**Design and Implementation of Q-Tire Network**

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CMPE 355

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**Project Objective**

The objective of this project is to design and implement the network infrastructure for Qatar Tires (Q-Tires), a multi-floor building accommodating various departments. The primary goal is to ensure connectivity and efficient resource allocation while meeting the specific requirements of the organization.

**Project Requirements**

1. **Building Layout**
   * **First Floor**: Reception, Store, and Logistics departments.
   * **Second Floor**: Finance, Human Resources (HR), and Sales departments.
   * **Third Floor**: IT and Admin departments.
2. **Network Design Considerations**
   * Use the private IP address block: **10.17.128.0/18**.
   * Configure IPv6 manually for the IT department using the network address: **2003:0D0A:ABCD::/64**.
   * Assign **dedicated VLANs** for each department with the following configurations:
     + **First Floor**:
       - Reception (VLAN-10): 270 hosts.
       - Store (VLAN-11): 300 hosts.
       - Logistics (VLAN-12): 50 hosts.
     + **Second Floor**:
       - Finance (VLAN-20): 60 hosts.
       - HR (VLAN-21): 20 hosts.
       - Sales (VLAN-22): 30 hosts.
     + **Third Floor**:
       - Admin (VLAN-30): 15 hosts.
       - IT (VLAN-31): 10 hosts.

**IP Addressing Scheme Using VLSM**

The IP addressing scheme for the Q-Tires network was designed using (VLSM) to optimize the allocation of the provided private IP block (**10.17.128.0/18**). Each department was assigned a subnet tailored to its specific host requirements. The following tables show the IP addressing scheme that we did using VLSM. Every other device except routers and the Main Server will be assigned an IP address automatically by DHCP.

| Private IP Address | 10.17.128.0/18 | Subnet Mask | 255.255.192.0 |
| --- | --- | --- | --- |

Table 1. Given Private IP Address

| Subnet Number | Department/Connection | Number of Hosts | Starting Address (Network) | First Usable Host Address | Last Usable Host Address | Last Address (Broadcast) | Bits needed for hosts + network + broadcast | New Subnet Mask (Full) | New Subnet Mask |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | Store | 300 | 10.17.128.0 | 10.17.128.1 | 10.17.129.254 | 10.17.129.255 | 9 | 255.255.254.0 | /23 |
| 2 | Reception | 270 | 10.17.130.0 | 10.17.130.1 | 10.17.131.254 | 10.17.131.255 | 9 | 255.255.254.0 | /23 |
| 3 | Finance | 60 | 10.17.132.0 | 10.17.132.1 | 10.17.132.62 | 10.17.132.63 | 6 | 255.255.255.192 | /26 |
| 4 | Logistics | 50 | 10.17.132.64 | 10.17.132.65 | 10.17.132.126 | 10.17.132.127 | 6 | 255.255.255.192 | /26 |
| 5 | Sales | 30 | 10.17.132.128 | 10.17.132.129 | 10.17.132.158 | 10.17.132.159 | 5 | 255.255.255.224 | /27 |
| 6 | HR | 20 | 10.17.132.160 | 10.17.132.161 | 10.17.132.190 | 10.17.132.191 | 5 | 255.255.255.224 | /27 |
| 7 | Admin | 15 | 10.17.132.192 | 10.17.132.193 | 10.17.132.222 | 10.17.132.223 | 5 | 255.255.255.224 | /27 |
| 8 | IT | 10 | 10.17.132.224 | 10.17.132.225 | 10.17.132.238 | 10.17.132.239 | 4 | 255.255.255.240 | /28 |
| 9 | WAN connections between R1 and R2 | 2 | 10.17.132.240 | 10.17.132.241 | 10.17.132.242 | 10.17.132.243 | 2 | 255.255.255.252 | /30 |
| 10 | WAN connections between R1 and R3 | 2 | 10.17.132.244 | 10.17.132.245 | 10.17.132.246 | 10.17.132.247 | 2 | 255.255.255.252 | /30 |
| 11 | WAN connections between R2 and R3 | 2 | 10.17.132.248 | 10.17.132.249 | 10.17.132.250 | 10.17.132.251 | 2 | 255.255.255.252 | /30 |

