HɪLCоE

Computer Networks
CS461
GROUP ASSIGNMENT
Multi Tier Enterprise Network Design

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<h1 style="text-align:center"><u>Corporate Multi-Site Network</u></h1>

<u>The Corporate</u>

Let's consider a fictional company named Shoe X that operates across 5 sites:

<u>*1. Main Site (Headquarters):*</u>

Located in Nifas Silk Lafto, A.A, Ethiopia.

Houses corporate headquarters, executive offices, and centralized administrative functions.
Departments include

- Administration
- Human Resources
- Finance
- Marketing
- Sales
- IT
- Research & Development

<u>*2. Regional Office:*</u>

Located in Kirkos, A.A, Ethiopia. It serves as a regional or District hub.
Departments include

- Regional sales
- Customer support
- Regional Marketing

<u>*3. Manufacturing Facility:*</u>

Located in Bole, A.A, Ethiopia. It is manufacturing site for the shoes.
Departments include

- Production
- Quality Control
- Maintenance
- Supply Chain Management

<u>*4. Distribution Center:*</u>

Located in Merkato, A.A, Ethiopia. It acts as a centralized distribution center for shipping products across the country. Departments include:

- Warehousing
- Logistics
- Shipping

<u>*5. Remote Site:*</u>

Located in Arada, A.A, Ethiopia. It serves as a satellite office for shoe..
Departments include

- Administrative Support
- Sales operations
- Client services

Shoe X is a shoe manufacturing company with operations spanning multiple sites and regions. Each site plays a crucial role in the company's overall strategy, allowing it to efficiently manage its business operations and serve customers.

<u>Network Structure and Topology</u>

- **Network Devices**
    - *Core Layer Devices:*
      Routers 2911 – Quantity: 5 (1 for each site)
    - *Distribution Layer:*
      3650 24P5 Switches (Multi Layer (Layer 3) Switches) – Quantity: 5 (1 for each site)
    - *Access Layer:*
      2960-24TT Switches (Layer 2 Switches) – Quantity: 20 (1 for each department)

- ***Network Topology: Partial Mesh***
  The decision to opt for a partial mesh topology over other network topologies is driven by several practical considerations tailored to organizational needs. The partial mesh topology was chosen for its balance between redundancy, scalability, and cost-effectiveness. By selectively establishing direct connections between critical sites, such as the main site, regional office, manufacturing facility, distribution center, and remote site, we ensure efficient and reliable communication pathways where they are most essential.
  This topology allows us to prioritize direct connectivity where it is most needed, facilitating seamless data exchange, collaboration, and resource sharing between key sites while avoiding unnecessary complexities and overhead associated with a full mesh topology.
  Additionally, the partial mesh design offers flexibility for future expansion, enabling the network to grow and adapt to evolving requirements without compromising performance or manageability. Overall, the partial mesh topology aligns closely with our organization's connectivity needs, providing a robust and scalable network infrastructure tailored to our specific operational demands.
- **Topology Structure:**
  The Main Site has direct connections to the Regional Office, Manufacturing Facility, and Distribution Center.
  The Regional Office has direct connections to the Main Site, Distribution Center, and Remote Site.
  The Manufacturing Facility has a direct connection to the Main Site and Distribution Center.
  The Distribution Center has direct connections to the Main Site, Regional Office, and Remote Site.
 The Remote Site has direct connections to the Regional Office and Distribution Center.
  This topology ensures that each site has direct communication links to the necessary sites as per requirements.

Naming Conventions
- *Routers* – Site + (RouterID)
  Multi Layer Switches – Site + Multi Layer Switch (ML-SwithID)
- *Switch* – Department (SwitchID)
- *PC* – Department + Site+PCID
- *Access Point* - Department+Site+Access Point
       SSID – Department+Site+AP   *Password* - "*AP-cs461*"
- *Laptop* - Department+Site+LaptopID
- *Printer* - Department+Site+Printer

