

# **Music Store Network Design Report**

Module code: 5FTC2095

Submission date: 22 March 2025

Module Leader: Dr. Nour Saad

Student Name: Haneen Osama

Student ID: 202200101

## Contents

1. Introduction
2. Network Design
  - Office Layout
  - Topology
  - Cable Specifications
3. IP Addressing and Subnetting
  - Calculation Table
  - Assigned IP addresses table
4. VLAN Configuration
  - Ground Floor
  - First Floor
5. Security Configuration
  - Setting of passwords on router and switches
  - ACLs
6. DHCP & NAT Configuration
7. ISP Configuration
8. Network Testing and Troubleshooting
9. Conclusion

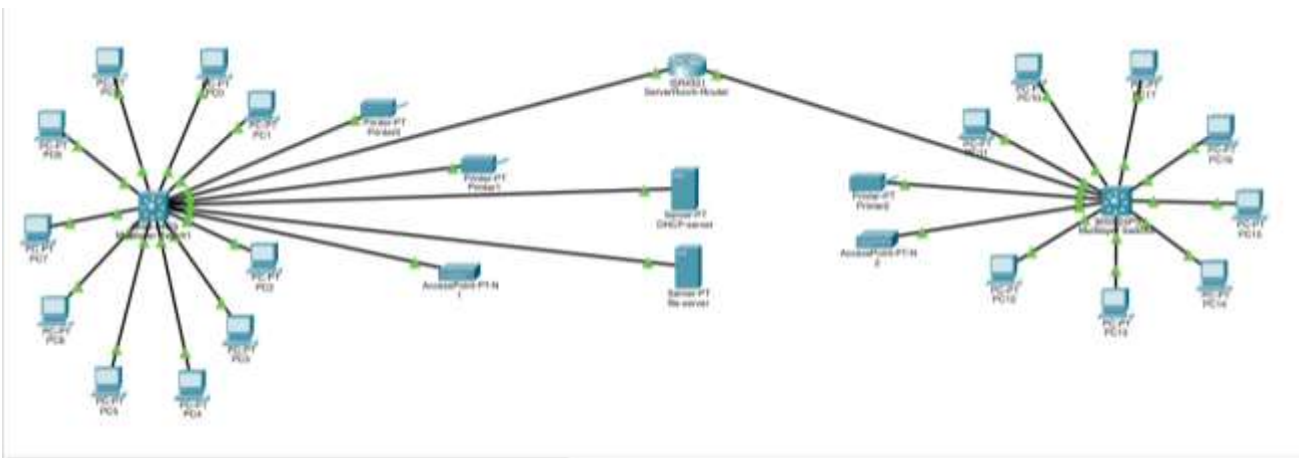
## Introduction

This report details the complete design, configuration, and security implementation of a network infrastructure made for a two-floor office. The configuration includes VLAN segmentation, IP addressing, inter-VLAN routing, and secure wireless connectivity. Firewall rules and access control lists (ACLs) have been implemented to enforce security policies, while ISP connectivity has been established for internet access. This report also includes testing and troubleshooting procedures to verify network functionality.

## Network Design

### Office Layout

1. Ground Floor:
  - 10 workstations
  - 2 printers
  - 1 wireless access point
  - Server room (File Server, DHCP Server, Router)
2. First Floor
  - 8 workstations
  - 1 printer
  - 1 wireless access point
  -
3. ISP Connection:
  - The router connects to the ISP via a serial interface



### Topology

The chosen network topology for this design is a Star Topology. This topology was chosen because it reduces congestion since network traffic is efficiently managed by the central switch rather than passing through multiple devices like in bus or ring topologies.

This structure ensures:

- High Reliability: a failure in one device or connection does not affect the rest of the network.
- Scalability: adding new devices is simple because each device connects directly to a switch.
- Ease of Troubleshooting & Management: it is easy to watch network traffic and identify issues quickly.

