



**Faculty of Engineering and Technology**  
**Department of Electrical and Computer Engineering**  
**ENCS3320-Computer Networks**  
**Project #2: Cisco Packet Tracer**

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## Abstract

The aim of the project is to focus on creating and testing computer networks, to understand and apply key networking concepts like IP addressing, subnetting, routing, switching, VLANs, and network security, using Cisco Packet Tracer, through this project, a network is designed to simulate real-world scenarios, where devices like routers, switches, and computers are configured and tested. Packet Tracer allows us to simulate data flow, troubleshoot issues, and explore advanced networking protocols such as OSPF and EIGRP.

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# Theory

- Subnetting

Subnetting involves breaking a large IP address range into smaller, more manageable sub-networks. This approach helps optimize IP address usage, reduce network congestion, and improve security by isolating different parts of the network. In this project, subnetting ensures that each part of the network, such as the servers, ECE subnet, CS subnet, and backbone has enough addresses for all devices while minimizing wasted space. Subnet sizes are defined using CIDR notation, for example /24 for 256 IPs and subnet masks, for example 255.255.255.0.

- Domain Name System (DNS)

DNS is essential for making the internet user-friendly by translating easy-to-remember domain names, like gmail.com, into the IP addresses that computers use to communicate. It also manages key domain records, such as A records (linking domain names to IP addresses), NS records (defining authoritative name servers), and CNAME records (creating domain aliases). In this project, the DNS server is set up to handle domain resolution for addresses like [www.it.birzeit.edu](http://www.it.birzeit.edu) and gmail.com. It also plays a crucial role in supporting email servers and other services, ensuring smooth communication across the network.

- Email Services

Email services make communication possible by using protocols like SMTP and POP3. SMTP is responsible for sending emails, while POP3 is used to retrieve messages from a server to a client device. In this project, email servers are configured with fixed IP addresses and domain-specific names, such as mail.it.birzeit.edu, along with user accounts for team members. To ensure everything works correctly, the setup is tested by sending and receiving emails between domains like gmail.com and it.birzeit.edu, while also verifying that DNS resolves the mail servers properly.

- **Web Services**

A web server plays an important role in any network, hosting websites and delivering web pages to users when requested. It relies on protocols like HTTP and HTTPS to transfer data between the server and client devices, ensuring secure and smooth access to websites. In this project, the web server is set up to host the Faculty of Engineering and Technology's website at [www.it.birzeit.edu](http://www.it.birzeit.edu). To ensure reliable access, the server is assigned a static IP and configured to handle both HTTP and HTTPS requests, enabling secure communication through encryption. The website's homepage is customized with details about the faculty, including information on the Electrical and Computer Engineering (ECE) and Computer Science (CS) departments. It features visuals, formatted text, and other elements to create a user-friendly and professional experience. Testing includes making sure the website is accessible from different devices on the network and verifying that the DNS correctly resolves the domain name to the server's IP address for seamless user access.

- **Dynamic Host Configuration Protocol (DHCP)**

DHCP streamlines the process of assigning IP addresses to devices within a network by automating the task, eliminating the need for manual configuration. This efficiency is achieved through DHCP servers, which dynamically allocate IP addresses from predefined pools, along with essential network details such as the subnet mask, default gateway, and DNS server settings. By doing so, it reduces the potential for errors, accelerates deployment, and enables devices to easily join and leave the network. In this project, distinct DHCP pools are established for the ECE and CS subnets, ensuring that devices in each subnet are dynamically assigned IP addresses while still reserving a few static addresses for essential devices like printers and servers.

- **Network Address Translation (NAT)**

NAT (Network Address Translation) acts like a gateway for devices within a private network, allowing them to access the internet using just one public IP address. Instead of each device needing its own public IP, NAT translates the private IP addresses of all the devices in the network into a single public IP when they connect to the internet. This helps save valuable public IP addresses and adds an extra layer of security by hiding the internal network's details from the outside world.

- **BGP (Border Gateway Protocol)**

BGP is designed to manage how data is routed between different networks, often across the internet, making it essential for communication between multiple autonomous systems (AS). Unlike protocols that work within a single network, BGP helps decide the best path for data to travel between separate networks by exchanging information based on attributes like the AS path. It also uses policies to determine the most efficient route. In this project, BGP is set up to ensure smooth communication between various networks, such as Google, the Faculty of Engineering, and Home-ISP, allowing data to flow efficiently across diverse and distant networks.

- **OSPF (Open Shortest Path First)**

OSPF (Open Shortest Path First) is a link-state protocol that helps routers within the same network (autonomous system or AS) figure out the best routes to send data. It works by sharing detailed information about the network's layout, allowing each router to create a complete map of how the network is structured. By considering factors like bandwidth and delay, OSPF calculates the most efficient path for data to travel. In this project, OSPF is set up for routing within the network, with different areas defined (such as Area 0 for the backbone) to improve routing efficiency and boost overall network performance.



## Procedure

- Subnetting

In As-100, it assigned 180.39.72.0/24 for all IPs in the AS, the AS divided into 4 subnets with different sizes as follows: first, we Sort Subnets from Highest to Lowest:

- ECE Subnet: 120 IP Required
- CS Subnet: 55 IP Required
- Servers Subnet: 28 IP Required
- Backbone Subnet: 4 IP Required

We take the first Client Bit from the left and add it to the Network Bits

- The first split: 180.39.72.0/24 -> 180.39.72.00000000 there are two possibilities 0 and 1:  
180.39.72.00000000 -> 180.39.72.0/25 (128 Available IP)  
180.39.72.10000000 -> 180.39.72.128/25 (128 Available IP)

We assigned to the ECE Subnet 180.39.72.128/25

- The second split: 180.39.72.0/24->180.39.72.00000000 there are two possibilities 0 and 1:  
180.39.72.00000000 -> 180.39.72.0/26 (64 Available IP)  
180.39.72.01000000 -> 180.39.72.64/26 (64 Available IP)

We assigned to the CS Subnet 180.39.72.64/26

- The third split: 180.39.72.0/24 -> 180.39.72.00000000 there are two possibilities 0 and 1:  
180.39.72.00000000 -> 180.39.72.0/27 (32 Available IP)  
180.39.72.00100000 -> 180.39.72.32/27 (32 Available IP)

We assigned to the Servers Subnet 180.39.72.32/27

- The fourth split: 180.39.72.0/24->180.39.72.00000000 there are two possibilities 0 and 1:  
180.39.72.00000000 -> 180.39.72.0/28 (16 Available IP)  
180.39.72.00010000 -> 180.39.72.16/28 (16 Available IP)

But we need more optimization, so we split it again

- The fifth split: 180.39.72.0/24 -> 180.39.72.00000000 there are two possibilities 0 and 1:  
180.39.72.00000000 -> 180.39.72.0/29 (8 Available IP)  
180.39.72.00001000 -> 180.39.72.8/29 (8 Available IP)

We assigned to the Backbone Subnet 180.39.72.8/29

Table 1: Subnetting for AS-100

Subnet Name	Subnet IP	Subnet Mask	Broadcast IP	First Usable IP	Last Usable IP
ECE	180.39.72.128/25	255.255.255.128	180.39.72.255	180.39.72.129	180.39.72.254
CS	180.39.72.64/26	255.255.255.192	180.39.72.127	180.39.72.65	180.39.72.126
Servers	180.39.72.32/27	255.255.255.224	180.39.72.63	180.39.72.33	180.39.72.62
BackBone	180.39.72.8/29	255.255.255.248	180.39.72.15	180.39.72.9	180.39.72.14

- Building the Topology

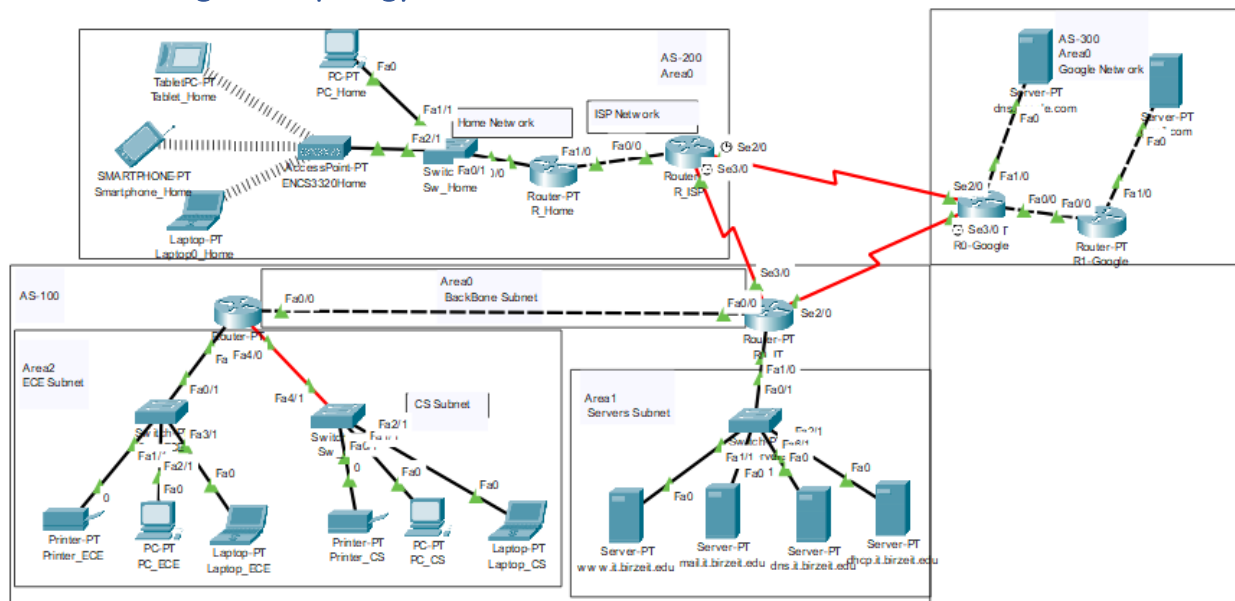


Figure 1: Topology

## Results & Discussions

- Google Network AS-300:

- Discussion:

The Google network is a vital part of the topology, acting as a hub for domain name resolution and email services. By setting up a DNS server (dns.google.com), the network ensures that domain names like gmail.com are translated into IP addresses, making communication smooth and intuitive for users. The email server allows team members to send and receive emails using standard protocols like SMTP and POP3, reflecting real-world scenarios. Static IP configurations ensure reliability and predictability, while OSPF handles routing efficiently within the network. BGP enables the Google network to communicate with other autonomous systems, like the Faculty and Home-ISP networks, ensuring everything stays interconnected.

- Results:

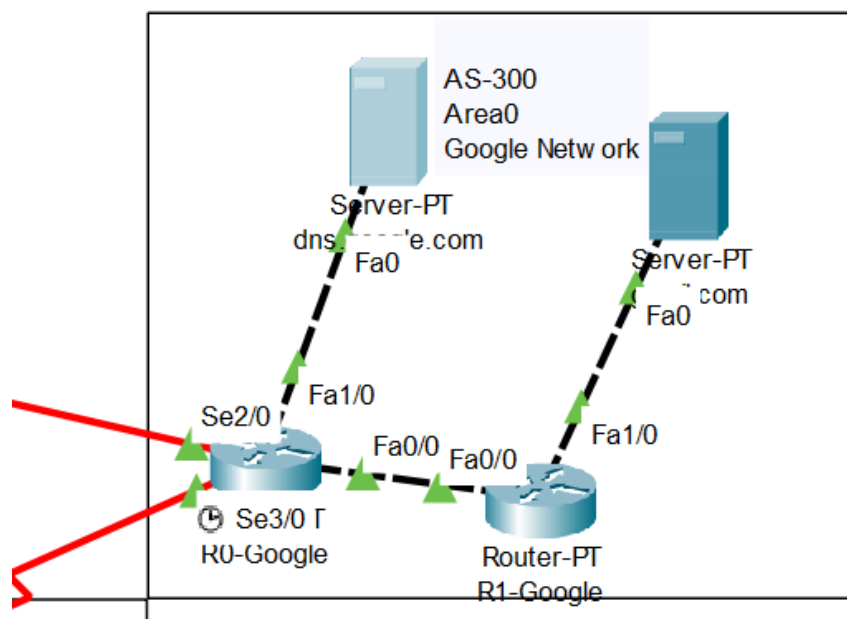


Figure 2: Google Network AS-300 Topology

Physical Config Services **Desktop** Programming Attributes

**IP Configuration** [X]

IP Configuration

☐ DHCP ☒ Static

IPv4 Address: 8.8.39.18

Subnet Mask: 255.255.255.252

Default Gateway: 8.8.39.17

DNS Server: 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::207:ECFF:FED0:5BB1

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

Authentication: MD5

Username:

Password:

Figure 3: dns.google.com server IP configuration

Physical Config **Services** Desktop Programming Attributes

**SERVICES**

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS**
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

DNS

DNS Service: ☒ On ☐ Off

Resource Records

Name: Type: A Record

Address:

Add Save Remove

No.	Name	Type	Detail
0	dns.it.birzeit.edu	A Record	180.39.72.36
1	gmail.com	A Record	8.8.39.26
2	it.birzeit.edu	NS	dns.it.birzeit.edu

Figure 4: dns.google.com server DNS services

gmail.com

Physical Config Services **Desktop** Programming Attributes

**IP Configuration** [X]

IP Configuration

☐ DHCP ☒ Static

IPv4 Address: 8.8.39.26

Subnet Mask: 255.255.255.252

Default Gateway: 8.8.39.25

DNS Server: 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::20B:BEFF:FEA2:4426

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

Authentication: MD5

Username:

Password:

Figure 5: gmail.com server IP configuration

gmail.com

Physical Config **Services** Desktop Programming Attributes

**SERVICES**

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL**
- FTP
- IoT
- VM Management
- Radius EAP

EMAIL

SMTP Service: ☒ ON ☐ OFF

POP3 Service: ☒ ON ☐ OFF

Domain Name: gmail.com [Set]

User Setup

User: Shelleh\_Tasneem Password: 1220439

Shelleh\_Tasneem

Asfour\_Lara

[+]

[-]

Change

Password

Figure 6: gmail.com server EMAIL services

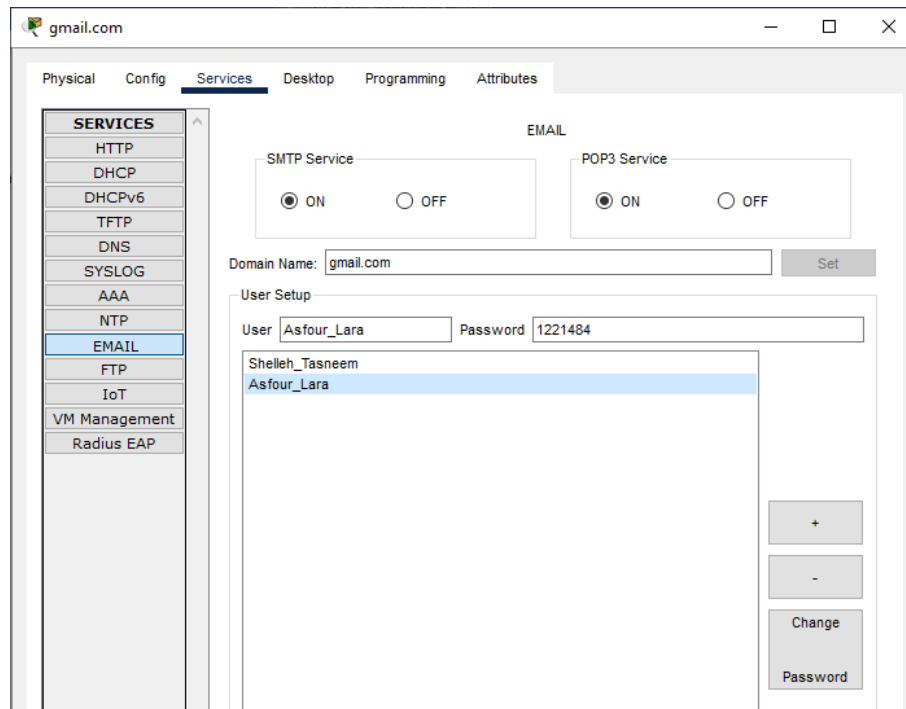


Figure 7: gmail.com server EMAIL services

- Faculty of Engineering and Technology Network (AS-100)
- Discussion:

The Faculty network is where things get a bit more intricate. It's divided into subnets designed for specific purposes, like the Electrical and Computer Engineering (ECE) and Computer Science (CS) departments. This setup helps keep things organized and ensures devices get the resources they need. The DHCP server simplifies the process of assigning IP addresses to devices, while the DNS server resolves local domain names like it.birzeit.edu to their respective IPs. The email server provides a professional email service for team members, and the web server hosts a customized page for the Faculty. OSPF is used here in a more complex way, with multiple areas to ensure scalability. It's a well-thought-out network that balances functionality and future-proofing.

- Results:

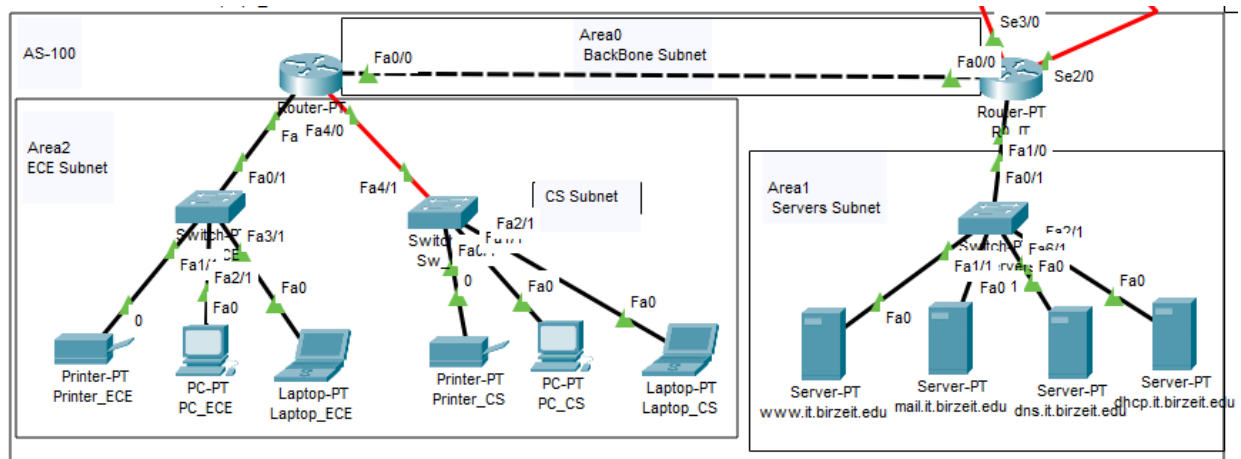


Figure 8: AS-100 Topology

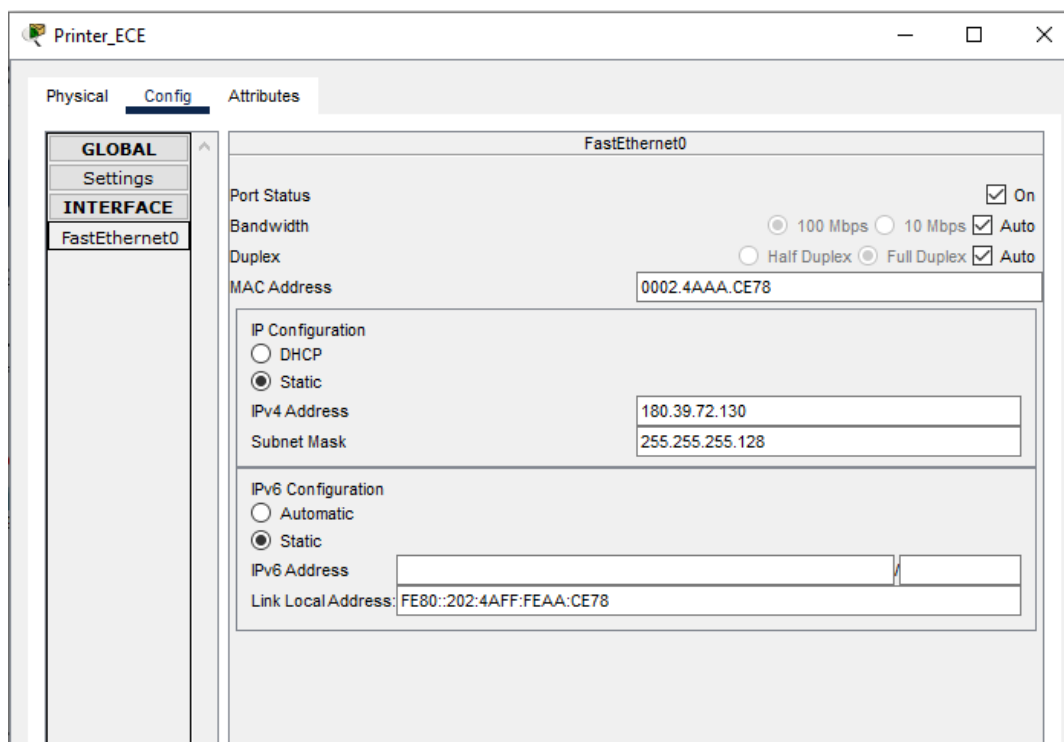


Figure 9: Printer\_ECE IP configuration

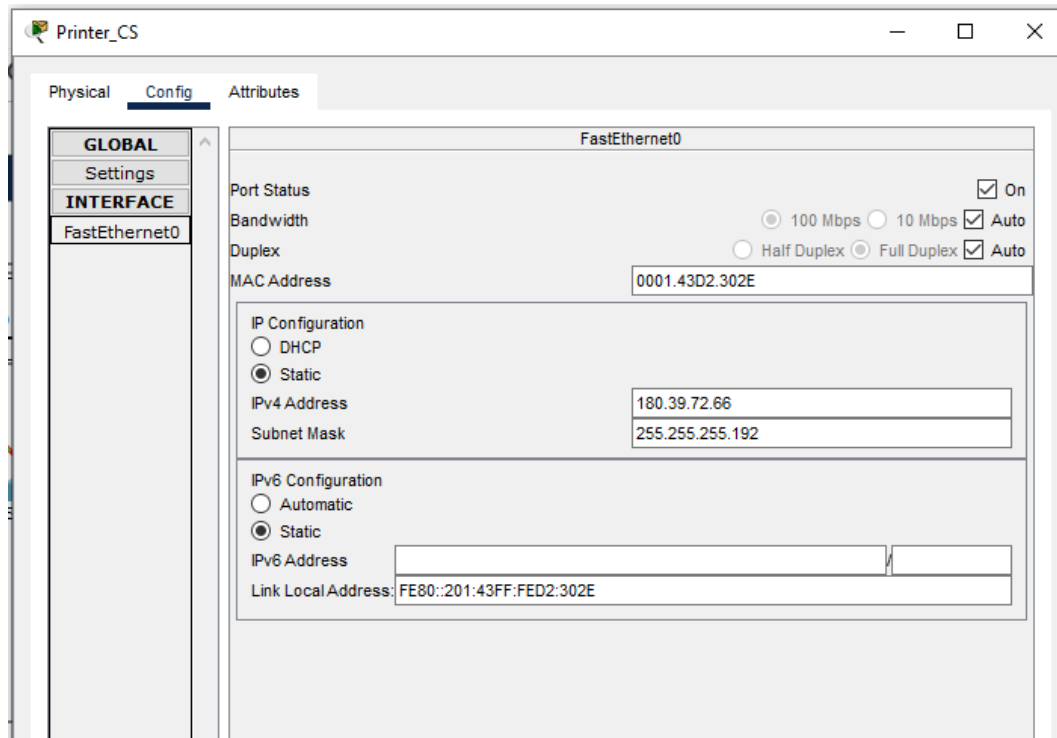


Figure 10: Printer\_CS IP configuration

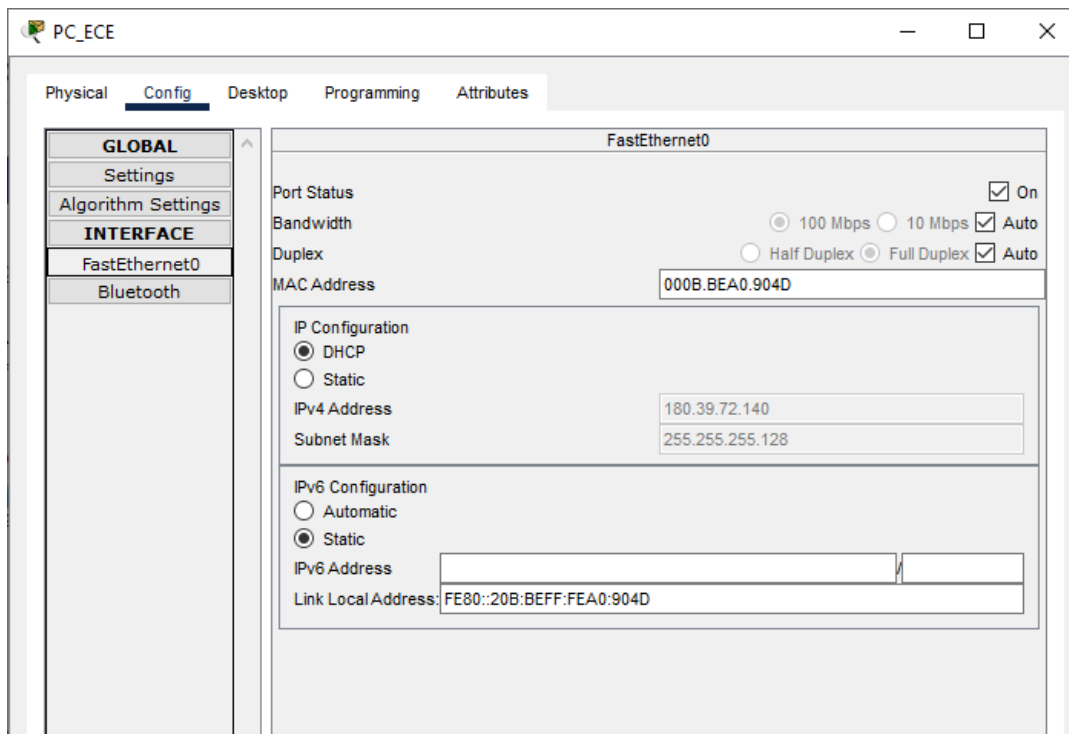


Figure 11: PC\_ECE IP configuration



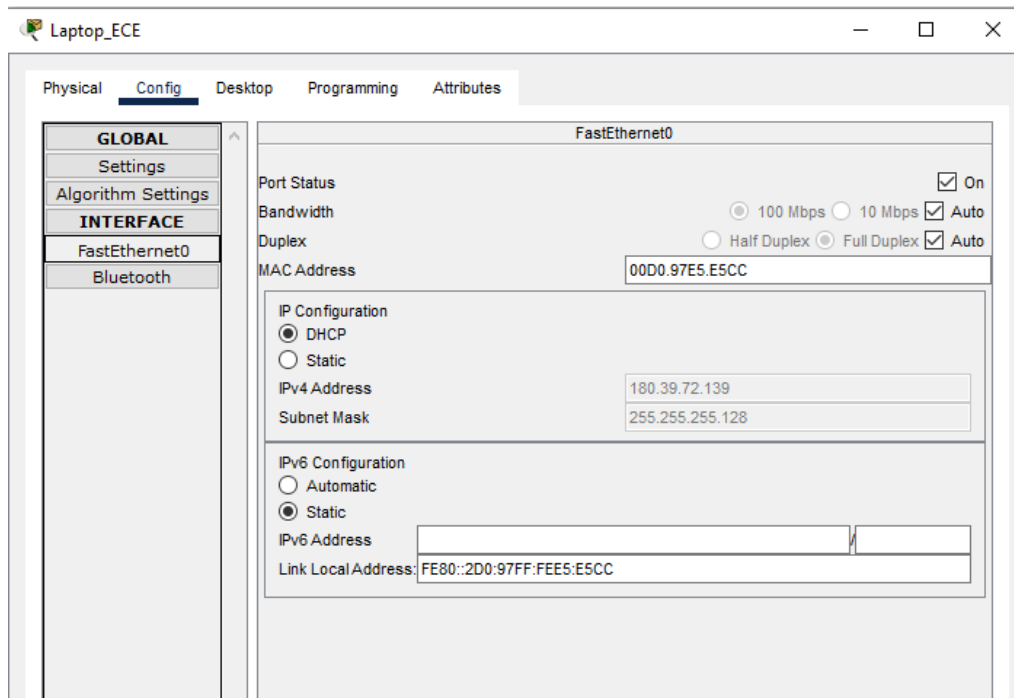


Figure 12: Laptop\_ECE IP configuration

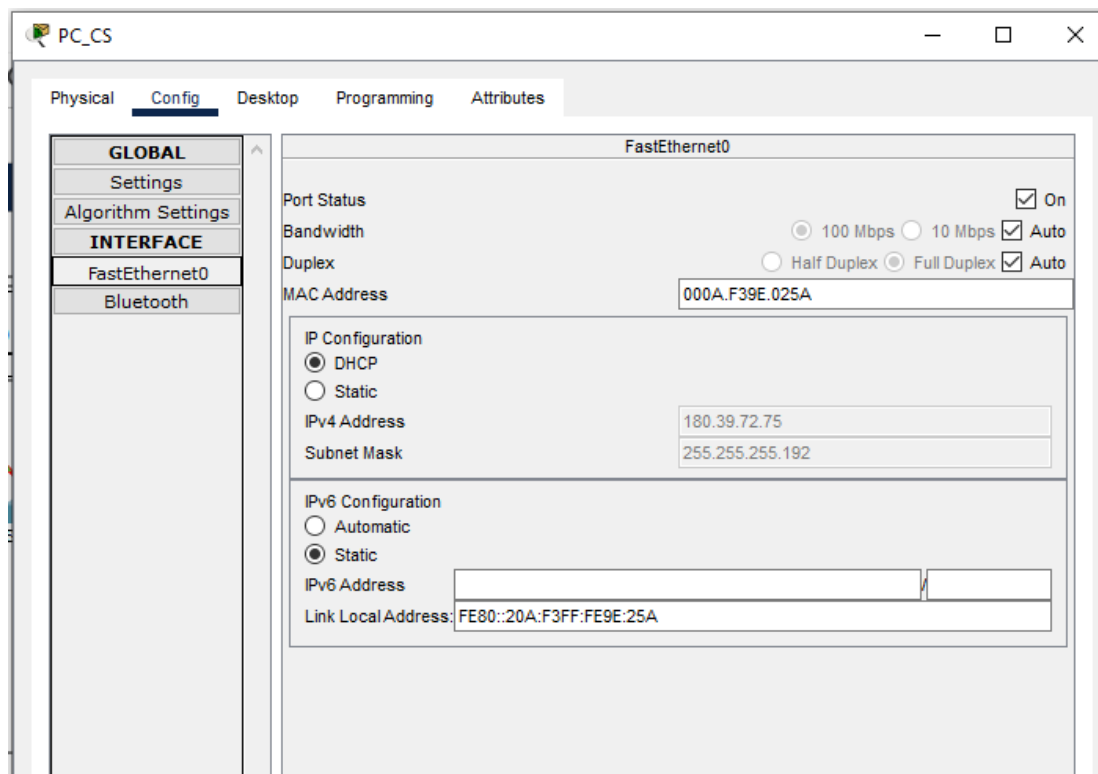


Figure 13: PC\_CS IP configuration

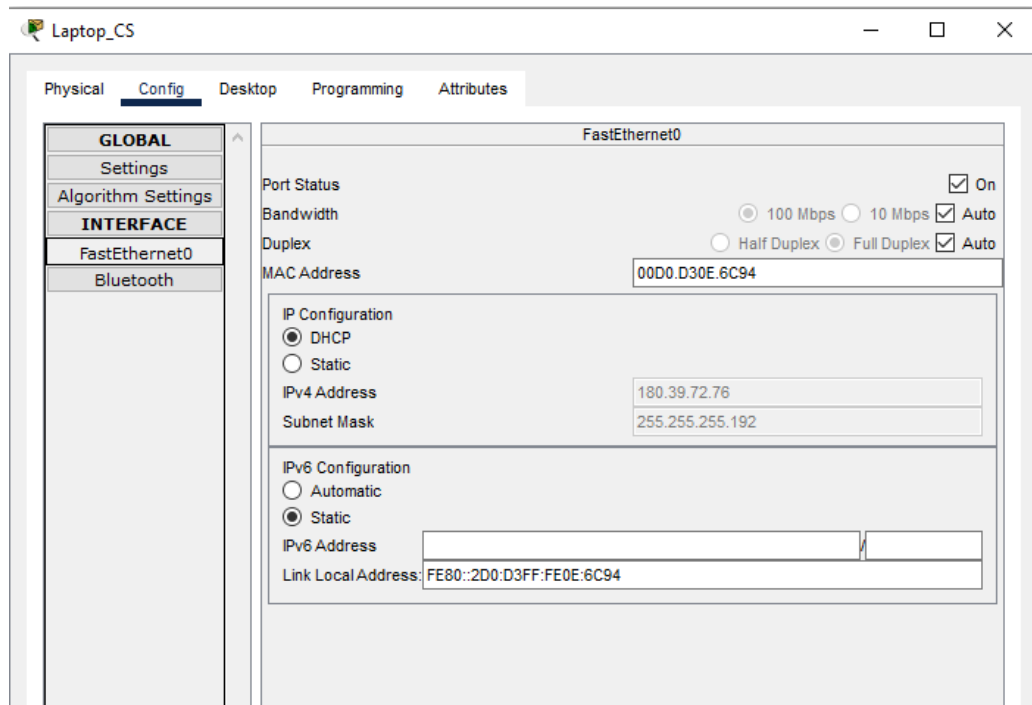


Figure 14: Laptop\_CS IP configuration

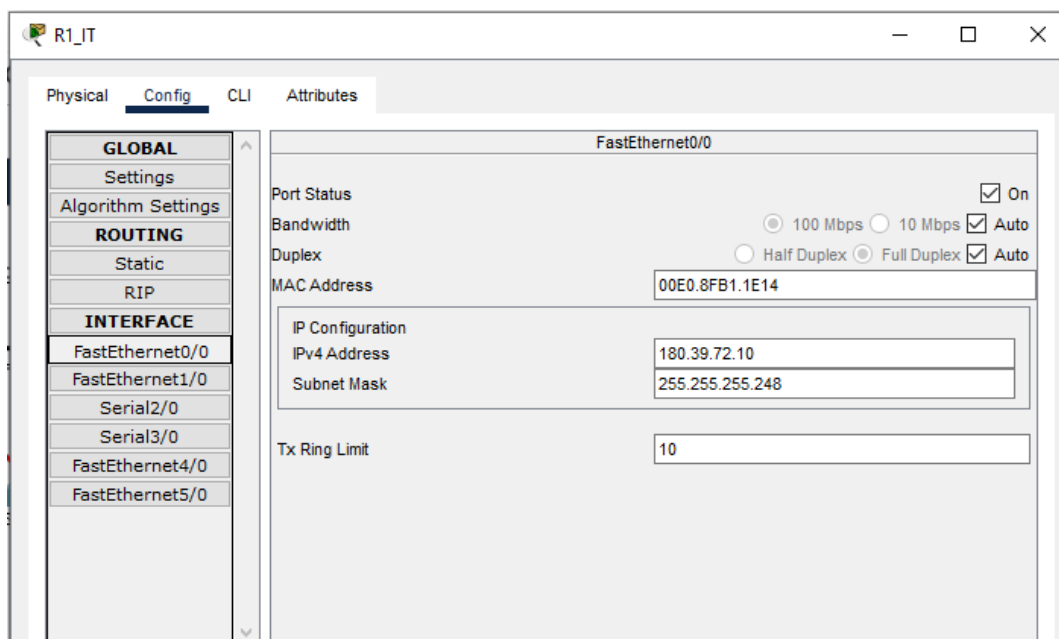


Figure 15: R1\_IT BackBone Port

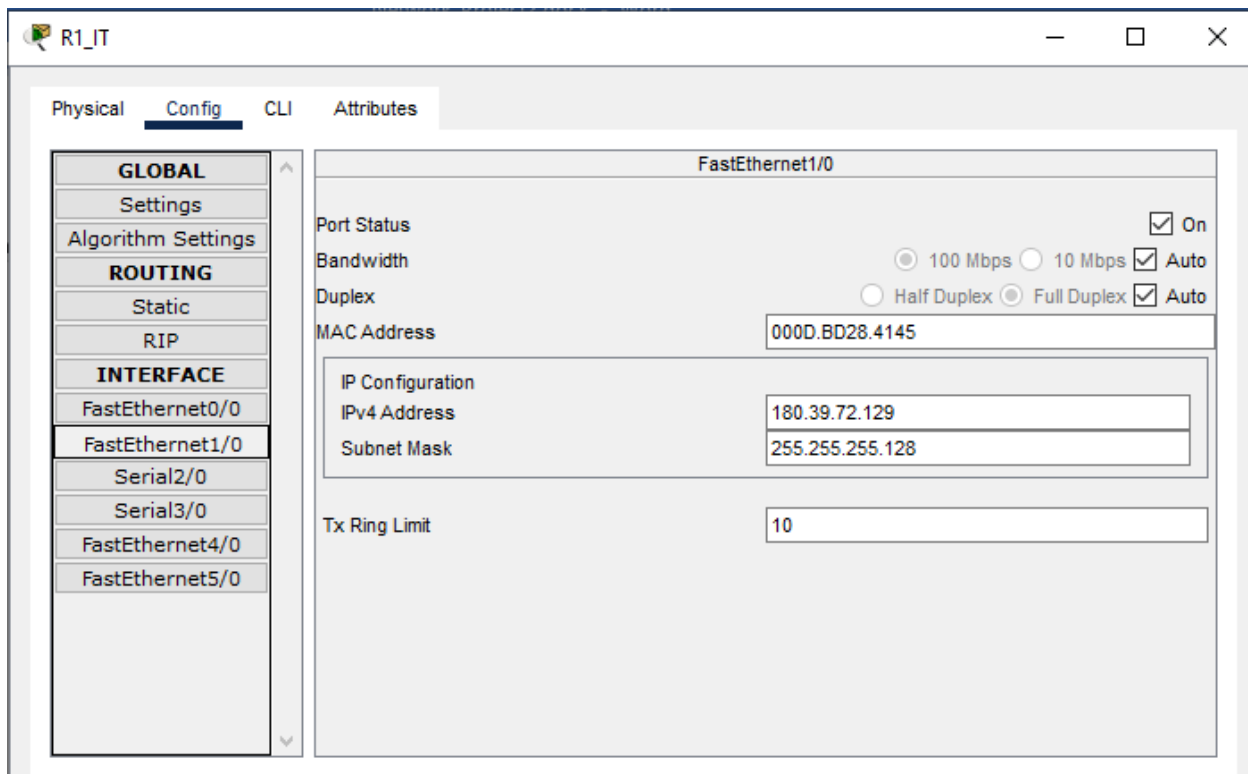


Figure 16: R1\_IT ECE Port

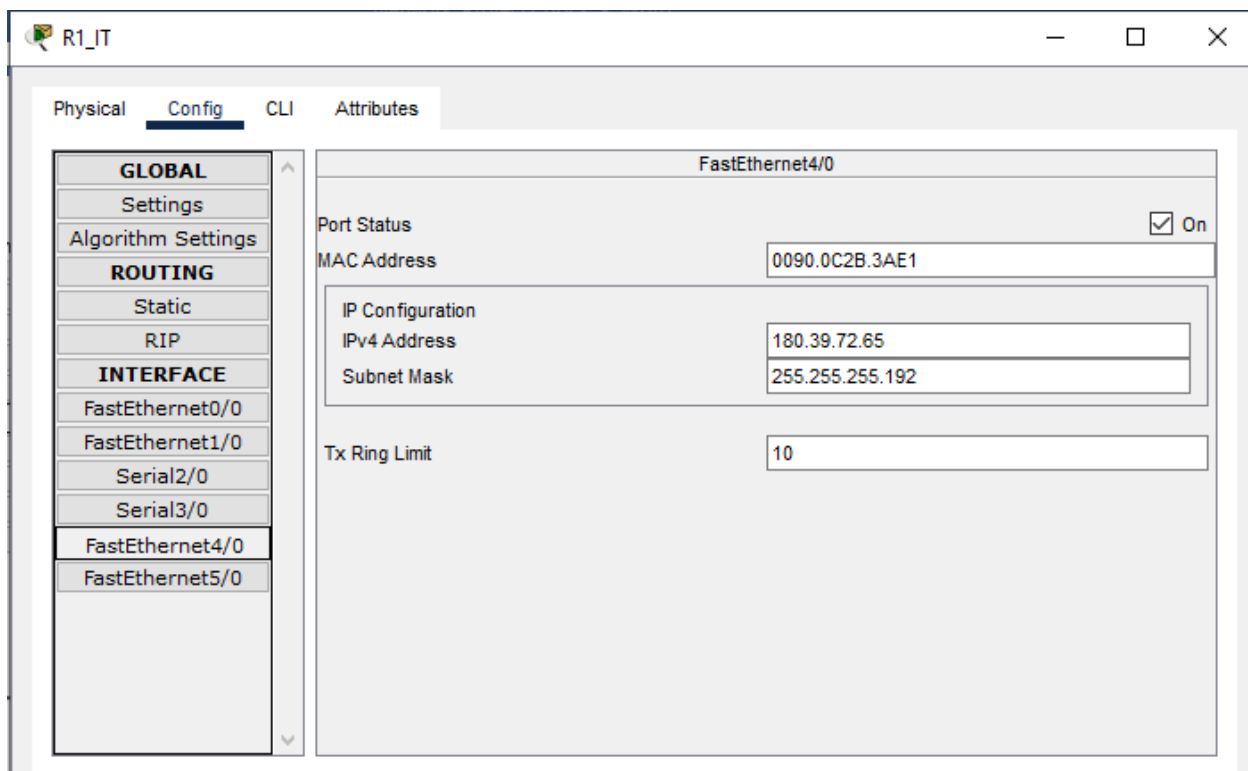


Figure 17: R1\_IT CS Port

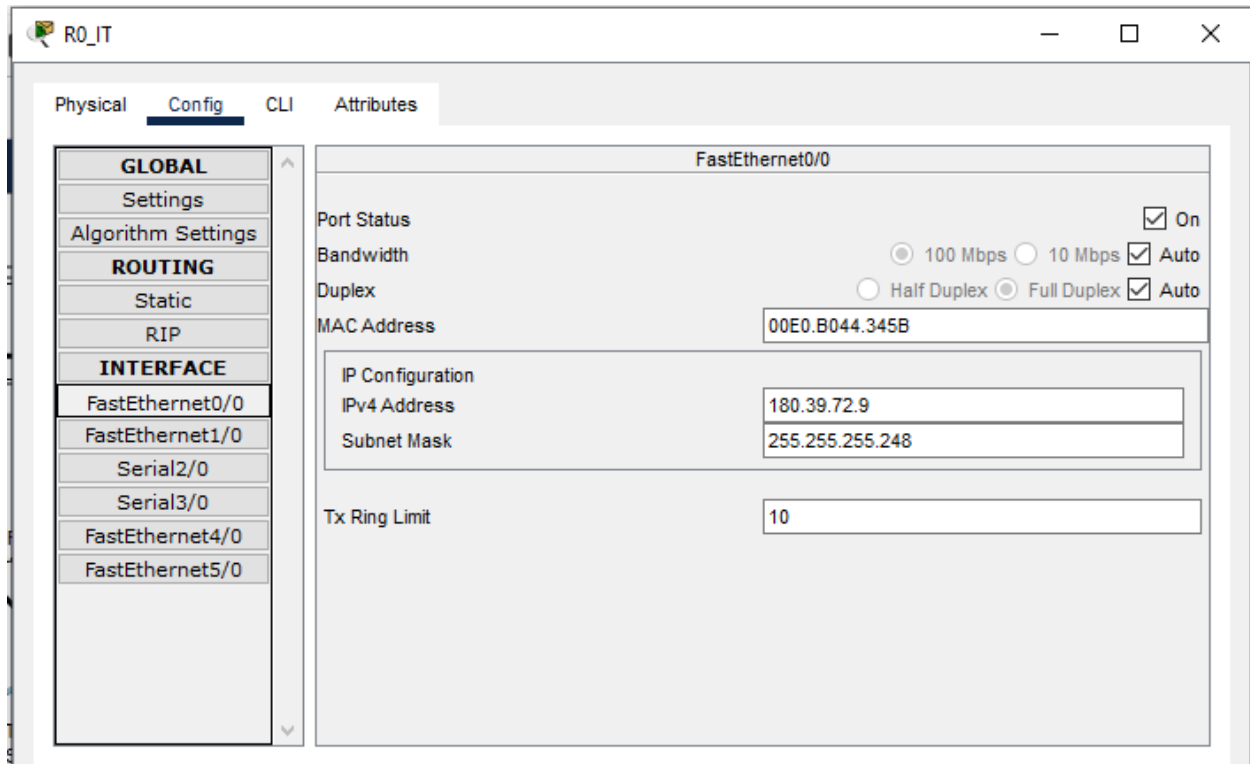


Figure 18: R0\_IT BackBone Port

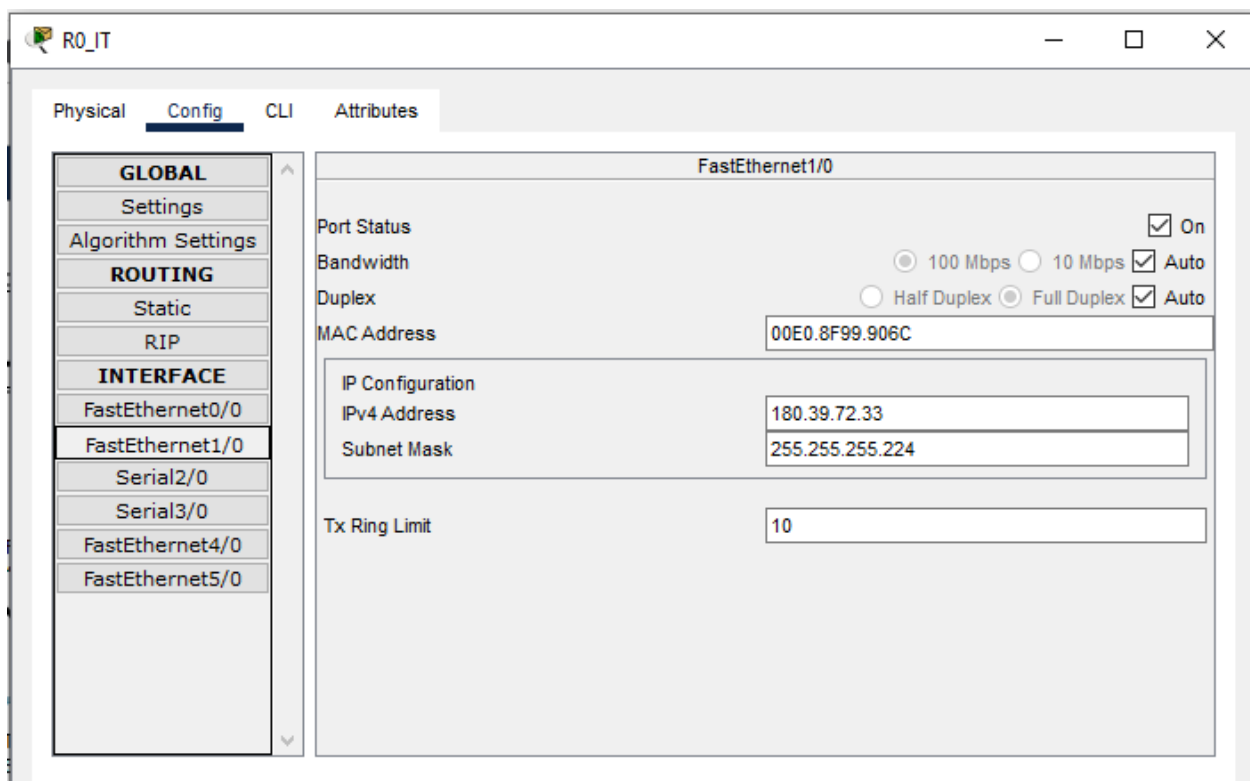


Figure 19: R0\_IT Servers Port

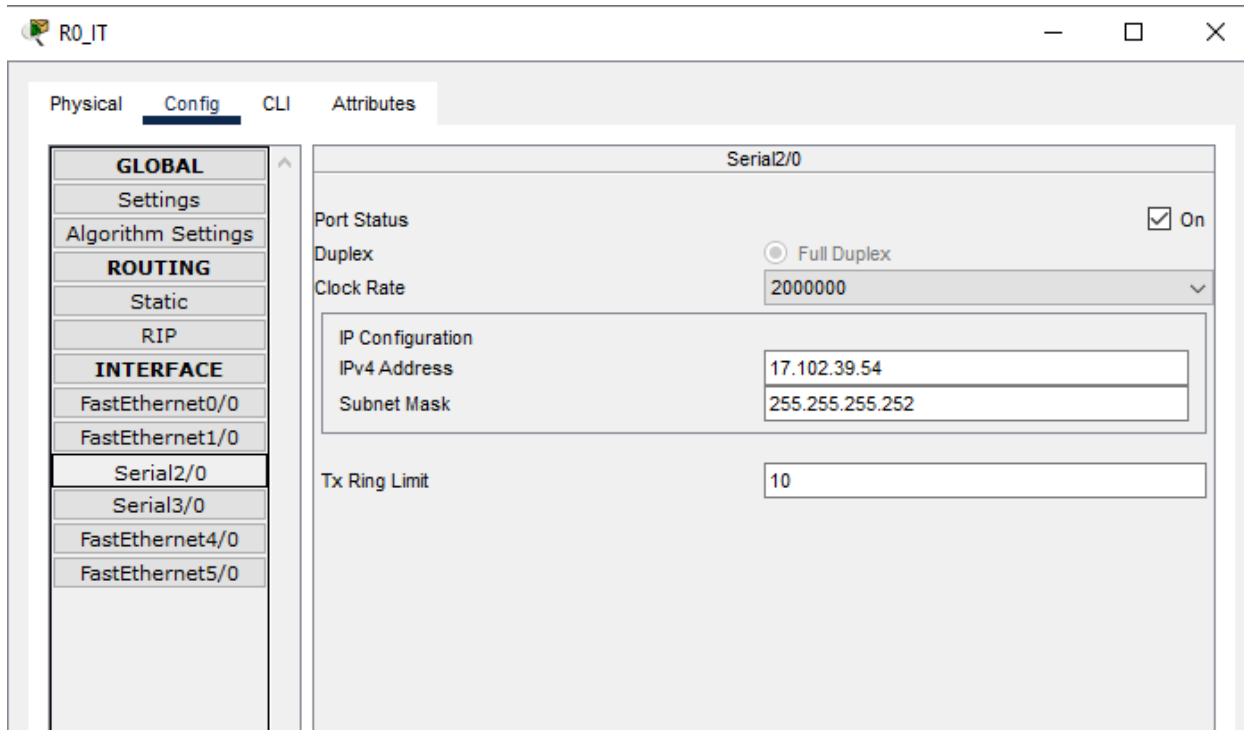


Figure 20: R0\_IT Port connected with AS-300

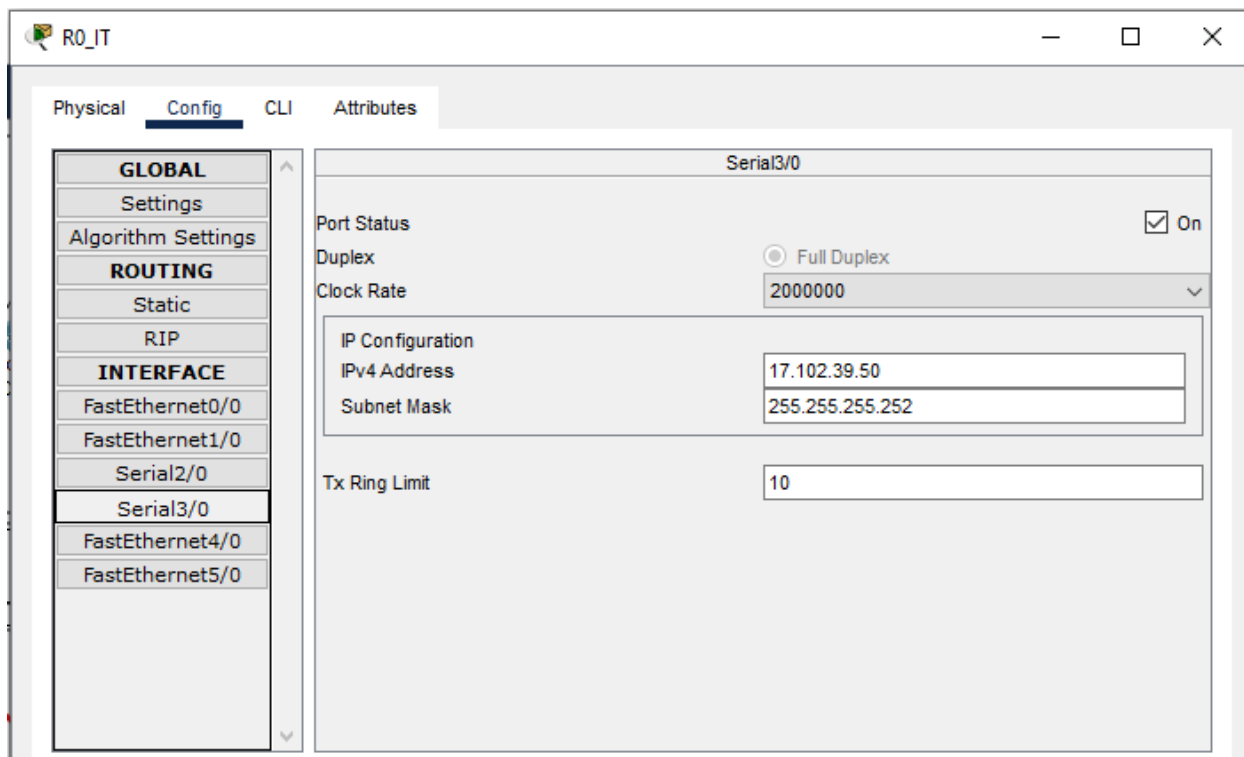


Figure 21: R0\_IT Port connected with AS-200







Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	R1_IT	PC_ECE	ICMP		0.000	N	0	(edit)
	Successful	R1_IT	Printer_CS	ICMP		0.000	N	1	(edit)
	Successful	R1_IT	mail.it.birz...	ICMP		0.000	N	2	(edit)

Figure 22: R1\_IT Successful Ping results







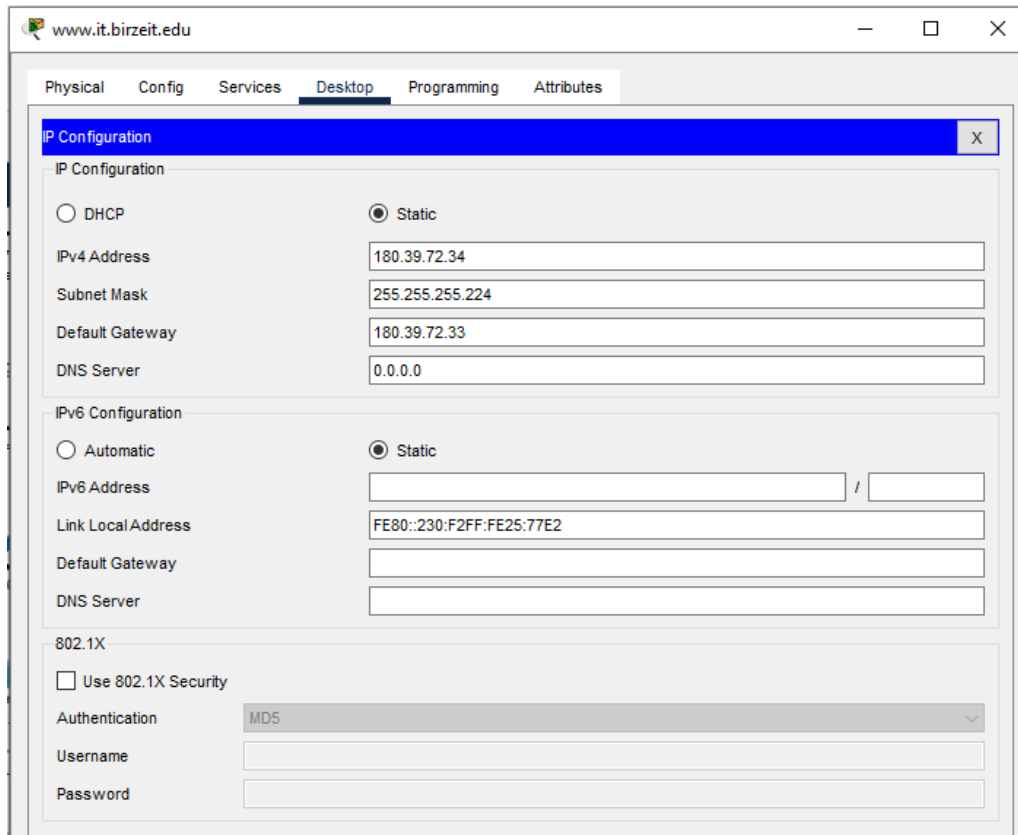
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	R0_IT	Laptop_ECE	ICMP		0.000	N	0	(edit)
	Successful	R0_IT	PC_CS	ICMP		0.000	N	1	(edit)
	Successful	R0_IT	dns.it.birz...	ICMP		0.000	N	2	(edit)

Figure 23: R0\_IT Successful Ping results



www.it.birzeit.edu

Physical Config Services **Desktop** Programming Attributes

**IP Configuration** [X]

IP Configuration

☐ DHCP ☒ Static

IPv4 Address: 180.39.72.34

Subnet Mask: 255.255.255.224

Default Gateway: 180.39.72.33

DNS Server: 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::230:F2FF:FE25:77E2

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

Authentication: MD5

Username:

Password:

Figure 24: Web server IP configuration

mail.it.birzeit.edu

Physical Config Services **Desktop** Programming Attributes

**IP Configuration** X

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 180.39.72.35

Subnet Mask 255.255.255.224

Default Gateway 180.39.72.33

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::200:CFF:FE1E:B7B0

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

Username

Password