Technologies Implemented
1. *VLAN*: Virtual Local Area Network to divide each department with in a site.
2. *Inter-VLANing* to enable communication between different VLANs (different departments).
3. *Subnetting*: Partitioning network to smaller networks.
4. *OSPF* Routing: Open Shortest Path First Routing on routers to route traffic.
5. *DHCP*: Dynamic Host Configuration Protocol hosted on a server to dynamically allocate IP address to all end devices.
6. *DNS*: Domain Name System that translate domain name to IP address.
7. *HTTPS*: Hypertext Transfer Protocol Secure used to access the simple hosted website.
8. *NAT (PAT)*: Network Address Translation (Port Address Translation) used to assigne different public IP address to end devices when accessing external network.
9. *ACL*: Access Control List a list implements to permit communication and translation by PAT
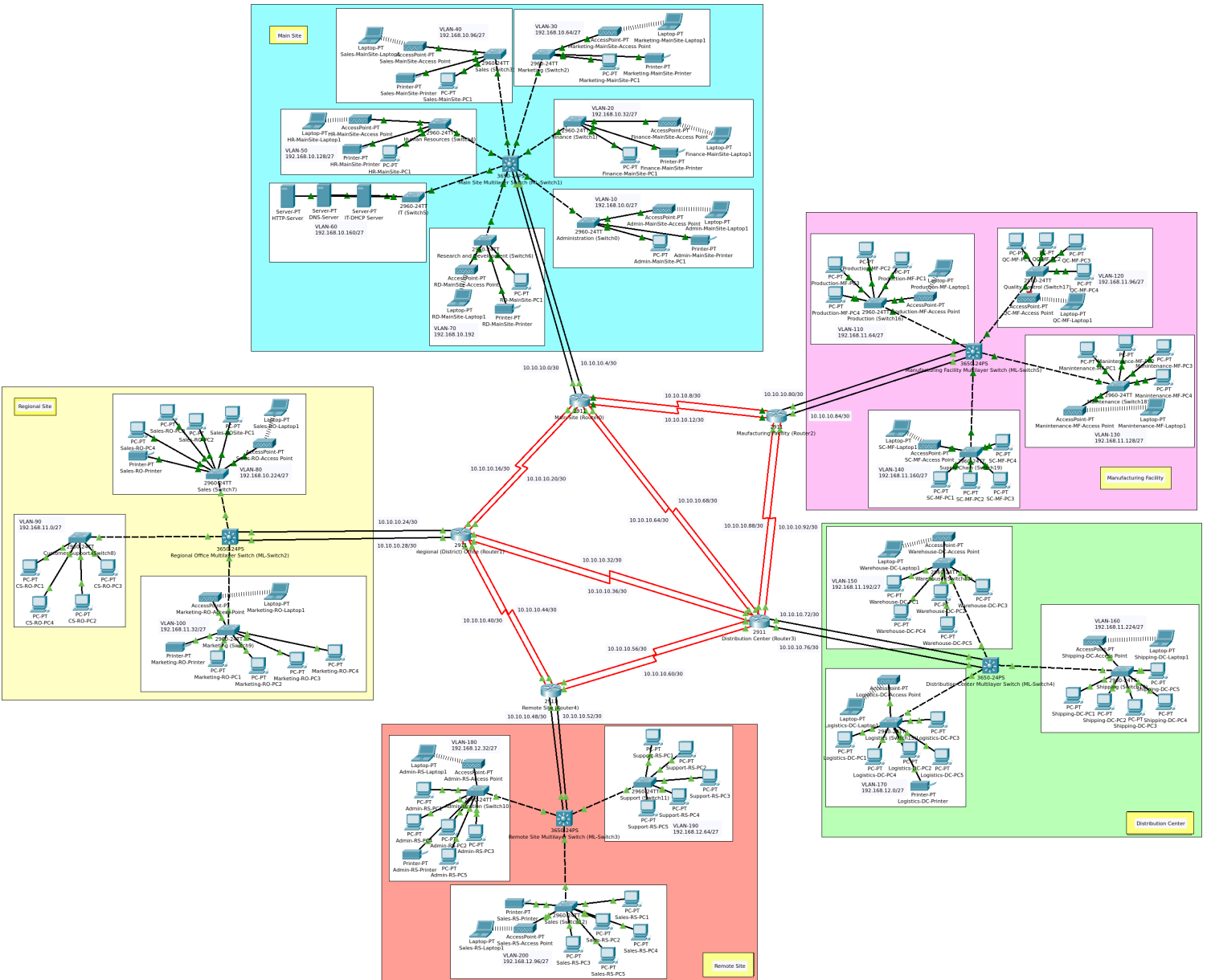
Sub-netting of Each Site and Respective Department

	Network Address	Sub-net Mask	Host Address Range	Broadcast Address
1. Main Site (Headquarters) Departments:				
Administration – VLAN 10	192.168.10.0	255.255.255.224/27	192.168.10.1 - 192.168.10.30	192.168.10.31
Finance – VLAN 20	192.168.10.32	255.255.255.224/27	192.168.10.33 – 192.168.10.62	192.168.10.63
Marketing – VLAN 30	192.168.10.64	255.255.255.224/27	192.168.10.65 – 192.168.10.94	192.168.10.95
Sales – VLAN 40	192.168.10.96	255.255.255.224/27	192.168.10.97 – 192.168.10.126	192.168.10.127
Human Resources – VLAN 50	192.168.10.128	255.255.255.224/27	192.168.10.129 – 192.168.10.158	192.168.10.159
IT Department – VLAN 60	192.168.10.160	255.255.255.224/27	192.168.10.161 – 192.168.10.190	192.168.10.191
Research & Development – VLAN 70	192.168.10.192	255.255.255.224/27	192.168.10.193 – 192.168.10.222	192.168.10.223
2. Regional Office Departments:				
Sales – VLAN 80	192.168.10.224	255.255.255.224/27	192.168.10.225 – 192.168.10.254	192.168.10.255
Customer Support – VLAN 90	192.168.11.0	255.255.255.224/27	192.168.11.1 – 192.168.11.30	192.168.11.31
Marketing – VLAN 100	192.168.11.32	255.255.255.224/27	192.168.11.33 – 192.168.11.62	192.168.11.63
3. Manufacturing Facility Departments:				
Production – VLAN 110	192.168.11.64	255.255.255.224/27	192.168.11.65 – 192.168.11.94	192.168.11.95
Quality Control – VLAN 120	192.168.11.96	255.255.255.224/27	192.168.11.97 – 192.168.11.126	192.168.11.127
Maintenance – VLAN 130	192.168.11.128	255.255.255.224/27	192.168.11.129 – 192.168.11.158	192.168.11.159
Supply Chain – VLAN 140	192.168.11.160	255.255.255.224/27	192.168.11.161 – 192.168.11.190	192.168.11.191
4. Distribution Center Departments:				
Warehouse – VLAN 150	192.168.11.192	255.255.255.224/27	192.168.11.193 – 192.168.11.222	192.168.11.223
Shipping – VLAN 160	192.168.11.224	255.255.255.224/27	192.168.11.225 – 192.168.11.254	192.168.11.255
Logistics – VLAN 170	192.168.12.0	255.255.255.224/27	192.168.12.1 – 192.168.12.30	192.168.12.31
5. Remote Site Departments:				
Administration – VLAN 180	192.168.12.32	255.255.255.224/27	192.168.12.33 – 192.168.12.62	192.168.12.63
Support – VLAN 190	192.168.12.64	255.255.255.224/27	192.168.12.65 – 192.168.12.94	192.168.12.95
Sales – VLAN 200	192.168.12.96	255.255.255.224/27	192.168.12.97 – 192.168.12.126	192.168.12.127