Table 2. Subnetting for Departments and WAN Connections

| First Floor | | |
| --- | --- | --- |
| Device-Interface | Address | Subnet Mask |
| Router - gig 2/0.10 | 10.17.130.1 | 255.255.254.0 |
| Router - gig 2/0.11 | 10.17.128.1 | 255.255.254.0 |
| Router - gig 2/0.12 | 10.17.132.65 | 255.255.255.192 |
| Other Devices | IP Address Assigned By Router’s DHCP | |

Table 3. First Floor IPV4 Addressing Scheme

| Second Floor | | |
| --- | --- | --- |
| Device-Interface | Address | Subnet Mask |
| Router - gig 2/0.20 | 10.17.132.1 | 255.255.255.192 |
| Router - gig 2/0.21 | 10.17.132.161 | 255.255.255.224 |
| Router - gig 2/0.22 | 10.17.132.129 | 255.255.255.224 |
| Other Devices | IP Address Assigned By Router’s DHCP | |

Table 4. Second Floor IPV4 Addressing Scheme

| Third Floor | | |
| --- | --- | --- |
| Device - Interface | Address | Subnet Mask |
| Router - gig 2/0.30 | 10.17.132.193 | 255.255.255.224 |
| Router - gig 2/0.31 | 10.17.132.225 | 255.255.255.240 |
| Main Server | 10.17.132.227 | 255.255.255.240 |
| Other Devices | IP Address Assigned By Router’s DHCP | |

Table 5. Third Floor IPV4 Addressing Scheme

| Routers (WAN Connection) | | |
| --- | --- | --- |
| Connections | Addresses | Subnet Mask |
| R1’s Gig 0/0 (IP address between R1 and R2) | 10.17.132.241 | 255.255.255.252 |
| R2’s Gig 0/0 (IP address between R1 and R2) | 10.17.132.242 | 255.255.255.252 |
| R1’s Gig 1/0 (IP address between R1 and R3) | 10.17.132.245 | 255.255.255.252 |
| R3’s Gig 1/0 (IP address between R1 and R3) | 10.17.132.246 | 255.255.255.252 |
| R2’s Gig 1/0 (IP address between R2 and R3) | 10.17.132.249 | 255.255.255.252 |
| R3’s Gig 0/0 (IP address between R2 and R3) | 10.17.132.250 | 255.255.255.252 |

Table 6. Routers (WAN Connection) IPV4 Addressing Scheme

| IPV6 Addressing Scheme | |
| --- | --- |
| Device | Address |
| IT-PC1 | 2003:0D0A:ABCD::1/64 |
| IT-PC2 | 2003:0D0A:ABCD::2/64 |
| Main Server | 2003:0D0A:ABCD::3/64 |

Table 7. IT Department IPV6 Addressing Scheme

**SSH Configuration Usernames and Passwords**

In order to remotely access the networking devices through a PC, we needed to configure SSH to make the connection secure. The following table shows the networking devices with their corresponding username, passwords, and domain names for the Admin to be able to use remote access on these devices.

| SSH Configuration | | | | |
| --- | --- | --- | --- | --- |
| Device | Username | Password | Enable Password | Domain Name |
| R1 | Admin | cisco | firstfloor | [qtiresr1.com](http://qtiresr3.com/) |
| R2 | Admin | cisco | secondfloor | [qtiresr2.com](http://qtiresr3.com/) |
| R3 | Admin | cisco | thirdfloor | [qtiresr3.com](http://qtiresr3.com/) |
| Floor-1-Switch | Admin | cisco | firstfloor | [qtiress1.com](http://qtiress1.com/) |
| Floor-2-Switch | Admin | cisco | secondfloor | [qtiress2.com](http://qtiress2.com/) |
| Floor-3-Switch | Admin | cisco | thirdfloor | [qtiress3.com](http://qtiress3.com/) |

Table 8. Username and Passwords for SSH Purposes.

