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22AIE204
COMPUTER NETWORKS

NETWORK LAYER

- **End device Configuration for Basic Network Creation**

Lab – Basic Network Connection Demo

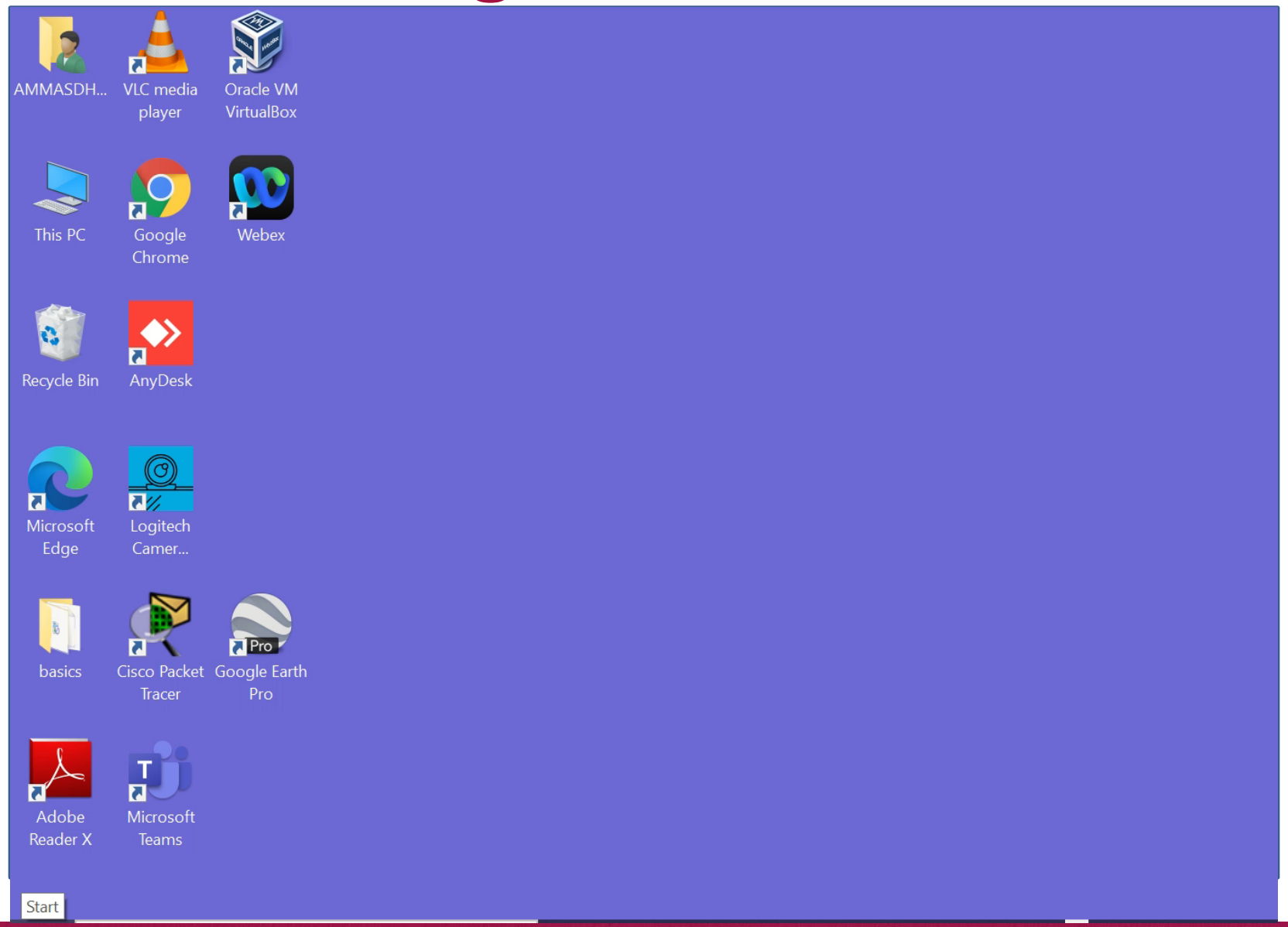
Demo in creating network using 2 end devices using UTP cable

Simulating the same in Packet Tracer

Objectives of Basic Network Connection Lab

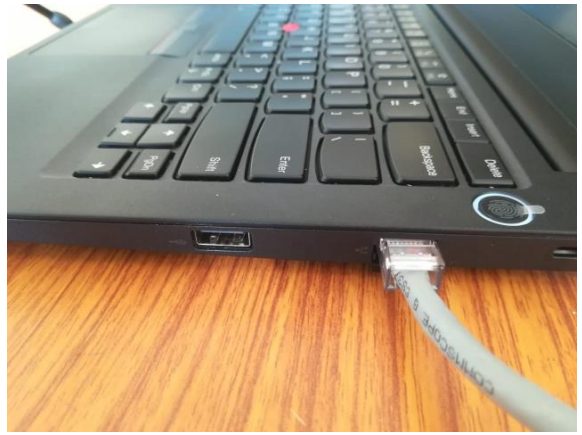
- Examine the wired and wireless NIC information in laptop
- Understand the wired connections
  - Straight through and Cross over cable connections
- Build a simple wired network using 2 PCs
- Introduction to Packet Tracer
- Simulation of wired network

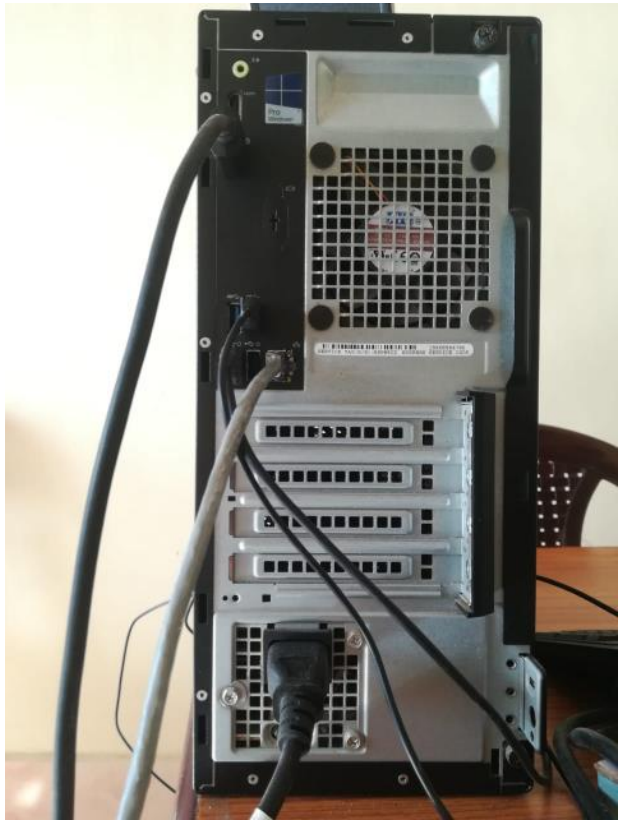
Demo in Viewing wired & wireless NIC info