Router and Multi Layer Switch Connections

NO	Connection	Network Address	Sub-net Mask
1	Main Site Router - Main Site Multi Layer (Layer 3) Switch	10.10.10.0	255.255.255.252/30
2	Main Site Router - Main Site Multi Layer (Layer 3) Switch	10.10.10.4	255.255.255.252/30
3	Main Site Router - Manufacturing Facility Router	10.10.10.8	255.255.255.252/30
4	Main Site Router - Manufacturing Facility Router	10.10.10.12	255.255.255.252/30
5	Main Site Router - Regional Office Router	10.10.10.16	255.255.255.252/30
6	Main Site Router - Regional Office Router	10.10.10.20	255.255.255.252/30
7	Regional Office Router - Regional Office Multi Layer (Layer 3) Switch	10.10.10.24	255.255.255.252/30
8	Regional Office Router - Regional Office Multi Layer (Layer 3) Switch	10.10.10.28	255.255.255.252/30
9	Regional Office Router – Distribution Center Router	10.10.10.32	255.255.255.252/30
10	Regional Office Router – Distribution Center Router	10.10.10.36	255.255.255.252/30
11	Regional Office Router – Remote Site Router	10.10.10.40	255.255.255.252/30
12	Regional Office Router – Remote Site Router	10.10.10.44	255.255.255.252/30
13	Remote Site Router – Remote Site Multi Layer (Layer 3) Switch	10.10.10.48	255.255.255.252/30
14	Remote Site Router – Remote Site Multi Layer (Layer 3) Switch	10.10.10.52	255.255.255.252/30
15	Remote Site Router – Distribution Center Router	10.10.10.56	255.255.255.252/30
16	Remote Site Router – Distribution Center Router	10.10.10.60	255.255.255.252/30
17	Main Site Router – Distribution Center Router	10.10.10.64	255.255.255.252/30
18	Main Site Router – Distribution Center Router	10.10.10.68	255.255.255.252/30
19	Distribution Center Router – Distribution Center Multi Layer (Layer 3) Switch	10.10.10.72	255.255.255.252/30
20	Distribution Center Router – Distribution Center Multi Layer (Layer 3) Switch	10.10.10.76	255.255.255.252/30
21	Manufacturing Facility Router – Manufacturing Facility Multi Layer (Layer 3) Switch	10.10.10.80	255.255.255.252/30
22	Manufacturing Facility Router – Manufacturing Facility Multi Layer (Layer 3) Switch	10.10.10.84	255.255.255.252/30
23	Manufacturing Facility Router – Distribution Center Router	10.10.10.88	255.255.255.252/30
24	Manufacturing Facility Router – Distribution Center Router	10.10.10.92	255.255.255.252/30

NO	Pool Name	Default Gateway	DNS Server	Start IP Address	Sub-net Mask
	DHCP IP Address Pool for each Department				
1	SupplyChain-MF-Pool	192.168.11.161	192.168.10.165	192.168.11.165	255.255.255.224
2	Maintenance-MF-Pool	192.168.11.129	192.168.10.165	192.168.11.133	255.255.255.224
3	QualityControl-MF-Pool	192.168.11.97	192.168.10.165	192.168.11.101	255.255.255.224
4	Production-MF-Pool	192.168.11.65	192.168.10.165	192.168.11.69	255.255.255.224
5	Logistics-DC-Pool	192.168.12.1	192.168.10.165	192.168.12.5	255.255.255.224
6	Shipping-DC-Pool	192.168.11.225	192.168.10.165	192.168.11.229	255.255.255.224
7	WareHouse-DC-Pool	192.168.11.193	192.168.10.165	192.168.11.197	255.255.255.224
8	Support-RS-Pool	192.168.12.65	192.168.10.165	192.168.12.69	255.255.255.224
9	Sales-RS-Pool	192.168.12.97	192.168.10.165	192.168.12.101	255.255.255.224
10	Admin-RS-Pool	192.168.12.33	192.168.10.165	192.168.12.37	255.255.255.224
11	Marketing-RO-Pool	192.168.11.33	192.168.10.165	192.168.11.37	255.255.255.224
12	CS-RO-Pool	192.168.11.1	192.168.10.165	192.168.11.5	255.255.255.224
13	Sales-RO-Pool	192.168.10.225	192.168.10.165	192.168.10.229	255.255.255.224
14	RD-Main-Pool	192.168.10.193	192.168.10.165	192.168.10.197	255.255.255.224
15	HR-Main-Pool	192.168.10.129	192.168.10.165	192.168.10.133	255.255.255.224
16	Sales-Main-Pool	192.168.10.97	192.168.10.165	192.168.10.101	255.255.255.224
17	Finance-Main-Pool	192.168.10.33	192.168.10.165	192.168.10.37	255.255.255.224
18	Marketing-Main-Pool	192.168.10.65	192.168.10.165	192.168.10.69	255.255.255.224
19	ICT-Main-Pool	192.168.10.161	192.168.10.165	192.168.10.167	255.255.255.224
20	Admin-Main-Pool	192.168.10.1	192.168.10.165	192.168.10.5	255.255.255.224

Port Assignment
  • *__Routers Port Assignment__*
I. Main Site (Router 0)
1. Serial0/0/0 – Regional (District) Office (Router 1) with it's port Serial0/0/0
2. Serial0/0/1 – Fail Back: Regional (District) Office (Router 1) with it's port Serial0/0/1
3. Serial0/1/0 – Manufacturing Facility (Router 2) with it's port Serial0/0/0
4. Serial0/1/1 – Fail Back: Manufacturing Facility (Router 2) with it's port Serial0/0/1
5. Serial0/2/0 – Distribution Center (Router 3) with it's port Serial0/0/0
6. Serial0/2/1 – Fail Back: Distribution Center (Router 3) with it's port Serial0/0/1

1. Gigabit Ethernet 0/0 – Main Site Multilayer (ML-Switch1) with its port Gigabit Ethernet 1/0/1
2. Gigabit Ethernet 0/1 – Fail Back:Main Site Multilayer (ML-Switch1) with its port Gigabit Ethernet 1/0/2
II. Regional (District) Office (Router 1)
1. Serial 0/0/0 – Main Site (Router 0) with it's port Serial0/0/0
2. Serial 0/0/1 - Fail Back: Main Site (Router 0) with it's port Serial0/0/1
3. Serial 0/1/0 - Distribution Center (Router 3) with it's port Serial0/1/1
4. Serial 0/1/1 - Fail Back: Distribution Center (Router 3) with it's port Serial0/1/1
5. Serial 0/2/0 - Remote Site (Router 4) with it's port Serial0/0/0
6. Serial 0/2/1 - Fail Back: Remote Site (Router 4) with it's port Serial0/0/1