### Cable Specifications

Cable Type	Use Case	Specifications
Copper Straight-Through	Connecting PCs, printers, and APs to switches	Cat6 Ethernet Cable

## IP addressing and subnetting

Calculation table

VLAN	Department	Needed IPs	Closest Subnet Block	Subnet Mask	Network Address	Broadcast Address	IP Range
10	HR	10	64 (/26)	255.255.255.192	192.168.1.0	192.168.1.63	192.168.1.1 - 192.168.1.62
20	Finance	7	64 (/26)	255.255.255.192	192.168.1.64	192.168.1.127	192.168.1.65 - 192.168.1.126
30	IT	2	64 (/26)	255.255.255.192	192.168.1.128	192.168.1.191	192.168.1.129 - 192.168.1.190
40	Guestwifi (additional)	0	32 (/27)	255.255.255.224	192.168.1.192	192.168.1.223	192.168.1.193 - 192.168.1.222

### Assigned IP addresses table

Device	IP Address	Subnet mask	Default gateway	VLAN
GROUND FLOOR				
PC0	192.168.1.1	255.255.255.192	192.168.1.1	10
PC1	192.168.1.6	255.255.255.192	192.168.1.1	10
PC2	192.168.1.5	255.255.255.192	192.168.1.1	10
PC3	192.168.1.2	255.255.255.192	192.168.1.1	10
PC4	192.168.1.4	255.255.255.192	192.168.1.1	10
PC5	192.168.1.71	255.255.255.192	192.168.1.65	20
PC6	192.168.1.70	255.255.255.192	192.168.1.65	20
PC7	192.168.1.69	255.255.255.192	192.168.1.65	20
PC8	192.168.1.68	255.255.255.192	192.168.1.65	20
PC9	192.168.1.66	255.255.255.192	192.168.1.65	20
DHCP SERVER	192.168.1.130	255.255.255.192	192.168.1.129	30
FILE SERVER	192.168.1.131	255.255.255.192	192.168.1.129	30
PRINTER0	192.168.1.140	255.255.255.192	192.168.1.129	30
PRINTER1	192.168.1.142	255.255.255.192	192.168.1.129	30
ACCESS POINT	—	—	—	—
FIRST FLOOR				
PC10	192.168.1.9	255.255.255.192	192.168.1.1	10

<b>PC11</b>	192.168.1.12	255.255.255.192	192.168.1.1	10
<b>PC12</b>	192.168.1.3	255.255.255.192	192.168.1.1	10
<b>PC13</b>	192.168.1.8	255.255.255.192	192.168.1.1	10
<b>PC14</b>	192.168.1.10	255.255.255.192	192.168.1.1	10
<b>PC15</b>	192.168.1.77	255.255.255.192	192.168.1.65	20
<b>PC16</b>	192.168.1.76	255.255.255.192	192.168.1.65	20
<b>PC17</b>	192.168.1.65	255.255.255.192	192.168.1.65	20
<b>PRINTER2</b>	192.168.1.146	255.255.255.192	192.168.1.129	30
<b>ACCESS POINT 2</b>	—	—		—
<b>ROUTER(ISP)</b>	11.1.1.1	255.255.255.252	11.1.1.2	WAN

## VLAN configuration

VLANs are implemented to segment the network logically, improving security and performance. The VLAN design follows the principle of separation based on department and function:

- VLAN 10 (HR Department): Used for HR employees.
- VLAN 20 (Finance): Used for the Finance department.
- VLAN 30 (IT Department): Used for IT staff and administrators.
- VLAN 40 (Guest Wi-Fi): Isolated Wi-Fi network for visitors (no internal access).

