



ZDC Enterprise Network Project Report

Prepared By :

Mohamed Ayman Nabawi Abd El-Maksoud

Supervised By :

Dr. Reem Alaa Eldin

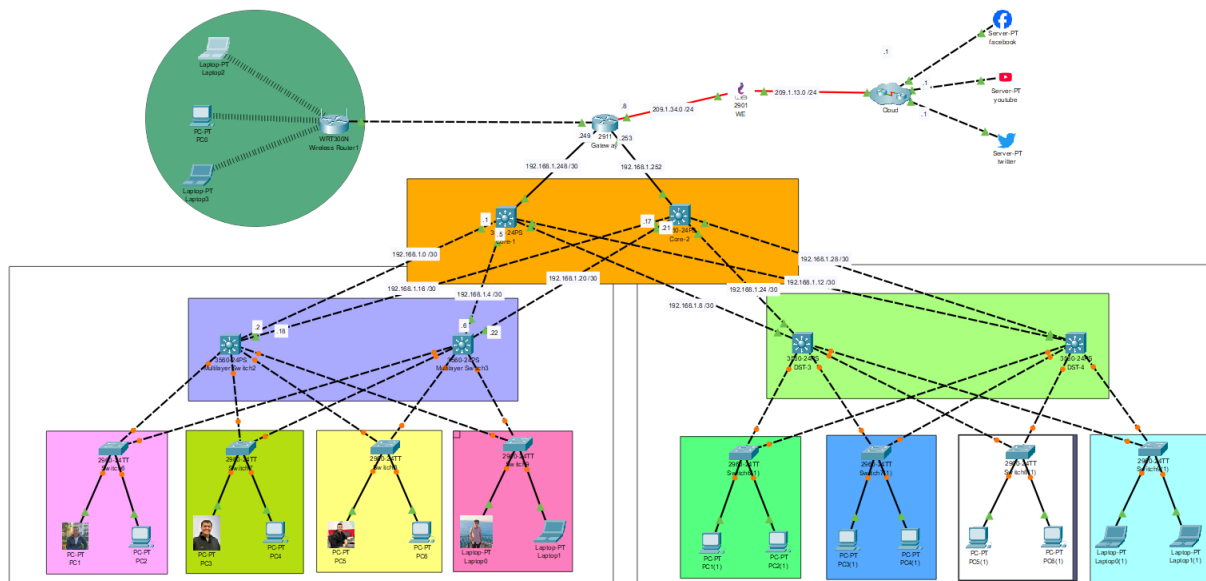
Content:

1. Introduction

ZDC is a medium-sized enterprise with three main facilities:

- **Two wired buildings** designed with a **3-Tier Architecture** (Core, Distribution, Access).
- **One wireless building** for mobile devices and IoT.
- **A centralized Data Center** connecting all buildings via high-speed links.
- The network is connected to the internet through an ISP (**WE**) using a border router, with advanced protocols for redundancy, security, and efficiency.

2. Network Topology Overview





Key Components:

- **Core Layer:** High-speed routing between buildings and Data Center.
- **Distribution Layer:** VLAN routing and traffic control.
- **Access Layer:** End-user devices including PCs, IP phones, and printers.
- **Wireless Building:** Configured with secure WLAN and DHCP services.
- **Data Center:** Hosts critical servers and connects to the ISP.

3. Implemented Protocols & Technologies

A. VLANs & Inter-VLAN Routing

- Network segmentation was implemented for security and performance optimization, separating departments like HR, Finance, and Guest networks.
- Router-on-a-Stick configuration enabled communication between different VLANs.

B. Redundancy with HSRP

- First Hop Redundancy Protocol was deployed to ensure continuous availability of gateway services for all VLANs.
- Primary and standby routers were configured with priority values to manage failover.

C. Dynamic Routing with OSPF

- OSPF protocol was implemented to automate and optimize path selection between buildings and the data center.
- All network segments were placed in OSPF Area 0 for efficient routing.

D. Loop Prevention with STP

- Spanning Tree Protocol in rapid-PVST mode was configured to prevent network loops while maintaining redundancy.