**Show Run for All Network Devices**

The "**show run**" command output displays the configurations applied to all network devices in the Q-Tires network. It includes details of hostname assignments, VLAN configurations, IP address allocations, routing protocols, and SSH setup for secure remote management. The following images show the results of the **show run** command that we did for each network device.

* **Floor-1-Router (R1)**

Current configuration : 2184 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R1

!

!

!

enable password firstfloor

!

!

ip dhcp excluded-address 10.17.130.1

ip dhcp excluded-address 10.17.128.1

ip dhcp excluded-address 10.17.132.65

!

ip dhcp pool ReceptionPool

network 10.17.130.0 255.255.254.0

default-router 10.17.130.1

dns-server 10.17.132.227

ip dhcp pool StorePool

network 10.17.128.0 255.255.254.0

default-router 10.17.128.1

dns-server 10.17.132.227

ip dhcp pool LogisticsPool

network 10.17.132.64 255.255.255.192

default-router 10.17.132.65

dns-server 10.17.132.227

!

!

!

no ip cef

no ipv6 cef

!

!

!

username Admin password 0 cisco

!

!

!

!

!

!

!

!

ip ssh version 2

ip domain-name qtiresr1.com

!

!

!

!

!

!

!

!

interface GigabitEthernet0/0

description Connected to Floor-2-Router

ip address 10.17.132.241 255.255.255.252

!

interface GigabitEthernet1/0

description Connected to Floor-3-Router

ip address 10.17.132.245 255.255.255.252

!

interface GigabitEthernet2/0

no ip address

duplex auto

speed auto

!

interface GigabitEthernet2/0.10

description Connected to Reception - VLAN 10

encapsulation dot1Q 10

ip address 10.17.130.1 255.255.254.0

!

interface GigabitEthernet2/0.11

description Connected to Store - VLAN 11

encapsulation dot1Q 11

ip address 10.17.128.1 255.255.254.0

!

interface GigabitEthernet2/0.12

description Connected to Logisitics - VLAN 12

encapsulation dot1Q 12

ip address 10.17.132.65 255.255.255.192

!

interface GigabitEthernet3/0

no ip address

duplex auto

speed auto

shutdown

!

interface GigabitEthernet4/0

no ip address

duplex auto

speed auto

shutdown

!

router rip

version 2

network 10.0.0.0

!

ip classless

ip route 10.17.132.0 255.255.255.192 10.17.132.242 150

ip route 10.17.132.160 255.255.255.224 10.17.132.242 150

ip route 10.17.132.128 255.255.255.224 10.17.132.242 150

ip route 10.17.132.224 255.255.255.240 10.17.132.246 150

ip route 10.17.132.192 255.255.255.224 10.17.132.246 150

!

ip flow-export version 9

!

!

!

!

!

!

!

!

line con 0

!

line aux 0

!

line vty 0 4

login local

transport input ssh

line vty 5 15

login local

transport input ssh

!

!

!

end

* **Floor-2-Router (R2)**

Current configuration : 2179 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R2

!

!

!

enable password secondfloor

!

!

ip dhcp excluded-address 10.17.132.1

ip dhcp excluded-address 10.17.132.161

ip dhcp excluded-address 10.17.132.129

!

ip dhcp pool FinancePool

network 10.17.132.0 255.255.255.192

default-router 10.17.132.1

dns-server 10.17.132.227

ip dhcp pool HRPool

network 10.17.132.160 255.255.255.224

default-router 10.17.132.161

dns-server 10.17.132.227

ip dhcp pool SalesPool

network 10.17.132.128 255.255.255.224

default-router 10.17.132.129

dns-server 10.17.132.227

!

!

!

no ip cef

no ipv6 cef

!

!

!

username Admin password 0 cisco

!

!

!

!

!

!

!

!

ip ssh version 2

ip domain-name qtiresr2.com

!

!

!

!

!

!

!