1. Gigabit Ethernet 0/0 – Multi Layer Switch with its port Gigabit Ethernet 1/0/1
2. Gigabit Ethernet 0/1 – Fail Back:Multi Layer Switch with its port Gigabit Ethernet 1/0/2
III. Manufacturing Facility (Router 2)
1. Serial 0/0/0 - Main Site (Router 0) with it's port Serial0/1/0
2. Serial 0/0/1 - Fail Back: Main Site (Router 0) with it's port Serial0/1/1
3. Serial 0/1/0 - Distribution Center (Router 3) with it's port Serial0/3/0
4. Serial 0/1/1 - Fail Back: Distribution Center (Router 3) with it's port Serial0/3/1
1. Gigabit Ethernet 0/0 – Multi Layer Switch with its port Gigabit Ethernet 1/0/1
2. Gigabit Ethernet 0/1 – Fail Back:Multi Layer Switch with its port Gigabit Ethernet 1/0/2
IV. Distribution Center (Router 3)
1. Serial 0/0/0 - Main Site (Router 0) with it's port Serial0/2/0
2. Serial 0/0/1 - Fail Back: Main Site (Router 0) with it's port Serial0/2/1
3. Serial 0/1/0 - Regional (District) Office (Router 1) with it's port Serial0/1/1
4. Serial 0/1/1 - Fail Back: Regional (District) Office (Router 1) with it's port Serial0/1/1
5. Serial 0/2/0 - Remote Site (Router 4) with it's port Serial0/1/0
6. Serial 0/2/1 - Fail Back: Remote Site (Router 4) with it's port Serial0/1/1
7. Serial 0/3/0 - Manufacturing Facility (Router 2) with it's port Serial0/1/0
8. Serial 0/3/1 - Fail Back: Manufacturing Facility (Router 2) with it's port Serial0/1/1

1. Gigabit Ethernet 0/0 – Multi Layer Switch with its port Gigabit Ethernet 1/0/1
2. Gigabit Ethernet 0/1 – Fail Back:Multi Layer Switch with its port Gigabit Ethernet 1/0/2
V. Remote Site (Router 4)
1. Serial 0/0/0 - Regional (District) Office (Router 1) with it's port Serial0/2/0
2. Serial 0/0/1 - Fail Back: Regional (District) Office (Router 1) with it's port Serial0/2/1
3. Serial 0/1/0 - Distribution Center (Router 3) with it's port Serial0/2/0
4. Serial 0/1/1 - Fail Back: Distribution Center (Router 3) with it's port Serial0/2/1
1. Gigabit Ethernet 0/0 – Multi Layer Switch with its port Gigabit Ethernet 1/0/1
2. Gigabit Ethernet 0/1 – Fail Back:Multi Layer Switch with its port Gigabit Ethernet 1/0/2

- *Switches Port Assignment*

I. Main Site (Headquarters) Multi Layer Switch (ML-Switch1):
1. Gigabit Ethernet 1/0/1 – Main Site Router with its Gigabit Ethernet 0/0
2. Gigabit Ethernet 1/0/2 – Fail Back: Main Site Router with its Gigabit Ethernet 0/1
3. Gigabit Ethernet 1/0/3 - Administration (Switch 0) with its port Fast Ethernet 0/1
4. Gigabit Ethernet 1/0/4 - Finance (Switch 1) with its port Fast Ethernet 0/1
5. Gigabit Ethernet 1/0/5 - Marketing (Switch 2) with its port Fast Ethernet 0/1
6. Gigabit Ethernet 1/0/6 - Sales (Switch 3) with its port Fast Ethernet 0/1
7. Gigabit Ethernet 1/0/7 - Human Resources (Switch 4) with its port Fast Ethernet 0/1
8. Gigabit Ethernet 1/0/8 - IT Department (Switch 5) with its port Fast Ethernet 0/1
9. Gigabit Ethernet 1/0/9 - Research & Development (Switch 6) with its port Fast Ethernet 0/1

II. Regional Office Multi Layer Switch (ML-Switch2):
1. Gigabit Ethernet 1/0/1 – Regional Office Router with its Gigabit Ethernet 0/0
2. Gigabit Ethernet 1/0/2 – Fail Back: Regional Office Router with its Gigabit Ethernet 0/1
3. Gigabit Ethernet 1/0/3 - Sales (Switch 7) with its port Fast Ethernet 0/1
4. Gigabit Ethernet 1/0/4 - Customer Support (Switch 8) with its port Fast Ethernet 0/1
5. Gigabit Ethernet 1/0/5 - Marketing (Switch 9) with its port Fast Ethernet 0/1

III. Manufacturing Facility Multi Layer Switch (ML-Switch5):
1. Gigabit Ethernet 1/0/1 – Manufacturing Facility Router with its Gigabit Ethernet 0/0
2. Gigabit Ethernet 1/0/2 – Fail Back: Manufacturing Facility Router with its Gigabit Ethernet 0/1
3. Gigabit Ethernet 1/0/3 - Production (Switch 16) with its port Fast Ethernet 0/1
4. Gigabit Ethernet 1/0/4 - Quality Control (Switch 17) with its port Fast Ethernet 0/1
5. Gigabit Ethernet 1/0/5 - Maintenance (Switch 18) with its port Fast Ethernet 0/1
6. Gigabit Ethernet 1/0/6 - Supply Chain (Switch 19) with its port Fast Ethernet 0/1

IV. Distribution Center Multi Layer Switch (ML-Switch4):
1. Gigabit Ethernet 1/0/1 – Distribution Center Router with its Gigabit Ethernet 0/0
2. Gigabit Ethernet 1/0/2 – Fail Back: Distribution Center Router with its Gigabit Ethernet 0/1
3. Gigabit Ethernet 1/0/3 - Warehouse (Switch 13) with its port Fast Ethernet 0/1
4. Gigabit Ethernet 1/0/4 - Shipping(Switch 14) with its port Fast Ethernet 0/1
5. Gigabit Ethernet 1/0/5 - Logistics (Switch 15) with its port Fast Ethernet 0/1

