



PRIFYSGOL CYMRU
Y Drindod Dewi Sant
UNIVERSITY OF WALES
Trinity Saint David
SWANSEA - ABERTAWE

Applied Computing

Wales Institute of Science and Art (WISA)

Networks and Cybersecurity Essentials (ACCA4024)

Lab 4: Design and Configure Home Network (Basic configurations in networking devices).

Cisco | **Networking Academy**[®]
| **Mind Wide Open**[™]

Task 1: Understand Networking devices and configure them to deploy a successful network.

Task 2: (Assignment) Complete and submit: (Submission via Moodle:- 25/10/2021)

Based on your acquired skills from all the lab works, complete the following.

- Build a Simple Network (include wired and wireless devices) and dedicate an IP Addressing scheme to the network.
- Configure the IP Address
- Use necessary commands to check if the connection is successful and document the results (use appropriate screen capture).
- Draw both Physical and Logical Topology and document the successful network.

Note: This work could be designed based on the scenario given for your coursework (Task 3: Point 2, 3, 4) and attach the same work for final submission as well.

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
	NIC			

LAB Objectives

Understand the types, purpose and functionality of various networking devices and configure them.

Requirements

- Use Packet Tracer to create a topology as per the requirement

Task 1: Understand Networking Devices.

Introduction:

LAN switches provide connectivity for a local area network. Routers interconnect local networks and are needed in a WAN environment.



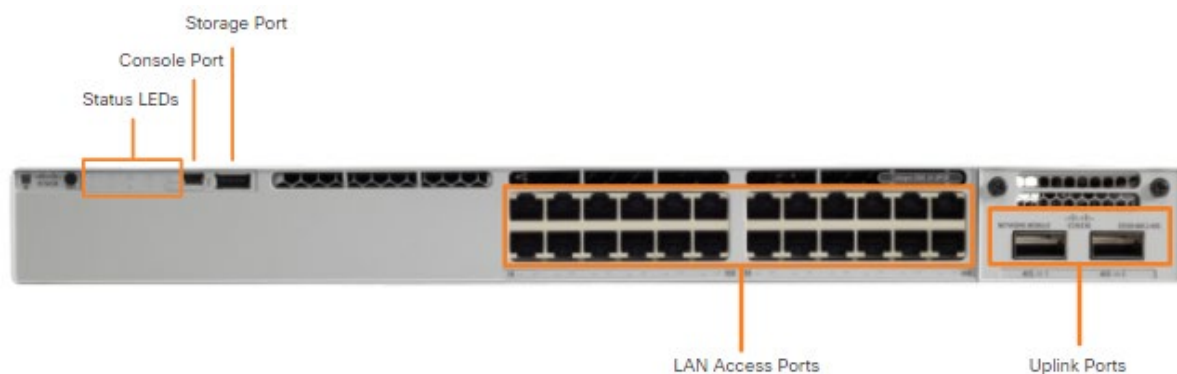
Cisco Catalyst 9300 Series Switches



Cisco 4300 Series Routers

When selecting a switch, keep in mind the **type of ports, speed required, expandability, and manageability of the device.**

- ✓ **Lower-cost switches** support only copper twisted-pair ports whereas **higher priced switches** may have fiber-optic connections to link the switch to other switches that may be located over long distances.
- ✓ A 10/100 Ethernet port can only function at either 10 or 100 Mbps. Switches may also include gigabit Ethernet ports that can also operate at 10/100 Mbps.
- ✓ **Fixed configurations** have a specific type and number of ports or interfaces and **Modular devices** have expansion slots that provide the flexibility to add new modules as required.
- ✓ A **managed switch** can be configured and controlled.
- ✓ Switches that support **Power over Ethernet (PoE)** allows some devices to be powered by attaching a cable from the device to a switch port.
- ✓ Uplink ports are used to connect to other switches.