E. Wireless Network Implementation

- A secure wireless network was established with WPA2-PSK encryption.
- Dedicated DHCP pool was created to manage IP assignments for wireless clients.

F. Network Security Measures

- **NAT Implementation:** Network Address Translation was configured to mask internal IP addresses.
- **Access Control Lists:** ACLs were implemented to restrict unauthorized access attempts.
- **Remote Access Security:** Banner messages and VTY line security were configured to protect against unauthorized access.

G. Centralized VLAN Management

- VTP protocol was deployed to synchronize VLAN databases across all network switches.
 - A VTP server was designated to manage VLAN propagation throughout the network.
-

4. Internet Connectivity

- The border router was configured with a default route to the ISP (WE) gateway.
 - Public IP addressing was properly implemented for external connectivity.
-

5. Testing & Verification

- Comprehensive testing confirmed successful inter-VLAN communication.
 - Wireless connectivity tests verified proper association and DHCP functionality.
 - Redundancy tests validated HSRP failover capabilities.
 - Security measures were tested to ensure proper access restrictions.
-

6. Server Connectivity

ISP is connected to three key servers:

Server	Description
FACEBOOK	Facebook Recognition Server
YOUTUBE	YouTube Streaming Server
<u>TWITTER</u>	Twitter Integration Server

Edge Router Data Sheet

Routers :

1- Edge Router

Device	Model	Description	Location	IOS
HQ_R_1	ISR 2911	Edge Router	ZDC location	Cisco IOS Software, C2900 Software (C2900-UNIVERSALK9-M), Version 15.1(4)M4, RELEASE SOFTWARE (fc2)
Interface	Description	IPv4 Address	MAC Address	Routing
GigabitEthernet0/0	Connected to core_sw_1	192.168.1.249 /30	0001.c78c.5401	OSPF
GigabitEthernet0/1	Connected to core_2 & wireless	Unassigned	0001.c78c.5402	OSPF
GigabitEthernet0/2			0001.c78c.5403	
GigabitEthernet0/1/0	Connected to ISP (WE)	209.1.34.8/24	000a.414d.3461	N/A

ISP_WE Data Sheet

2- ISP_WE Router

Device	Model	Description	Location	IOS
ISP_WE	ISR 2911	Internet service provider	ISP_WE location	Cisco IOS Software, C2900 Software (C2900-UNIVERSALK9-M), Version 15.1(4)M4, RELEASE SOFTWARE (fc2)
Interface	Description	IPv4 Address	MAC Address	Routing
GigabitEthernet0/1/0	Connected to edge router	209.1.34.1 /24	0001.c78c.5401	Static
GigabitEthernet0/3/0	Connected to Internet cloud	209.1.13.1/24	000a.414d.3461	Static