V. Remote Site Multi Layer Switch (ML-Switch3):
1. Gigabit Ethernet 1/0/1 – Remote Site Router with its Gigabit Ethernet 0/0
2. Gigabit Ethernet 1/0/2 – Fail Back: Remote Site Router with its Gigabit Ethernet 0/1
3. Gigabit Ethernet 1/0/3 - Administration (Switch 10) with its port Fast Ethernet 0/1
4. Gigabit Ethernet 1/0/4 - Support (Switch 11) with its port Fast Ethernet 0/1
5. Gigabit Ethernet 1/0/5 - Sales (Switch 12) with its port Fast Ethernet 0/1

VLANS
1. Main Site (Headquarters) Departments:
- Administration – VLAN 10
- Finance – VLAN 20
- Marketing – VLAN 30
- Sales – VLAN 40
- Human Resources – VLAN 50
- IT Department – VLAN 60
- Research & Development – VLAN 70

2. Regional Office Departments:
- Sales – VLAN 80
- Customer Support – VLAN 90
- Marketing – VLAN 100

3. Manufacturing Facility Departments:
- Production – VLAN 110
- Quality Control – VLAN 120
- Maintenance – VLAN 130
- Supply Chain – VLAN 140

4. Distribution Center Departments:
- Warehouse – VLAN 150
- Shipping – VLAN 160
- Logistics – VLAN 170

5. Remote Site Departments:
- Administration – VLAN 180
- Support – VLAN 190
- Sales – VLAN 200

Process of Enterprise Network Creation and Configuration

Step 1: Create physical connection with fail back capability between the Sites (Routers) using Serial DCE Cables. (CORE LAYER)

Step 2: Create physical connection with fail back capability between the Sites (Routers) and Multi layer (Layer 3) switches using Copper Straight Through Cables. (DISTRIBUTION LAYER)

Step 3: Create physical connection between Multi layer (Layer 3) switches and (Layer 2) Switches of respective departments of a site using Copper Cross Over Cables. (ACCESS LAYER)

Step 4: Create physical connection between (Layer 2) Switches of respective departments of a site and End Devices (Servers, PC and Access Point) using Copper Straight Through Cables.

Step 5: Demark Every Site and Department.

Step 6: Assign VLAN to each Department with in each site.

Step 7: Turn ON the interfaces of all the 5 Routers. (CORE LAYER)

Once at configuration stage (en→conf t)

- *Main Site and Regional Office Router*

interface Serial0/0/0

no shutdown

exit

interface Serial0/0/1

no shutdown

exit

interface Serial0/1/0

no shutdown

exit

interface Serial0/1/1

no shutdown

exit

interface Serial0/2/0

no shutdown

exit

interface Serial0/2/1

no shutdown

exit

interface GigabitEthernet0/0

no shutdown

exit

interface GigabitEthernet0/1

no shutdown

exit

- *Manufacturing Facility and Remote Site Router*

interface Serial0/0/0

no shutdown

exit

interface Serial0/0/1

no shutdown

exit

interface Serial0/1/0

no shutdown

exit

interface Serial0/1/1
no shutdown
exit
interface GigabitEthernet0/0
no shutdown
exit
interface GigabitEthernet0/1
no shutdown
exit

- *Distribution Center Router*

interface Serial0/0/0
no shutdown
exit
interface Serial0/0/1
no shutdown
exit
interface Serial0/1/0
no shutdown
exit
interface Serial0/1/1
no shutdown
exit
interface Serial0/2/0
no shutdown
exit
interface Serial0/2/1
no shutdown
exit
interface Serial0/3/0
no shutdown
exit
interface Serial0/3/1
no shutdown
exit
interface GigabitEthernet0/0
no shutdown
exit
interface GigabitEthernet0/1
no shutdown
exit

Step 8: Add AC Power Supply to the Multi Layer (Layer 3) Switches. (DISTRIBUTION LAYER)

Step 9: Configure all layer 2 Switches. (ACCESS LAYER)
Once at configuration stage (en→conf t)
hostname Dept-Site-Layer-2-SW ------- Replace Dept and Site with name of department & Site
line console 0
password cs461
login
exit

line vty 0 15
password cs461vty
login
exit
no ip domain-lookup
enable password cisco
service password-encryption
do wr

Step 10: Configure all Multi Layer (Layer 3) Switches. (DISTRIBUTION LAYER)
Once at configuration stage (en→conf t)

hostname Site-Layer-3-SW ------- Replace Site with name of Site
line console 0
password cs461
login
exit
ip domain-name cisco.net
username cisco password cisco
crypto key generate rsa
1024
line vty 0 15
login local
transport input ssh
exit
no ip domain-lookup
enable password cisco
service password-encryption
do wr

Step 11: Configure Site Routers. (CORE LAYER)
Once at configuration stage (en→conf t)

hostname Site-CoreLayer-Router ------- Replace Site with name of Site
line console 0
password cs461
login
exit
ip domain-name cisco.net
username cisco password cisco
crypto key generate rsa
1024
line vty 0 15
login local
transport input ssh
exit
no ip domain-lookup
enable password cisco
service password-encryption
do wr

Step 12: Configure VLAN and Ports of Layer 2 switches. (ACCESS LAYER)
Once at configuration stage (en→conf t)

int fa0/1
switchport mode trunk
exit
int range fa 0/2-24
switchport mode access
switchport access vlan 10 ------10 is edited for every department with respective VLAN
switchport port-security
switchport port-security maximum 2
switchport port-security mac-address sticky
switchport port-security violation shutdown
do wr

Step 13: Setting up Sub-netting and IP addressing for each department.

