows a separation of concerns between the client and server.
   * The client handles the user interface and interactions, while the server handles data processing and storage.
3. **Uniform Interface**
   * REST APIs use a consistent and standardized way to interact with resources.
   * Common HTTP methods include:
     + GET – Retrieve data
     + POST – Create new data
     + PUT – Update existing data
     + DELETE – Remove data
4. **Resource-Based**
   * Everything in a RESTful system is treated as a resource, represented by unique URLs (e.g., /users/123).
   * Resources are typically represented in JSON or XML format.
5. **Use of HTTP Methods & Status Codes**
   * RESTful APIs rely on standard HTTP methods for CRUD (Create, Read, Update, Delete) operations.
   * HTTP status codes are used to indicate success or failure (e.g., 200 OK, 404 Not Found, 500 Internal Server Error).
6. **Representation of Resources**
   * Resources can be represented in multiple formats, such as JSON, XML, or plain text, with JSON being the most common.
7. **Stateless Communication**
   * Each request is independent, meaning no session information is stored on the server side.
8. **Layered System**
   * REST APIs can be designed with multiple layers (e.g., caching, authentication, load balancing) without affecting client interaction.
9. **Cacheable**
   * Responses can be explicitly marked as cacheable or non-cacheable to optimize performance.
10. **Explain methods of Automation.**

**Ans.**

**1. Fixed Automation (Hard Automation)**

* Used in high-volume production with repetitive tasks.
* Machines are designed for a specific function and cannot be easily reconfigured.
* Example: Assembly lines in automobile manufacturing (e.g., robotic arms for welding).

**2. Programmable Automation**

* Machines can be reprogrammed to handle different tasks.
* Suitable for batch production where changes are required occasionally.
* Example: CNC (Computer Numerical Control) machines, industrial robots.

**3. Flexible Automation**

* More advanced than programmable automation.
* Machines can automatically switch between different tasks without reprogramming.
* Example: Automated manufacturing systems used in electronics and consumer goods industries.

**4. Robotic Process Automation (RPA)**

* Uses software robots (bots) to automate repetitive, rule-based tasks in business processes.
* Works on UI-level interactions, mimicking human actions.
* Example: Data entry, invoice processing, customer support chatbots.

**5. Business Process Automation (BPA)**

* Focuses on automating entire business workflows and operations.
* Integrates software applications to streamline processes.
* Example: CRM (Customer Relationship Management) automation, HR payroll automation.

**6. AI-Based Automation (Cognitive Automation)**

* Uses Artificial Intelligence (AI) and Machine Learning (ML) to make intelligent decisions.
* Can handle complex tasks involving data analysis and decision-making.
* Example: Chatbots, fraud detection systems, predictive analytics.

**7. IT Process Automation (ITPA)**

* Automates IT operations such as network monitoring, cloud management, and security compliance.
* Reduces manual efforts in IT management.
* Example: Automated software deployment, system monitoring, cybersecurity automation.

**8. Industrial Automation**

* Uses sensors, actuators, and control systems to automate industrial processes.
* Can be categorized into:
  + Supervisory Control and Data Acquisition (SCADA) – Monitoring and controlling industrial processes.
  + Distributed Control Systems (DCS) – Used in large-scale industrial automation.
* Example: Power plants, chemical processing, oil & gas industry automation.

**9. Home Automation (Smart Automation)**

* Uses IoT (Internet of Things) to control home appliances and systems remotely.
* Example: Smart lighting, security cameras, voice-controlled assistants (Alexa, Google Assistant).

**10. Test Automation**

* Automates software testing to improve accuracy and efficiency.
* Uses tools like Selenium, JUnit, Appium.
* Example: Automated UI testing for web applications, performance testing for mobile apps.

1. **Explain SDN**

**Ans. Software-Defined Networking (SDN)**

Software-Defined Networking (SDN) is a modern networking approach that separates the control plane (decision-making) from the data plane (packet forwarding) to create a more flexible, efficient, and programmable network.

**Use Cases of SDN :**

* **Data Centers** – Cloud providers use SDN to manage large-scale network infrastructure dynamically.
* **Enterprise Networks** – Businesses deploy SDN to improve network security and optimize traffic.
* **5G and IoT Networks** – SDN enables dynamic network slicing for different applications.
* **Cybersecurity** – Centralized monitoring helps detect threats and enforce security policies.

1. **Explain DNA Centre**

**Ans. Cisco DNA Center (Digital Network Architecture Center)**

Cisco DNA Center (DNAC) is an advanced network management and automation platform developed by Cisco. It provides a centralized controller for intent-based networking (IBN), helping organizations simplify, automate, and secure their networks.

**Use Cases of Cisco DNA Center:**

* **Enterprise Networks** – Automates and secures large-scale corporate networks.
* **Data Centers & Campuses** – Enhances performance and security in IT infrastructure
* **IoT & Smart Cities** – Manages connected devices and ensures secure communication.
* **Retail & Hospitality** – Optimizes customer Wi-Fi experiences and security.

1. **Explain SD-Access and SD-WAN**

**Ans. SD-Access vs. SD-WAN**

**SD-Access (Software-Defined Access) and SD-WAN (Software-Defined Wide Area Network) are both Cisco-driven software-defined networking (SDN) solutions, but they serve different purposes.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | **Feature** | **SD-Access** | **SD-WAN** | | **Purpose** | Automates and secures LAN (Local Area Network) and campus networks | Optimizes and secures WAN (Wide Area Network) connectivity between branch offices and data centers/cloud | | **Scope** | Enterprise Campus & Local Networks | Branch Offices, Data Centers, Cloud Networks | | **Architecture** | Uses Cisco DNA Center as a centralized controller | Uses vManage as a centralized controller | | **Security** | Enforces network segmentation, identity-based policies, and access control using Cisco ISE | Uses end-to-end encryption, zero-trust security, and cloud security integrations | | **Performance Optimization** | AI-driven analytics, automation, and Software-Defined Access (SDA) for network optimization | Dynamic traffic steering, direct internet access (DIA), and cloud-based security | | **Use Case** | Secure and automated access control in campus networks, hospitals, and universities | Cost-effective, secure, and optimized WAN connectivity for distributed businesses | |