Connecting the Ethernet Cable to End device

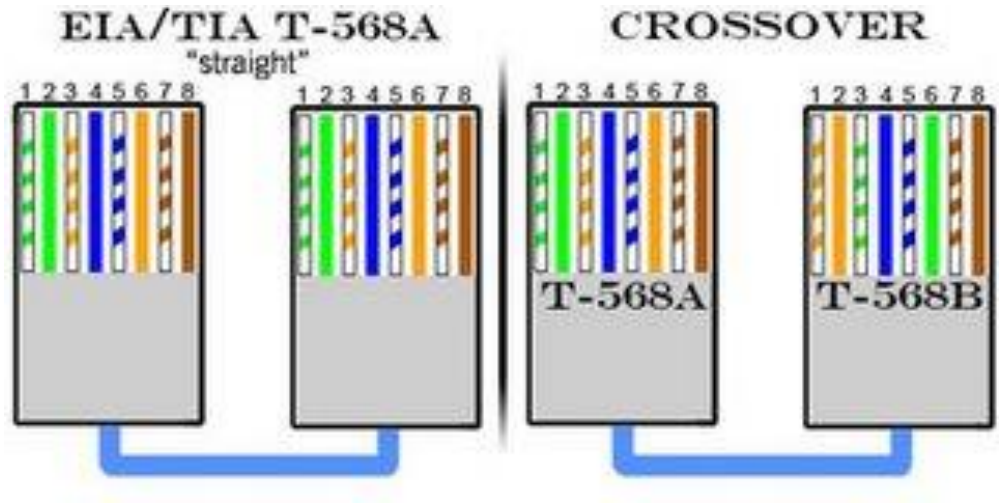
- Connect RJ-45 connector one end to one PC/End device
- Connect the other end of the cable to another device.
- Example: Laptop->cross-over cable->PC

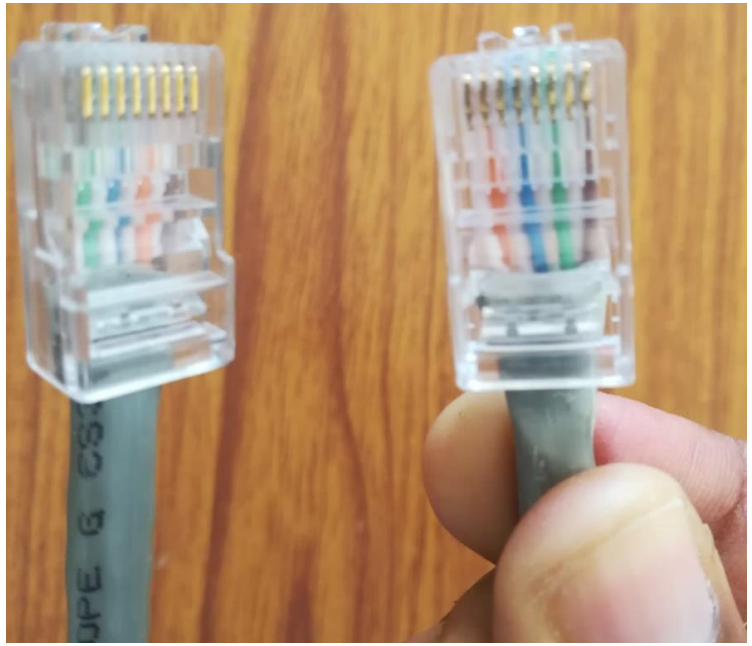




Understanding UTP Cable Connections

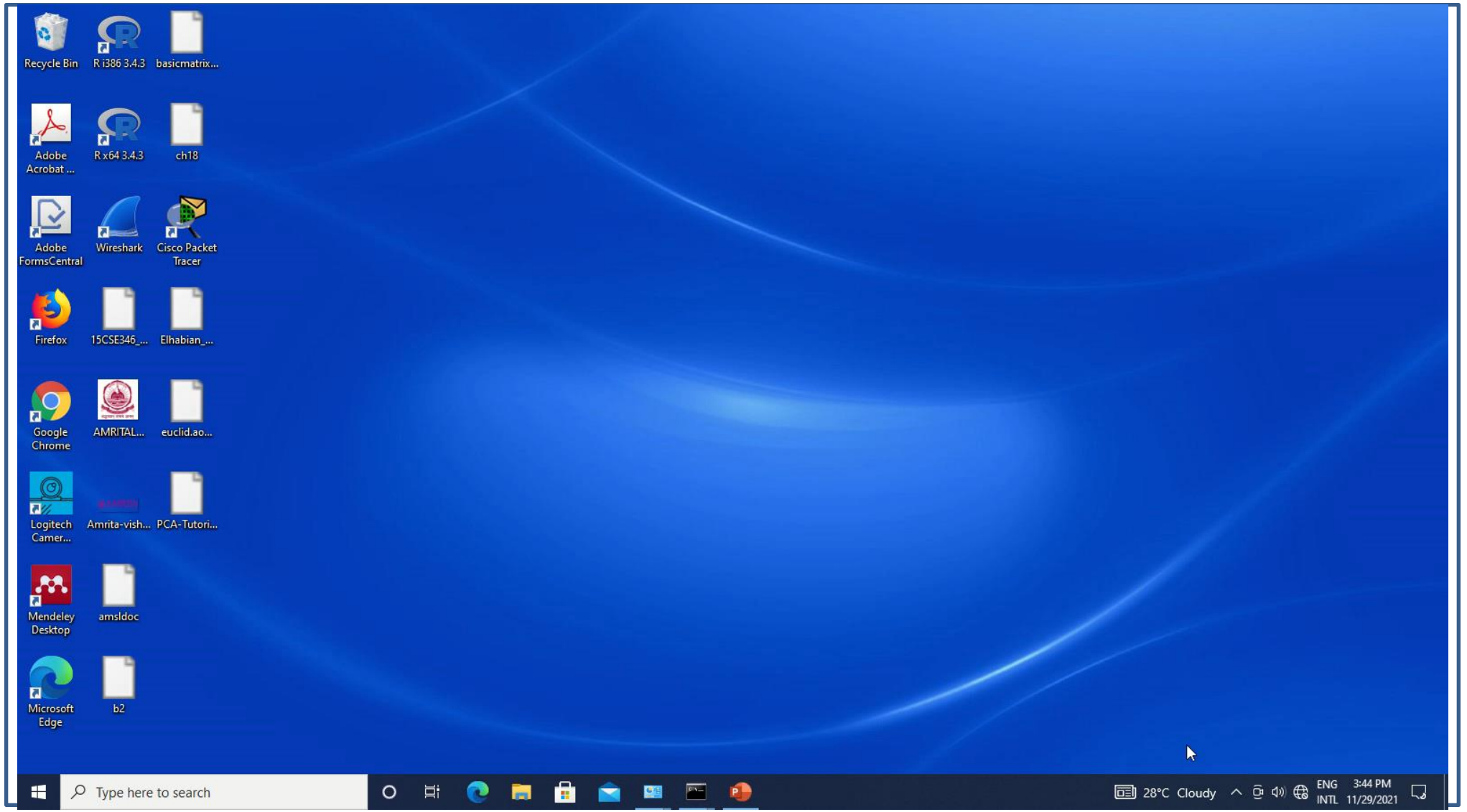
- Straight through cable – to connect different devices
  - Ex: Connecting a PC and a switch
- Cross over cable – to connect similar devices
  - Ex: Connecting 2 PCs/Laptops/End-devices etc.