Figure 25: Email server IP configuration

dns.it.birzeit.edu

Physical Config Services **Desktop** Programming Attributes

**IP Configuration** X

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 180.39.72.36

Subnet Mask 255.255.255.224

Default Gateway 180.39.72.33

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::260:47FF:FE8B:5E13

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

Username

Password

Figure 26: DNS server IP configuration

dhcp.it.birzeit.edu

Physical Config Services **Desktop** Programming Attributes

**IP Configuration** X

IP Configuration

☐ DHCP ☒ Static

IPv4 Address: 180.39.72.37

Subnet Mask: 255.255.255.224

Default Gateway: 180.39.72.33

DNS Server: 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::20D:B0FF:FE82:DBDB

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

Authentication: MD5

Username:

Password:

Figure 27: DHCP server IP configuration

mail.it.birzeit.edu

Physical Config **Services** Desktop Programming Attributes

**SERVICES**

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL**
- FTP
- IoT
- VM Management
- Radius EAP

**EMAIL**

SMTP Service: ☒ ON ☐ OFF

POP3 Service: ☒ ON ☐ OFF

Domain Name: it.birzeit.edu Set

User Setup

User: 1220439 Password: 1220439

1220439

1221484

+

-

Change

Password

Figure 28: Email service with the user setup



dns.it.birzeit.edu

Physical Config **Services** Desktop Programming Attributes

**SERVICES**

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS**
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

**DNS**

DNS Service ☒ On ☐ Off

Resource Records

Name  Type

Address

No.	Name	Type	Detail
0	dns.google.com	A Record	8.8.39.18
1	gmail.com	NS	dns.google.com
2	it.birzeit.edu	CNAME	mail.it.birzeit.edu
3	mail.it.birzeit.edu	A Record	180.39.72.35
4	www.it.birzeit.edu	A Record	180.39.72.34

Figure 29: DNS service with the RRs

dhcp.it.birzeit.edu

Physical Config **Services** Desktop Programming Attributes

**SERVICES**

- HTTP
- DHCP**
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

**DHCP**

Interface  Service ☒ On ☐ Off

Pool Name

Default Gateway

DNS Server

Start IP Address :

Subnet Mask:

Maximum Number of Users :

TFTP Server:

WLC Address:

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
CS_Pool	180.39.7...	180.39.7...	180.39.7...	255.255...	52	0.0.0.0	0.0.0.0
ECE_Pool	180.39.7...	180.39.7...	180.39.7...	255.255...	116	0.0.0.0	0.0.0.0
serverPool	0.0.0.0	0.0.0.0	180.39.7...	255.255...	512	0.0.0.0	0.0.0.0

