

## 1. How Automation Impacts Network Management

Network automation refers to using software, scripts, and tools to automatically configure, manage, and troubleshoot network devices.

### Impact of automation:

- **Reduces manual work:** Tasks like configuring VLANs, updating routing protocols, or changing ACLs can be done automatically.
  - **Improves speed:** Large-scale changes can be deployed instantly instead of configuring devices one by one.
  - **Reduces errors:** Human configuration mistakes are minimized.
  - **Improves consistency:** Ensures the same configuration is applied across all devices.
  - **Enhances scalability:** Makes it easier to manage large enterprise or cloud networks.
  - **Allows real-time monitoring:** Automated alerts and responses increase network reliability.
  - **Supports programmability:** Networks adapt to changes dynamically (e.g., increased load, failures).
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## 2. Compare Traditional Networking with Controller-Based Networking

### Traditional (Legacy) Networking

- Devices are **configured manually**, one by one.
- Control plane and data plane are **on the same device**.
- Lacks central visibility; troubleshooting is more difficult.
- Changes take longer and cause downtime.
- Not scalable for large modern networks.
- High risk of configuration errors.

### Controller-Based Networking (SDN)

- A **central controller** manages all devices.
  - Control plane is **centralized**; devices mainly forward traffic.
  - Automation and orchestration tools allow fast configuration.
  - Network-wide visibility and analytics.
  - Scalable, flexible, and easier to troubleshoot.
  - Supports APIs for programmability.
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## 3. Explain Virtualization

Virtualization is the technology that allows multiple virtual instances to run on a single physical device or resource.

**Types of virtualization:**

- **Server virtualization:** Multiple virtual machines (VMs) on one physical server.
- **Network virtualization:** Logical networks created over physical networks (VLANs, VXLAN).
- **Storage virtualization:** Combining storage devices into a single virtual storage system.
- **Desktop virtualization:** Virtual desktops accessed remotely.

**Benefits:**

- Reduces hardware costs.
  - Easy to scale and deploy.
  - Efficient use of resources.
  - Simplifies backup and disaster recovery.
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#### 4. Characteristics of REST-Based API

REST (Representational State Transfer) APIs allow applications to communicate over HTTP.

**Key characteristics:**

- **Stateless:** Every request is independent; server doesn't store session info.
  - **Uses standard HTTP methods** (GET, POST, PUT, DELETE).
  - **Uses structured data formats** like JSON or XML.
  - **Uniform Resource Identifiers (URI)** identify resources (e.g., /devices/1).
  - **Client-server architecture:** Separation of user interface and data storage.
  - **Cacheable:** Improves performance by reducing redundant requests.
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#### 5. Methods of Automation

**Common automation methods:**

1. **Scripting**

- Using Python, Bash, PowerShell, etc.
- Used for repetitive tasks like configuration or backups.

2. **Configuration management tools**

- Tools like Ansible, Puppet, Chef, and SaltStack.
- Automate large-scale configuration deployment.

### 3. APIs

- Using REST APIs to communicate with devices and controllers.

### 4. Templates

- Pre-defined configuration templates ensure consistency.

### 5. Orchestration

- Combining multiple automation tasks into workflows.

### 6. Network controllers

- Central management platforms (e.g., Cisco DNA Center).
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## 6. Explain SDN (Software-Defined Networking)

SDN is a networking architecture where the **control plane** is separated from the **data plane**, and a central controller manages the entire network.

### Key features:

- **Centralized control:** One controller makes decisions for all devices.
  - **Programmability:** Administrators can automate configurations through software.
  - **Simplified management:** Easy monitoring and changes.
  - **Dynamic network behavior:** Adjusts traffic flows based on conditions.
  - **Supports REST APIs and automation tools.**
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## 7. Explain Cisco DNA Center

Cisco DNA Center is a centralized controller and management platform for enterprise networks.

### Functions:

- **Centralized device management**
- **Automation of configurations**
- **Network analytics and monitoring**
- **AI-driven insights** for troubleshooting
- **Policy-based network management** (Intent-Based Networking)
- **Software image management**
- **Integration through REST APIs**

DNA Center simplifies network operations using automation, assurance, and analytics.

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

### SD-Access (Software-Defined Access)

Cisco's SDN solution for **LAN networks (inside the enterprise)**.

#### Features:

- Automates campus LANs.
- Uses Cisco DNA Center for management.
- Provides segmentation using **VXLAN**.
- Uses **LISP** for identity-based traffic routing.
- Zero-touch provisioning.

### SD-WAN (Software-Defined Wide Area Network)

Used for WAN connectivity between remote branches and cloud.

#### Features:

- Centralized controller for managing WAN edge routers.
- Uses multiple links (MPLS, Broadband, LTE).
- Intelligent path selection based on performance.
- Strong security (IPSec tunnels).
- Improved WAN performance and reduced cost