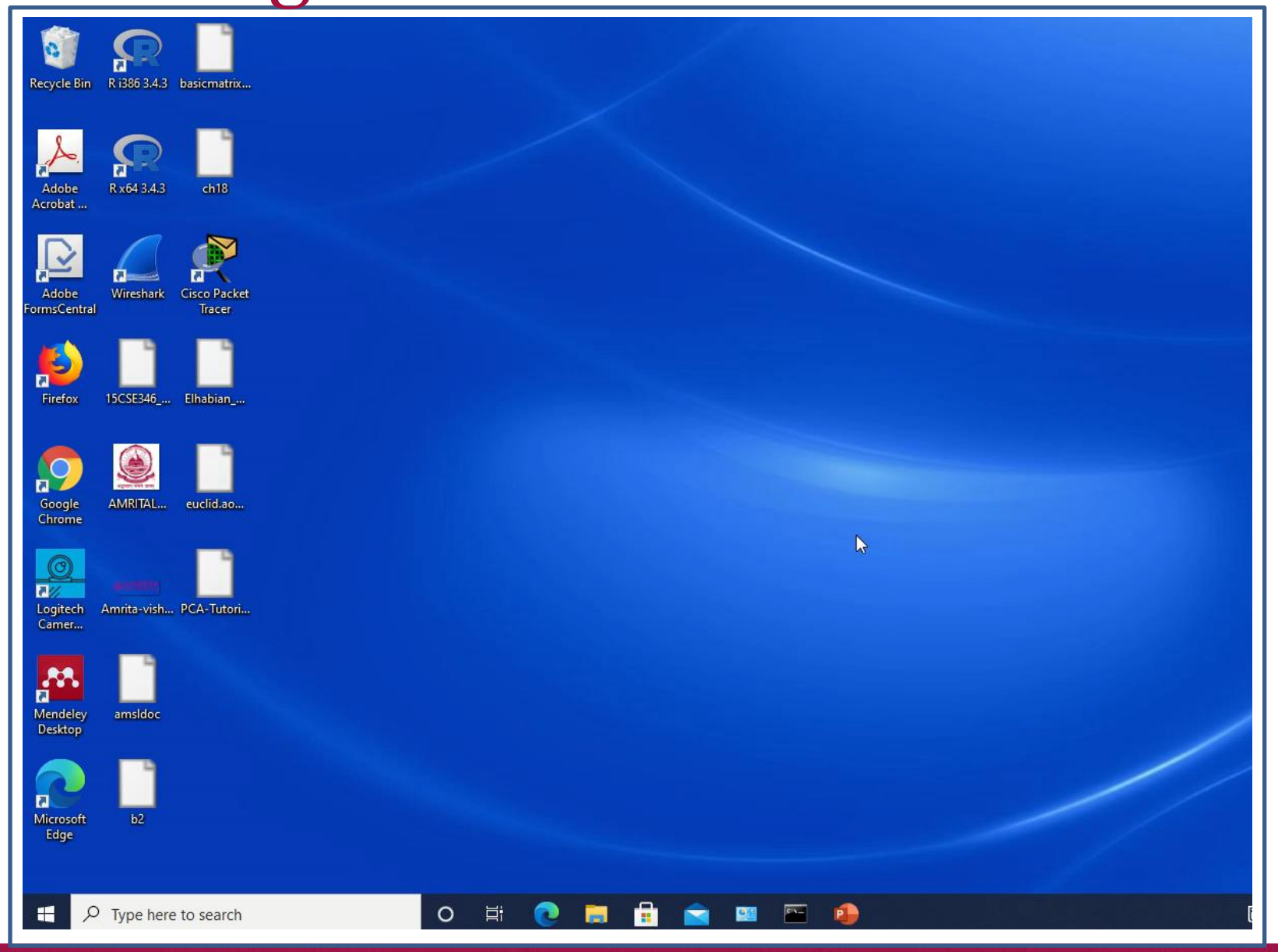


Crimping RJ45 terminator for UTP cable

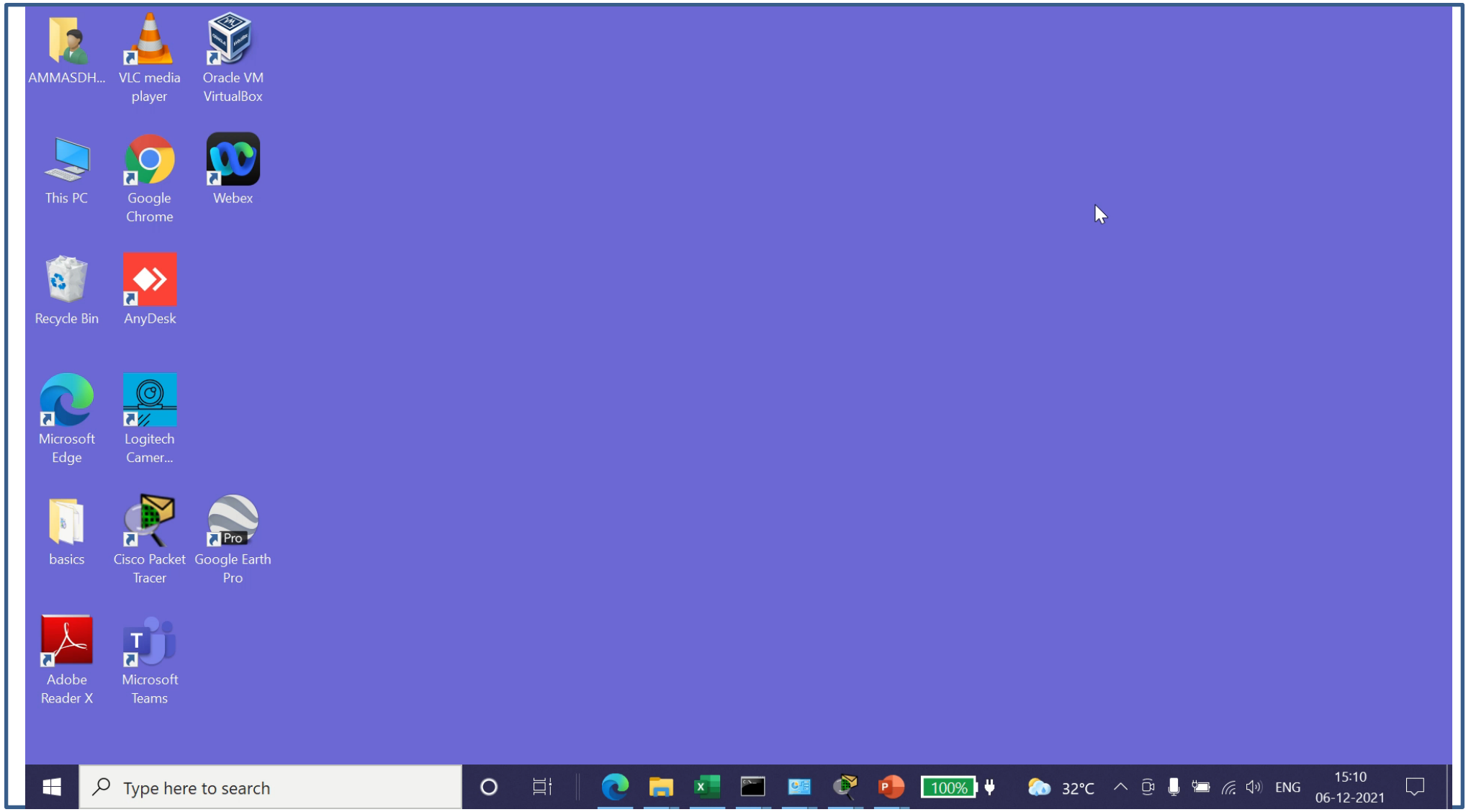
Configuring PCo with 192.168.10.1



Checking and Share Enable in PCo



Configuring and checking Laptopo connection



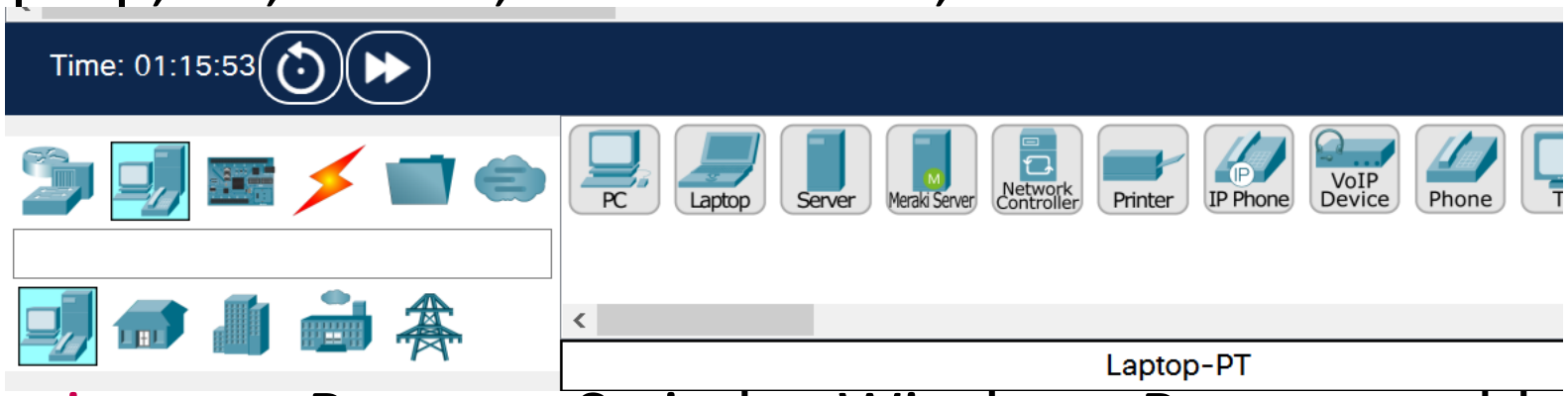
Introduction to Packet Tracer

- Packet Tracer is a powerful cross-platform visual simulation tool designed by Cisco Systems