Gateway_Router

- **Host name**

Hostname Router

- **Banner motd**

Banner motd \$

** Welcome to ZDC Company!

** Group name : ZDC Team

** Special Thanks to Our Respected Instructor:

** - Dr. Reem Alaa EL-Din

** Team Members:

** - Mahmoud Gamal

** - Mohamed Wagih

** - Omar Mongy

** - Mohamed A Nabawi

** Have a Great Day!

\$

- **Line VTY (telnet)**

line vty 0 4

password zdc123

login

- **STP**

spanning-tree mode pvst

- **IP , NAT**

interface GigabitEthernet0/0

ip address 192.168.1.249 255.255.255.252

ip nat inside

duplex auto

speed auto

interface GigabitEthernet0/1

ip address 192.168.1.253 255.255.255.252

ip nat inside

duplex auto

speed auto

interface GigabitEthernet0/2

ip address 192.168.160.1 255.255.255.252

ip nat inside

duplex auto

speed auto

interface GigabitEthernet0/1/0

ip address dhcp

ip nat outside

ip nat inside source list 1 interface

GigabitEthernet0/1/0 overload

ip nat inside source list 1 interface

GigabitEthernet0/1/0 overload

- **OSPF , Static Routing**

router ospf 1

router-id 0.0.0.5

log-adjacency-changes

network 192.168.0.0 0.0.255.255 area 0

default-information originate

- **ACL**

access-list 1 permit 192.168.0.0 0.0.255.255

ISP_WE

- **Host name**

Hostname Router

- **Banner motd**

Banner motd \$

** Welcome to ZDC Company!

** Group name : ZDC Team

** Special Thanks to Our Respected Instructor:

** - Dr. Reem Alaa EL-Din

** Team Members:

** - Mahmoud Gamal

** - Mohamed Wagih

** - Omar Mongy

** - Mohamed A Nabawi

** Have a Great Day!

\$

- **Line VTY (telnet)**

line vty 0 4

password zdc123

login

- **STP**

spanning-tree mode pvst

- **IP , NAT**

interface GigabitEthernet0/0/0

ip address 209.1.12.1 255.255.255.0

ip nat inside

interface GigabitEthernet0/1/0

ip address 209.1.34.1 255.255.255.0

ip nat inside

!

interface GigabitEthernet0/3/0

ip address 209.1.13.2 255.255.255.0

ip nat outside

ip nat inside source list 10 interface

GigabitEthernet0/3/0 overload

ip nat inside source list 20 interface

GigabitEthernet0/3/0 overload

- **DHCP Pool**

ip dhcp excluded-address 209.1.12.1

209.1.12.7

ip dhcp excluded-address 209.1.34.1

209.1.34.7

ip dhcp excluded-address 209.1.34.9

209.1.34.254

ip dhcp excluded-address 209.1.13.2

209.1.13.254

ip dhcp excluded-address 209.1.12.9

209.1.12.254

!

ip dhcp pool WE1

network 209.1.12.0 255.255.255.0

default-router 209.1.12.1

domain-name cisco.com

ip dhcp pool WE2

network 209.1.34.0 255.255.255.0

default-router 209.1.34.1

domain-name cisco.com

ip dhcp pool WE2_Br1

network 209.1.35.0 255.255.255.0

default-router 209.1.35.1

domain-name cisco.com

ip dhcp pool WE1_Br2

network 209.1.13.0 255.255.255.0

default-router 209.1.13.2

domain-name wr

- **Static Routing**

ip route 0.0.0.0 0.0.0.0 209.1.13.1

- **ACL**

access-list 10 permit 209.1.34.0 0.0.0.255

access-list 20 permit 209.1.12.0 0.0.0.255

Core_SW-1 Data Sheet

Device	Model	IOS			VTP (V2)	
Core_sw_1	3650-24PS	Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M), Version 16.3.2, RELEASE SOFTWARE (fc4)			Domain: ZDC	Password: Zdc123
Port	Description	Access	Trunk	IPv4 Address	Native	Enabled
F0/1	Connected to DST-1 Switch	-	Yes	192.168.1.1 /30	99	Yes
F0/2	Connected to DST-2 Switch	-	Yes	192.168.1.5 /30	99	Yes
F0/3	Connected to DST-3 Switch	-	Yes	192.168.1.6 /30	99	Yes
F0/4	Connected to DST-4 Switch	-	Yes	192.168.1.13 /30	99	Yes
F 0/5	Connected to Edge router	-	-	192.168.1.250 /30	-	Yes

Core_SW-2 Data Sheet

Device	Model	IOS			VTP (V2)	
Core_sw_1	3650-24PS	Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M), Version 16.3.2, RELEASE SOFTWARE (fc4)			Domain: ZDC	Password: Zdc123
Port	Description	Access	Trunk	IPv4 Address	Native	Enabled
F0/1	Connected to DST-1 Switch	-	Yes	192.168.1.17 /30	99	Yes
F0/2	Connected to DST-2 Switch	-	Yes	192.168.1.21 /30	99	Yes
F0/3	Connected to DST-3 Switch	-	Yes	192.168.1.29 /30	99	Yes
F0/4	Connected to DST-4 Switch	-	Yes	192.168.1.25 /30	99	Yes
F 0/5	Connected to Edge router	-	-	192.168.1.250 /30	-	Yes