Understanding a Switch:

Checklist: (What you need to connect and configure a switch)

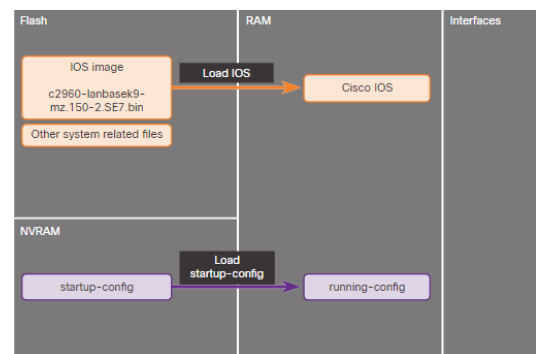
- ✓ console cable,
- ✓ power cord,
- ✓ Ethernet cable, and
- ✓ switch documentation



There are two methods to connect a PC to a network device to monitor or configure 1. Out-of-band management and 2. In-band management

Two files load into RAM when a switch boots

- **IOS image file** that is initially stored in flash, but loaded into RAM
- **Startup configuration** file that is initially stored in NVRAM (then loaded into RAM) and contains configuration commands



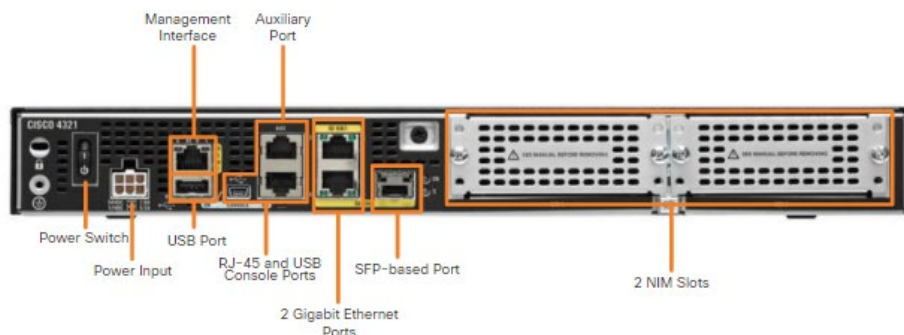
Understanding a Router:

Routers have components similar to computers, tablets, and smart devices:

- ✓ Operating system (OS) that is Cisco Internetwork Operating System (IOS)
- ✓ Central processing unit (CPU)
- ✓ Random-access memory (RAM)
- ✓ Nonvolatile random-access memory (NVRAM)

Each router model has a different type and number of ports. An example is a Cisco 4321 Integrated Services Router (ISR) that has the following connections:

- ✓ Multiple console ports used for initial configuration and command-line interface (CLI) work that includes an RJ-45 and mini-B USB connectors.
- ✓ Two RJ-45 LAN Gigabit Ethernet interfaces
- Expansion slots that can hold network interface modules (NIMs)



Connecting and Configuring a Switch/ Router

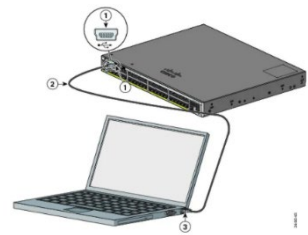
Out-of-band management

- ✓ Requires a **console cable connection**, not a network connection, and a terminal emulation client
- ✓ Commonly done to initially configure a device
- ✓ Might be done if network connectivity is not possible

In-band management

- ✓ Uses a **network connection** and an IP address to connect to the network device. (**Virtual Terminals** – we discussed during our previous lecture session)
- ✓ Telnet, HTTP, or SSH used

Step 1: Connect the console cable to the switch/ Router and start a terminal emulation session. Connect the AC power cord for a switch/ power on the router.