- Supplements physical networking equipment by allowing students to create a network with an almost unlimited number of devices.
- Use drag and drop interface
- Useful to learn networking concepts by doing it in the simulator
- Improve Troubleshooting skills aspiring a network administrator profession

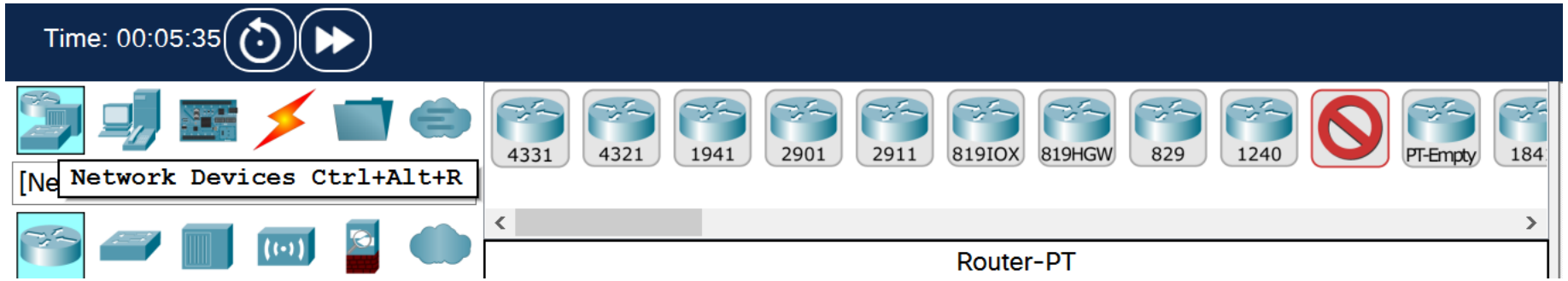
Ref: CCNA Introduction to Networks from Cisco Netacad

Identifying Devices

- End Devices – Laptop, PC, Server, Home Printer, Phone etc.