Figure 30: DHCP service with the pools

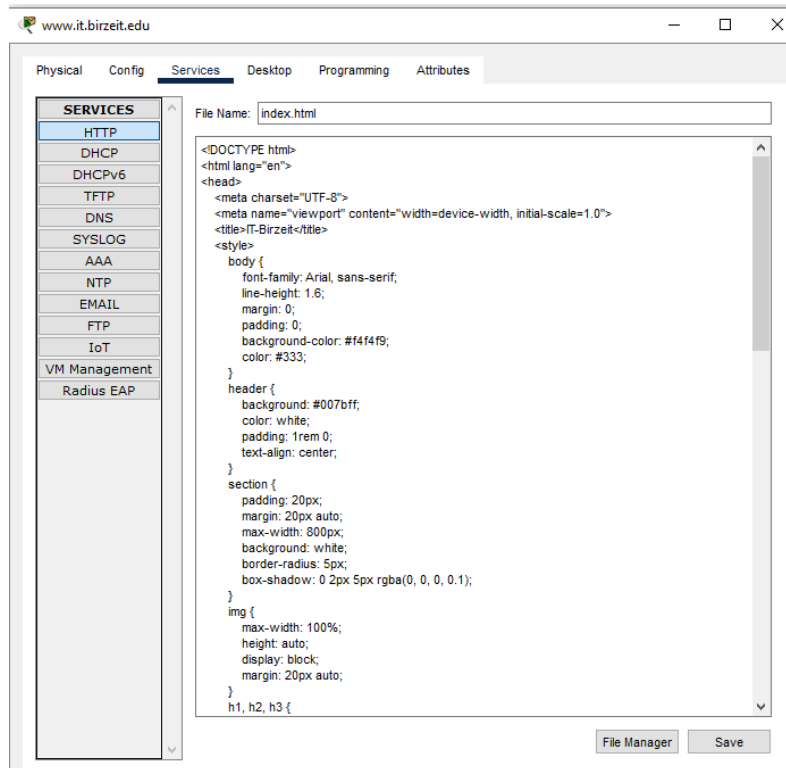


Figure 31: index.html code

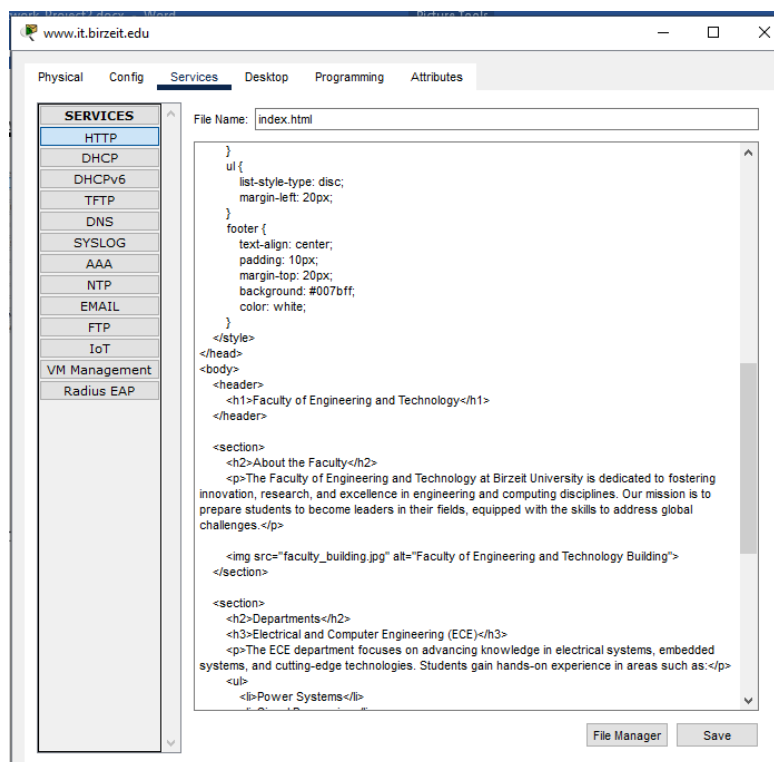


Figure 32: index.html code

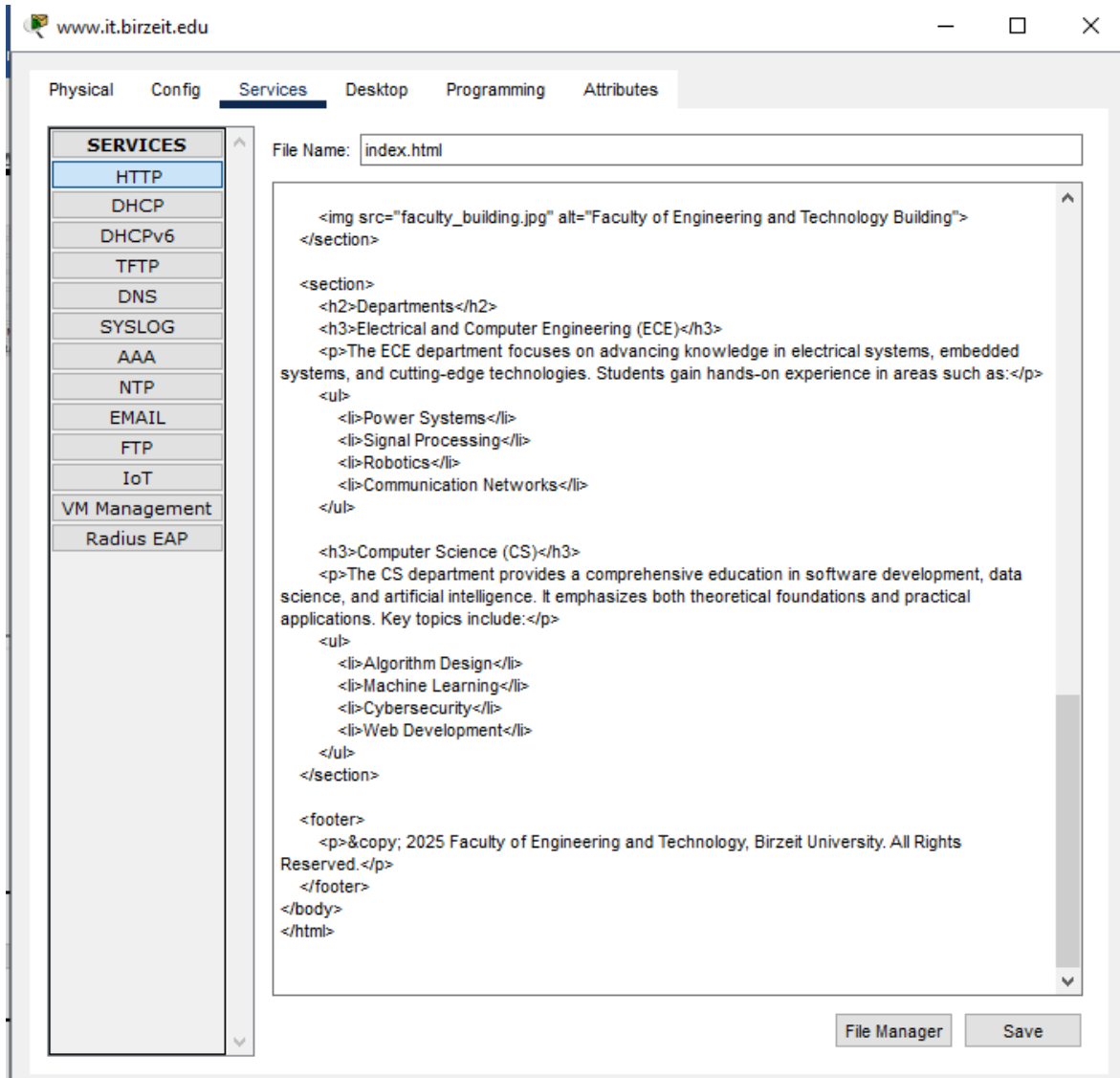


Figure 33: index.html code

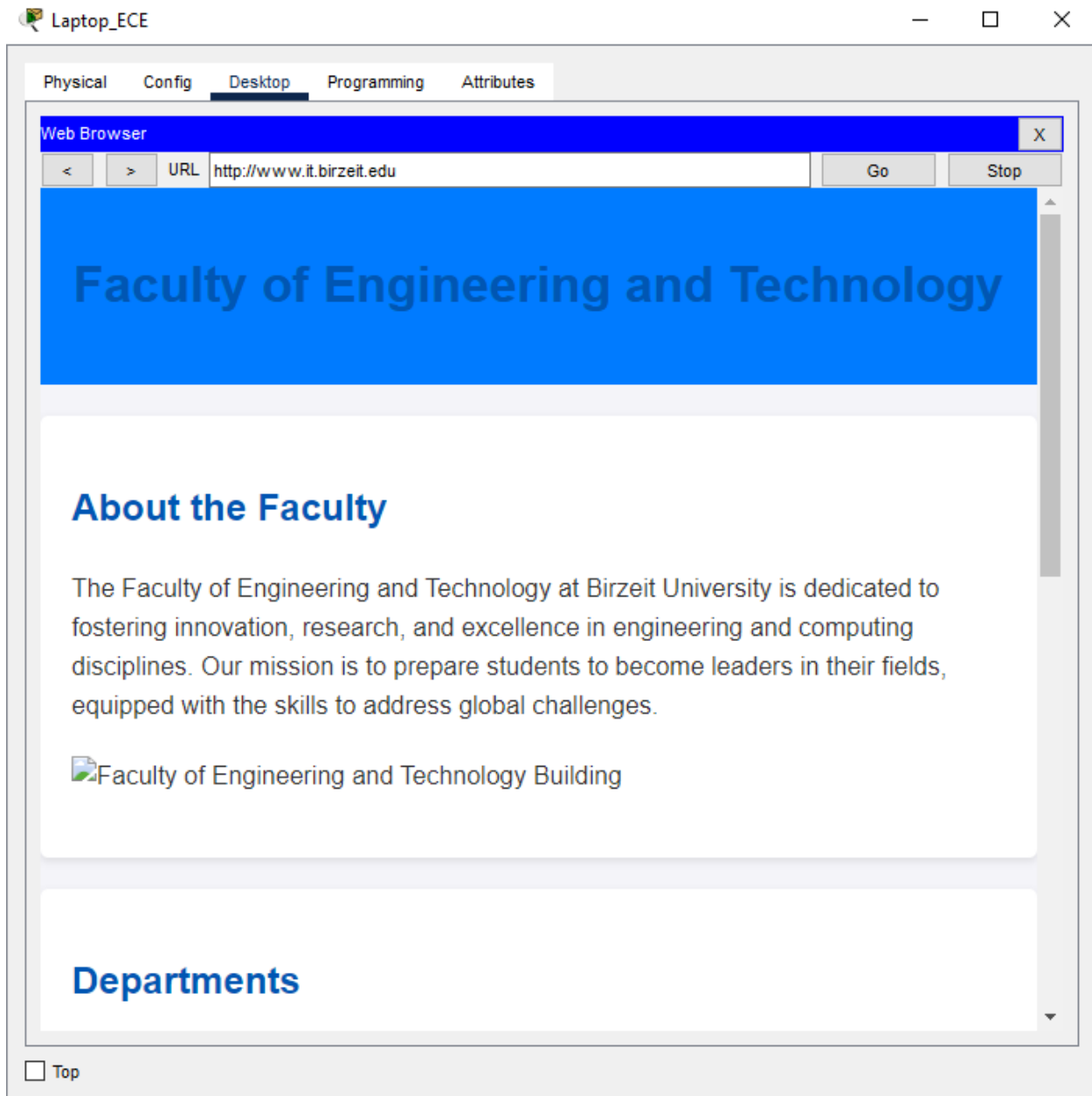


Figure 34: Successful access to [www.it.birzeit.edu](http://www.it.birzeit.edu) from Laptop\_ECE

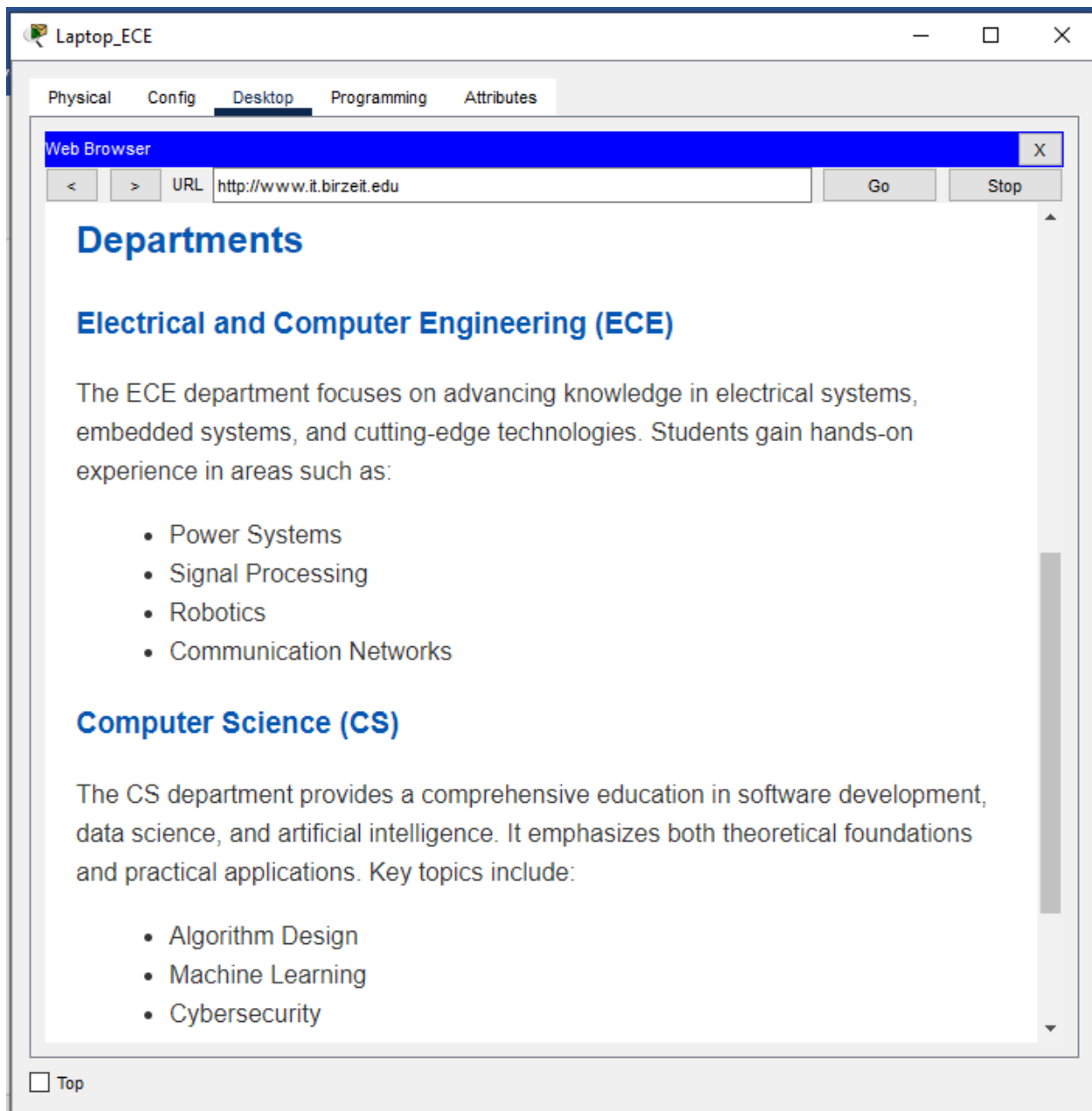
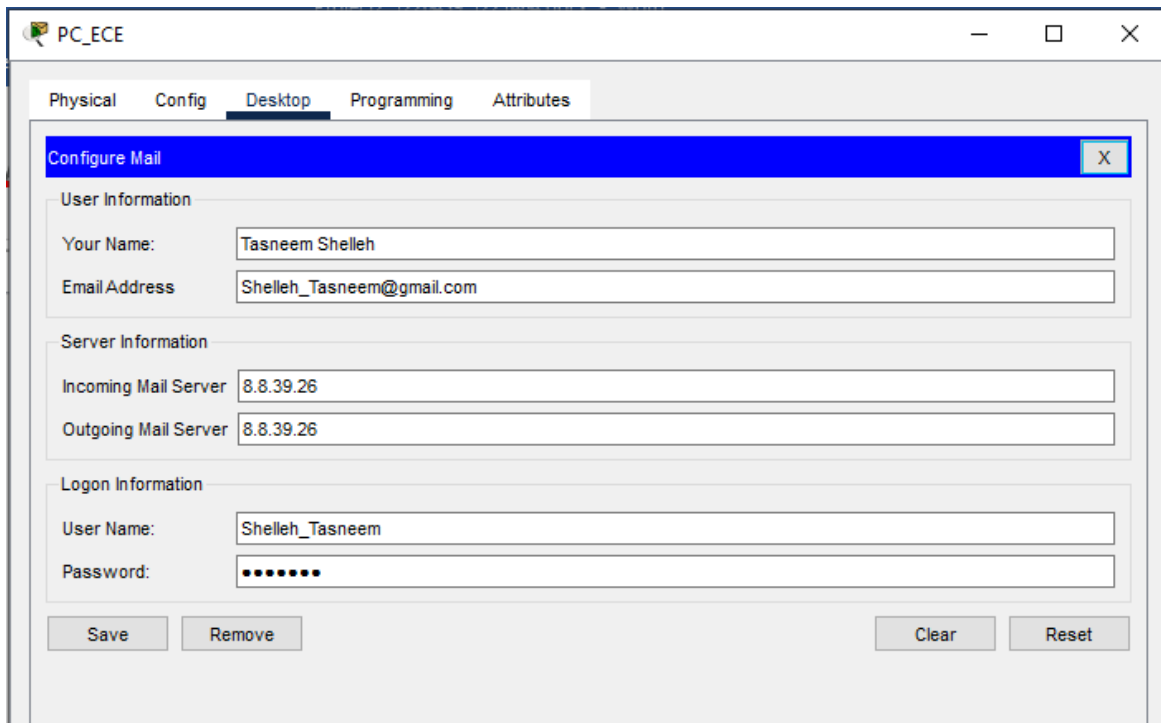


Figure 35: Successful access to [www.it.birzeit.edu](http://www.it.birzeit.edu) from Laptop\_ECE

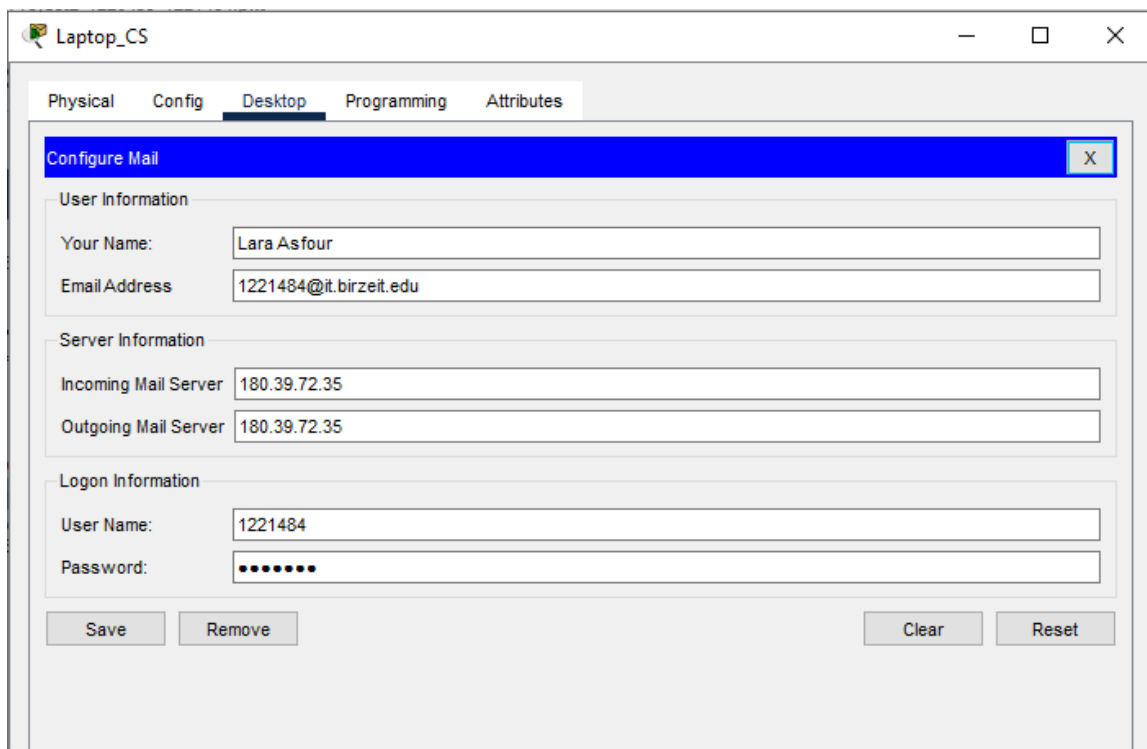


The screenshot shows a software window titled "PC\_ECE" with a tabbed interface. The "Desktop" tab is selected, and a "Configure Mail" dialog box is open. The dialog has three sections: "User Information", "Server Information", and "Logon Information".

Section	Field	Value
User Information	Your Name:	Tasneem Shelleh
	Email Address	Shelleh_Tasneem@gmail.com
Server Information	Incoming Mail Server	8.8.39.26
	Outgoing Mail Server	8.8.39.26
Logon Information	User Name:	Shelleh_Tasneem
	Password:	••••••

Buttons at the bottom: Save, Remove, Clear, Reset.