### 1. GROUND FLOOR

VLAN configuration

## User Access Verification

Password:

Osana1>enable

Osana1#

Osana1#configure terminal

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

Osana1(config)#interface FastEthernet0/1

Osana1(config-if)#

Osana1(config-if)#exit

Osana1(config)#

Osana1(config)#vlan 10

Osana1(config-vlan)#name HR

Osana1(config-vlan)#vlan 20

Osana1(config-vlan)#name Finance

VLAN #15 and #20 have an identical name: Finance

Osana1(config-vlan)#no vlan 15

Osana1(config)#no vlan 20

Osana1(config)#vlan 20

Osana1(config-vlan)#name Finance

Osana1(config-vlan)#vlan 30

Osana1(config-vlan)#name IT

Osana1(config-vlan)#vlan 40

Osana1(config-vlan)#name guestWifi

Osana1(config-vlan)#exit

Osana1(config)#

## VLAN assignments on ports

```
Osamal(config)#interface FastEthernet0/1
Osamal(config-if)#switchport mode access
Osamal(config-if)#switchport access vlan 10
Osamal(config-if)#exit
Osamal(config)#interface fa0/2
Osamal(config-if)#switchport mode access
Osamal(config-if)#switchport access vlan 10
Osamal(config-if)#exit
Osamal(config)#interface fa0/3
Osamal(config-if)#switchport mode access
Osamal(config-if)#switchport access vlan 10
Osamal(config-if)#exit
Osamal(config)#interface fa0/4
Osamal(config-if)#switchport mode access
Osamal(config-if)#switchport access vlan 10
```

## Trunk configuration of VLANS

```
groundfloor_switch>enable
groundfloor_switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
groundfloor_switch(config)#interface Gi1/0/1
groundfloor_switch(config-if)#switchport mode trunk

groundfloor_switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan30, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan40, changed state to up

groundfloor_switch(config-if)#switchport trunk allowed vlan 10,20,30,40
groundfloor_switch(config-if)#exit
groundfloor_switch(config)#
```



## 2. FIRST FLOOR

### VLANs and trunk configuration

```
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#ip routing
Switch(config)#
Switch(config)#
Switch(config)#interface GigabitEthernet1/0/1
Switch(config-if)#exit
Switch(config)#hostname firstfloor_switch
firstfloor_switch(config)#vlan 10
firstfloor_switch(config-vlan)#name HR
firstfloor_switch(config-vlan)#exit
firstfloor_switch(config)#vlan 20
firstfloor_switch(config-vlan)#name Finance
firstfloor_switch(config-vlan)#exit
firstfloor_switch(config)#vlan 30
firstfloor_switch(config-vlan)#name IT
firstfloor_switch(config-vlan)#exit
firstfloor_switch(config)#vlan 40
firstfloor_switch(config-vlan)#name Guestwifi
firstfloor_switch(config-vlan)#exit
firstfloor_switch(config)#interface range Gi1/0/1-3
firstfloor_switch(config-if-range)#switchport mode access
firstfloor_switch(config-if-range)#switchport access vlan 10
firstfloor_switch(config-if-range)#exit
firstfloor_switch(config)#interface range Gi1/0/4-6
firstfloor_switch(config-if-range)#switchport mode access
firstfloor_switch(config-if-range)#switchport access vlan 20
firstfloor_switch(config-if-range)#exit
firstfloor_switch(config)#interface range Gi1/0/7-8
firstfloor_switch(config-if-range)#switchport mode access
firstfloor_switch(config-if-range)#switchport access vlan 30
firstfloor_switch(config-if-range)#exit
firstfloor_switch(config)#interface range Gi1/0/10
firstfloor_switch(config-if-range)#switchport mode access
firstfloor_switch(config-if-range)#switchport access vlan 40
firstfloor_switch(config-if-range)#exit
```

## Security configuration

### Setting of passwords on router and switches

```
r1>enable
r1#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
r1(config)#hostname Haneen
Haneen(config)#no ip domain-lookup
Haneen(config)#line con 0
Haneen(config-line)#password password
% Password too short - must be at least 10 characters. Password not configured.
Haneen(config-line)#line con 0
Haneen(config-line)#no security passwords min-length 10
Haneen(config)#line con 0
Haneen(config-line)#password password
Haneen(config-line)#login
Haneen(config-line)#exit
Haneen(config)#enable secret cisco
Haneen(config)#line vty 0 4
Haneen(config-line)#password 1234
Haneen(config-line)#login
Haneen(config-line)#exit
Haneen(config)#service password-encryption
Haneen(config)#banner motd #Unauthorized access prohibited!#
Haneen(config)#
```