Core-1 Sw

- **Host name**

Hostname Core-1

- **Banner motd**

Banner motd \$

** Welcome to ZDC Company!

** Group name : ZDC Team

** Special Thanks to Our Respected Instructor:

** - Dr. Reem Alaa EL-Din

** Team Members:

** - Mahmoud Gamal

** - Mohamed Wagih

** - Omar Mongy

** - Mohamed A Nabawi

** Have a Great Day!

\$

- **Line VTY (telnet)**

line vty 0 4

password zdc123

login

- **STP**

spanning-tree mode pvst

- **IP**

interface FastEthernet0/1

no switchport

ip address 192.168.1.1 255.255.255.252

duplex auto

speed auto

interface FastEthernet0/2

no switchport

ip address 192.168.1.5 255.255.255.252

duplex auto

speed auto

interface FastEthernet0/3

no switchport

ip address 192.168.1.13 255.255.255.252

duplex auto

speed auto

interface FastEthernet0/4

no switchport

ip address 192.168.1.9 255.255.255.252

duplex auto

speed auto

interface FastEthernet0/5

no switchport

ip address 192.168.1.250 255.255.255.252

duplex auto

speed auto

- **OSPF Routing**

router ospf 1

router-id 1.1.1.1

log-adjacency-changes

network 192.168.0.0 0.0.255.255 area 0

Core-2 Sw

- **Host name**

Hostname Core-2

- **Banner motd**

Banner motd \$

```
*****
** Welcome to ZDC Company!
** Group name : ZDC Team
** Special Thanks to Our Respected Instructor:
** - Dr. Reem Alaa EL-Din
** Team Members:
** - Mahmoud Gamal
** - Mohamed Wagih
** - Omar Mongy
** - Mohamed A Nabawi
** Have a Great Day!
*****
$
```

- **Line VTY (telnet)**

```
line vty 0 4
password zdc123
login
```

- **STP**

spanning-tree mode pvst

- **IP**

```
interface FastEthernet0/1
no switchport
ip address 192.168.1.17 255.255.255.252
duplex auto
speed auto
```

```
interface FastEthernet0/2
no switchport
ip address 192.168.1.21 255.255.255.252
duplex auto
speed auto
```

```
interface FastEthernet0/3
no switchport
ip address 192.168.1.29 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet0/4
no switchport
ip address 192.168.1.25 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet0/5
no switchport
ip address 192.168.1.254 255.255.255.252
duplex auto
speed auto
    • OSPF Routing

router ospf 1
router-id 2.2.2.2
log-adjacency-changes
network 192.168.0.0 0.0.255.255 area 0
```

DST-1_SW Data Sheet

Device		Model	Description		Location		IOS	VTP (V2)	
DST-1_sw		3650-24PS	Primary L3 Switch		ZDC Building 1		Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M), Version 16.3.2, RELEASE SOFTWARE (fc4)	Domain: ZDC-1	Password: Zdc123
Port	Description		Access	VLAN	Trunk	IPv4 Address		Native	Enabled
F 0/1	Connected to vlan 10		Yes	160	-	-		-	Yes
F 0/2	Connected to vlan 20		Yes	160	-	-		-	Yes
F 0/3	Connected to vlan 30		Yes	160	-	-		-	Yes
F 0/4	Connected to vlan 40		Yes	160	-	-		-	Yes
F 0/6	Connected to Core-1_sw		Yes	160	-	192.168.1.2/30		-	Yes
F 0/7	Connected to Core-2_sw		Yes	160	-	192.168.1.18/30		-	Yes
G 1/1/1 - 4	-		Yes	-	-			-	Shut
VLAN 10	Connected to sw-1		-	-	-	192.168.10.251/24		-	Yes
VLAN 20	Connected to sw-2		-	-	-	192.168.20.251/24		-	Yes
VLAN 30	Connected to sw-3		-	-	-	192.168.30.251/24		-	Yes
VLAN 40	Connected to sw-4		-	-	-	192.168.40.251/24		-	Yes