Figure 36: PC\_ECE configuration for gmail.com



The screenshot shows a software window titled "Laptop\_CS" with a tabbed interface. The "Desktop" tab is selected, and a "Configure Mail" dialog box is open. The dialog has three sections: "User Information", "Server Information", and "Logon Information".

Section	Field	Value
User Information	Your Name:	Lara Asfour
	Email Address	1221484@it.birzeit.edu
Server Information	Incoming Mail Server	180.39.72.35
	Outgoing Mail Server	180.39.72.35
Logon Information	User Name:	1221484
	Password:	••••••

Buttons at the bottom: Save, Remove, Clear, Reset.

Figure 37: Laptop\_CS configuration for it.birzeit.edu

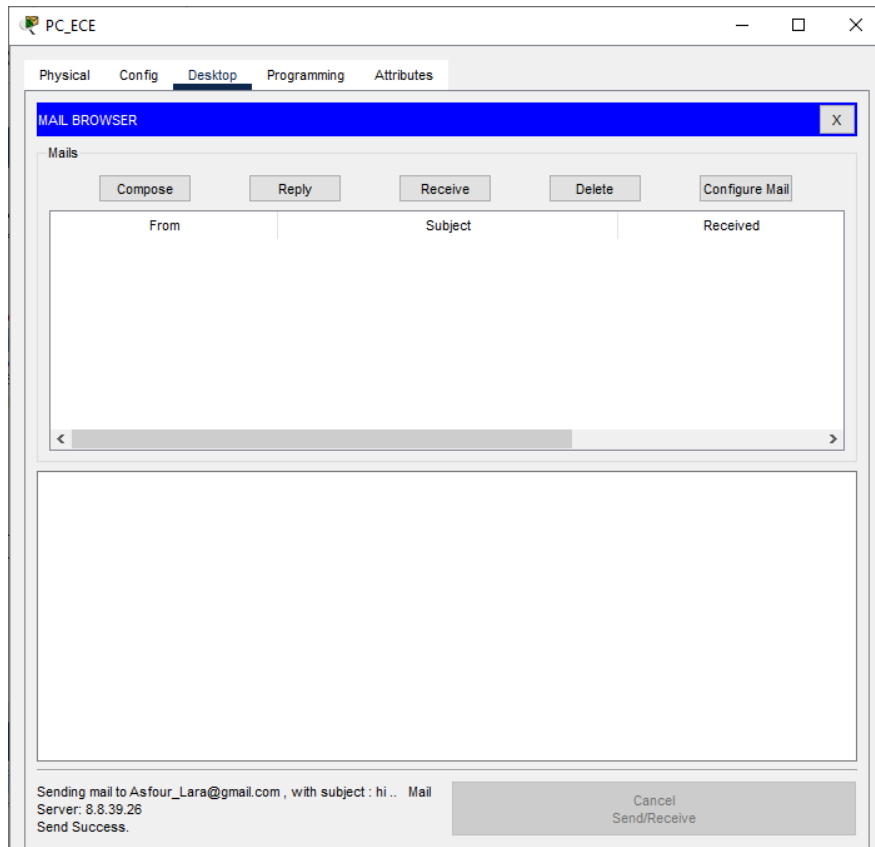


Figure 38: successful sending Between Gmail accounts

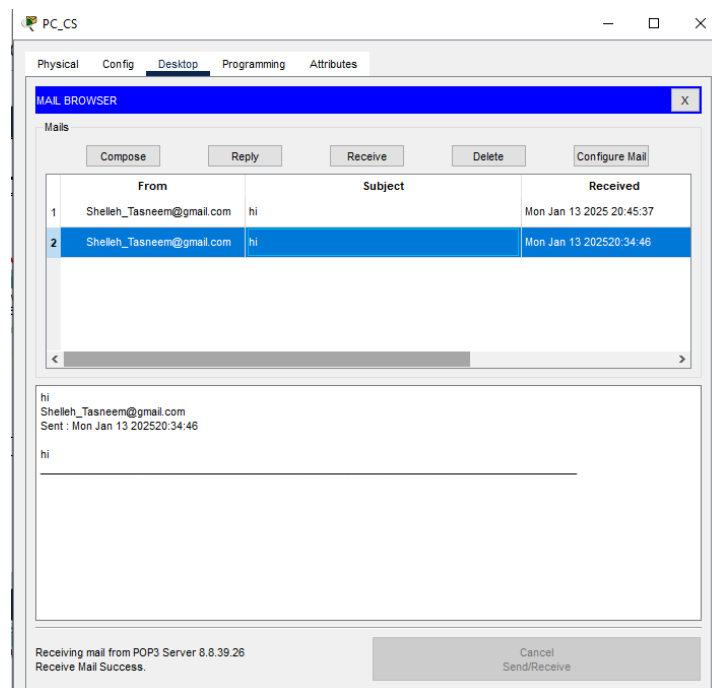


Figure 39: successful receiving Between Gmail accounts

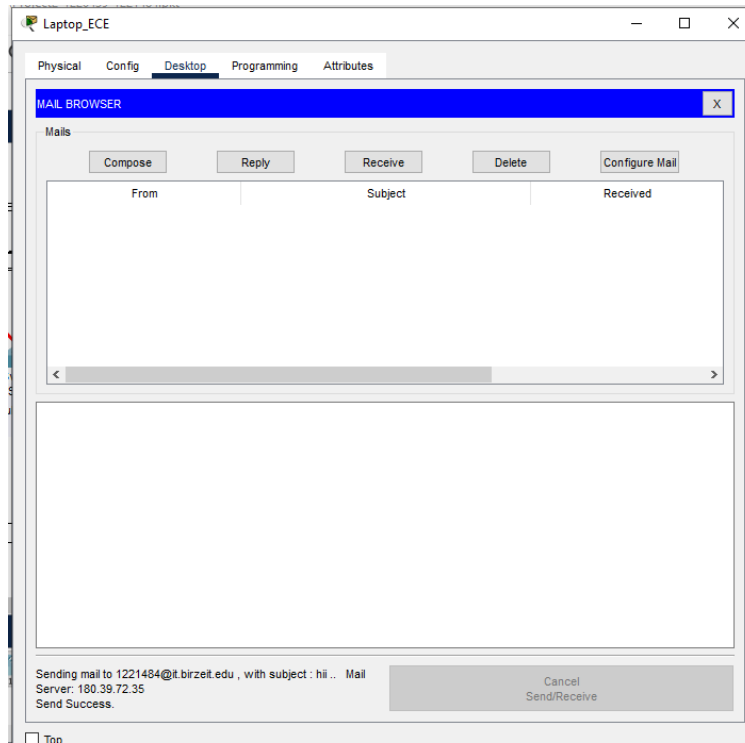


Figure 40: successful sending Between Birzeit accounts

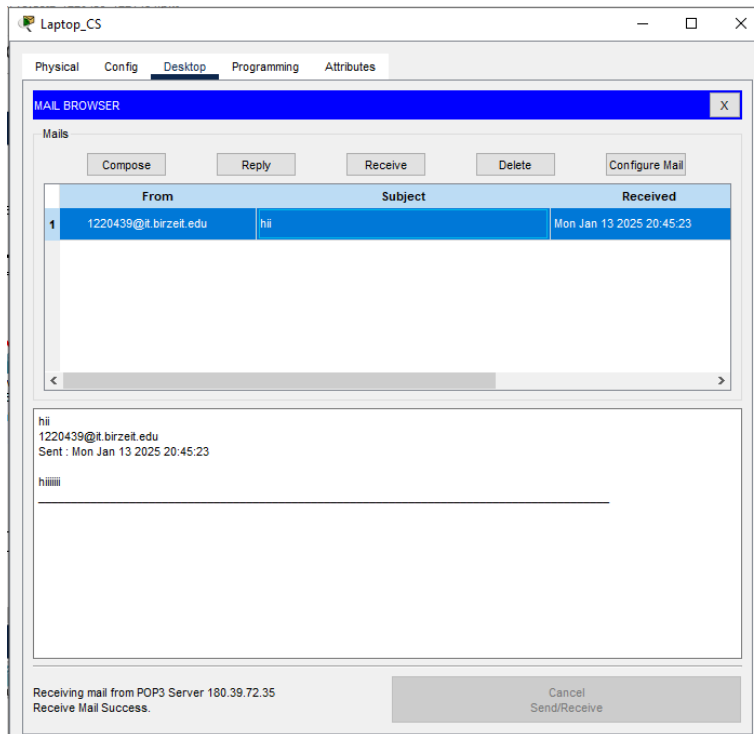


Figure 41: successful receiving Between Birzeit accounts



- Home-ISP Network AS-200

- Discussion:

The Home-ISP network brings it all together on a smaller scale, focusing on connecting devices within a home environment while also allowing access to the wider internet. The wireless network setup is especially relevant here, as it mirrors a typical home Wi-Fi scenario with secure encryption to keep connections safe. Dynamic NAT with PAT ensures private home devices can communicate with public networks by sharing a single public IP address. The DHCP server takes care of assigning IPs automatically, making life easier for users who just want their devices to work without extra configuration. With OSPF managing internal routing and BGP handling external connections, the Home-ISP network is both simple and effective. It's a great demonstration of how home networks can integrate seamlessly with larger systems.

- Results:

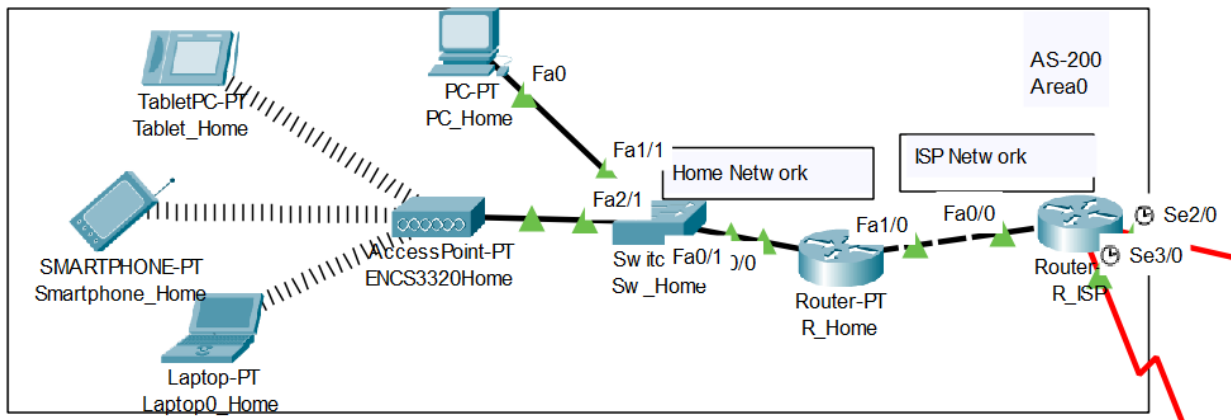


Figure 42: AS-200 Topology

PC\_Home

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.39.2

Subnet Mask 255.255.255.0

Default Gateway 192.168.39.1

DNS Server 8.8.39.18

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::201:97FF:FE1B:A112

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

Username

Password

Figure 43: PC\_Home static IP configuration

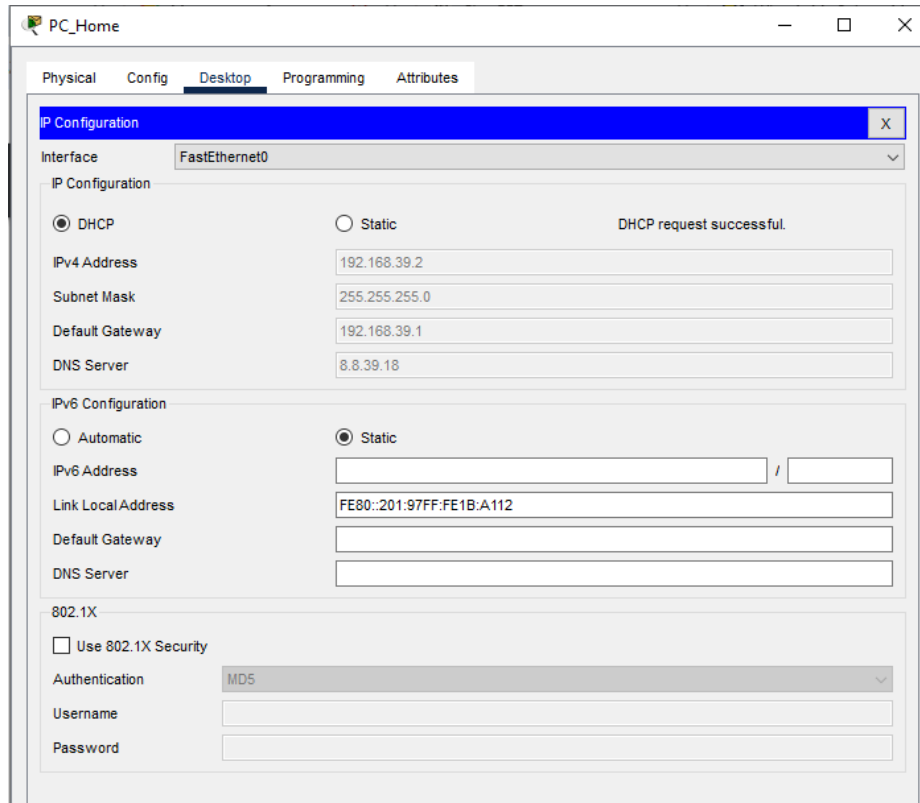


Figure 44: PC\_Home Dynamic IP configuration

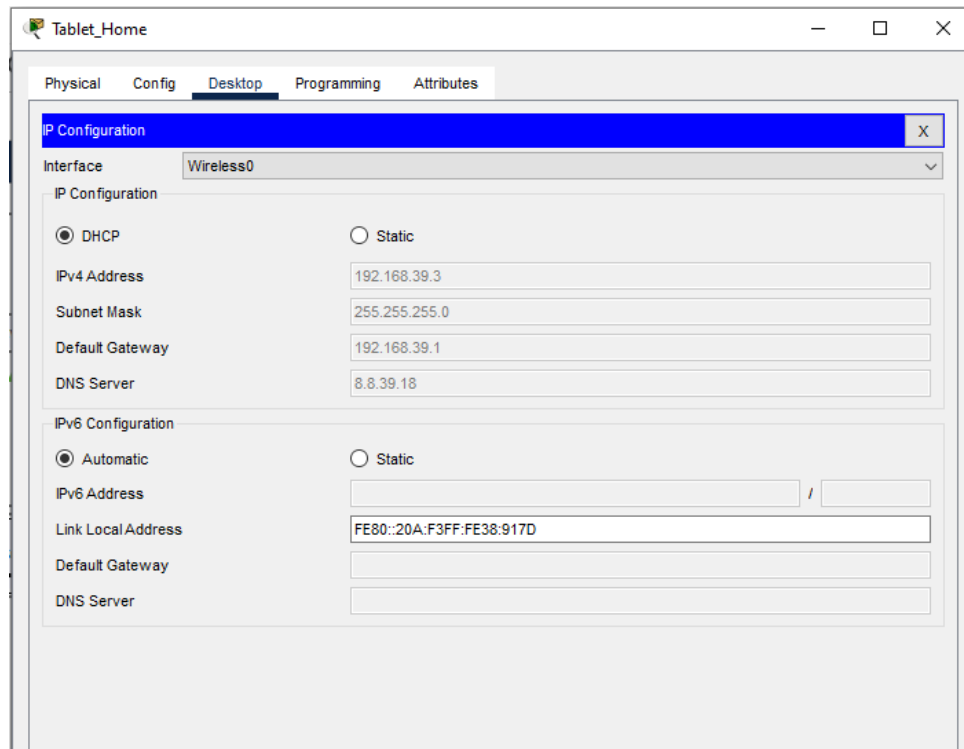


Figure 45: Tablet\_Home Dynamic IP configuration

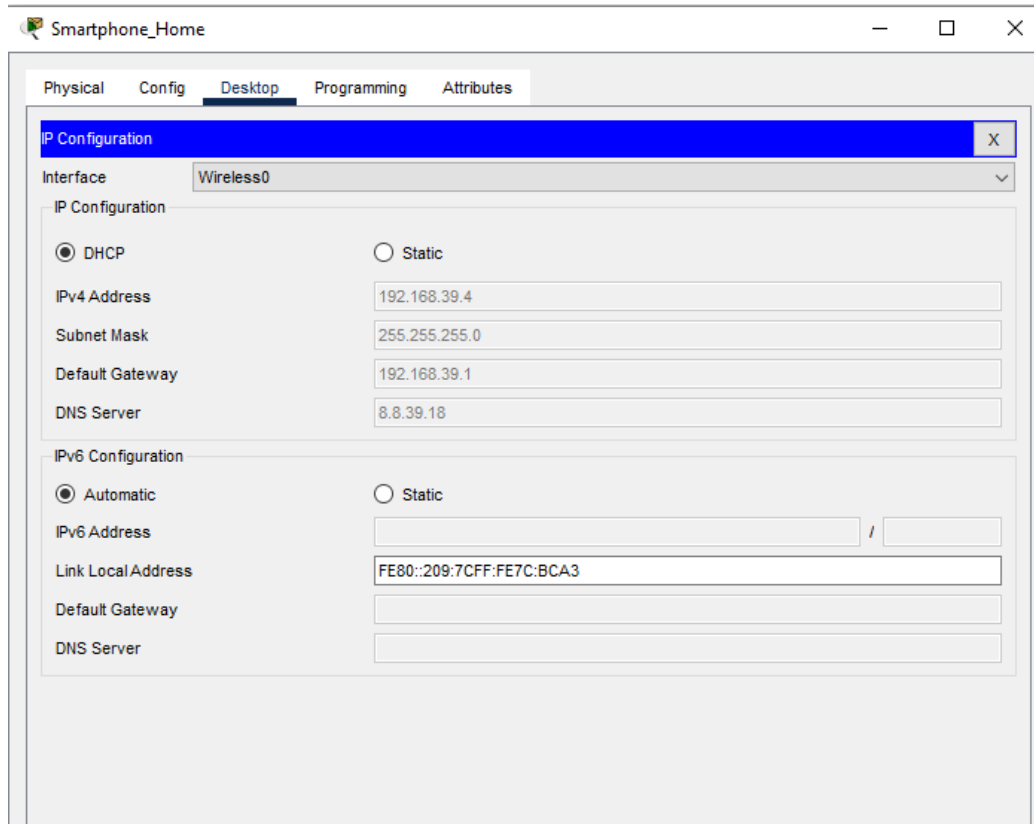


Figure 46: Smartphone\_Home Dynamic IP configuration

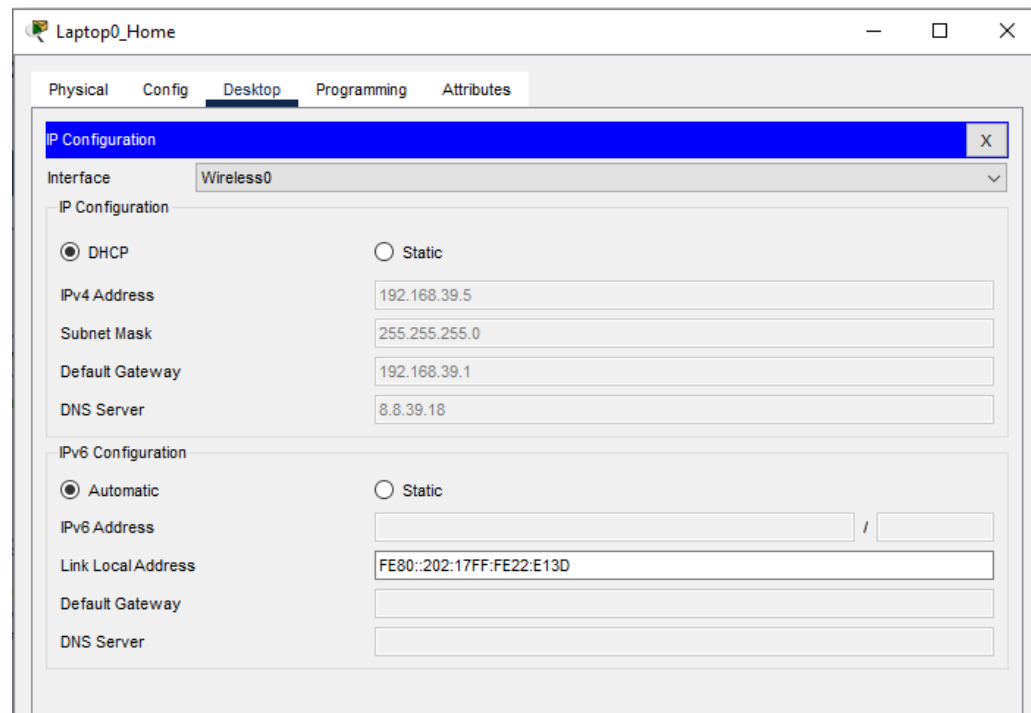


Figure 47: Laptop0\_Home Dynamic IP configuration

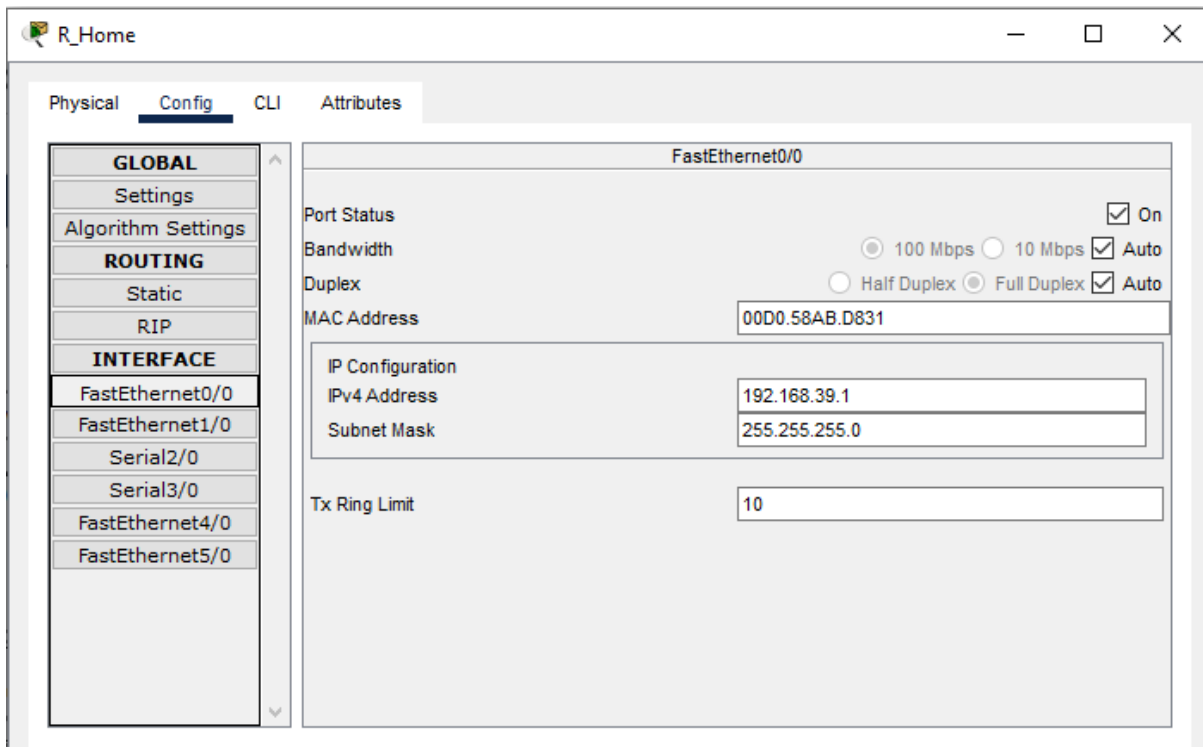


Figure 48: R\_Home Static IP configuration Home Network Port

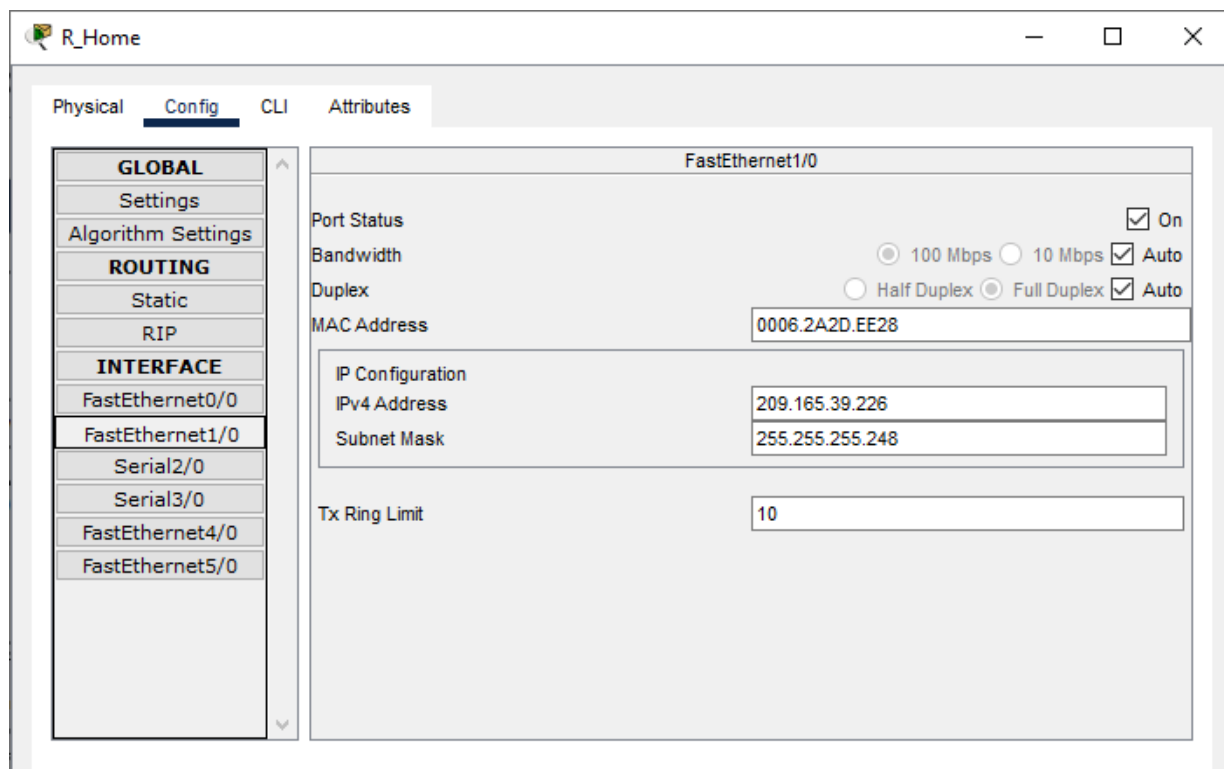


Figure 49: R\_Home Static IP configuration ISP Network Port

The screenshot shows the CLI of a router named R\_Home. The interface displays system information, including the processor (PT2005), software version (X.25 3.0.0), and network interfaces (4 FastEthernet/IEEE 802.3 and 2 Low-speed serial). It also shows the status of line protocols and OSPF processes. The user has entered the command 'show ip nat translations', which displays a table of NAT entries. The table has columns for 'Pro', 'Inside global', 'Inside local', 'Outside local', and 'Outside global'. The entries are for ICMP traffic from the 209.165.39.227 network to the 180.39.72.140 network.

```

PT2005 processor: part number 0, mask 01
Bridging software.
X.25 software, Version 3.0.0.
4 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)

Press RETURN to get started!

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up
00:00:45: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.39.225 on FastEthernet1/0 from LOADING
to FULL, Loading Done

Router>
Router>
Router>en
Router#show ip nat translations
Router#show ip nat translations
Pro Inside global Inside local Outside local Outside global
icmp 209.165.39.227:1024 192.168.39.3:1 8.8.39.18:1 8.8.39.18:1024
icmp 209.165.39.227:1025 192.168.39.3:2 8.8.39.18:2 8.8.39.18:1025
icmp 209.165.39.227:1026 192.168.39.5:1 180.39.72.66:1 180.39.72.66:1026
icmp 209.165.39.227:1027 192.168.39.5:2 180.39.72.66:2 180.39.72.66:1027
icmp 209.165.39.227:1028 192.168.39.4:1 180.39.72.35:1 180.39.72.35:1028
icmp 209.165.39.227:1029 192.168.39.4:2 180.39.72.35:2 180.39.72.35:1029
icmp 209.165.39.227:1030 192.168.39.3:3 180.39.72.130:3 180.39.72.130:1030
icmp 209.165.39.227:1031 192.168.39.3:4 180.39.72.130:4 180.39.72.130:1031
icmp 209.165.39.227:4 192.168.39.2:4 180.39.72.140:4 180.39.72.140:4
icmp 209.165.39.227:5 192.168.39.2:5 180.39.72.140:5 180.39.72.140:5

Router#
  
```

Figure 50: NAT table of R\_Home router

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	Tablet...	Laptop0_H...	ICMP		0.000	N	1	(ec
	Successful	Smart...	R_Home	ICMP		0.000	N	2	(ec
	Successful	PC_H...	Smartphon...	ICMP		0.000	N	3	(ec

Figure 51: Successful Ping results between home network devices.

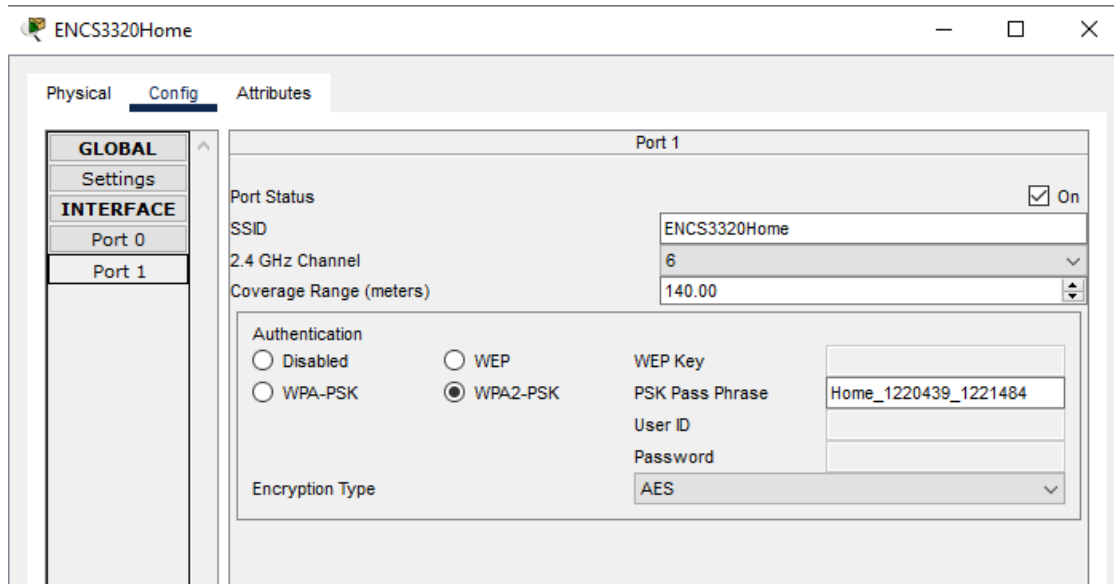


Figure 52: ENC3320Home Wireless network configuration

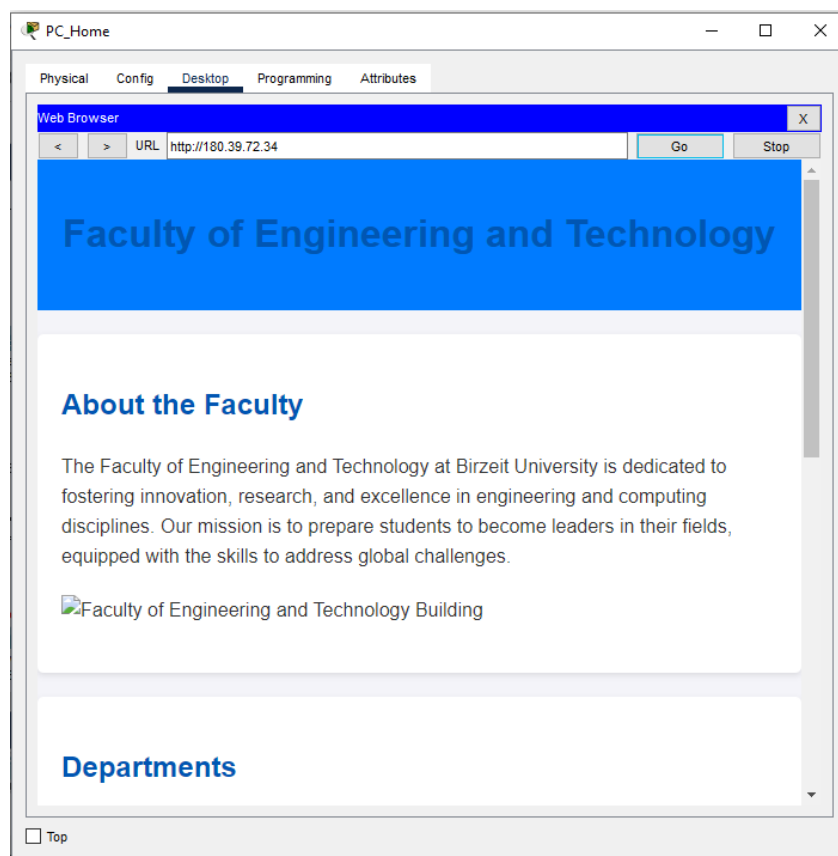


Figure 53: Successful access to www.it.birzeit.edu

**PC\_Home**

Physical Config **Desktop** Programming Attributes

**Configure Mail** [X]

**User Information**

Your Name: Tasneem Shelleh

Email Address: Shelleh\_Tasneem@gmail.com

**Server Information**

Incoming Mail Server: 8.8.39.26

Outgoing Mail Server: 8.8.39.26

**Logon Information**

User Name: Shelleh\_Tasneem

Password: .....

Save Remove Clear Reset

Figure 54: PC\_Home Email client configuration for gmail.com

**Laptop0\_Home**

Physical Config **Desktop** Programming Attributes

**Configure Mail** [X]

**User Information**

Your Name: Lara Asfour

Email Address: 1221484@it.birzeit.edu

**Server Information**

Incoming Mail Server: 180.39.72.35

Outgoing Mail Server: 180.39.72.35

**Logon Information**

User Name: 1221484

Password: .....

Save Remove Clear Reset

Figure 55: Laptop0\_Home Email client configuration for it.birzeit.edu



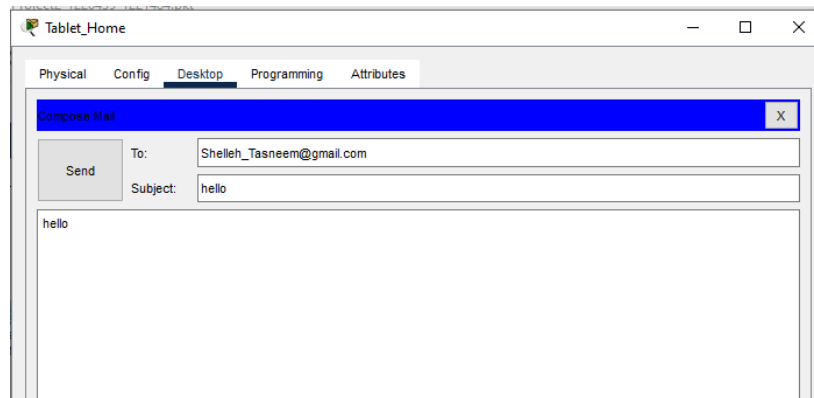


Figure 56: send Email between gmail.com accounts within the Home-ISP network

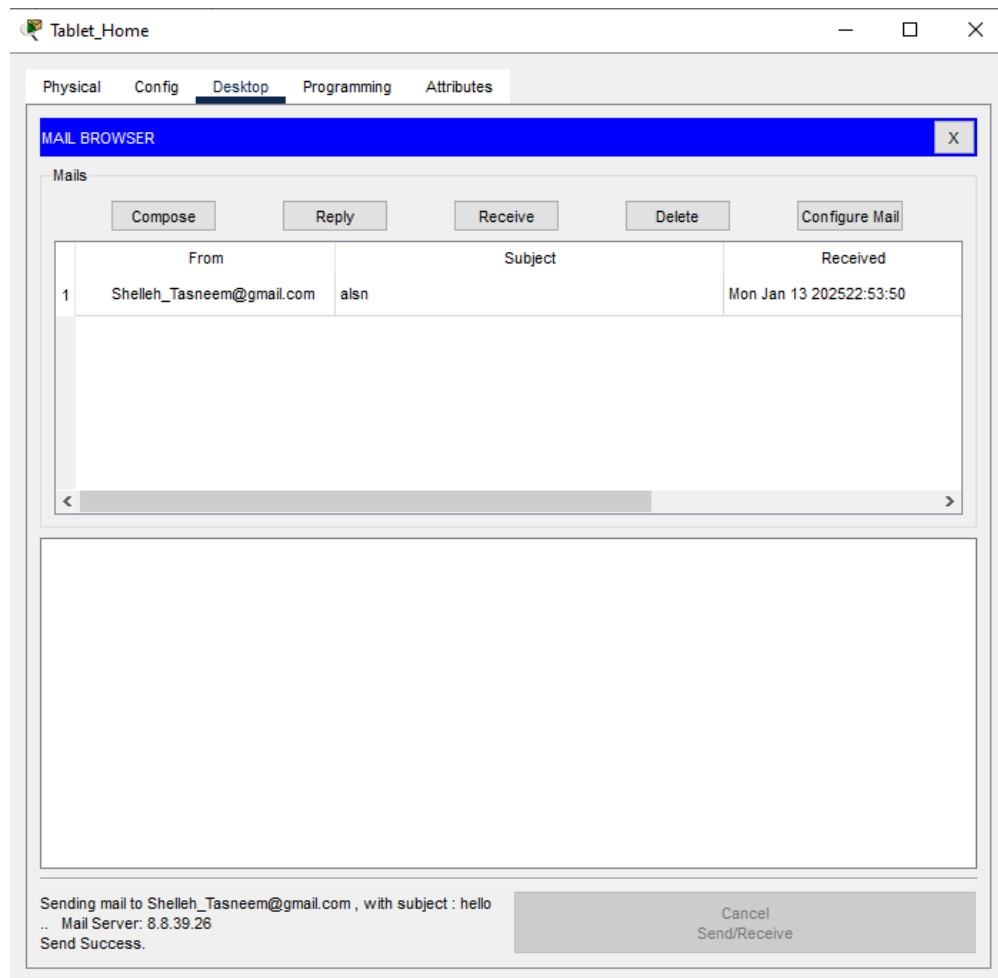


Figure 57: Successful sending between gmail.com accounts within the Home-ISP network.

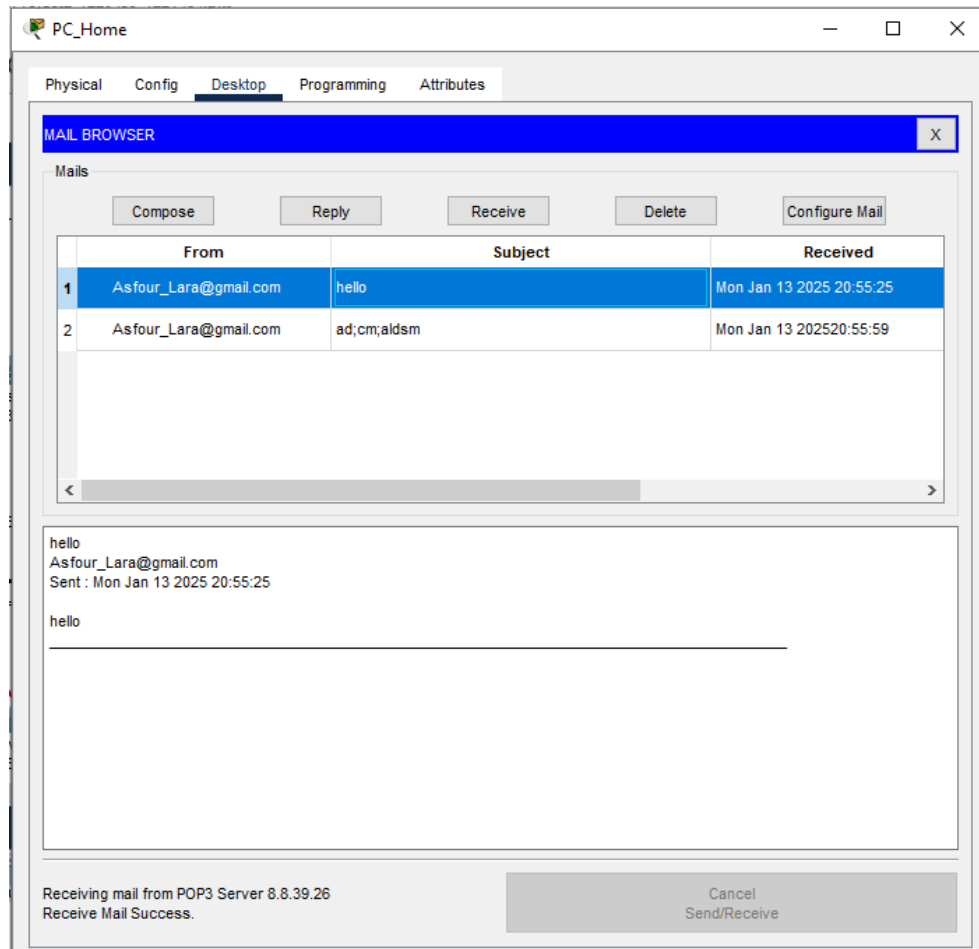


Figure 58: Successful receiving between gmail.com accounts within the Home-ISP network.