Step 2: Power up the switch and note that some models do not have an on/off switch. Power-on self-test (POST) begins. Observe startup messages.

```

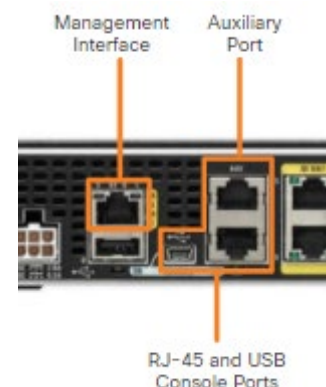
Located isr4200-universalk9_ias.16.09.04.SPA.bin
*****
(output omitted)

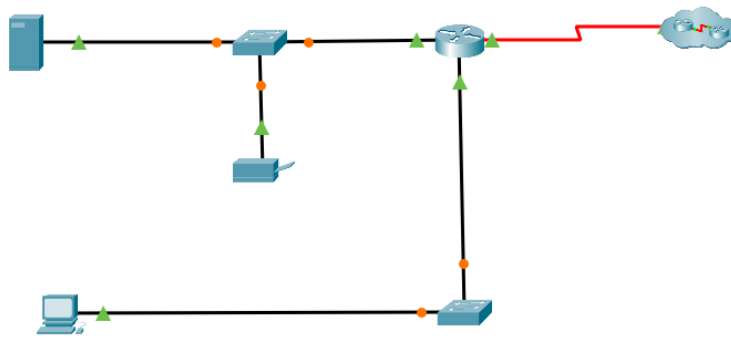
Package header rev 3 structure detected
IsoSize = 486723584
Calculating SHA-1 hash...Validate package: SHA-1 hash:
  calculated 4155409B:CC0DB23E:6D72A6AE:EA887F82:AC94DC6A
  expected   4155409B:CC0DB23E:6D72A6AE:EA887F82:AC94DC6A
RSA Signed RELEASE Image Signature Verification Successful.
Image validated
  
```

On both Switch and Router:

To access the CLI on a router three methods can be used

- ✓ Console port (serial or USB connection) for out-of-band management
- ✓ SSH using the network and an IP address on the router
- ✓ AUX port that can connect to a modem and a dial-up telephone line
- ✓ LAN and WAN interfaces are available as a type of network interface.





Topology 1

To configure a router or a switch in a real time, refer to our lecture video's. Below are the instructions to configure using packet tracer. (If working with Real Time Devices, use PC's for Printer and Server. A router with Serial Connection for ISP)

- ✓ The Cisco IOS command line interface (CLI) is a text-based program that enables entering and executing Cisco IOS commands to configure, monitor, and maintain Cisco devices.
- ✓ The Cisco CLI can be used with either in-band or out-of-band management tasks.
- ✓ CLI commands are used to alter the configuration of the device and to display the current status of processes on the router.
- ✓ The CLI can be used to enter Cisco IOS commands.

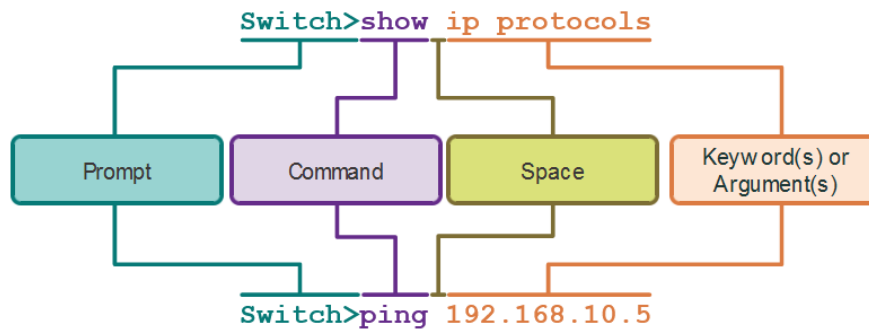
```

Router con0 is now available

Press RETURN to get started!

Router> enable
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# hostname R1
R1(config)# interface gigabitethernet 0/0/0
R1(config-if)#
  
```

Command Mode	Description	Default Device Prompt
User Exec Mode	Mode allows access to only a limited number of basic monitoring commands. It is often referred to as "view-only" mode.	Switch> Router>
Privileged EXEC Mode	Mode allows access to all commands and features. The user can use any monitoring commands and execute configuration and management commands.	Switch# Router#



Command	Used to
show running-config	Verify the current configuration and settings.
show interfaces	Verify the interface status and see if there are any error messages.
show ip interface	Verify the Layer 3 information of an interface.
show arp	Verify the list of known hosts on the local Ethernet LANs.
show ip route	Verify the Layer 3 routing information.
show protocols	Verify which protocols are operational.
show version	Verify the memory, interfaces, and licenses of the device.

