
Ex. No: 7A — STUDY OF NETWORK SIMULATOR (NS)

Aim:

To explore Cisco Packet Tracer for network simulation and understand how to set up and configure a virtual lab.

Introduction:

Cisco Packet Tracer is a **network simulation software** developed by Cisco Systems.
It allows users to **design, configure, and test networks** without physical devices.
It provides a **virtual environment** for learning routing, switching, and network troubleshooting.

Features of Cisco Packet Tracer:

1. **Wide Device Support:** Includes routers, switches, PCs, hubs, and servers.
2. **Real-Time Simulation:** Shows how data moves through a network.
3. **Supports Protocols:** Simulates TCP/IP, DHCP, DNS, and HTTP operations.
4. **Multi-User Mode:** Allows collaborative work among students.
5. **Assessment Tools:** Teachers can assign tasks and evaluate students.
6. **Custom Device Creation:** Users can add custom devices and networks.

Setting Up Packet Tracer:

1. Download Packet Tracer from the **Cisco Networking Academy** website.
2. Install and log in using your Cisco account.
3. Open the workspace and start building your topology.

Exploring the Interface:

- **Device Palette:** Contains all devices (routers, switches, PCs, etc.).
- **Workspace:** Area where network devices are placed.
- **Toolbar:** Tools for connecting devices and simulation.
- **Menu Bar:** Options for file, edit, and help operations.

Basic Configuration Steps:

1. **Connecting Devices:**
    - Use straight-through or crossover cables based on devices.
    - Connect routers, switches, and PCs as per the design.
2. **Assigning IP Addresses:**
    - Configure IPs on routers and PCs in the same subnet.
    - Example:
        - PC1 → 192.168.10.2
        - Router → 192.168.10.1
3. **Testing Connectivity:**
    - Use the **ping command** between PCs to verify connections.
4. **Troubleshooting Tools:**
    - Use **ping** and **traceroute** to find and fix errors.
    - Check device status lights and IP configuration.

Advanced Configurations:

- **VLANs:** To separate network segments.
- **DHCP:** To assign IPs automatically.
- **NAT:** To enable Internet access.
- **ACLs:** To secure network traffic.

Conclusion:

Cisco Packet Tracer helps students **visualize and practice** networking concepts in a safe, simulated environment.
It provides **hands-on experience** with real Cisco commands, making it a powerful tool for learning network design and troubleshooting.

Ex. No: 8A — SIMULATION OF DISTANCE VECTOR ROUTING ALGORITHM

Aim:

To implement the **Distance Vector Routing Algorithm** and study how routers exchange routing information to find the shortest paths.

Theory:

In the **Distance Vector (DV)** algorithm, each router keeps a table showing the distance (cost) to every other router.
Routers share these tables with their **neighbors** and update them using the **Bellman-Ford algorithm**.

Key Concepts:

1. **Routing Table:**
   Stores the best-known paths and their costs to all destinations.
2. **Distance Vector:**
   A list of distances from one router to all others.
3. **Cost Metric:**
   Usually based on **hop count**, bandwidth, or delay.
4. **Periodic Updates:**
   Routers share their tables regularly to stay updated.
5. **Convergence:**
   The state when all routers have consistent routing tables.

Procedure in Packet Tracer:

1. **Create a Network:**
   - Add **3 routers (R1, R2, R3)** and **3 PCs (PC1, PC2, PC3)**.
   - Connect them using **serial or Ethernet cables**.
2. **Assign IP Addresses:**
   - R1: 192.168.10.1
   - R2: 192.168.20.1
   - R3: 192.168.30.1
   - PCs get IPs in the same subnet with proper default gateways.

3. **Enable RIP (Routing Information Protocol):**
4. `Router(config)# router rip`
5. `Router(config-router)# network 192.168.10.0`
6. `Router(config-router)# network 10.0.0.0`

   Repeat similar steps for all routers with their respective networks.

7. **Exchange of Tables:**
   Once RIP is enabled, routers share routing tables automatically.
8. **Check Routing Table:**
   Use the command:
9. `Router# show ip route`

   It displays the shortest path to every network.

Router0 Configuration

```
enable
configure terminal
hostname Router0

interface fastethernet0/0
ip address 192.168.1.1 255.255.255.0
no shutdown
exit

interface serial2/0
ip address 10.0.0.1 255.255.255.252
clock rate 64000
no  shutdown
exit

interface serial3/0
ip address 10.0.0.5 255.255.255.252
clock rate 64000
no  shutdown
exit

router rip
version 2
network 192.168.1.0
network 10.0.0.0
no auto-summary
exit

end
write memory
```