Step 14: Configure the Multi Layer (Layer 3) Switch trunk ports. (DISTRIBUTION LAYER)
Once at configuration stage (en→conf t)
  - *Main Site Multi Layer (Layer 3) Switch*

int range gig1/0/3-9
switchport mode trunk
exit
do wr
  - *Regional Office, Remote Site and Distribution Center Multi Layer (Layer 3) Switch*

int range gig1/0/3-5
switchport mode trunk
exit
do wr
  - *Manufacturing Facility Multi Layer (Layer 3) Switch*

int range gig1/0/3-6
switchport mode trunk
exit
do wr

Note: To check if setup was correct use : *do sh start*

Step 15: Configure IP address of Multi Layer (Layer 3) Switches Ports. (DISTRIBUTION LAYER)
Once at configuration stage (en→conf t)

  - *Main Site Multi Layer (Layer 3) Switch*

int range gig1/0/1-2
no switchport ----------------Makes a layer 2 port a layer 3 interface
exit
int gig1/0/1
ip address 10.10.10.1 255.255.255.252
exit
int gig 1/0/2
ip address 10.10.10.5 255.255.255.252
exit
do wr

- <u>Regional Office Multi Layer (Layer 3) Switch</u>

int range gig1/0/1-2
no switchport
exit
int gig1/0/1
ip address 10.10.10.25 255.255.255.252
exit
int gig 1/0/2
ip address 10.10.10.29 255.255.255.252
exit
do wr

- <u>Manufacturing Facility Multi Layer (Layer 3) Switch</u>

int range gig1/0/1-2
no switchport
exit
int gig1/0/1
ip address 10.10.10.81 255.255.255.252
exit
int gig 1/0/2
ip address 10.10.10.85 255.255.255.252
exit
do wr

- <u>Distribution Center Multi Layer (Layer 3) Switch</u>

int range gig1/0/1-2
no switchport
exit
int gig1/0/1
ip address 10.10.10.73 255.255.255.252
exit
int gig 1/0/2
ip address 10.10.10.77 255.255.255.252
exit
do wr

- <u>Remote Site Layer (Layer 3) Switch</u>

int range gig1/0/1-2
no switchport
exit
int gig1/0/1
ip address 10.10.10.49 255.255.255.252
exit
int gig 1/0/2
ip address 10.10.10.53 255.255.255.252
exit
do wr

Step 16: Configure IP address of Router Ports. (CORE LAYER)

Once at configuration stage (en→conf t)

- **Main Site Router**

int gig0/0
ip address 10.10.10.2 255.255.255.252
exit
int gig0/1
ip address 10.10.10.6 255.255.255.252
exit
do wr
int se 0/0/0
ip address 10.10.10.17 255.255.255.252
clock rate 64000
exit
int se 0/0/1
ip address 10.10.10.21 255.255.255.252
clock rate 64000
exit
int se 0/1/0
ip address 10.10.10.9 255.255.255.252
clock rate 64000
exit
int se 0/1/1
ip address 10.10.10.13 255.255.255.252
clock rate 64000
exit
int se 0/2/0
ip address 10.10.10.65 255.255.255.252
clock rate 64000
exit
int se 0/2/1
ip address 10.10.10.69 255.255.255.252
clock rate 64000
exit
do wr

- **Regional Office Router**

int gig0/0
ip address 10.10.10.26 255.255.255.252
exit
int gig0/1
ip address 10.10.10.30 255.255.255.252
exit
do wr
int se 0/0/0
ip address 10.10.10.18 255.255.255.252
exit
int se 0/0/1
ip address 10.10.10.22 255.255.255.252
exit

int se 0/1/0
ip address 10.10.10.33 255.255.255.252
clock rate 64000
exit
int se 0/1/1
ip address 10.10.10.37 255.255.255.252
clock rate 64000
exit
int se 0/2/0
ip address 10.10.10.41 255.255.255.252
clock rate 64000
exit
int se 0/2/1
ip address 10.10.10.45 255.255.255.252
clock rate 64000
exit
do wr

- <u>Manufacturing Facility Router</u>

int gig0/0
ip address 10.10.10.82 255.255.255.252
exit
int gig0/1
ip address 10.10.10.86 255.255.255.252
exit
do wr
int se 0/0/0
ip address 10.10.10.10 255.255.255.252
exit
int se 0/0/1
ip address 10.10.10.14 255.255.255.252
exit
int se 0/1/0
ip address 10.10.10.89 255.255.255.252
clock rate 64000
exit
int se 0/1/1
ip address 10.10.10.93 255.255.255.252
clock rate 64000
exit
do wr

- <u>Distribution Center Router</u>

int gig0/0
ip address 10.10.10.74 255.255.255.252
exit
int gig0/1
ip address 10.10.10.78 255.255.255.252
exit
do wr

int se 0/0/0
ip address 10.10.10.66 255.255.255.252
exit
int se 0/0/1
ip address 10.10.10.70 255.255.255.252
exit
int se 0/1/0
ip address 10.10.10.34 255.255.255.252
exit
int se 0/1/1
ip address 10.10.10.38 255.255.255.252
exit
int se 0/2/0
ip address 10.10.10.57 255.255.255.252
clock rate 64000
exit
int se 0/2/1
ip address 10.10.10.61 255.255.255.252
clock rate 64000
exit
int se 0/3/0
ip address 10.10.10.90 255.255.255.252
exit
int se 0/3/1
ip address 10.10.10.94 255.255.255.252
exit
do wr

- Remote Site Router

int gig0/0
ip address 10.10.10.50 255.255.255.252
exit
int gig0/1
ip address 10.10.10.54 255.255.255.252
exit
do wr
int se 0/0/0
ip address 10.10.10.42 255.255.255.252
exit
int se 0/0/1
ip address 10.10.10.46 255.255.255.252
exit
int se 0/1/0
ip address 10.10.10.58 255.255.255.252
exit
int se 0/1/1
ip address 10.10.10.62 255.255.255.252
exit
do wr
Note: Serial interface with a clock symbol is an interface with DC and have clock rate assigned.