Key Stroke	Description
Ctrl+E	Moves the cursor to the end of command line.
Up Arrow or Ctrl+P	Recalls the previous command in the history buffer, beginning with the most recent command.
Down Arrow or Ctrl+N	Goes to the next line in the history buffer.
Ctrl+R or Ctrl+I or Ctrl+L	Redisplays the system prompt and command line after a console message is received.
Enter	Displays the next line.
Space	Displays the next screen.
Any other key*	Ends the display string, returning to previous prompt. *Except "y", which answers "yes" to the --More-- prompt, and acts like the Space.

Ctrl-C	When in any configuration mode, ends the configuration mode and returns to privileged EXEC mode. When in setup mode, aborts back to the command prompt.
Ctrl-Z	When in any configuration mode, ends the configuration mode and returns to privileged EXEC mode.
Ctrl-Shift-6	All-purpose break sequence used to abort DNS lookups, traceroutes, pings, and to interrupt an IOS process.
Backspace	Erases the character to the left of the cursor.
Ctrl+D	Erases the character at the cursor.
Ctrl+K	Erases all characters from the cursor to the end of the command line.
Esc D	Erases all characters from the cursor to the end of the word.
Ctrl+U or Ctrl+X	Erases all characters from the cursor back to the beginning of the command line.
Ctrl+W	Erases the word to the left of the cursor.
Ctrl+A	Moves the cursor to the beginning of the line.
Left Arrow or Ctrl+B	Moves the cursor one character to the left.

Router Basic Configuration

Step 1. Configure the device name.

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

```
Router(config)# hostname R1
```

Step 2. Privileged EXEC mode.

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

```
R1(config)# enable password class
```

Step 3. Secure privileged EXEC mode.

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

```
R1(config)# enable secret class
```

Step 4. Secure user EXEC mode.

```
Router(config)# line console 0
Router(config-line)# password password
R1(config-line)# password cisco
Router(config-line)# login
```

Step 5. Secure remote Telnet / SSH access.

```
Router(config-line)# line vty 0 4
Router(config-line)# password password
R1(config-line)# password cisco
Router(config-line)# login
Router(config-line)# transport input {ssh | telnet | none | all}
R1(config-line)# transport input ssh telnet
```

Step 6. Secure all passwords in the config file.

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

Step 7. Provide legal notification.

```
Router(config)# banner motd delimiter message delimiter
```

Step 8. Save the configuration.

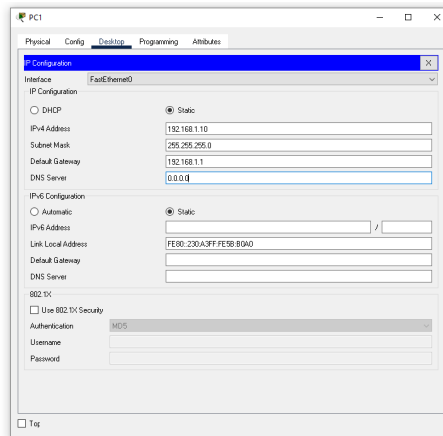
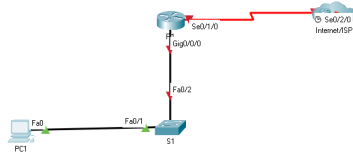
```
Router# copy running-config startup-config
```

Before beginning to configure your network, understand another aspect of network.

If your local network has only one router, it will be the gateway router, and all hosts and switches on your network must be configured with this information. The default gateway is only used when the host wants to send 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. The IP address of the host device and the router interface address must be in the same network.

In our Topology 1, R1's Gi0/0/0 will be the default gateway for that LAN Network.

Let's assume that the following design is made for the above topology. (Consider this as a sample for your Task 2 and also your Coursework Task)



S1 → CLI

```
Switch>enable
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#host
Switch(config)#hostname S1
S1(config)#enab
S1(config)#enable se
S1(config)#enable secret cisco
S1(config)#ser
S1(config)#service ?
    dhcp          Enable DHCP server and relay agent
    password-encryption  Encrypt system passwords
    timestamps     Timestamp debug/log messages
S1(config)#service pas
S1(config)#service password-encryption
S1(config)#line con 0
S1(config-line)#pass
S1(config-line)#password cisco
S1(config-line)#login
S1(config-line)#logg
S1(config-line)#logging sy
S1(config-line)#logging synchronous
S1(config-line)#exit
S1(config)#show vlan brief
^
% Invalid input detected at '^' marker.
S1(config)#do show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gig0/1, Gig0/2
1002	fdi-default	active	
1003	token-ring-default	active	
1004	fdinet-default	active	
1005	trnet-default	active	

