



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

COMPUTER NETWORKS

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Class	CS-A
Lab	13
Course	Computer Networks
Date	26 th -December-25
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Lab – 12

IP Routing protocols

Warm-up Task [30 Minutes]

1. What is the Internet of Things (IoT)?

The Internet of Things (IoT) refers to a network of everyday physical objects—like appliances, vehicles, sensors, and machines—that are connected to the internet. These devices can collect, share, and act on data without requiring constant human input.

2. How do IoT devices collect and transmit data?

- **Collection:** IoT devices use built-in sensors (temperature, motion, GPS, cameras, etc.) to gather information from their environment.
 - **Transmission:** The collected data is sent through communication technologies such as Wi-Fi, Bluetooth, Zigbee, or cellular networks to other devices or cloud platforms for processing and analysis.
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3. What are the main components of an IoT system?

- **Devices/Sensors:** Physical objects that detect and measure data.
 - **Connectivity:** Communication channels (Wi-Fi, 4G/5G, Bluetooth, etc.) that link devices to networks.
 - **Data Processing:** Cloud servers or local gateways that analyze and interpret the data.
 - **User Interface:** Applications or dashboards that allow humans to monitor, control, and interact with IoT devices.
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4. What is the primary role of IoT in modern networks?

IoT's main role is to enable **automation and real-time communication** between devices. It integrates physical systems with digital networks, allowing organizations and individuals to monitor, control, and optimize processes more efficiently.

5. How does IoT improve efficiency in smart homes?

- **Energy Management:** Smart thermostats and lighting systems reduce unnecessary energy use.
 - **Automation:** Devices like smart locks, appliances, and assistants perform tasks automatically.
 - **Convenience:** Centralized control through apps or voice assistants saves time and effort.
 - **Monitoring:** Sensors detect issues (like water leaks or smoke) early, preventing damage and reducing costs.
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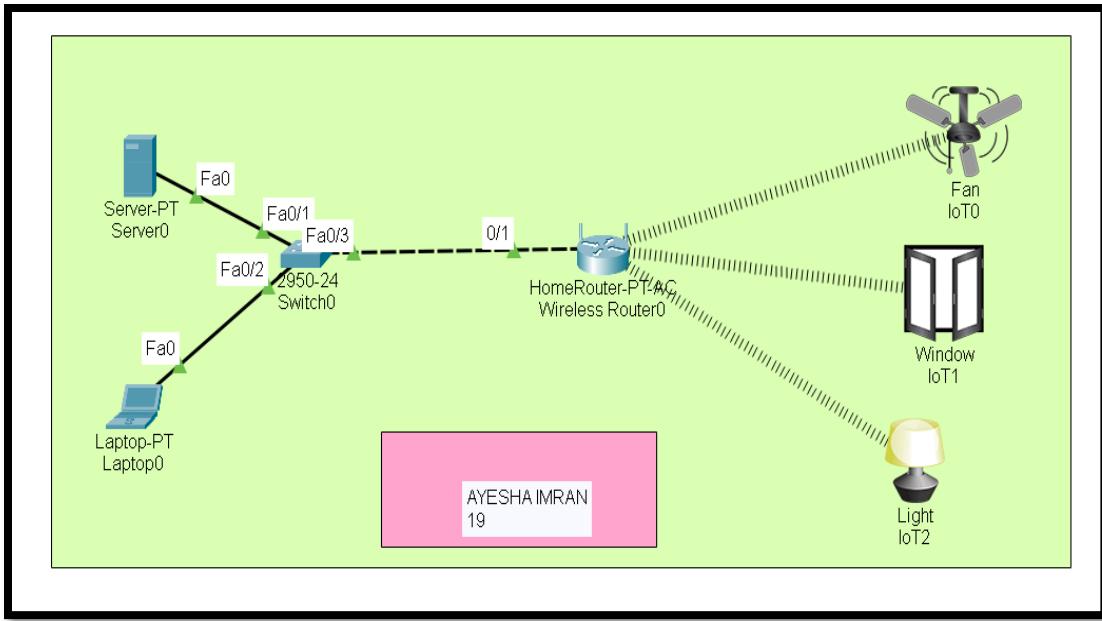
6. What are the common security challenges associated with IoT networks?

- **Weak Authentication:** Many devices lack strong password protection.
 - **Data Privacy Risks:** Sensitive personal data can be exposed if not encrypted.
 - **Device Vulnerabilities:** Insecure firmware or outdated software can be exploited.
 - **Large Attack Surface:** With millions of devices connected, hackers have more entry points.
 - **Denial of Service (DoS) Attacks:** Compromised IoT devices can be used in botnets to disrupt services.
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TASK 01:

Instructions:

- Implement the given topology diagram.
- Make Server Account/profile of your name and roll number instead of Admin for example “ali05”
- Operate all IOT devices from Client laptop and take screen shots.
- Send packets(Simulation).