!

interface GigabitEthernet0/0

description Connected to Floor-1-Router

ip address 10.17.132.242 255.255.255.252

!

interface GigabitEthernet1/0

description Connected to Floor-3-Router

ip address 10.17.132.249 255.255.255.252

!

interface GigabitEthernet2/0

no ip address

duplex auto

speed auto

!

interface GigabitEthernet2/0.20

description Connected to Finance - VLAN 20

encapsulation dot1Q 20

ip address 10.17.132.1 255.255.255.192

!

interface GigabitEthernet2/0.21

description Connected to HR - VLAN 21

encapsulation dot1Q 21

ip address 10.17.132.161 255.255.255.224

!

interface GigabitEthernet2/0.22

description Connected to Sales - VLAN 22

encapsulation dot1Q 22

ip address 10.17.132.129 255.255.255.224

!

interface GigabitEthernet3/0

no ip address

duplex auto

speed auto

shutdown

!

interface GigabitEthernet4/0

no ip address

duplex auto

speed auto

shutdown

!

router rip

version 2

network 10.0.0.0

!

ip classless

ip route 10.17.130.0 255.255.254.0 10.17.132.241 150

ip route 10.17.128.0 255.255.254.0 10.17.132.241 150

ip route 10.17.132.64 255.255.255.192 10.17.132.241 150

ip route 10.17.132.224 255.255.255.240 10.17.132.250 150

ip route 10.17.132.192 255.255.255.224 10.17.132.250 150

!

ip flow-export version 9

!

!

!

!

!

!

!

!

line con 0

!

line aux 0

!

line vty 0 4

login local

transport input ssh

line vty 5 15

login local

transport input ssh

!

!

!

end

* **Floor-3-Router (R3)**

Current configuration : 1928 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R3

!

!

!

enable password thirdfloor

!

!

ip dhcp excluded-address 10.17.132.193

ip dhcp excluded-address 10.17.132.225

ip dhcp excluded-address 10.17.132.227

!

ip dhcp pool AdminPool

network 10.17.132.192 255.255.255.224

default-router 10.17.132.193

dns-server 10.17.132.227

ip dhcp pool IT-Pool

network 10.17.132.224 255.255.255.240

default-router 10.17.132.225

dns-server 10.17.132.227

!

!

!

no ip cef

no ipv6 cef

!

!

!

username Admin password 0 cisco

username AdminR3 password 0 cisco

!

!

!

!

!

!

!

!

ip ssh version 2

ip domain-name qtiresr3.com

!

!

!

!

!

!

!

!

interface GigabitEthernet0/0

description Connected to Floor-2-Router

ip address 10.17.132.250 255.255.255.252

!

interface GigabitEthernet1/0

description Connected to Floor-1-Router

ip address 10.17.132.246 255.255.255.252

!

interface GigabitEthernet2/0

no ip address

duplex auto

speed auto

!

interface GigabitEthernet2/0.30

description Connected to HR - VLAN 30

encapsulation dot1Q 30

ip address 10.17.132.193 255.255.255.224

!

interface GigabitEthernet2/0.31

description Connected to IT - VLAN 31

encapsulation dot1Q 31

ip address 10.17.132.225 255.255.255.240

!

interface GigabitEthernet3/0

no ip address

duplex auto

speed auto

shutdown

!

router rip

version 2

network 10.0.0.0

!

ip classless

ip route 10.17.130.0 255.255.254.0 10.17.132.245 150

ip route 10.17.128.0 255.255.254.0 10.17.132.245 150

ip route 10.17.132.64 255.255.255.192 10.17.132.245 150

ip route 10.17.132.0 255.255.255.192 10.17.132.249 150

ip route 10.17.132.160 255.255.255.224 10.17.132.249 150

ip route 10.17.132.128 255.255.255.224 10.17.132.249 150

!

ip flow-export version 9

!

!

!

!

!

!

!

!

line con 0

!

line aux 0

!

line vty 0 4

login local

transport input ssh

line vty 5 15

login local

transport input ssh

!

!

!

end

* **First Floor Switch**

Current configuration : 2069 bytes

!

version 15.0

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Floor-1-Switch

!

enable password firstfloor

!

!

!

ip ssh version 2

!

username Admin privilege 1 password 0 cisco

!

!