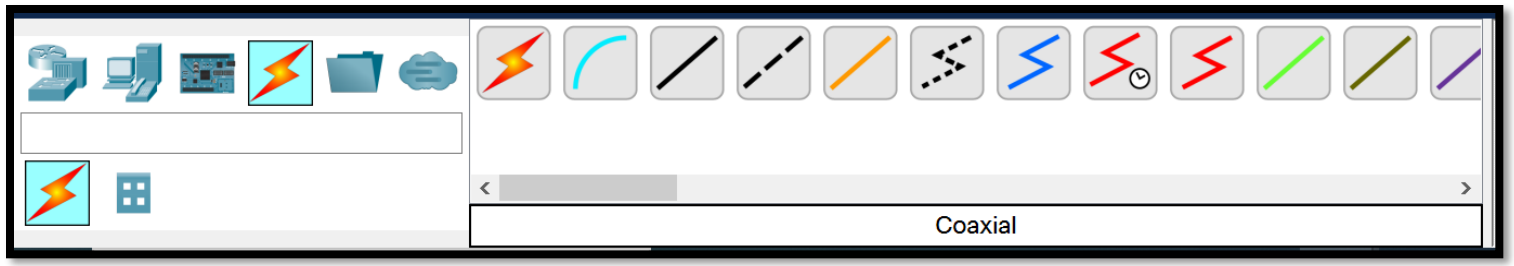


- Intermediary Devices – Router, Switch, Wireless Router, cable modem



Identifying Connections

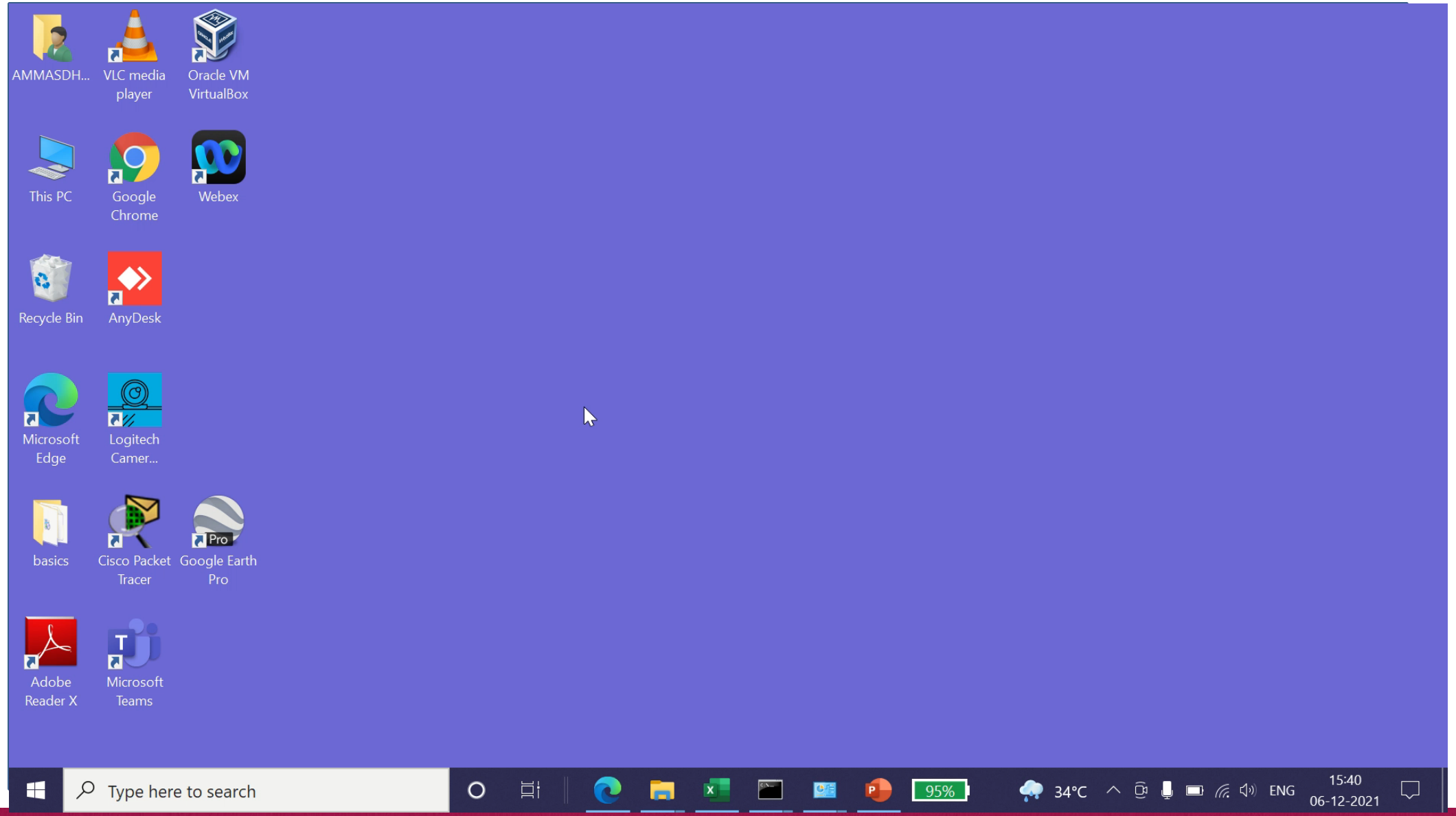
Place your
Webcam Video here
Size 38%



- Wired Local Area Network uses Copper Twisted Pair cable to connect among the devices for communication
  - As discussed, straight-through cable is used for connecting two different devices. Ex: Router-Switch.
  - Connecting traditional router and computer uses cross-over cable, as router is also like a computer using same wire to transmit & receive
  - To configure the networking devices, console cable is used. Will discuss this in detail in the coming modules.

Ref: Chapter4, CCNA Introduction to Networks from Cisco
Netacad

Real time demo in the Packet Tracer Simulator



Summary

- Viewed IP address and MAC address of Wired Ethernet LAN and Wireless LAN
- Connect 2 PCs/laptops using cross over Ethernet cable
- Identified devices and connections in the simulator packet tracer
- Real time demo is also simulated in packet tracer.

Objectives – Configure Initial Router Settings

- Learn and understand the basic router configuration
- How to configure device name?
- How to secure the user and privileged access mode?
- How to provide legal notification?
- How to encrypt password in the configuration files?
- How to save the configuration commands?

Basic Router Configuration Steps

- Configure the device name.

```
Router(config)# hostname hostname
```

- Secure privileged EXEC mode.

```
Router(config)# enable secret password
```

- Secure user EXEC mode.

```
Router(config)# line console 0
Router(config-line)# password password
Router(config-line)# login
```

- Secure remote Telnet or SSH access.

```
Router(config)# line vty 0 4
Router(config-line)# password password
Router(config-line)# login
Router(config-line)# transport input {ssh | telnet}
```

- Encrypt all plaintext passwords.

```
Router(config)# service password encryption
```

- Provide legal notification and save the configuration.

```
Router(config)# banner motd # message #
Router(config)# end
Router# copy running-config startup-config
```

Reference: CCNA ITN Ch10 Basic Router Configuration

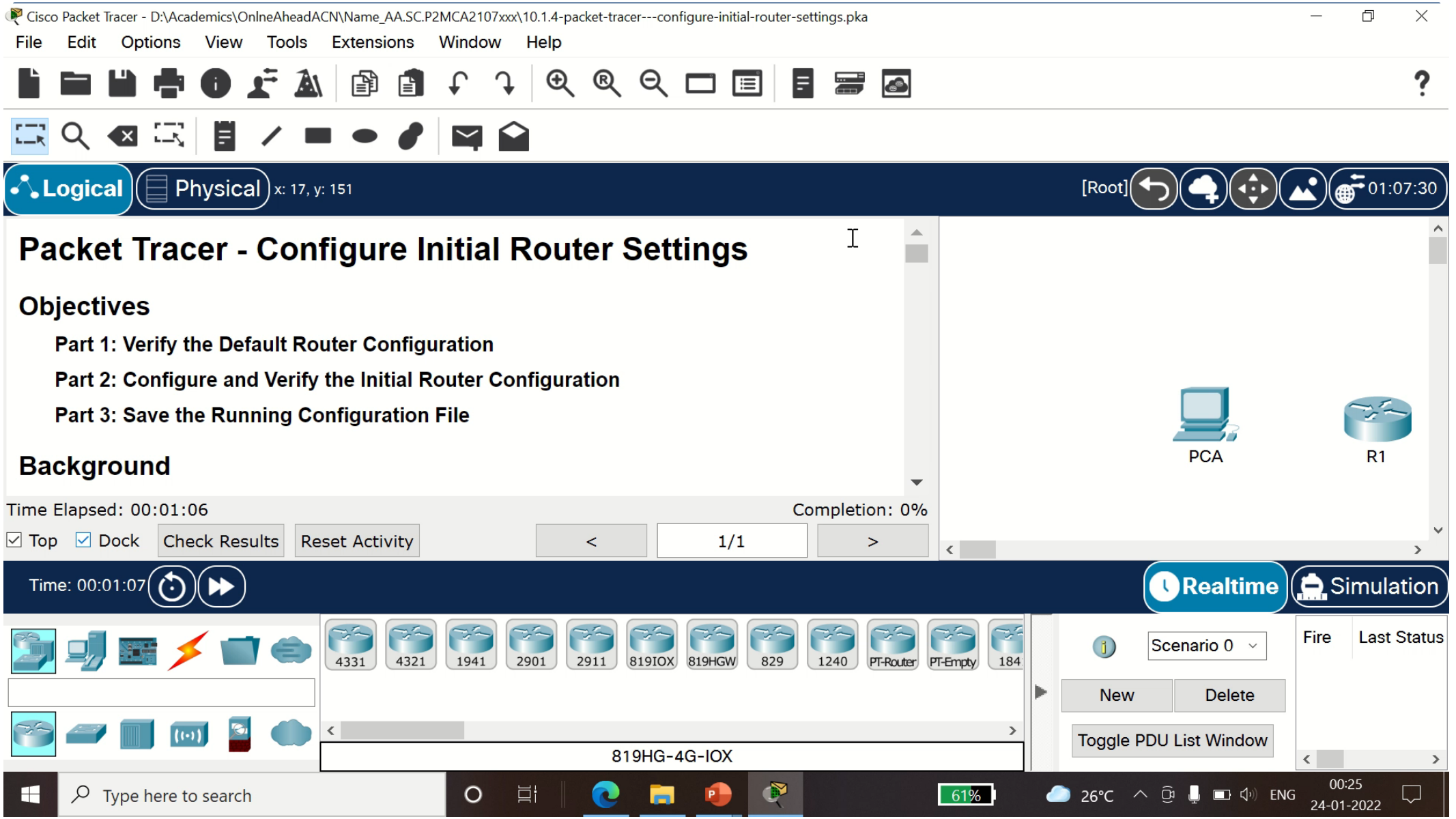
Basic Router Configuration Example

- Commands for basic router configuration on R1.
- Configure hostname
- Secure Privileged EXEC mode - enable
- Secure user EXEC mode – console
- Configuration is saved to NVRAM.

```
R1(config)# hostname R1
R1(config)# enable secret class
R1(config)# line console 0
R1(config-line)# password cisco
R1(config-line)# login
R1(config-line)# line vty 0 4
R1(config-line)# password cisco
R1(config-line)# login
R1(config-line)# transport input ssh telnet
R1(config-line)# exit
R1(config)# service password encryption
R1(config)# banner motd #
Enter TEXT message. End with a new line and the #
**********************************************
WARNING: Unauthorized access is prohibited!
**********************************************
R1(config)# exit
R1# copy running-config startup-config
```