S E R V E R

Step 1: goto AAA, add client Account, and devices

Physical Config Services Desktop Programming Attributes

SERVICES

- HTTP
- DHCP
- DCHPv6
- TFTP
- DNS
- SYSLOG
- AAA**
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

AAA

Service On Off Radius Port 1645

Network Configuration

Client Name Client IP
Secret ServerType Radius

	Client Name	Client IP	Server Type	Key
1	home	192.168.0.1	Radius	pass

Add Save Remove

User Setup

Username Password

	Username	Password
1	fan	fan
2	light	light
3	window	window

Add Save Remove

The screenshot shows a software interface for managing network services. The top navigation bar includes tabs for Physical, Config, Services, Desktop, Programming, and Attributes. The Services tab is selected, revealing a sidebar with a list of service types: HTTP, DHCP, DCHPv6, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, FTP, IoT, VM Management, and Radius EAP. The AAA section is currently active, displaying settings for a radius port (1645) and a table of client configurations. The table has columns for Client Name, Client IP, Server Type, and Key. One entry is present: Client Name 'home' with Client IP '192.168.0.1', Server Type 'Radius', and Key 'pass'. Below this is a 'User Setup' section with tables for Username and Password. The first row shows 'fan' with 'fan' as both Username and Password. The second row shows 'light' with 'light' as both Username and Password. The third row shows 'window' with 'window' as both Username and Password. Each section includes 'Add', 'Save', and 'Remove' buttons.

Step 02: goto IoT and just ON

Physical Config Services Desktop Programming Attributes

SERVICES	
HTTP	Registration Server
DHCP	This service runs on top of the HTTP or HTTPS service.
DHCPv6	
TFTP	
DNS	
SYSLOG	
AAA	
NTP	
EMAIL	
FTP	
IoT	
VM Management	
Radius EAP	

Service On

Username	Password
1 admin	admin

Router Configuration:

Step 01: goto Wireless

2.4 GHz

Network Mode: Auto

Network Name (SSID): home

SSID Broadcast: Enabled Disabled

Standard Channel: 1 - 2.412GHz

Channel Bandwidth: 20 MHz

5 GHz - 2

Network Mode: Auto

Network Name (SSID): home

SSID Broadcast: Enabled Disabled

Standard Channel: 165 - 5.825GHz

Channel Bandwidth: 20 MHz

5 GHz - 1

Network Mode: Auto

Network Name (SSID): home

SSID Broadcast: Enabled Disabled

Standard Channel: Auto

Channel Bandwidth: Auto

Step 02: goto wireless security:

Physical	Config	GUI	Attributes
2.4 GHz			
Security Mode:	WPA2 Enterprise		
Encryption:	AES		
RADIUS Server:	192	.	168
RADIUS Port:	1645		
Shared Secret:	pass		
Key Renewal:	3600 seconds		
5 GHz - 1			
Security Mode:	WPA2 Enterprise		
Encryption:	AES		
RADIUS Server:	192	.	168
RADIUS Port:	1645		
Shared Secret:	pass		
Key Renewal:	3600 seconds		
5 GHz - 2			
Security Mode:	WPA2 Enterprise		
Encryption:	AES		
RADIUS Server:	192	.	168
RADIUS Port:	1645		
Shared Secret:	pass		
Key Renewal:	3600 seconds		