## ACLs

ACLs are configured on the router to control traffic between VLANs and to/from the internet:

```
User Access Verification

Password:

Haneen>enable
Password:
Haneen#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Haneen(config)#access-list 100 deny ip 192.168.1.0 0.0.0.255 any
Haneen(config)#access-list 100 permit ip any any
Haneen(config)#interface GigabitEthernet 0/0
%Invalid interface type and number
Haneen(config)#exit
Haneen#
%SYS-5-CONFIG_I: Configured from console by console

Haneen#show ip interface brief

```

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0/0	192.168.1.1	YES	manual	up	up
GigabitEthernet0/0/1	192.168.1.65	YES	manual	up	up
Vlan1	unassigned	YES	unset	administratively down	down

## DHCP and NAT configuration

### DHCP

DHCP relay is configured on the router to forward DHCP requests from each VLAN to the central DHCP server:

```
Haneen(config)#ip dhcp pool HR_Pool
Haneen(dhcp-config)#network 192.168.1.0 255.255.255.192
Haneen(dhcp-config)#default-router 192.168.1.1
Haneen(dhcp-config)#dns-server 8.8.8.8
Haneen(dhcp-config)#exit
Haneen(config)#ip dhcp pool Finance_Pool
Haneen(dhcp-config)#network 192.168.1.64 255.255.255.192
Haneen(dhcp-config)#default-router 192.168.65
Haneen(dhcp-config)#exit
% Invalid input detected at '^' marker.
Haneen(dhcp-config)#default-router 192.168.65
Haneen(dhcp-config)#exit
% Invalid input detected at '^' marker.
Haneen(dhcp-config)#default-router 192.168.1.65
Haneen(dhcp-config)#dns-server 8.8.8.8
Haneen(dhcp-config)#exit
Haneen(config)#ip dhcp pool IT_Pool
Haneen(dhcp-config)#network 192.168.1.128 255.255.255.192
Haneen(dhcp-config)#default-router 192.168.1.129
Haneen(dhcp-config)#dns-server 8.8.8.8
Haneen(dhcp-config)#exit
Haneen(config)#ip dhcp pool guestWifi_Pool
Haneen(dhcp-config)#network 192.168.1.192 255.255.255.224
Haneen(dhcp-config)#default-router 192.168.1.193
Haneen(dhcp-config)#dns-server 8.8.8.8
Haneen(dhcp-config)#exit
Haneen#
```

### NAT

Network Address Translation is implemented on the router to allow internal devices to access the internet:

```
ISP_router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
ISP_router(config)#access-list 1 permit 192.168.1.0 0.0.0.255
ISP_router(config)#ip nat inside source list 1 interface Serial0/1/0 overload
ISP_router(config)#interface GigabitEthernet0/0/0
ISP_router(config-if)#ip nat inside
ISP_router(config-if)#exit
ISP_router(config)#interface Serial0/1/0
ISP_router(config-if)#ip nat outside
ISP_router(config-if)#exit
ISP_router(config)#exit
ISP_router#
%SYS-5-CONFIG_I: Configured from console by console
show ip nat translations
ISP_router#show ip nat translations
ISP_router#show running-config | include ip nat
ip nat inside
ip nat outside
ip nat inside source list 1 interface Serial0/1/0 overload
ISP_router#
```

## ISP configuration

```
Haneen(config)#interface Serial0/1/0
Haneen(config-if)#ip address 11.1.1.1 255.255.255.252
Haneen(config-if)#clock rate 640000
Unknown clock rate
Haneen(config-if)#clock rate 64000
Haneen(config-if)#no shutdown
Haneen(config-if)#exit
Haneen(config)#ip route 0.0.0.0 0.0.0.0 11.1.1.2
Haneen(config)#
```

## Testing and troubleshooting

Test 1: ping vlan 10 pc to router

### Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time<1ms TTL=255
Reply from 192.168.1.1: bytes=32 time<1ms TTL=255
Reply from 192.168.1.1: bytes=32 time<1ms TTL=255
Reply from 192.168.1.1: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Test 2: ping vlan 10 pc to vlan 20 pc

### Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.66

Pinging 192.168.1.66 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.66: bytes=32 time<1ms TTL=127
Reply from 192.168.1.66: bytes=32 time<1ms TTL=127
Reply from 192.168.1.66: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.1.66:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

### Test 3: DHCP binding

```
groundfloor_switch#show ip dhcp binding
IP address      Client-ID/      Lease expiration   Type
Hardware address
192.168.1.2     0002.1745.1A9B  --                 Automatic
192.168.1.3     00D0.BA23.801E  --                 Automatic
192.168.1.4     0001.6339.81AC  --                 Automatic
192.168.1.5     0030.A3C1.0DB8  --                 Automatic
192.168.1.6     0060.3E12.454A  --                 Automatic
192.168.1.7     0060.4740.0808  --                 Automatic
192.168.1.66    0001.97A7.BDB5  --                 Automatic
192.168.1.67    0030.A3E6.3CD1  --                 Automatic
192.168.1.68    0001.9756.2646  --                 Automatic
192.168.1.69    00D0.589B.8D28  --                 Automatic
```

```
groundfloor_switch#show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Gig1/0/13, Gig1/0/14, Gig1/0/15, Gig1/0/16 Gig1/0/17, Gig1/0/18, Gig1/0/19, Gig1/0/20 Gig1/0/21, Gig1/0/22, Gig1/0/23, Gig1/0/24 Gig1/1/1, Gig1/1/2, Gig1/1/3, Gig1/1/4
10	HR	active	Gig1/0/1, Gig1/0/2, Gig1/0/3, Gig1/0/4 Gig1/0/5, Gig1/0/11
20	Finance	active	Gig1/0/6, Gig1/0/7, Gig1/0/8, Gig1/0/9 Gig1/0/10, Gig1/0/12
30	IT	active	
40	Guestwifi	active	
1002	fdi-default	active	
1003	token-ring-default	active	
1004	fdiinet-default	active	
1005	trinet-default	active	

## Test 4: show vlan brief, show ip interface

```
192.168.1.69 00D0.589B.6D28 -- Automatic
groundfloor_switch#show vlan brief

VLAN Name                Status    Ports
-----
1    default                active    Gig1/0/13, Gig1/0/14, Gig1/0/15, Gig1/0/16
                                           Gig1/0/17, Gig1/0/18, Gig1/0/19, Gig1/0/20
                                           Gig1/0/21, Gig1/0/22, Gig1/0/23, Gig1/0/24
10   HR                      active    Gig1/1/1, Gig1/1/2, Gig1/1/3, Gig1/1/4
                                           Gig1/0/1, Gig1/0/2, Gig1/0/3, Gig1/0/4
                                           Gig1/0/5, Gig1/0/11
20   Finance                 active    Gig1/0/6, Gig1/0/7, Gig1/0/8, Gig1/0/9
                                           Gig1/0/10, Gig1/0/12
30   IT                      active
40   Guestwifi               active
1002 fddi-default           active
1003 token-ring-default    active
1004 fddinet-default        active
1005 trnet-default          active

groundfloor_switch#show ip interface
GigabitEthernet1/0/1 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/2 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/3 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/4 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/5 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/6 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/7 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/8 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/9 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/10 is up, line protocol is up
  Internet protocol processing disabled
GigabitEthernet1/0/11 is up, line protocol is up
  Internet protocol processing disabled

groundfloor_switch#show running-config | include interface Vlan | ip address
no ip address
ip address 192.168.1.1 255.255.255.192
ip address 192.168.1.65 255.255.255.192
ip address 192.168.1.129 255.255.255.192
ip address 192.168.1.193 255.255.255.224
groundfloor_switch#
```

## Conclusion

This report documents the successful implementation of a fully functional network, including VLAN segmentation, DHCP configuration, NAT, firewall security, and ISP connectivity. Extensive testing confirmed full functionality.