DST-2_SW Data Sheet

Device	Model	Description	Location		IOS	VTP (V2)	
DST-2_sw	3650-24PS	Primary L3 Switch	ZDC Building 1		Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M), Version 16.3.2, RELEASE SOFTWARE (fc4)	Domain: ZDC-1	Password: Zdc123
Port	Description	Access	VLAN	Trunk	IPv4 Address	Native	Enabled
F 0/1	Connected to vlan 10	Yes	160	-	-	-	Yes
F 0/2	Connected to vlan 20	Yes	160	-	-	-	Yes
F 0/3	Connected to vlan 30	Yes	160	-	-	-	Yes
F 0/4	Connected to vlan 40	Yes	160	-	-	-	Yes
F 0/6	Connected to Core-1_sw	Yes	160	-	192.168.1.6 /30	-	Yes
F 0/7	Connected to Core-2_sw	Yes	160	-	192.168.1.22 /30	-	Yes
G 1/1/1 - 4	-	Yes	-	-		-	Shut
VLAN 10	Connected to sw-1	-	-	-	192.168.10.252 /24	-	Yes
VLAN 20	Connected to sw-2	-	-	-	192.168.20.252 /24	-	Yes
VLAN 30	Connected to sw-3	-	-	-	192.168.30.252 /24	-	Yes
VLAN 40	Connected to sw-4	-	-	-	192.168.40.252 /24	-	Yes

DST-3_SW Data Sheet

Device		Model	Description		Location		IOS	VTP (V2)	
DST-3_sw		3650-24PS	Primary L3 Switch		ZDC Building 2		Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M), Version 16.3.2, RELEASE SOFTWARE (fc4)	Domain: ZDC-1	Password: Zdc123
Port	Description		Access	VLAN	Trunk	IPv4 Address		Native	Enabled
F 0/1	Connected to vlan 50		Yes	160	-	-		-	Yes
F 0/2	Connected to vlan 60		Yes	160	-	-		-	Yes
F 0/3	Connected to vlan 70		Yes	160	-	-		-	Yes
F 0/4	Connected to vlan 80		Yes	160	-	-		-	Yes
F 0/6	Connected to Core-1_sw		Yes	160	-	192.168.1.10 /30		-	Yes
F 0/7	Connected to Core-2_sw		Yes	160	-	192.168.1.26 /30		-	Yes
G 1/1/1 - 4	-		Yes	200	-			-	Shut
VLAN 50	Connected to sw-1		-	-	-	192.168.50.251 /24		-	Yes
VLAN 60	Connected to sw-2		-	-	-	192.168.60.251 /24		-	Yes
VLAN 70	Connected to sw-3		-	-	-	192.168.70.251 /24		-	Yes
VLAN 80	Connected to sw-4		-	-	-	192.168.80.251 /24		-	Yes

DST-4_SW Data Sheet

Device	Model	Description	Location		IOS	VTP (V2)	
DST-4_sw	3650-24PS	Primary L3 Switch	ZDC Building 1		Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M), Version 16.3.2, RELEASE SOFTWARE (fc4)	Domain: ZDC-1	Password: Zdc123
Port	Description	Access	VLAN	Trunk	IPv4 Address	Native	Enabled
F 0/1	Connected to vlan 60	Yes	160	-	-	-	Yes
F 0/2	Connected to vlan 70	Yes	160	-	-	-	Yes
F 0/3	Connected to vlan 80	Yes	160	-	-	-	Yes
F0/4	-	-	-	-	-	-	Shut
F 0/5	Connected to vlan 50	Yes	160	-	-	-	Yes
F 0/6	Connected to Core-2_sw	Yes	160	-	192.168.1.30/30	-	Yes
F 0/7	Connected to Core-1_sw	Yes	160	-	192.168.1.14/30	-	Yes
G 1/1/1 - 4	-	Yes	-	-		-	Shut
VLAN 50	Connected to sw-1	-	-	-	192.168.50.252/24	-	Yes
VLAN 60	Connected to sw-2	-	-	-	192.168.60.252/24	-	Yes
VLAN 70	Connected to sw-3	-	-	-	192.168.70.252/24	-	Yes
VLAN 80	Connected to sw-4	-	-	-	192.168.80.252/24	-	Yes