```
S1(config)#int
S1(config)#interface vlan 1
S1(config-if)#ip add
S1(config-if)#ip address 192.168.1.9 255.255.255.0
S1(config-if)#exit
S1(config)#ip de
S1(config)#ip default-gateway 192.168.1.1
S1(config)#
```

```
S1(config)#line vty ?
    <0-15> First Line number
S1(config)#line vty 0 4
S1(config-line)#pas
S1(config-line)#password cisco
S1(config-line)#log
S1(config-line)#login
S1(config-line)#login
S1(config-line)#logg
S1(config-line)#logging s
S1(config-line)#logging synchronous
S1(config-line)#tr
S1(config-line)#transport in
S1(config-line)#transport input ?
    all      All protocols
    none     No protocols
    ssh      TCP/IP SSH protocol
    telnet   TCP/IP Telnet protocol
S1(config-line)#transport input all
S1(config-line)#exit
```

```
S1(config)#banner motd "
Enter TEXT message. End with the character ''.
Restricted Access - Only to ACCA4024 "#
```

```

S1#sho running-config
Building configuration...

Current configuration : 1330 bytes
!
version 15.0
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
!
hostname S1
!
enable secret 5 $1$mERr$hX5rVt7rPNoS4wqbXKX7m0
!
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
  --More-- |

```

R1 → CLI

--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: no

Press RETURN to get started!

```

Router>enab
Router>enable
Router#confi t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#host
Router(config)#hostname R1
R1(config)#ip domain-n
R1(config)#ip domain-name www.acca4024.com
R1(config)#no ip doma
R1(config)#no ip domain-l
R1(config)#no ip domain-lookup

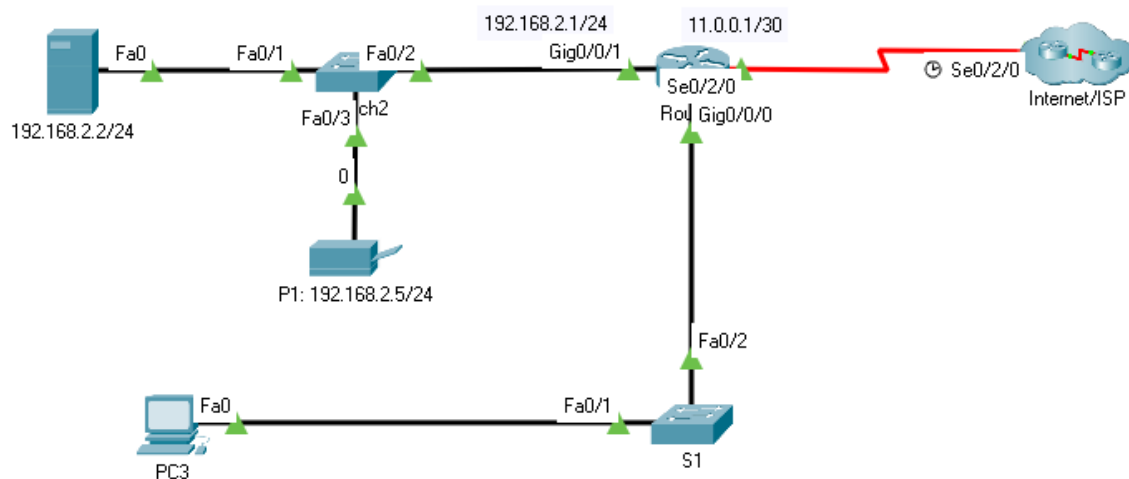
R1(config)#interface gi0/0/0
R1(config-if)#ip add
R1(config-if)#des
R1(config-if)#description LAN Network
R1(config-if)#ip ad
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#no shutdown