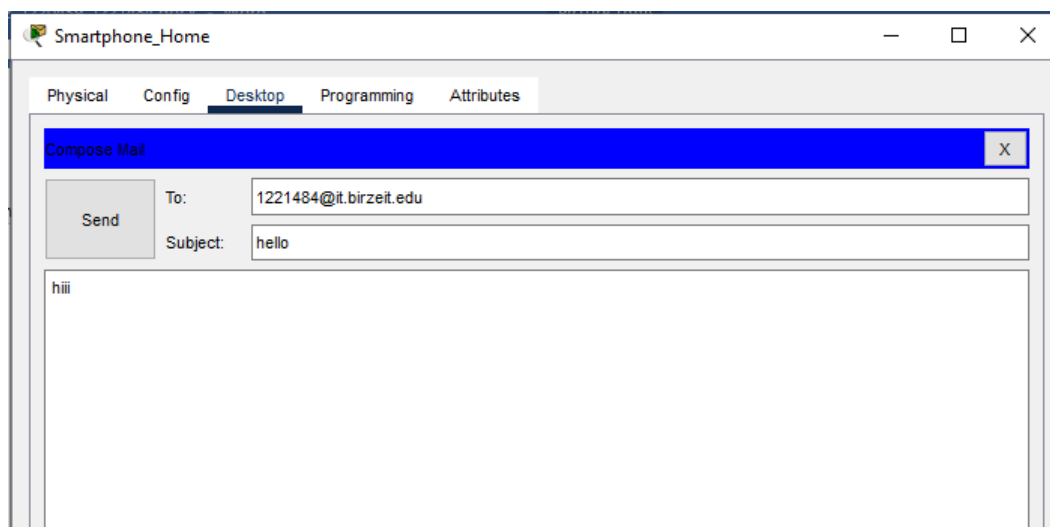


Figure 59: send Email Between it.birzeit.edu accounts within the Home-ISP network.

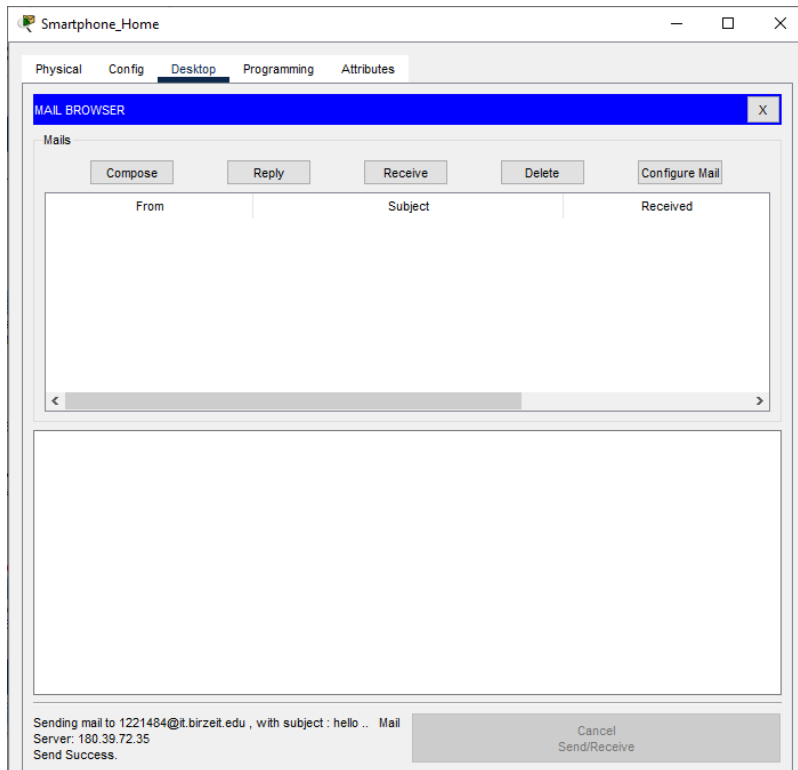


Figure 60: Successful sending between it.birzeit.edu accounts within the Home-ISP network.

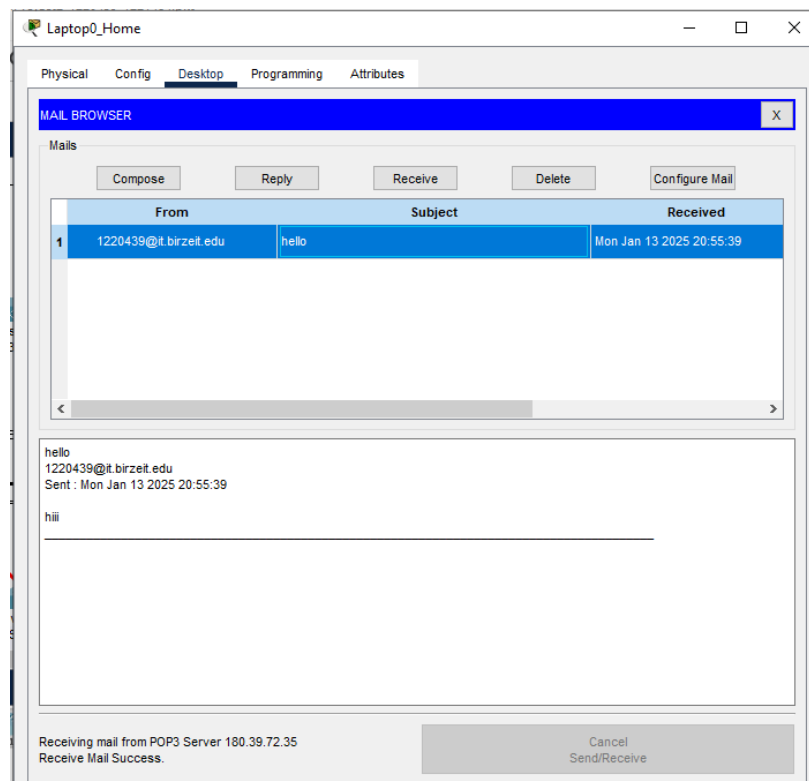


Figure 61: Successful receiving between it.birzeit.edu accounts within the Home-ISP network.

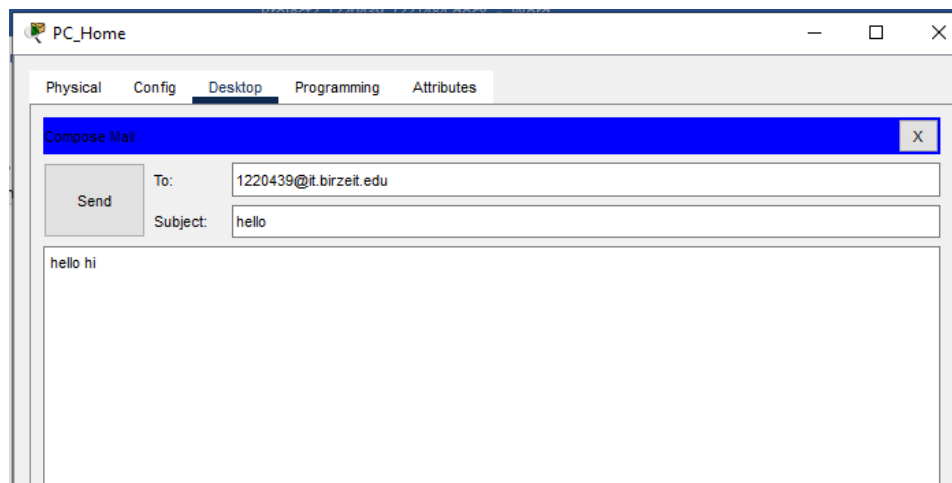


Figure 62: send Email Between gamil.com and it.birzeit.edu accounts within the Home-ISP network.

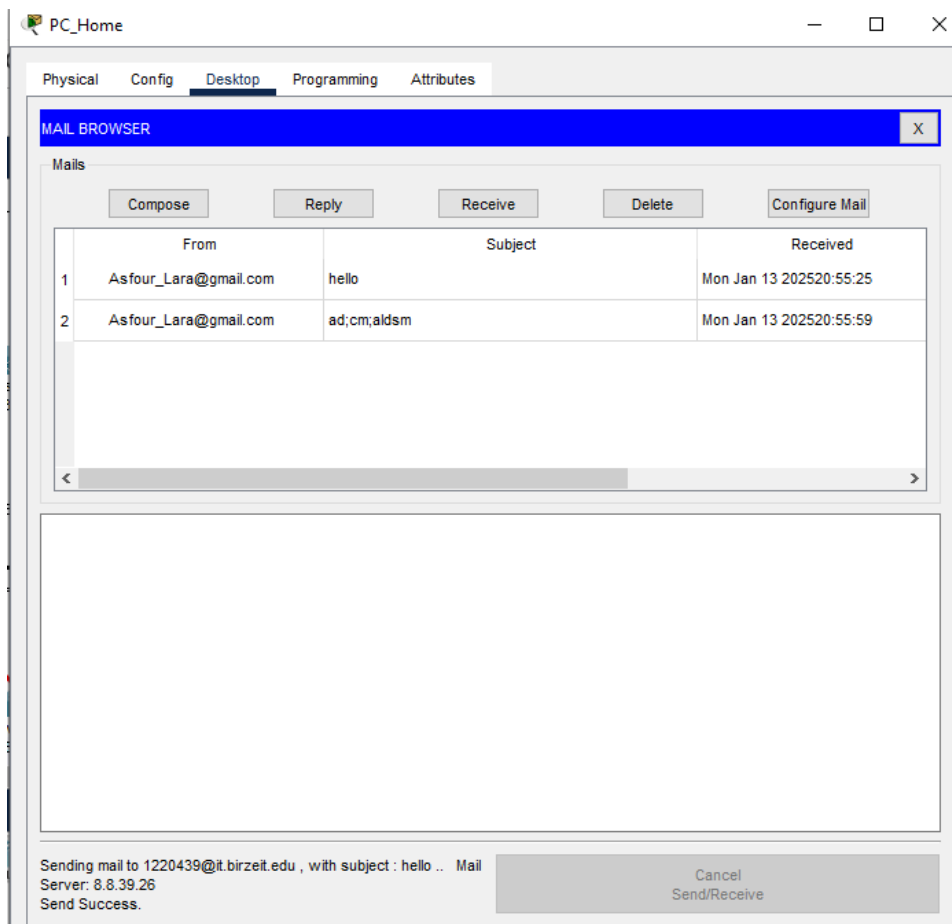


Figure 63: Successful sending between gmail.com and it.birzeit.edu accounts within the Home-ISP network.

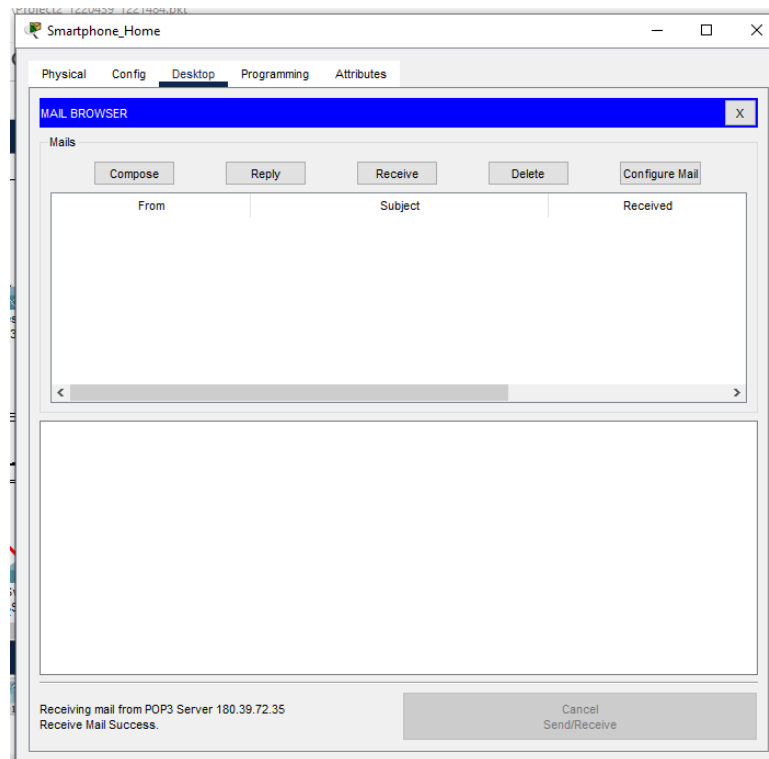


Figure 64: Successful receiving between gmail.com and it.birzeit.edu accounts within the Home-ISP network.

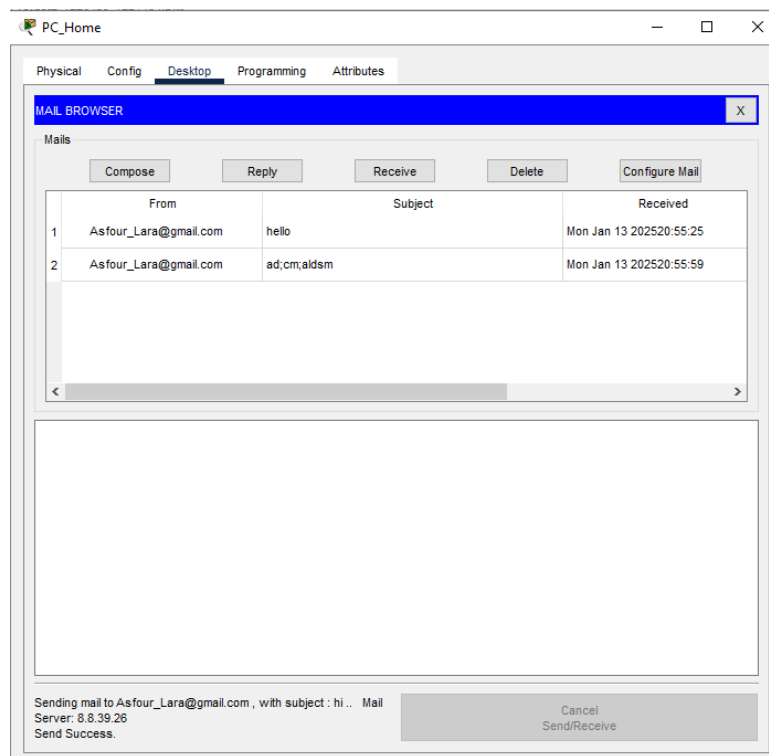


Figure 65:successful sending between Gmail accounts within the Home-ISP network and the Faculty of Engineering

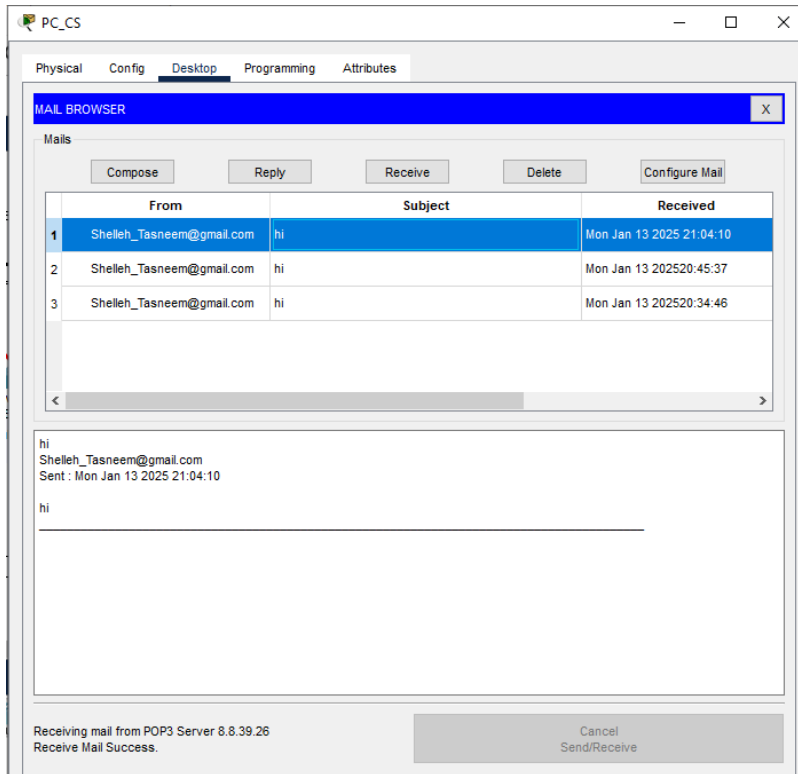


Figure 66: successful receiving between Gmail accounts within the Home-ISP network and the Faculty of Engineering

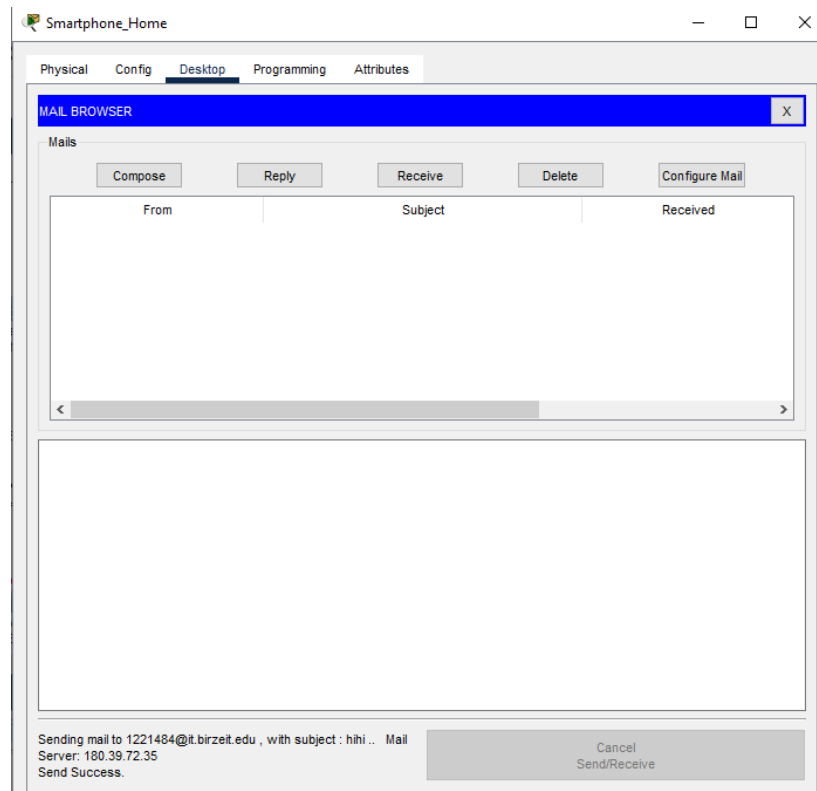


Figure 67: successful sending between Birzeit accounts within the Home-ISP network and the Faculty of Engineering

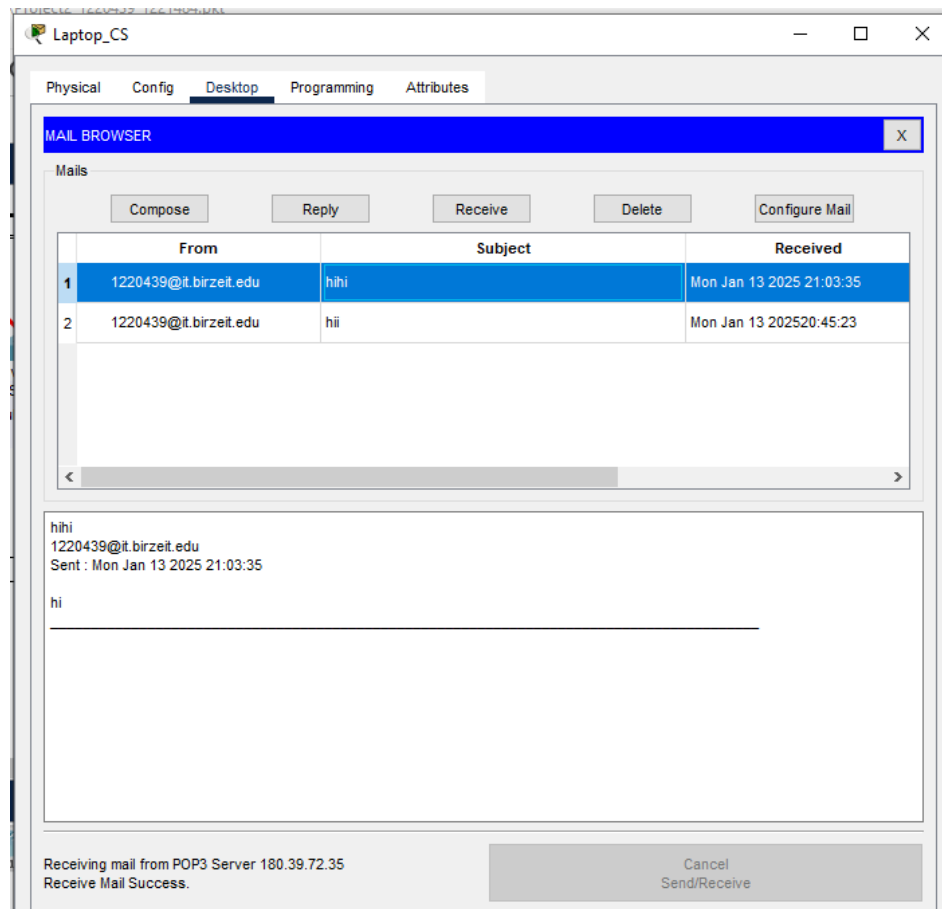


Figure 68: successful receiving between Birzeit accounts within the Home-ISP network and the Faculty of Engineering