Router1 Configuration

```
enable
configure terminal
hostname Router1

interface fastethernet0/0
ip address 192.168.3.1 255.255.255.0
no shutdown
exit

interface serial3/0
ip address 10.0.0.6 255.255.255.252
no shutdown
exit

interface serial2/0
ip address 10.0.0.9 255.255.255.252
clock rate 64000
no  shutdown
exit

router rip
version 2
network 192.168.3.0
network 10.0.0.0
no auto-summary
exit

end
write memory
```

Router2 Configuration

```
enable
configure terminal
hostname Router2

interface fastethernet0/0
ip address 192.168.2.1 255.255.255.0
no shutdown
exit

interface serial3/0
ip address 10.0.0.2 255.255.255.252
no shutdown
exit

interface serial2/0
ip address 10.0.0.10 255.255.255.252
no shutdown
exit
```

```
router rip
version 2
network 192.168.2.0
network 10.0.0.0
no auto-summary
exit

end
write memory
```

PC Configurations

PC	IP Address	Subnet Mask	Default Gateway
PC0	192.168.1.2	255.255.255.0	192.168.1.1
PC1	192.168.2.2	255.255.255.0	192.168.2.1

Observation:

Routers gradually update their tables with the **lowest-cost paths** after exchanging information multiple times.

Conclusion:

The Distance Vector Routing Algorithm allows routers to determine the shortest path by **sharing distance information** with neighbors.
RIP in Cisco Packet Tracer demonstrates how **dynamic routing** updates automatically without manual reconfiguration.

Ex. No: 9A — SIMULATION OF LINK STATE ROUTING ALGORITHM

Aim:

To simulate and study the **Link State Routing Algorithm (OSPF)** in Cisco Packet Tracer.

Theory:

In **Link State Routing**, each router shares information about its **direct neighbors** with all other routers in the network.
This is done using the **flooding process** to ensure every router knows the complete network topology.

Key Concepts:

1. **Neighbor Knowledge:**
   Each router knows the cost and state of its direct links.
2. **Flooding:**
   Routers broadcast link information to all others.
3. **Link-State Packet (LSP):**
   Contains router ID, link IDs, and costs.
4. **Database:**
   Each router builds the same **link-state database** from all LSPs.
5. **SPF Algorithm:**
   Dijkstra's Shortest Path First (SPF) algorithm computes the shortest path.

Procedure in Packet Tracer:

1. **Add Routers:**
   Connect Router1 and Router2 using proper cables.
2. **Assign IP Addresses:**
3. `Router1: Fa0/0 - 192.168.1.1 255.255.255.0`
4. `Router2: Fa0/0 - 192.168.1.2 255.255.255.0`
5. `Router2: Fa0/1 - 192.168.2.1 255.255.255.0`
6. **Enable OSPF Routing:**
7. `Router(config)# router ospf 1`

8. `Router(config-router)# network 192.168.1.0 0.0.0.255 area 0`
9. `Router(config-router)# network 192.168.2.0 0.0.0.255 area 0`
10. **Automatic Update:**
    OSPF automatically finds and maintains the shortest path.
11. **Verify Routing Table:**
    Use the command:
12. `Router# show ip route`

Router0

```
enable
configure terminal
hostname Router0

interface fastethernet0/0
ip address 192.168.1.1 255.255.255.0
no shutdown
exit

interface serial2/0
ip address 10.0.0.1 255.255.255.252
clock rate 64000
no  shutdown
exit

interface serial3/0
ip address 10.0.0.5 255.255.255.252
clock rate 64000
no  shutdown
exit

router ospf 1
network 192.168.1.0 0.0.0.255 area 0
network 10.0.0.0 0.0.0.255 area 0
exit

end
write memory
```

Router2 (middle router)

```
enable
configure terminal
hostname Router2

interface fastethernet0/0
ip address 192.168.2.1 255.255.255.0
no shutdown
exit

interface serial3/0
ip address 10.0.0.2 255.255.255.252
no shutdown
exit

interface serial2/0
ip address 10.0.0.10 255.255.255.252
no shutdown
exit

router ospf 1
network 192.168.2.0 0.0.0.255 area 0
network 10.0.0.0 0.0.0.255 area 0
exit

end
write memory
```

Router1

```
enable
configure terminal
hostname Router1

interface fastethernet0/0
ip address 192.168.3.1 255.255.255.0
no shutdown
exit

interface serial3/0
ip address 10.0.0.6 255.255.255.252
no shutdown
exit

interface serial2/0
ip address 10.0.0.9 255.255.255.252
clock rate 64000
no  shutdown
exit

router ospf 1
network 192.168.3.0 0.0.0.255 area 0
network 10.0.0.0 0.0.0.255 area 0
exit

end
write memory
```

PC Configurations

PC0

```
IP Address: 192.168.1.2
Subnet Mask: 255.255.255.0
Default Gateway: 192.168.1.1
```

PC1

```
IP Address: 192.168.2.2
Subnet Mask: 255.255.255.0
Default Gateway: 192.168.2.1
```

Conclusion:

Link State Routing (OSPF) provides **faster convergence** and more accurate routing than Distance Vector algorithms.
It efficiently updates only when changes occur, reducing network overhead.

