

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.

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