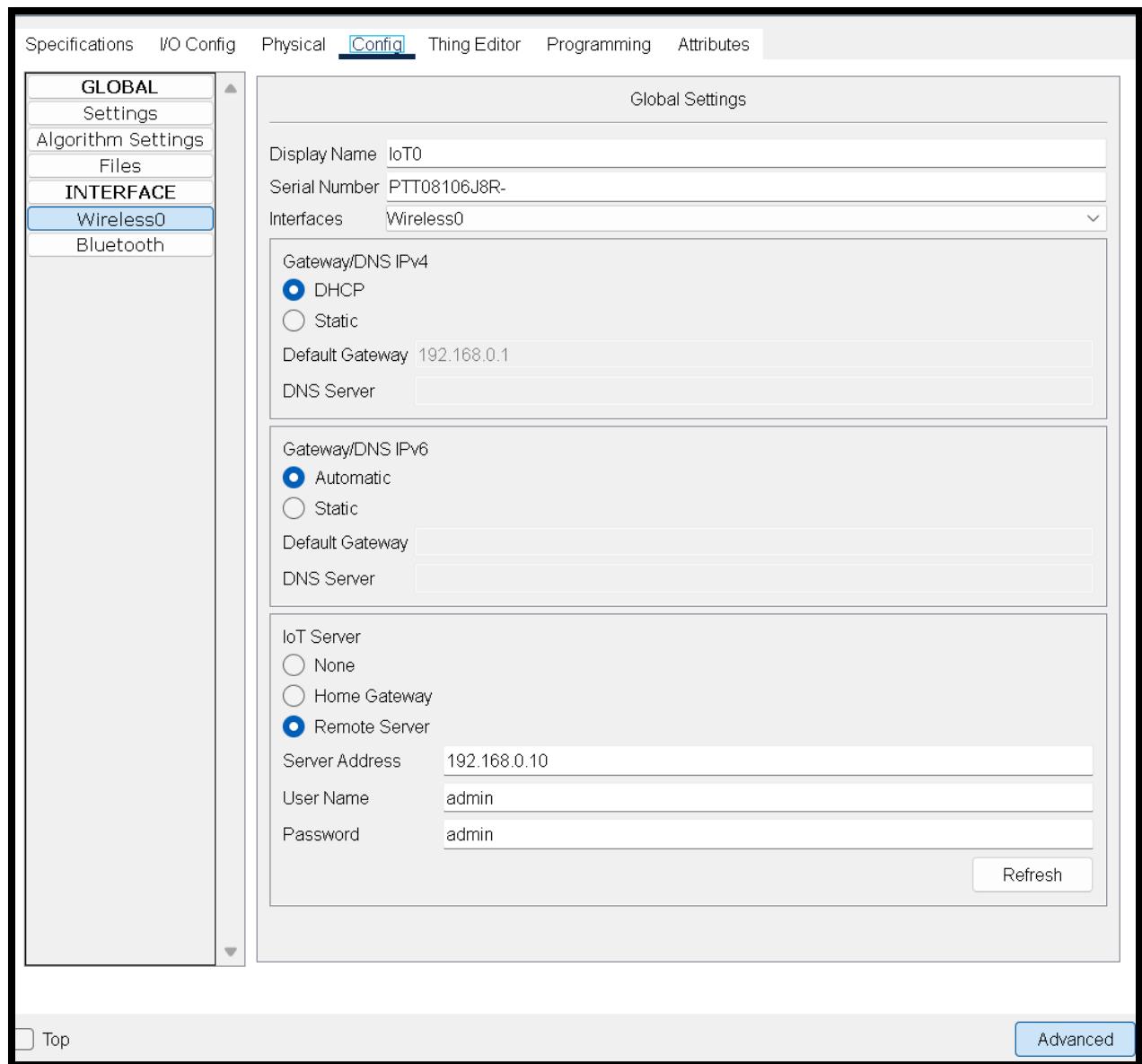
Fan Configuration:

Step 01: goto Wireless0 then config:

Specifications Physical **Config** Attributes

GLOBAL	Wireless0		
Settings	Port Status		
Algorithm Settings	Bandwidth		
Files	300 Mbps		
INTERFACE	MAC Address		
Wireless0	0090.2B7B.D998		
Bluetooth	SSID		
	home		
Authentication			
<input type="radio"/> Disabled	<input type="radio"/> WEP	WEP Key	
<input type="radio"/> WPA-PSK	<input type="radio"/> WPA2-PSK	PSK Pass Phrase	
<input type="radio"/> WPA	<input checked="" type="radio"/> WPA2	User ID	fan
<input type="radio"/> 802.1X		Password	fan
	Method:	MD5	
		User Name	
		Password	
		Encryption Type	AES
IP Configuration			
<input checked="" type="radio"/> DHCP	IPv4 Address		
<input type="radio"/> Static	192.168.0.103		
	Subnet Mask		
	255.255.255.0		
IPv6 Configuration			
<input checked="" type="radio"/> Automatic	IPv6 Address		
<input type="radio"/> Static	/		
Link Local Address: FE80::290:2BFF:FE7B:D998			

Step 02: goto remote Server:



Repeat these process for all the devices :

Lamp:

Specifications Physical **Config** Attributes

GLOBAL

Settings

Algorithm Settings

Files

INTERFACE

Wireless0

Bluetooth

Global Settings

Display Name IoT2

Serial Number PTT081096NA-

Interfaces Wireless0

Gateway/DNS IPv4

DHCP

Static

Default Gateway 192.168.0.1

DNS Server

Gateway/DNS IPv6

Automatic

Static

Default Gateway

DNS Server

IoT Server

None

Home Gateway

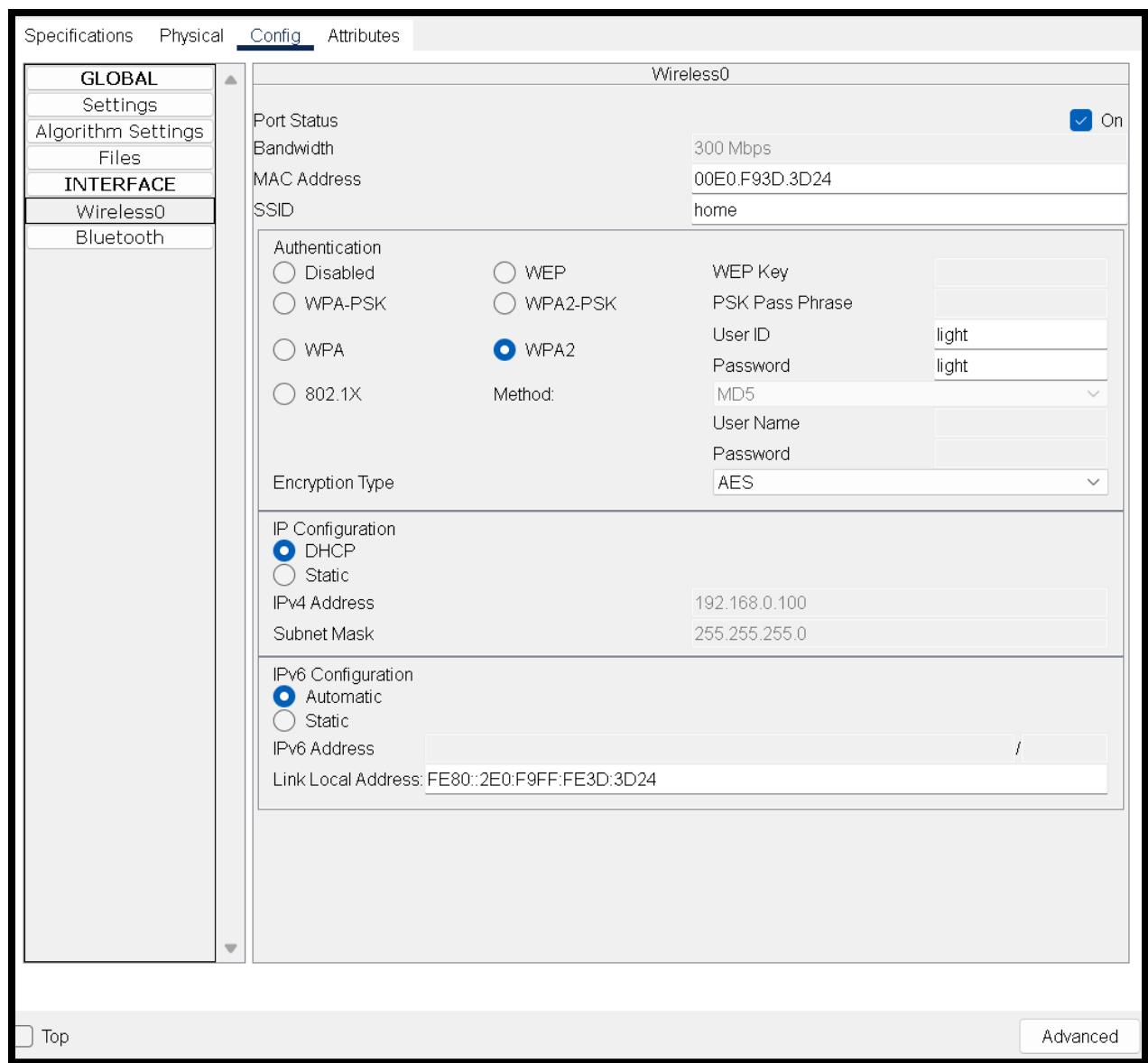
Remote Server

Server Address 192.168.0.10

User Name admin

Password admin

Refresh



Window:

Specifications I/O Config Physical **Config** Thing Editor Programming Attributes