Reference: CCNA ITN Ch10 Basic Router Configuration

Packet Tracer Demo



Re-cap – Basic Router Configuration

- Discussed the basic router configuration commands
- hostname
- Console password
- Enable secret <password>
- Encrypt password
- Check the password configuration in the router
- copy run start
- Next, we will discuss to configure router interfaces

Configure Router Interfaces

Reference: CCNA ITN Chapter 10.2 Interfaces
Week9 Lesson2

Objectives – Configure Router Interfaces

- Learn to Configure Router Interfaces and understand with examples
- Explore Verification commands
  - Status of All IPv4 Interfaces
  - Status of all IPv6 Interfaces
  - IPv4 routing table
  - IPv6 routing table
  - Statistics of specific IPv4 or IPv6 interfaces

Configure Interfaces

- Configuring a router interface includes issuing the following commands:

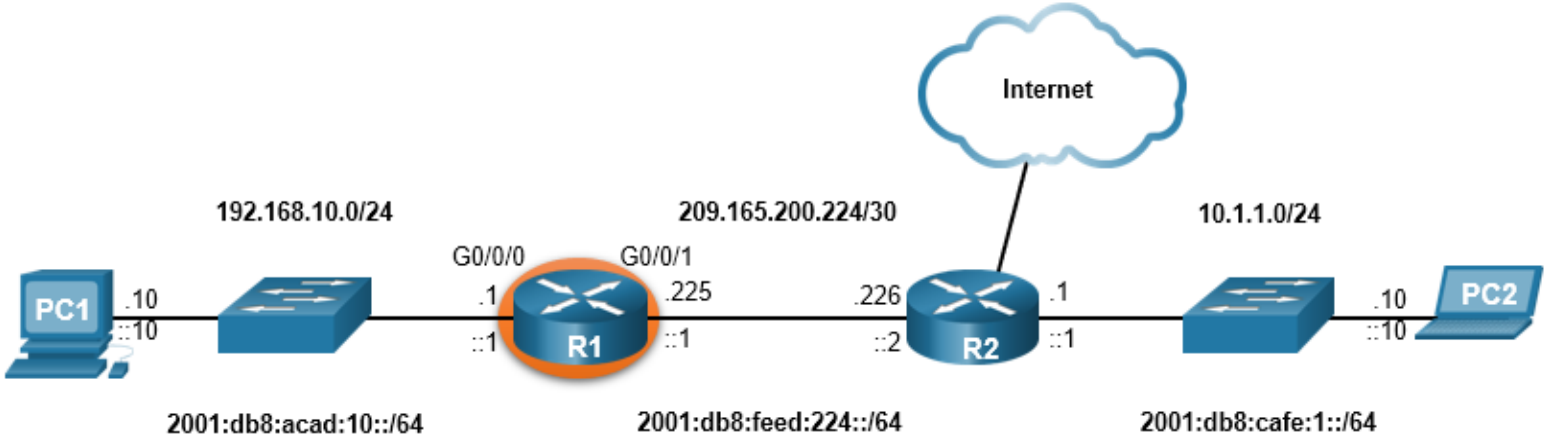
```
Router(config)# interface type-and-number
Router(config-if)# description description-text
Router(config-if)# ip address ipv4-address subnet-mask
Router(config-if)# ipv6 address ipv6-address/prefix-length
Router(config-if)# no shutdown
```

- It is a good practice to use the description command to add information about the network connected to the interface.
- The no shutdown command activates the interface.

Reference: CCNA ITN Ch10 Basic Router Configuration

Configure Router Interfaces Example

- Inspect the commands to configure interface G0/0/0 on R1

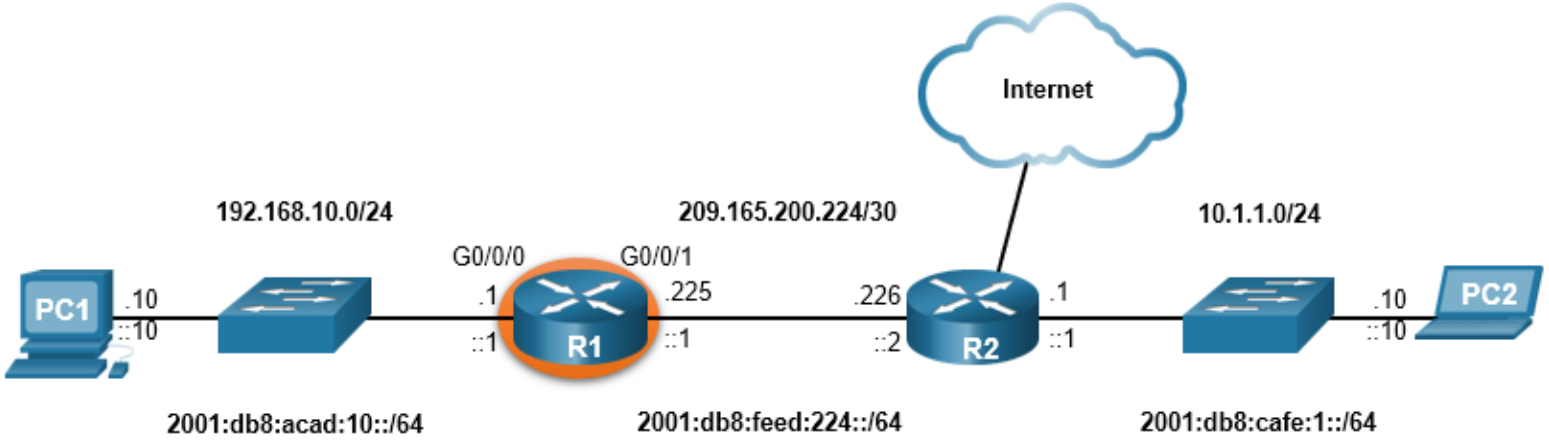



```
R1(config)# interface gigabitEthernet 0/0/0
R1(config-if)# description Link to LAN
R1(config-if)# ip address 192.168.10.1 255.255.255.0
R1(config-if)# ipv6 address 2001:db8:acad:10::1/64
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)#
*Aug  1 01:43:53.435: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0, changed
state to down
state to up
*Aug  1 01:43:57.447: %LINEPROTO-5-UPDOWN: Line protocol on Interface
```

Reference: CCNA ITN Ch10 Basic Router Configuration

Configure Router Interfaces Example

- Inspect the commands to configure interface G0/0/1 on R1




```
R1(config)# interface gigabitEthernet 0/0/1
R1(config-if)# description Link to R2
R1(config-if)# ip address 209.165.200.225 255.255.255.252
R1(config-if)# ipv6 address 2001:db8:feed:224::1/64
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)#
*Aug  1 01:46:29.170: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/1, changed state to down
*Aug  1 01:46:32.171: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/1, changed state to up
*Aug  1 01:46:33.171: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/1,
changed state to up
```

Reference: CCNA ITN Ch10 Basic Router Configuration

Verification Commands

- Show commands used to verify interface configuration is listed here.