Ex. No: 10A — STUDY OF TCP/UDP PERFORMANCE USING SIMULATION TOOL

Aim:

To study and compare the performance of **TCP and UDP protocols** using a network simulation tool.

Theory:

1. TCP (Transmission Control Protocol):

- **Connection-oriented** protocol.
- Ensures **reliable, ordered, and error-checked** data delivery.
- Used for web browsing, emails, file transfers.
- Uses **acknowledgments (ACKs)** and **retransmissions**.

2. UDP (User Datagram Protocol):

- **Connectionless** and **faster** than TCP.
- No delivery guarantee; suitable for **real-time applications** like video streaming or gaming.
- Lightweight and less overhead.

Procedure in Packet Tracer:

1. **Create a Network Topology:**
   Add one **multi-server** and connect multiple clients (HTTP, FTP, DNS, and Email) through a switch.
2. **Assign IP Addresses:**
   Configure appropriate IPs for all devices and ensure connectivity.
3. **Configure Servers:**
   - Enable **HTTP**, **FTP**, **DNS**, and **Email** services.
   - Create a domain (e.g., `pvg.edu.in`).
   - Add users to the mail server.
4. **Edit Web Page:**
   - Open `index.html` on the server and add sample content.
   - Access it via the HTTP client using the domain name.

5. **FTP Access:**
    - Connect to `pvg.edu.in` domain using the FTP client.
    - Upload or download test files.
6. **Email Communication:**
    - Send and receive mails between configured clients.

💻 Devices you'll use

1. **1 Multi-Server**
2. **1 Switch**
3. **4 PCs**

We'll assign:

- **PC0 → HTTP & DNS Client**
- **PC1 → FTP Client**
- **PC2 → Email Sender (Alice)**
- **PC3 → Email Receiver (Bob)**

So you can do *all tasks* with just 4 PCs.

🧩 Step-by-step (Simple)

1. **Connect all PCs + Server to the Switch** using straight cables.
2. **Set IP addresses:**

Device	IP Address	Subnet Mask	DNS Server
Server	192.168.1.10	255.255.255.0	—
PC0	192.168.1.11	255.255.255.0	192.168.1.10
PC1	192.168.1.12	255.255.255.0	192.168.1.10
PC2	192.168.1.13	255.255.255.0	192.168.1.10
PC3	192.168.1.14	255.255.255.0	192.168.1.10

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3. **On the Server → Services tab**
    - Turn ON **HTTP, FTP, DNS, Email**.
    - In **DNS**, add:
      Name: `pvg.edu.in` → Address: `192.168.1.10`
    - In **FTP**, add user → `user1 / 123`
    - In **Email**, add:
        - `alice / alicepwd`
        - `bob / bobpwd`

4. **In HTTP service**, edit `index.html`:
5. `<h1>Welcome to pvg.edu.in</h1>`

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5. **On PC0 (HTTP & DNS test)**
   - Open Web Browser → type `http://pvg.edu.in`
     ✅ Page opens → DNS & HTTP working.

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6. **On PC1 (FTP test)**
   - Open Command Prompt → type
     `ftp pvg.edu.in`
     Login → user: `user1`, password: `123`
     ✅ FTP working.

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7. **On PC2 (Alice – Email sender)**
   - Desktop → Email → Configure:
     - Email: `alice@pvg.edu.in`
     - Incoming Mail Server: `pvg.edu.in`
     - Outgoing Mail Server: `pvg.edu.in`
     - Username: `alice`
     - Password: `alicepwd`
   - Compose mail to `bob@pvg.edu.in` → Send.

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8. **On PC3 (Bob – Email receiver)**
   - Desktop → Email → Configure:
     - Email: `bob@pvg.edu.in`
     - Incoming: `pvg.edu.in`
     - Outgoing: `pvg.edu.in`
     - Username: `bob`
     - Password: `bobpwd`
   - Click **Receive** → Mail arrives from Alice.

Observation:

- **TCP** ensures all packets are delivered correctly (used by HTTP, FTP, Email).
- **UDP** sends packets without confirmation, achieving **higher speed** but **less reliability** (used by DNS, video apps).

Comparison Table:

Feature	TCP	UDP
Type	Connection-oriented	Connectionless
Reliability	Reliable	Unreliable
Speed	Slower	Faster
Header Size	20 bytes	8 bytes
Applications	HTTP, FTP, Email	DNS, Video streaming

Conclusion:

TCP provides **reliable communication** suitable for file transfers and web traffic, while UDP provides **faster but unreliable** communication ideal for real-time applications.
Simulation using Packet Tracer helps in visualizing how each protocol performs in real-world scenarios.