Step 17: OSPF Configuration for Routers. (CORE LAYER)
Once at configuration stage (en→conf t)
- *Main Site Router*

router ospf 10
network 10.10.10.0 0.0.0.3 area 0
network 10.10.10.4 0.0.0.3 area 0
network 10.10.10.8 0.0.0.3 area 0
network 10.10.10.12 0.0.0.3 area 0
network 10.10.10.16 0.0.0.3 area 0
network 10.10.10.20 0.0.0.3 area 0
network 10.10.10.64 0.0.0.3 area 0
network 10.10.10.68 0.0.0.3 area 0
exit
do wr
- *Regional Office Router*

router ospf 10
network 10.10.10.16 0.0.0.3 area 0
network 10.10.10.20 0.0.0.3 area 0
network 10.10.10.24 0.0.0.3 area 0
network 10.10.10.28 0.0.0.3 area 0
network 10.10.10.32 0.0.0.3 area 0
network 10.10.10.36 0.0.0.3 area 0
network 10.10.10.40 0.0.0.3 area 0
network 10.10.10.44 0.0.0.3 area 0
exit
do wr
- *Manufacturing Facility Router*

router ospf 10
network 10.10.10.8 0.0.0.3 area 0
network 10.10.10.12 0.0.0.3 area 0
network 10.10.10.80 0.0.0.3 area 0
network 10.10.10.84 0.0.0.3 area 0
network 10.10.10.88 0.0.0.3 area 0
network 10.10.10.92 0.0.0.3 area 0
exit
do wr
- *Distribution Center Router*

router ospf 10
network 10.10.10.72 0.0.0.3 area 0
network 10.10.10.76 0.0.0.3 area 0
network 10.10.10.88 0.0.0.3 area 0
network 10.10.10.92 0.0.0.3 area 0
network 10.10.10.64 0.0.0.3 area 0
network 10.10.10.68 0.0.0.3 area 0
network 10.10.10.32 0.0.0.3 area 0
network 10.10.10.36 0.0.0.3 area 0
network 10.10.10.56 0.0.0.3 area 0
network 10.10.10.60 0.0.0.3 area 0
exit
do wr

- *Remote Site Router*

router ospf 10
network 10.10.10.40 0.0.0.3 area 0
network 10.10.10.44 0.0.0.3 area 0
network 10.10.10.48 0.0.0.3 area 0
network 10.10.10.52 0.0.0.3 area 0
network 10.10.10.56 0.0.0.3 area 0
network 10.10.10.60 0.0.0.3 area 0
exit
do wr

Step 18: OSPF Configuration for Multi Layer (Layer 3) Switches. (DISTRIBUTION LAYER)
Once at configuration stage (en→conf t)
- *Main Site Multi Layer (Layer 3) Switch*

ip routing
router ospf 10
network 10.10.10.0 0.0.0.3 area 0
network 10.10.10.4 0.0.0.3 area 0

network 192.168.10.0 0.0.0.31 area 0
network 192.168.10.32 0.0.0.31 area 0
network 192.168.10.64 0.0.0.31 area 0
network 192.168.10.96 0.0.0.31 area 0
network 192.168.10.128 0.0.0.31 area 0
network 192.168.10.160 0.0.0.31 area 0
network 192.168.10.192 0.0.0.31 area 0
exit
do wr

- *Regional Office Multi Layer (Layer 3) Switch*

ip routing
router ospf 10
network 10.10.10.24 0.0.0.3 area 0
network 10.10.10.28 0.0.0.3 area 0
network 192.168.10.224 0.0.0.31 area 0
network 192.168.11.0 0.0.0.31 area 0
network 192.168.11.32 0.0.0.31 area 0
exit
do wr

- *Manufacturing Facility Multi Layer (Layer 3) Switch*

ip routing
router ospf 10
network 10.10.10.80 0.0.0.3 area 0
network 10.10.10.84 0.0.0.3 area 0

network 192.168.11.64 0.0.0.31 area 0
network 192.168.11.96 0.0.0.31 area 0
network 192.168.11.128 0.0.0.31 area 0
network 192.168.11.160 0.0.0.31 area 0
exit
do wr

- *Distribution Center Multi Layer (Layer 3) Switch*

ip routing
router ospf 10
network 10.10.10.72 0.0.0.3 area 0
network 10.10.10.76 0.0.0.3 area 0
network 192.168.11.192 0.0.0.31 area 0
network 192.168.11.224 0.0.0.31 area 0
network 192.168.12.0 0.0.0.31 area 0
exit
do wr

- *Remote Site Multi Layer (Layer 3) Switch*

ip routing
router ospf 10
network 10.10.10.48 0.0.0.3 area 0
network 10.10.10.52 0.0.0.3 area 0

network 192.168.12.32 0.0.0.31 area 0
network 192.168.12.64 0.0.0.31 area 0
network 192.168.12.96 0.0.0.31 area 0
exit
do wr

Step 19: Statically allocate IP address to the servers.
- DHCP Server: 192.168.10.164
- DNS Server: 192.168.10.165
- HTTP Server: 192.168.10.166

Step 20: DHCP IP Pool creation and Assign the statically assigned IP address of the DNS server to all the DHCP server pool DNS sever field.

Step 21: Inter VLAN routing for Multi Layer (Layer 3) switches. (Access layer)
Once at configuration stage (en→conf t)
- *Main Site Multi Layer (Layer 3) Switch*

vlan 10
vlan 20
vlan 30
vlan 40
vlan 50
vlan 60
vlan 70
exit

int vlan 10
no shutdown
ip address 192.168.10.1 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 20
no shutdown
ip address 192.168.10.33 255.255.255.224
ip helper-address 192.168.10.164
exit

int vlan 30
no shutdown
ip address 192.168.10.65 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 40
no shutdown
ip address 192.168.10.97 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 50
no shutdown
ip address 192.168.10.129 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 60
no shutdown
ip address 192.168.10.161 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 70
no shutdown
ip address 192.168.10.193 255.255.255.224
ip helper-address 192.168.10.164
exit
do wr