Commands	Description
show ip interface brief **show ipv6 interface brief**	Displays all interfaces, their IP addresses, and their current status.
show ip route **show ipv6 route**	Displays the contents of the IP routing tables stored in RAM.
show interfaces	Displays statistics for all interfaces on the device. Only displays the IPv4 addressing information.
show ip interfaces	Displays the IPv4 statistics for all interfaces on a router.
show ipv6 interfaces	Displays the IPv6 statistics for all interfaces on a router.

Reference: CCNA ITN Ch10 Basic Router Configuration

Verify Interface Configuration

- To verify interface configuration, use the show ip interface brief and show ipv6 interface brief commands shown here:
- These commands are used to view status of all interfaces

```
R1#  show ip interface brief
Interface                  IP-Address      OK? Method Status
Protocol
GigabitEthernet0/0/0   192.168.10.1    YES manual up
```

```
R1#  show ipv6 interface brief
GigabitEthernet0/0/0       [up/up]
    FE80::201:C9FF:FE89:4501
    2001:DB8:ACAD:10::1
GigabitEthernet0/0/1       [up/up]
    FE80::201:C9FF:FE89:4502
    2001:DB8:FEED:224::1
Vlan1                      [administratively down/down]
R1#
```

Reference: CCNA ITN Ch10 Basic Router Configuration

Verify Routing Tables

```
R1# show ip route
< output omitted>
Gateway of last resort is not set
      192.168.10.0/24 is variably subnetted, 2 subnets,
2 masks
C        192.168.10.0/24 is directly connected,
GigabitEthernet0/0/0
L        192.168.10.1/32 is directly connected,
```

- Display the contents of the IPv4 routing tables with the show ip route and
- IPv4 routing tables with the show ipv6 route commands

```
R1# show ipv6 route
<output omitted>
C   2001:DB8:ACAD:10::/64 [0/0]
     via GigabitEthernet0/0/0, directly
connected
L   2001:DB8:ACAD:10::1/128 [0/0]
     via GigabitEthernet0/0/0, receive
C   2001:DB8:FEED:224::/64 [0/0]
     via GigabitEthernet0/0/1, directly
connected
```

Reference: CCNA ITN Ch10 Basic Router Configuration

Verification Commands

- Display statistics for specific interface with the show interfaces command, as shown here:

```
R1# show interfaces gig0/0/0
GigabitEthernet0/0/0 is up, line protocol is up
  Hardware is ISR4321-2x1GE, address is a0e0.af0d.e140 (bia
a0e0.af0d.e140)
  Description: Link to LAN
  Internet address is 192.168.10.1/24
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Full Duplex, 100Mbps, link type is auto, media type is
RJ45
  output flow-control is off, input flow-control is off
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:01, output 00:00:35, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0(size/max/drops/flushes);
```

Reference: CCNA ITN Ch10 Basic Router Configuration

Verification Commands

- Display IPv4 statistics for specific router interfaces with the show ip interface command, as shown here:

```
R1# show ip interface g0/0/0
GigabitEthernet0/0/0 is up, line protocol is up
  Internet address is 192.168.10.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Outgoing Common access list is not set
  Outgoing access list is not set
  Inbound Common access list is not set
  Inbound  access list is not set
  Proxy ARP is enabled
  Local Proxy ARP is disabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
```

Reference: CCNA ITN Ch10 Basic Router Configuration

Verification Commands

- Display IPv6 statistics for specific router interfaces with the show ipv6 interface command shown here:

```
R1# show ipv6 interface g0/0/0
GigabitEthernet0/0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is
FE80::868A:8DFF:FE44:49B0
  No Virtual link-local address(es):
  Description: Link to LAN
  Global unicast address(es):
    2001:DB8:ACAD:10::1, subnet is 2001:DB8:ACAD:10::/64
  Joined group address(es):
    FF02::1
    FF02::1:FF00:1
    FF02::1:FF44:49B0
  MTU is 1500 bytes
  ICMP error messages limited to one every 100
milliseconds
  ND NS retransmit interval is 1000 milliseconds
R1#
```

Reference: CCNA ITN Ch10 Basic Router Configuration

Re-cap – Router Interface Configuration

- Discussed the examples of configuring Interfaces
  - Interface Gi0/0/0 or Gi0/0/1
  - no shutdown

- Investigated Verification commands
  - show ip interface brief
  - show ipv6 interface brief
  - show ip route
  - show ipv6 route
  - show interface Gi0/0/0
  - show ip interface
  - show ipv6 interface

Configure Default Gateway

Reference: CCNA ITN Chapter 10.3 Default Gateway

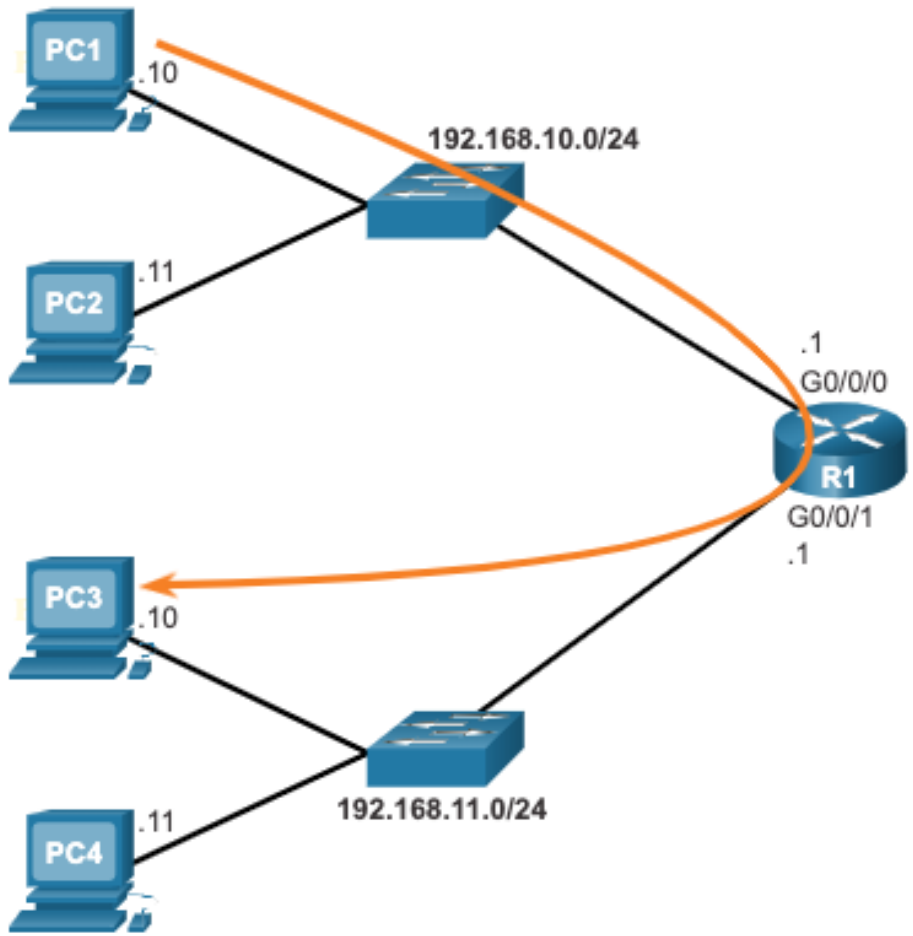
Week9 Lesson3

Objectives – Configure Default Gateway

- Explore How to Configure Default Gateway on the host?
- Explore how to configure default gateway on the switch?
- Investigate the configuration commands in the Packet Tracer simulator

Default Gateway on a Host

- The default gateway is used when a host sends a packet to a device on another network.
- The default gateway address is generally the router interface address attached to the local network of the host.
- To reach PC3, PC1 addresses a packet with the IPv4 address of PC3, but forwards the packet to its default gateway, the G0/0/0 interface of R1.