GLOBAL

- Settings
- Algorithm Settings
- Files

INTERFACE

- Wireless0
- Bluetooth

Global Settings

Display Name IoT1

Serial Number PTT0810U0HE-

Interfaces Wireless0

Gateway/DNS IPv4

DHCP
 Static

Default Gateway 192.168.0.1

DNS Server

Gateway/DNS IPv6

Automatic
 Static

Default Gateway

DNS Server

IoT Server

None
 Home Gateway
 Remote Server

Server Address 192.168.0.10

User Name admin

Password admin

Top

Specifications Physical **Config** Attributes

GLOBAL

Settings
Algorithm Settings
Files

INTERFACE

Wireless0
Bluetooth

Global Settings

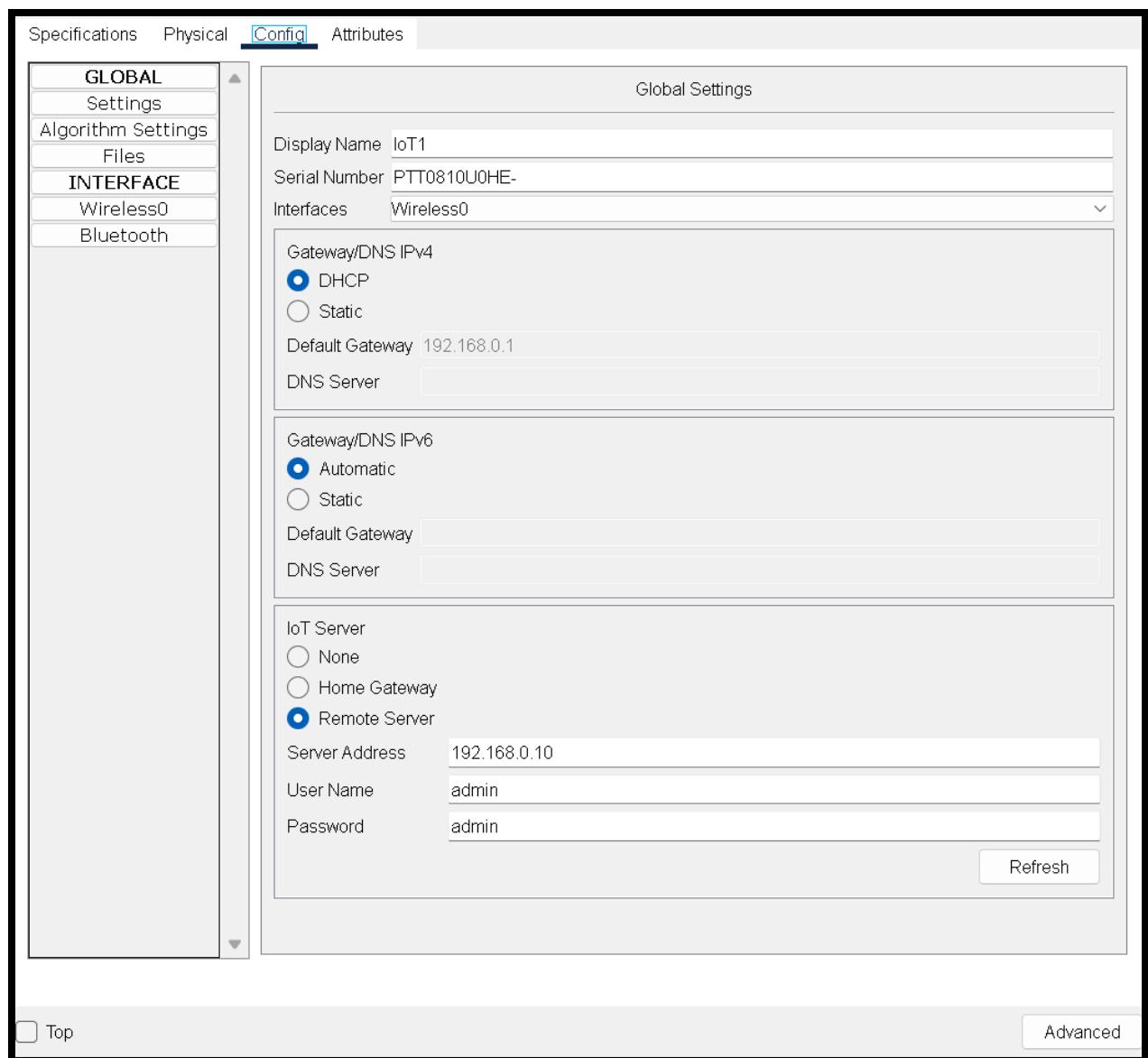
Display Name IoT1
Serial Number PTT0810U0HE-
Interfaces Wireless0