- *Regional Office Multi Layer (Layer 3) Switch*

vlan 80
vlan 90
vlan 100
exit

int vlan 80
no shutdown
ip address 192.168.10.225 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 90
no shutdown
ip address 192.168.11.1 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 100
no shutdown
ip address 192.168.11.33 255.255.255.224
ip helper-address 192.168.10.164
exit
do wr

- *Manufacturing Facility Multi Layer (Layer 3) Switch*

```
vlan 110
vlan 120
vlan 130
vlan 140
exit

int vlan 110
no shutdown
ip address 192.168.11.65 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 120
no shutdown
ip address 192.168.11.97 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 130
no shutdown
ip address 192.168.11.129 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 140
no shutdown
ip address 192.168.11.161 255.255.255.224
ip helper-address 192.168.10.164
exit
do wr
```

- *Distribution Center Multi Layer (Layer 3) Switch*

```
vlan 150
vlan 160
vlan 170
exit

int vlan 150
no shutdown
ip address 192.168.11.193 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 160
no shutdown
ip address 192.168.11.225 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 170
no shutdown
ip address 192.168.12.1 255.255.255.224
ip helper-address 192.168.10.164
exit
do wr
```

- *Remote Site Multi Layer (Layer 3) Switch*

vlan 180
vlan 190
vlan 200
exit

int vlan 180
no shutdown
ip address 192.168.12.33 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 190
no shutdown
ip address 192.168.12.65 255.255.255.224
ip helper-address 192.168.10.164
exit
int vlan 200
no shutdown
ip address 192.168.12.97 255.255.255.224
ip helper-address 192.168.10.164
exit
do wr

Note: To check for VLAN: *do sh vlan*

Step 22: Change all PC IP configuration to DHCP.

Step 23: Configure the DNS Server as DNS and add domain name and IP (IP Address of the HTTP Server). Turn *OFF* HTTP and HTTPS.

Step 24: Configure Access point. Give SSID and Password.

Step 25: Set up the HTTP Server by just turning HTTP *ON* and TFTP *OFF* then edit the *index.html* file

Step 26: Configure NAT with ACL.

Once at configuration stage (en→conf t)

- *Main Site Router*

int range gig0/0-1
ip nat inside
exit
int se0/0/0
ip nat outside
exit
int se0/0/1
ip nat outside
exit
int se0/1/0
ip nat outside
exit
int se0/1/1
ip nat outside
exit
int se0/2/0
ip nat outside
exit

int se0/2/1

ip nat outside

exit

do wr

access-list 1 permit 192.168.10.0 0.0.0.31

access-list 1 permit 192.168.10.32 0.0.0.31

access-list 1 permit 192.168.10.64 0.0.0.31

access-list 1 permit 192.168.10.96 0.0.0.31

access-list 1 permit 192.168.10.128 0.0.0.31

access-list 1 permit 192.168.10.160 0.0.0.31

access-list 1 permit 192.168.10.192 0.0.0.31

ip nat pool MainSitePool 10.10.10.0 10.10.10.255 netmask 255.255.254.0

ip nat inside source list 1 pool MainSitePool overload

- *Regional Office Router*

int range gig0/0-1

ip nat inside

exit

int se0/0/0

ip nat outside

exit

int se0/0/1

ip nat outside

exit

int se0/1/0

ip nat outside

exit

int se0/1/1

ip nat outside

exit

int se0/2/0

ip nat outside

exit

int se0/2/1

ip nat outside

exit

do wr

access-list 1 permit 192.168.10.224 0.0.0.31

access-list 1 permit 192.168.11.0 0.0.0.31

access-list 1 permit 192.168.11.32 0.0.0.31

ip nat pool RegionalOfficePool 10.10.10.0 10.10.10.255 netmask 255.255.254.0

ip nat inside source list 1 pool RegionalOfficePool overload

do wr

- *Manufacturing Facility Router*

int range gig0/0-1

ip nat inside

exit

int se0/0/0

ip nat outside

exit

int se0/0/1
ip nat outside
exit
int se0/1/0
ip nat outside
exit
int se0/1/1
ip nat outside
exit
int se0/2/0
ip nat outside
exit
int se0/2/1
ip nat outside
exit
int se0/3/0
ip nat outside
exit
int se0/3/1
ip nat outside
exit
do wr

access-list 1 permit 192.168.11.64 0.0.0.31
access-list 1 permit 192.168.11.96 0.0.0.31
access-list 1 permit 192.168.11.128 0.0.0.31
access-list 1 permit 192.168.11.160 0.0.0.31
ip nat pool ManufacturingFacilityPool 10.10.10.0 10.10.10.255 netmask 255.255.254.0
ip nat inside source list 1 pool ManufacturingFacilityPool overload
do wr

- *Distribution Center Router*

int range gig0/0-1
ip nat inside
exit
int se0/0/0
ip nat outside
exit
int se0/0/1
ip nat outside
exit
int se0/1/0
ip nat outside
exit
int se0/1/1
ip nat outside
exit
int se0/2/0
ip nat outside
exit

int se0/2/1
ip nat outside
exit
do wr

access-list 1 permit 192.168.11.192 0.0.0.31
access-list 1 permit 192.168.11.224 0.0.0.31
access-list 1 permit 192.168.12.0 0.0.0.31
ip nat pool DistributionnCenterPool 10.10.10.0 10.10.10.255 netmask 255.255.254.0
ip nat inside source list 1 pool DistributionnCenterPool overload
do wr

- <u>*Remote Site Router*</u>

int range gig0/0-1
ip nat inside
exit
int se0/0/0
ip nat outside
exit
int se0/0/1
ip nat outside
exit
int se0/1/0
ip nat outside
exit
int se0/1/1
ip nat outside
exit
int se0/2/0
ip nat outside
exit
int se0/2/1
ip nat outside
exit
exit
do wr

access-list 1 permit 192.168.12.32 0.0.0.31
access-list 1 permit 192.168.12.64 0.0.0.31
access-list 1 permit 192.168.12.96 0.0.0.31
ip nat pool RemoteSitePool 10.10.10.0 10.10.10.255 netmask 255.255.254.0
ip nat inside source list 1 pool RemoteSitePool overload
do wr