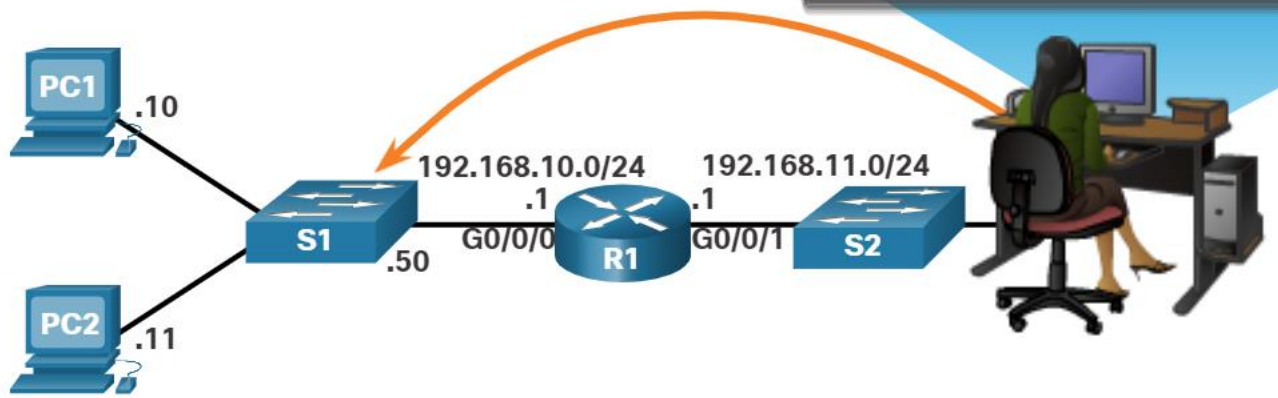
Note: The IP address of the host and the router interface must be in the same network.

Reference: CCNA ITN Ch10 Basic Router Configuration

Default Gateway on a Switch

- A switch must have a default gateway address configured to remotely manage the switch from another network.
- To configure an IPv4 default gateway on a switch, use the **ip default-gateway** *ip-address* global configuration command.

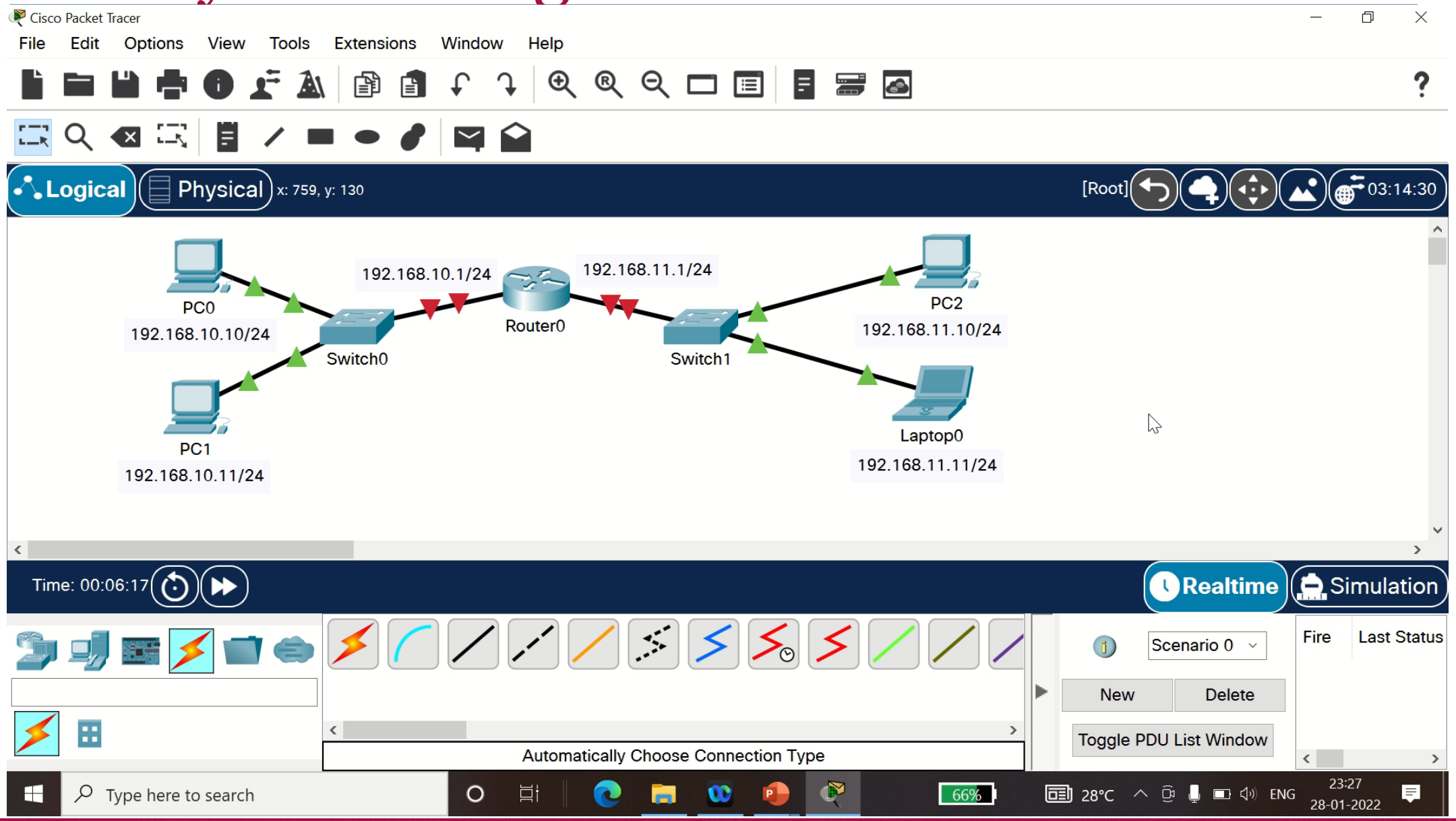
```
S1# show running-config
Building configuration...
!
<Output Omitted>
service password-encryption
!
hostname S1
!
interface Vlan1
  ip address 192.168.10.50.255.255.255.0
!
<Output Omitted>
!
ip default-gateway 192.168.10.1
<Output Omitted>
```



Note: The IP address of Layer 2 switch is just used for remote management purpose.

Reference: CCNA ITN Ch10 Basic Router Configuration

Activity – ANDing to determine network address



Re-cap – Configuring Default Gateway

- Configure Default Gateway on the host
  - IP Address, Subnet mask
  - Interface IP of gateway router

- Configure default gateway on the switch
  - ip default-gateway <IP-addr>

- Investigate the configuration commands in the Packet Tracer simulator
  - show ip interface brief

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