Gateway/DNS IPv4
 DHCP
 Static
Default Gateway 192.168.0.1
DNS Server

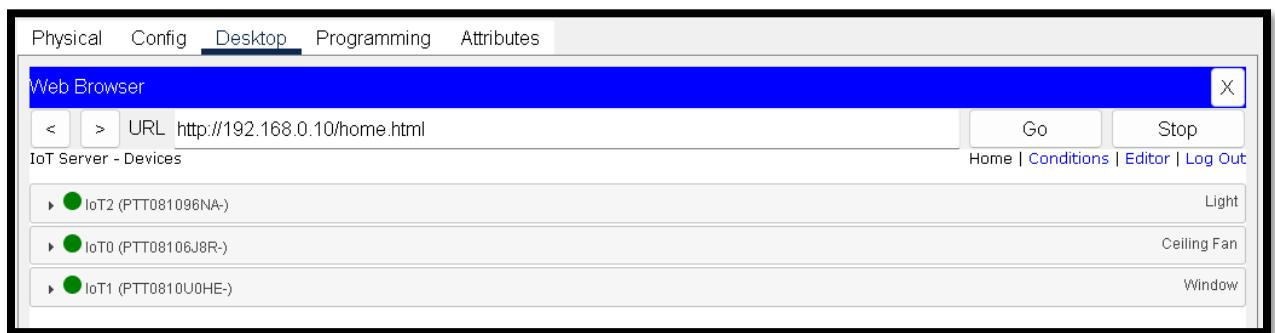
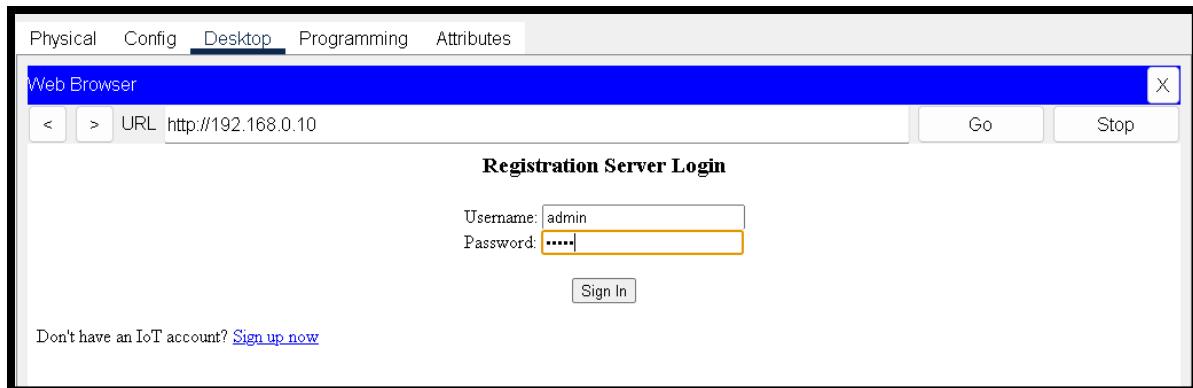
Gateway/DNS IPv6
 Automatic
 Static
Default Gateway
DNS Server

IoT Server
 None
 Home Gateway
 Remote Server
Server Address 192.168.0.10
User Name admin
Password admin

Top



Make User Account On the Laptop Device:



Now you can control the devices From IoT Monitor

Packet Real Time:

Realtime Simulation											
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete	
●	Successful	Server0	IoT2	ICMP	■	0.000	N	0	(edit)	(delete)	
●	Successful	Server0	IoT1	ICMP	■	0.000	N	1	(edit)	(delete)	
●	Successful	Server0	IoT0	ICMP	■	0.000	N	2	(edit)	(delete)	
●	Successful	Server0	Wireless R...	ICMP	■	0.000	N	3	(edit)	(delete)	