R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up

R1(config-if)#exit

```



Switch Commands (Reference)

Switch>enable

Switch#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Switch(config)#hostname S1

S1(config)#enable secret cisco

S1(config)#line console 0

S1(config-line)#password ciscocon

S1(config-line)#login

S1(config-line)#logging synchronous

S1(config-line)#exit

S1(config)#line vty 0 4

S1(config-line)#password ciscovty

S1(config-line)#login

S1(config-line)#logging synchronous

S1(config-line)#transport input all

S1(config-line)#exit

S1(config)#service password-encryption

S1(config)#int vlan 1

S1(config-if)#ip address 192.168.1.9 255.255.255.0

S1(config-if)#no shut

S1(config-if)#exit

S1(config)#ip default-gateway 192.168.1.1

S1(config)#banner motd "

Enter TEXT message. End with the character "".
Restricted Access only for ACCA4024 "
S1(config)#exit

```
Restricted Access only for ACCA4024
User Access Verification
Password:
S1>ena
S1>enable
Password:
S1#
```

Router Commands (Reference)

Router(config)#hostname R1
R1(config)#enable secret cisco

R1(config)#no ip domain-lookup

R1(config)#ip domain-name www.acca4024.com

R1(config)#username admin secret cisco
R1(config)#exit

R1#
R1(config)#line con 0
R1(config-line)#password cisco
R1(config-line)#login
R1(config-line)#logging synchronous
R1(config-line)#exit

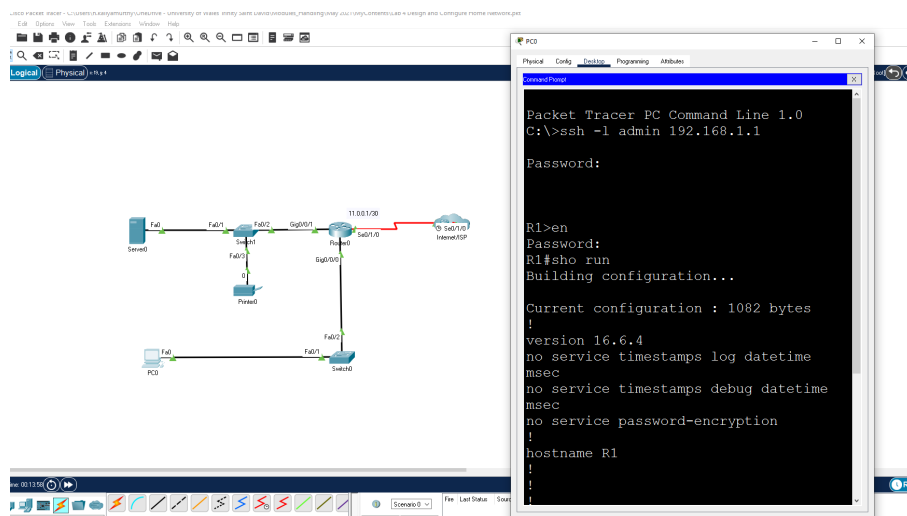
R1(config)#line vty 0 1
R1(config-line)#password ciscovty
R1(config-line)#logging synchronous
R1(config-line)#transport input all
R1(config-line)#exit

R1(config)#crypto key ?
generate Generate new keys
zeroize Remove keys

R1(config)#crypto key generate rsa
The name for the keys will be: R1.www.acca4024.com
Choose the size of the key modulus in the range of 360 to 2048 for your
General Purpose Keys. Choosing a key modulus greater than 512 may take
a few minutes.

How many bits in the modulus [512]: 1024
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]

R1(config)#ip ssh version 2
R1(config)#



Learnings from tutorials done so far:

- ✓ Build a Simple Network
- ✓ Understand and configure IP Address
- ✓ Use Ping/ Trace route Utility to check the connection status
- ✓ Use ipconfig /all command to determine the MAC address of a Windows computer on an Ethernet network.
- ✓ Analyze a MAC address to determine the manufacturer.
- ✓ Analyze the Wired and Wireless Network connection.
- ✓ Analyze Address Resolution Protocol (ARP).
- ✓ Connect to a Wireless Router and configure the basic settings in a wireless router
- ✓ Use nslookup command to understand the url to ip conversion
- ✓ Build a Small Network, do basic configurations and establish a successful network connectivity.
- ✓ Use simulated/real time environment in packet tracer.