

**Hardware Networking**

**CCNA -Automation and Programmability**

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**1. How Does Automation Impact Network Management?**

Network automation involves using software tools and scripts to perform network management tasks without human intervention.

**Key Impacts of Network Automation:**

1. **Efficiency**
   * Automates repetitive tasks like configuration and monitoring.
   * Reduces human errors and speeds up network deployment.
2. **Security**
   * Enforces security policies automatically.
   * Detects and mitigates threats in real time.
3. **Scalability**
   * Allows networks to grow without excessive manual intervention.
   * Dynamically adjusts resources as needed.
4. **Cost Reduction**
   * Reduces dependency on manual operations.
   * Lowers downtime, improving business continuity.
5. **Improved Troubleshooting**
   * AI-based monitoring predicts and resolves network issues before failures occur.

**2. Compare Traditional Networking with Controller-Based Networking**

| **Feature** | **Traditional Networking** | **Controller-Based Networking** |
| --- | --- | --- |
| **Management** | Manually configured per device | Centrally managed via a controller |
| **Scalability** | Difficult to scale | Easily scalable |
| **Configuration** | CLI-based, device-by-device | Automated via software |
| **Security** | Manually applied policies | Centralized policy enforcement |
| **Troubleshooting** | Requires manual intervention | AI/ML-based predictive analytics |
| **Automation** | Limited | Fully automated |

**Example:**

* **Traditional Networking:** A network admin must configure each router and switch individually.
* **Controller-Based Networking:** Uses SDN controllers to manage multiple devices from a single point.

**3. Explain Virtualization in Networking**

**Definition:**

Virtualization in networking refers to the creation of virtual network resources that function independently of physical hardware.

**Types of Virtualization:**

1. **Network Function Virtualization (NFV)** – Virtualizes firewalls, load balancers, etc.
2. **Software-Defined Networking (SDN)** – Separates control and data planes for flexibility.
3. **Server Virtualization** – Allows multiple virtual machines (VMs) on a single physical server.

**Benefits of Virtualization:**

* **Cost Reduction:** Consolidates multiple network functions onto fewer devices.
* **Scalability:** Allows easy expansion without physical hardware changes.
* **Flexibility:** Adapts dynamically to network requirements.

**4. Describe Characteristics of REST-Based API**

**What is REST API?**

A **Representational State Transfer (REST) API** is a web service that allows communication between a client and a server using HTTP.

**Key Characteristics:**

1. **Stateless** – Each request is processed independently.
2. **Client-Server Architecture** – Separates client and server for better scalability.
3. **Cacheable** – Supports caching for improved performance.
4. **Uniform Interface** – Uses standard HTTP methods:
   * GET → Retrieve data
   * POST → Submit data
   * PUT → Update data
   * DELETE → Remove data
5. **Data Format** – Uses JSON or XML for data exchange.

**Example:**

GET https://api.example.com/devices

{

"device\_id": 12345,

"status": "active"

}

This API request retrieves details of a network device.

**5. Explain Methods of Network Automation**

**1. Scripting & CLI Automation**

* Uses shell scripts or Python for network configurations.
* Example: A Python script to automate router configuration.

**2. Configuration Management Tools**

* Tools like Ansible, Puppet, and Chef automate device configuration.

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

* Centralized controllers manage network devices dynamically.

**4. AI/ML-Based Automation**

* Uses AI for predictive analytics and automated issue resolution.

**5. API-Based Automation**

* Uses REST APIs to interact with network devices programmatically.

**6. Explain Software-Defined Networking (SDN)**

**Definition:**

SDN is a networking approach that separates the control plane (decision-making) from the data plane (traffic forwarding), enabling centralized network management.

**Components of SDN Architecture:**

1. **Application Layer** – User applications that interact with the network.
2. **Control Layer** – SDN Controller that manages network traffic.
3. **Infrastructure Layer** – Physical and virtual network devices.

**Benefits of SDN:**

* **Simplifies Management:** Centralized control via software.
* **Improves Scalability:** Easily adapts to network changes.
* **Enhances Security:** Policies applied across the entire network.

**Example:**

* OpenFlow protocol is commonly used in SDN to control switches dynamically.

**7. Explain Cisco DNA Center**

**What is Cisco DNA Center?**

Cisco DNA (Digital Network Architecture) Center is a centralized platform that automates and manages enterprise networks.

**Features of DNA Center:**

1. **Automation:** Configures network devices automatically.
2. **Analytics:** Uses AI for proactive network monitoring.
3. **Security:** Implements access control and threat detection.
4. **SDN Integration:** Works with software-defined networks to enhance flexibility.

**Benefits of Cisco DNA Center:**

* Reduces operational costs.
* Improves network visibility.
* Simplifies device configuration and troubleshooting.

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

**1. SD-Access (Software-Defined Access)**

**Definition:**  
Cisco **SD-Access** simplifies campus network management using software-defined technology.

**Features:**

* Centralized policy enforcement.
* Secure segmentation of users and devices.
* Automated provisioning and network management.

**Benefits:**

* Improves security with micro-segmentation.
* Reduces manual configurations.

**2. SD-WAN (Software-Defined Wide Area Network)**

**Definition:**  
SD-WAN is a software-defined approach to managing wide-area networks (WANs), allowing multiple connectivity options like MPLS, LTE, and broadband.

**Comparison: Traditional WAN vs. SD-WAN**

| **Feature** | **Traditional WAN** | **SD-WAN** |
| --- | --- | --- |
| Cost | Expensive MPLS links | Uses cheaper broadband connections |
| Security | Basic encryption | Advanced security with built-in firewalls |
| Performance | Fixed paths | Dynamic path selection |
| Management | Manually configured | Centralized control |