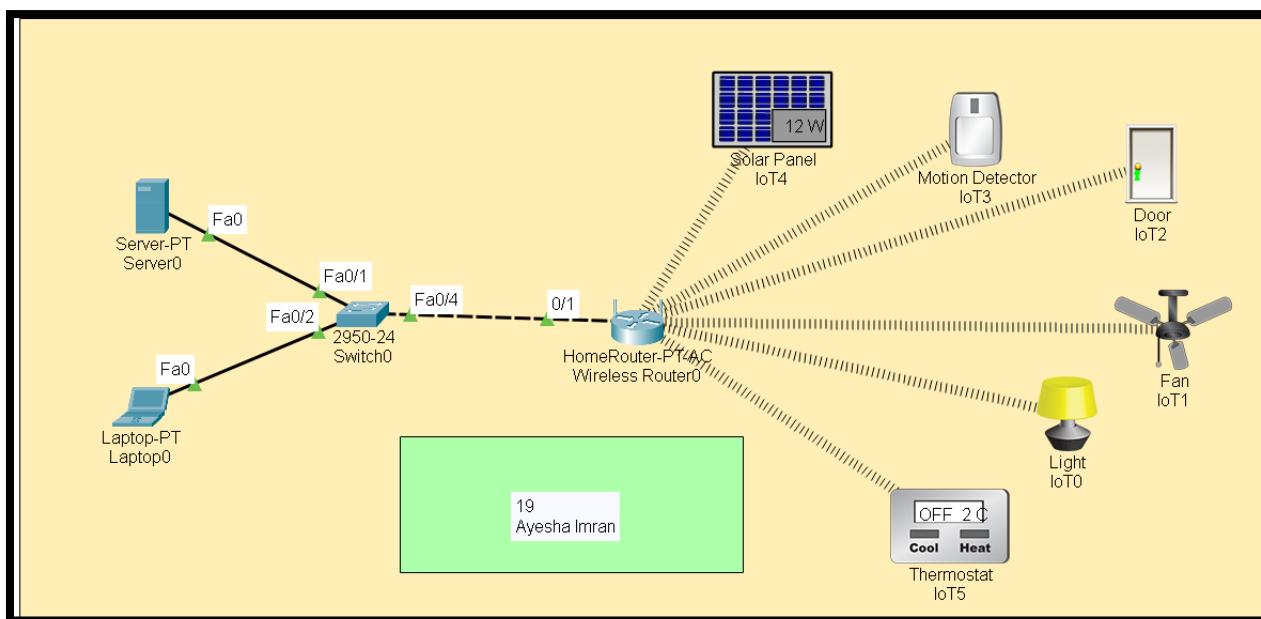
Post Lab Task

Design a smart home network using Cisco Packet Tracer. The smart home will include various IoT devices for automation and monitoring, and it will utilize solar panels for renewable energy.

Your goal is to ensure that all devices are connected and can be managed centrally.

Add IoT Devices:

- Place smart lights, smart Fans, a smart thermostat, smart door lock, smart motion sensors, smart plugs, and a smart energy meter in the topology.
- Add the solar panel system with a monitoring interface.
- Instructions:
- Implement the given topology diagram.
- Make Server Account/profile of your name and roll number instead of Admin
- for example “ali05” otherwise you will get zero marks.
- Operate all IOT devices from Client laptop and take screen shots.



Server Configuration:

Physical Config Services Desktop Programming Attributes

SERVICES

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA**
- NTP
- EMAIL
- FTP
- IoT

VM Management Radius EAP

AAA

Service On Off Radius Port 1645

Network Configuration

Client Name Client IP
Secret ServerType

	Client Name	Client IP	Server Type	Key
1	home	192.168.0.1	Radius	pass

Add Save Remove

User Setup

Username Password

	Username	Password
1	solar	solar
2	motion	motion
3	door	door
4	fan	fan
5	light	light
6	thermo	thermo

Add Save Remove

The screenshot shows a software interface for managing network services. The 'Services' tab is selected, displaying options like HTTP, DHCP, DNS, etc., with 'AAA' highlighted. Under the 'AAA' section, 'Radius Port' is set to 1645. The 'User Setup' section lists six users with their respective usernames and passwords.

Index	Username	Password
1	solar	solar
2	motion	motion
3	door	door
4	fan	fan
5	light	light
6	thermo	thermo

SOLAR PANEL:

Specifications Physical **Config** Attributes

GLOBAL

Settings
Algorithm Settings
Files

INTERFACE

Wireless0 **Bluetooth**

Global Settings

Display Name IoT4
Serial Number PTT0810WPIA-
Interfaces Wireless0

Gateway/DNS IPv4

DHCP
 Static
Default Gateway 192.168.0.1
DNS Server

Gateway/DNS IPv6

Automatic
 Static
Default Gateway
DNS Server

IoT Server

None
 Home Gateway
 Remote Server
Server Address 192.168.0.10
User Name admin
Password admin