- Central routers

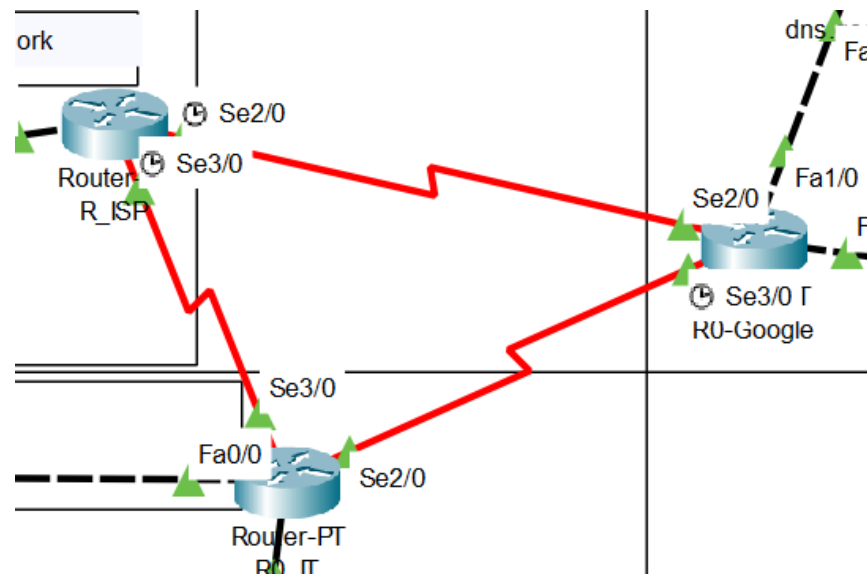


Figure 69: central routers

IP configuration of them:

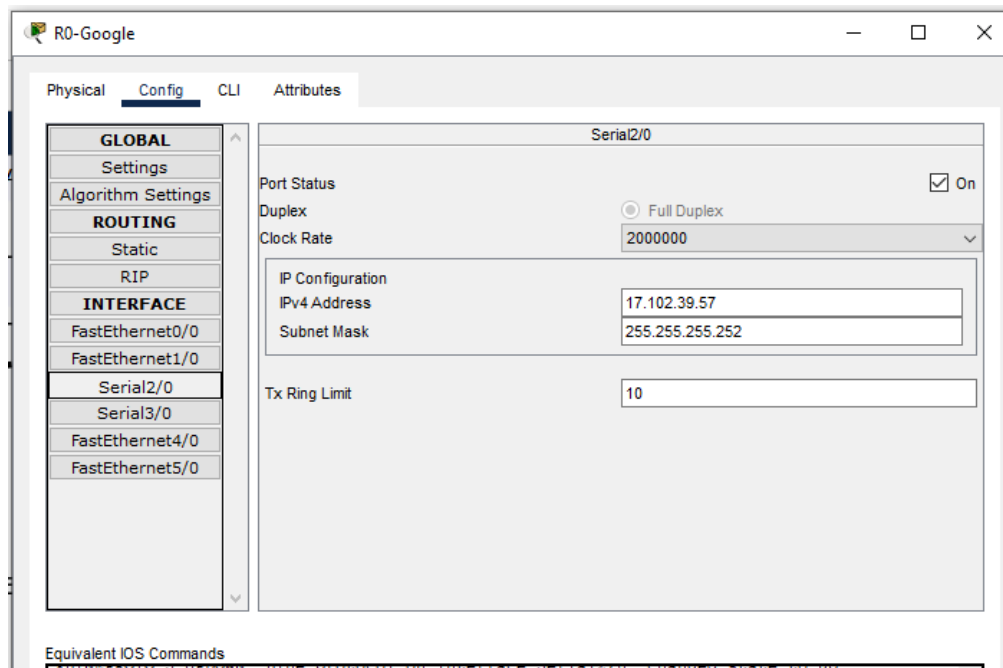


Figure 70: R0\_google IP configuration between AS-300 and AS-200



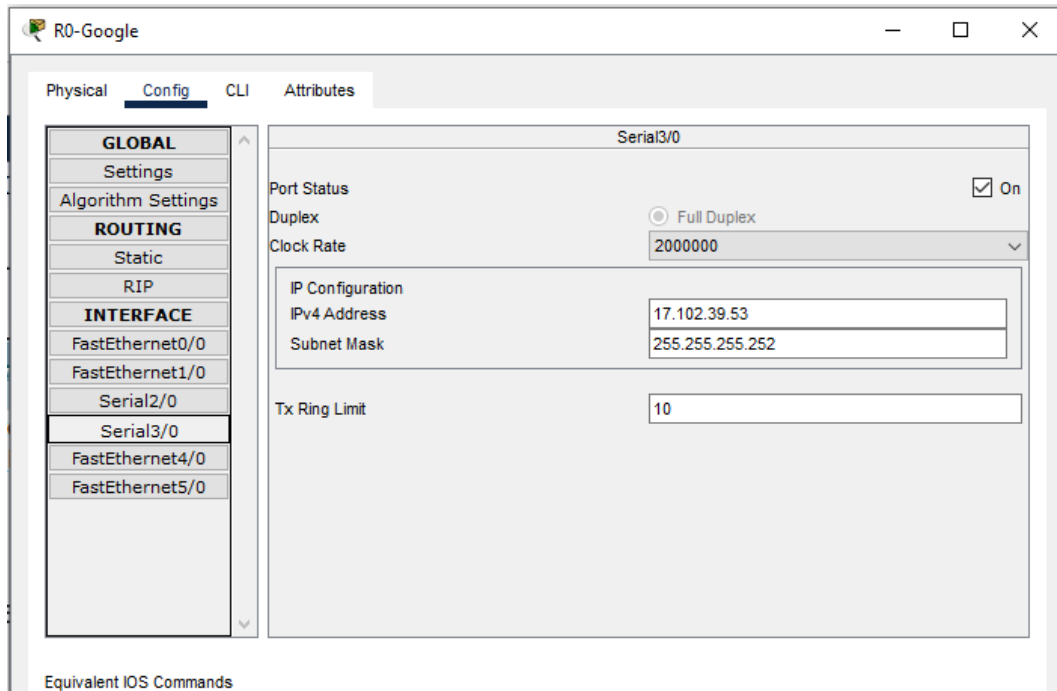


Figure 71: R0\_google IP configuration between AS-300 and AS-100

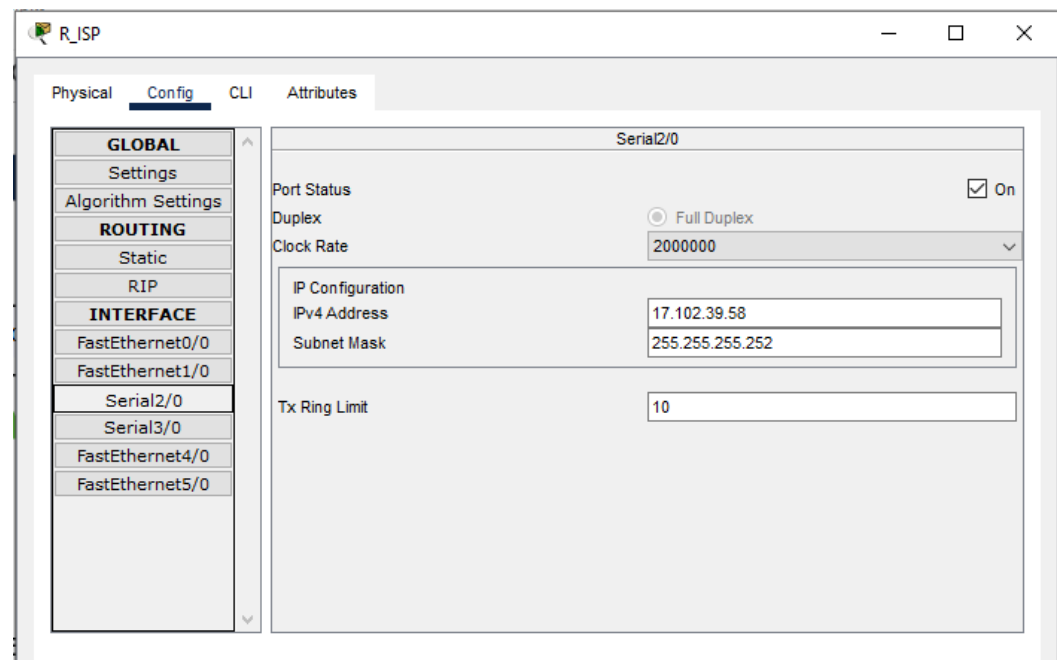


Figure 72: R\_ISP IP configuration between AS-200 and AS-300

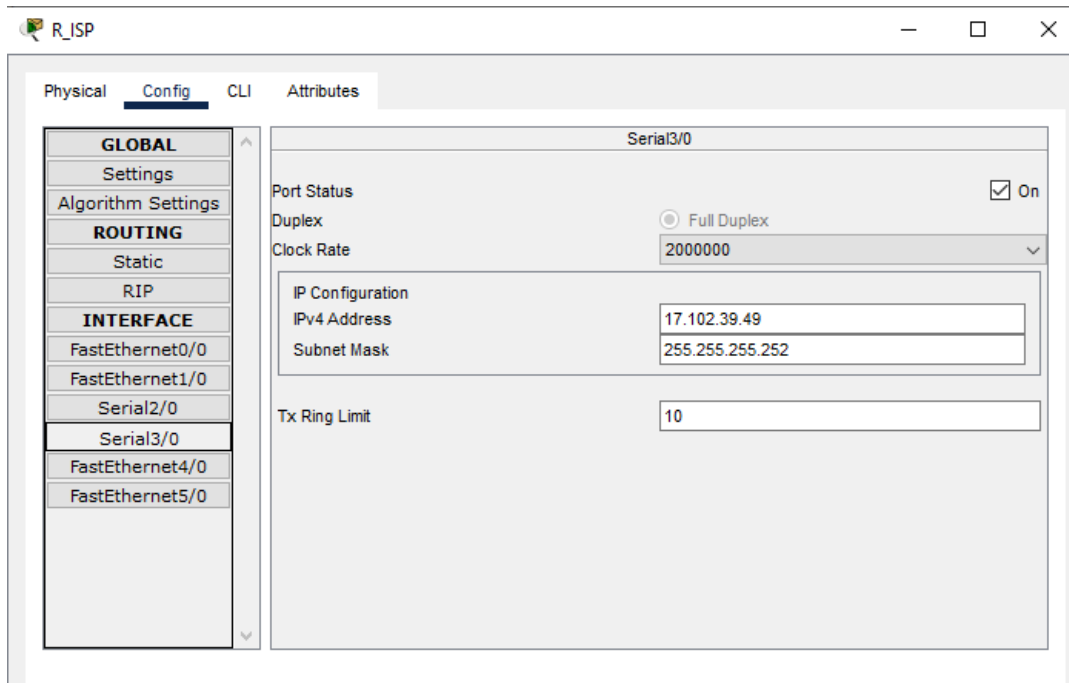


Figure 73: R\_ISP IP configuration between AS-200 and AS-100

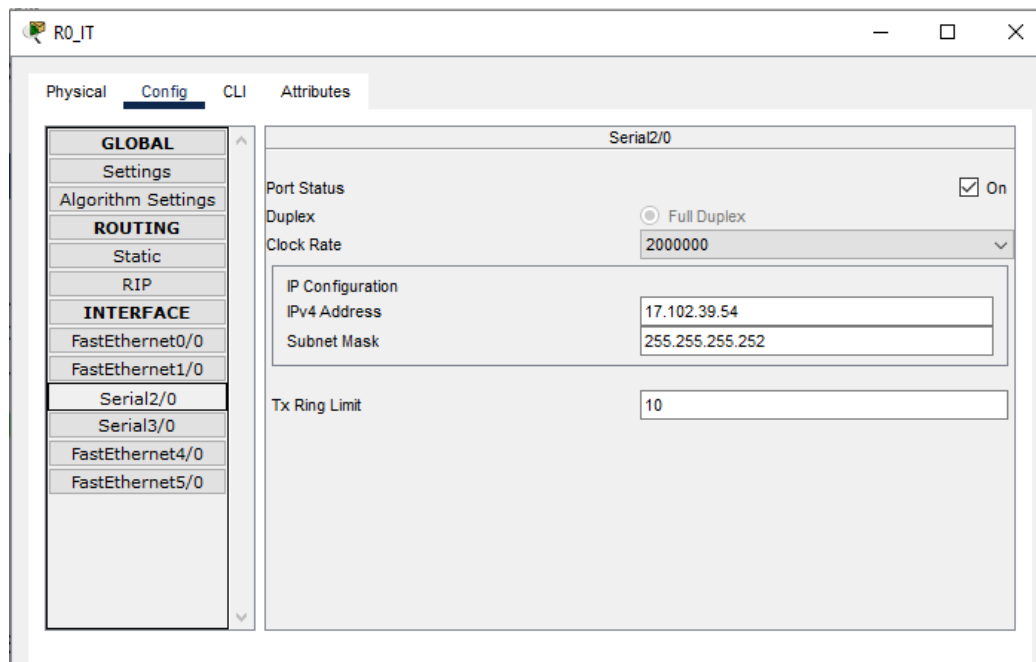


Figure 74: R0\_IT IP configuration between AS-100 and AS-300

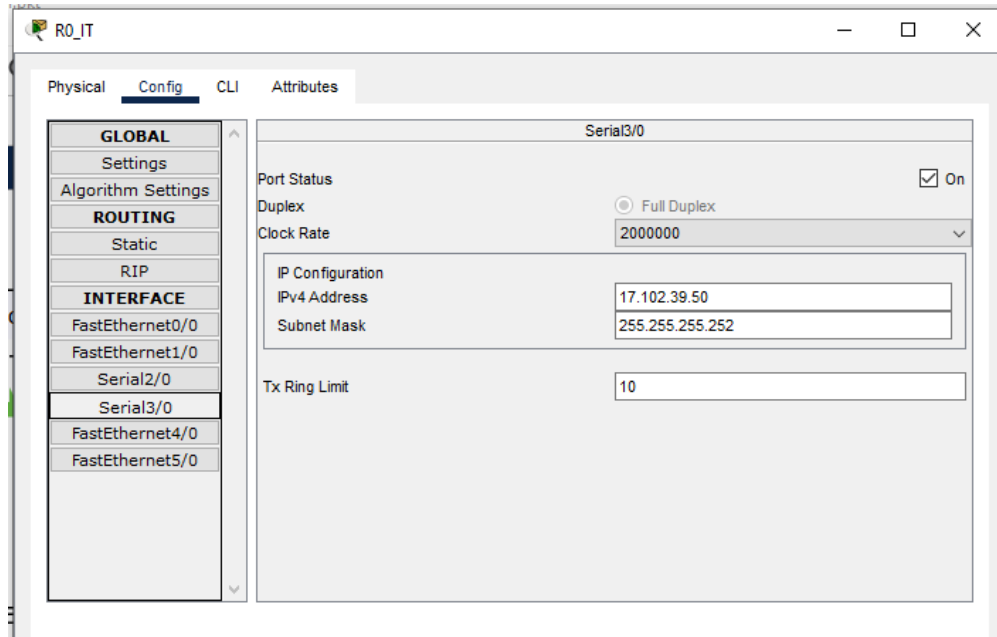


Figure 75: R0\_IT IP configuration between AS-100 and AS-200

## Issues and Limitations

Some problems that we faced it, then solved it:

- Overlaps occurred when try to set the IP address for ECE and CS subnets in AS-100, that we were mistaken in calculating the subnets, then we recalculate them.
- We could not connect more than 3 ports (servers) with the switch in servers subnet in As-100, then we changed the physical settings if the switch to make accept 4 ports.
- When we try to set the IP configuration of the end devices on DHCP (Dynamically), it gave us that DHCP Failed, until we set all the OSPF and BGP protocols it success.

## Conclusion

This project focused on creating and testing computer networks to deepen our understanding and application of key networking concepts, including IP addressing, subnetting, routing, switching, VLANs, and network security. Using Cisco Packet Tracer, we designed a network to simulate real-world scenarios, configuring and testing devices such as routers, switches, and computers. The platform allowed us to simulate data flow, troubleshoot network issues, and explore advanced protocols like OSPF and EIGRP, providing valuable hands-on experience in network design and management.

## Teamwork

For our project, we formed a team of two students to make sure everyone had an equal share of the work. We were open meetings and worked together on every task of the project, from connecting the networks until the results shown. By working closely together, we made sure to do the project completely. We was in project 1, three partners, but in this project one student went to another team, so the name of the team changed to our student IDs.

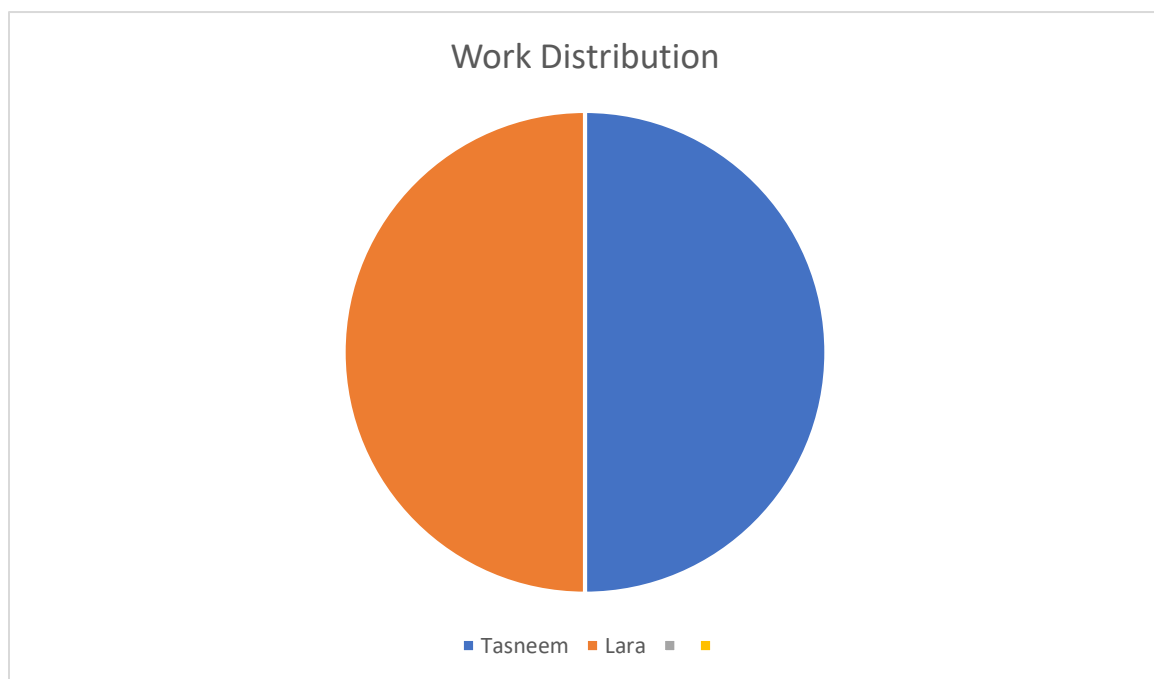


Figure 76: Team Work

## References

- Cisco Networking Academy, *Subnetting: IPv4 and IPv6 Concepts*, <https://www.netacad.com/>
- Internet Engineering Task Force (IETF), RFC 1034: *Domain Names - Concepts and Facilities*, <https://www.rfc-editor.org/>
- Internet Engineering Task Force (IETF), RFC 5321: *Simple Mail Transfer Protocol*, <https://www.rfc-editor.org/>
- HTTP/1.1: RFC 2616, *Hypertext Transfer Protocol*, <https://www.rfc-editor.org/>
- <https://www.techjunkie.com/what-is-my-subnet-mask/>