Refresh

GLOBAL

Settings

Algorithm Settings

INTERFACE

FastEthernet0

FastEthernet0

Port Status

Bandwidth

Duplex

MAC Address

On 100 Mbps 10 Mbps Auto
Half Duplex Full Duplex Auto

00D0.58CA.159E

IP Configuration

DHCP
 Static

IPv4 Address: 192.168.0.10

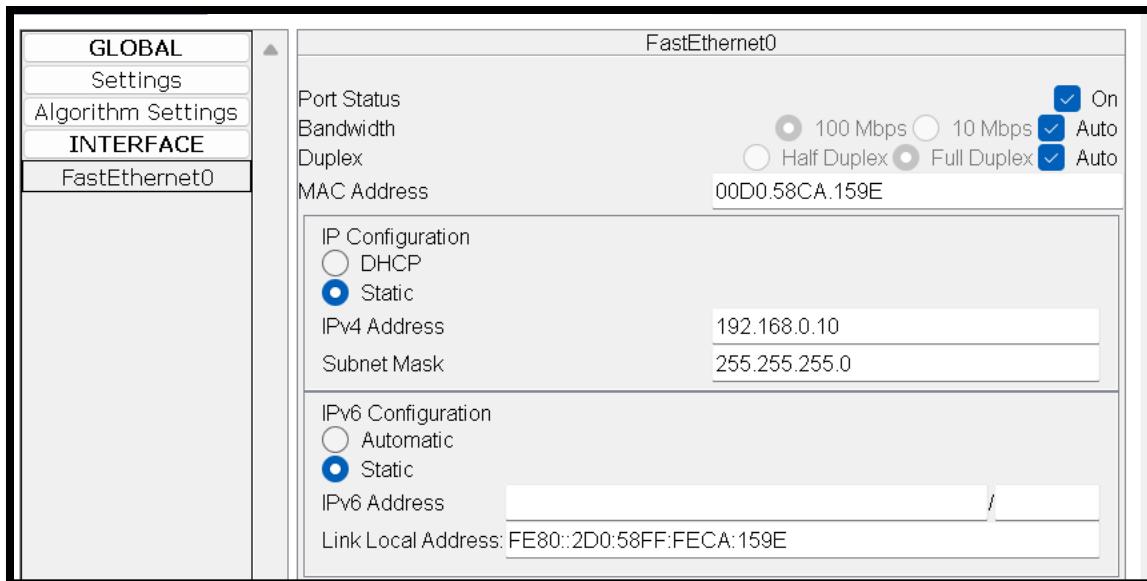
Subnet Mask: 255.255.255.0

IPv6 Configuration

Automatic
 Static

IPv6 Address: /

Link Local Address: FE80::2D0:58FF:FECA:159E



Router Configuration:

Wireless Security

2.4 GHz					
Security Mode:	WPA2 Enterprise				
Encryption:	AES				
RADIUS Server:	192	.	168	.	0
RADIUS Port:	1645				
Shared Secret:	pass				
Key Renewal:	3600 seconds				
5 GHz - 1					
Security Mode:	WPA2 Enterprise				
Encryption:	AES				
RADIUS Server:	192	.	168	.	0
RADIUS Port:	1645				
Shared Secret:	pass				
Key Renewal:	3600 seconds				
5 GHz - 2					
Security Mode:	WPA2 Enterprise				
Encryption:	AES				
RADIUS Server:	192	.	168	.	0
RADIUS Port:	1645				
Shared Secret:	pass				
Key Renewal:	3600 seconds				

Motion Sensor:

Specifications IO Config Physical **Config** Thing Editor Programming Attributes

GLOBAL

- Settings
- Algorithm Settings
- Files

INTERFACE

- Wireless0**
- Bluetooth

Display Name IoT3

Serial Number PTT08108620-

Interfaces Wireless0

Gateway/DNS IPv4

- DHCP
- Static

Default Gateway 192.168.0.1

DNS Server

Gateway/DNS IPv6

- Automatic
- Static

Default Gateway

DNS Server

IoT Server

- None
- Home Gateway
- Remote Server

Server Address 192.168.0.10

User Name admin

Password admin

Physical Config **Desktop** Programming Attributes

Web Browser X

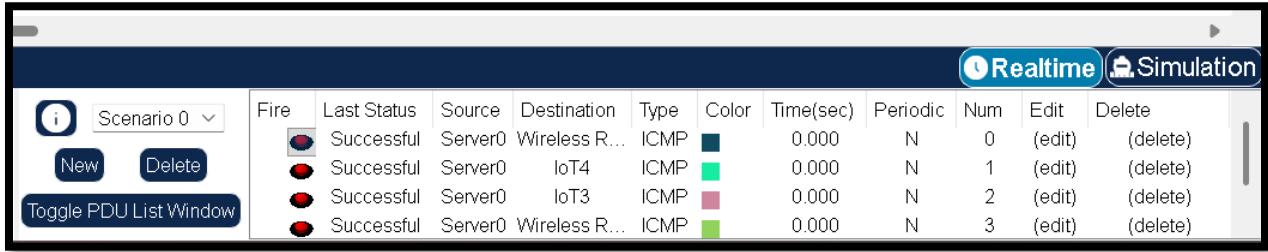
< > URL http://192.168.0.10/home.html Go Stop

Home | Conditions | Editor | Log Out

IoT Server - Devices

Device	Type
IoT4 (PTT0810WPIA-)	Solar
IoT3 (PTT08108620-)	Motion Detector
IoT2 (PTT08106K6S-)	Door
IoT1 (PTT08100NNNA-)	Ceiling Fan
IoT0 (PTT0810103J-)	Light
IoT5 (PTT08103GM2-)	Thermostat

Packet Send:



The screenshot shows a software interface for managing network traffic. At the top right, there are two tabs: "Realtime" and "Simulation". On the left, there's a toolbar with icons for "New" and "Delete", and a button labeled "Toggle PDU List Window". The main area is a table with the following columns: Fire, Last Status, Source, Destination, Type, Color, Time(sec), Periodic, Num, Edit, and Delete. The table contains four rows, each representing a successful ICMP packet transmission from Server0 to various destinations (IoT4, IoT3, Wireless R...). The "Edit" and "Delete" buttons are located at the end of each row.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Server0	Wireless R...	ICMP	■	0.000	N	0	(edit)	(delete)
	Successful	Server0	IoT4	ICMP	■	0.000	N	1	(edit)	(delete)
	Successful	Server0	IoT3	ICMP	■	0.000	N	2	(edit)	(delete)
	Successful	Server0	Wireless R...	ICMP	■	0.000	N	3	(edit)	(delete)