!

spanning-tree mode pvst

spanning-tree extend system-id

!

interface FastEthernet0/1

description Connected to Reception-Printer

switchport access vlan 10

switchport mode access

!

interface FastEthernet0/2

description Connected to Reception-AP

switchport access vlan 10

switchport mode access

!

interface FastEthernet0/3

!

interface FastEthernet0/4

!

interface FastEthernet0/5

!

interface FastEthernet0/6

!

interface FastEthernet0/7

!

interface FastEthernet0/8

!

interface FastEthernet0/9

description Connected to Store-Printer

switchport access vlan 11

switchport mode access

!

interface FastEthernet0/10

description Connected to Store-AP

switchport access vlan 11

switchport mode access

!

interface FastEthernet0/11

!

interface FastEthernet0/12

!

interface FastEthernet0/13

!

interface FastEthernet0/14

!

interface FastEthernet0/15

!

interface FastEthernet0/16

!

interface FastEthernet0/17

description Connected to Logistics-AP

switchport access vlan 12

switchport mode access

!

interface FastEthernet0/18

description Connected to Logistics-Printer

switchport access vlan 12

switchport mode access

!

interface FastEthernet0/19

!

interface FastEthernet0/20

!

interface FastEthernet0/21

!

interface FastEthernet0/22

!

interface FastEthernet0/23

!

interface FastEthernet0/24

!

interface GigabitEthernet0/1

description Connected to Floor-1-Router

switchport mode trunk

!

interface GigabitEthernet0/2

!

interface Vlan1

no ip address

shutdown

!

interface Vlan10

description Connected to Reception LAN

ip address dhcp

!

interface Vlan11

description Connected to Store LAN

ip address dhcp

!

interface Vlan12

description Connected to Logistics LAN

ip address dhcp

!

!

!

!

line con 0

!

line vty 0 4

login local

transport input ssh

line vty 5 15

login local

transport input ssh

!

!

!

!

end

* **Second Floor Switch**

Current configuration : 2043 bytes

!

version 15.0

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Floor-2-Switch

!

enable password secondfloor

!

!

!

ip ssh version 2

!

username Admin privilege 1 password 0 cisco

!

!

!

spanning-tree mode pvst

spanning-tree extend system-id

!

interface FastEthernet0/1

description Connected to Finance-Printer

switchport access vlan 20

switchport mode access

!

interface FastEthernet0/2

description Connected to Finance-AP

switchport access vlan 20

switchport mode access

!

interface FastEthernet0/3

!

interface FastEthernet0/4

!

interface FastEthernet0/5

!

interface FastEthernet0/6

!

interface FastEthernet0/7

!

interface FastEthernet0/8

!

interface FastEthernet0/9

description Connected to HR-Printer

switchport access vlan 21

switchport mode access

!

interface FastEthernet0/10

description Connected to HR-AP

switchport access vlan 21

switchport mode access

!

interface FastEthernet0/11

!

interface FastEthernet0/12

!

interface FastEthernet0/13

!

interface FastEthernet0/14

!

interface FastEthernet0/15

!

interface FastEthernet0/16

!

interface FastEthernet0/17

description Connected to Sales-AP

switchport access vlan 22

switchport mode access

!

interface FastEthernet0/18

description Connected to Sales-Printer

switchport access vlan 22

switchport mode access

!

interface FastEthernet0/19

!

interface FastEthernet0/20

!

interface FastEthernet0/21

!

interface FastEthernet0/22

!

interface FastEthernet0/23

!

interface FastEthernet0/24

!

interface GigabitEthernet0/1

description Connected to Floor-2-Router

switchport mode trunk

!

interface GigabitEthernet0/2

!

interface Vlan1

no ip address

shutdown

!

interface Vlan20

description Connected to Finance LAN

ip address dhcp

!

interface Vlan21

description Connected to HR LAN

ip address dhcp

!

interface Vlan22

description Connected to Sales LAN

ip address dhcp

!

!

!

!

line con 0

!

line vty 0 4

login local

transport input ssh

line vty 5 15

login local

transport input ssh

!

!

!

!

end

* **Third Floor Switch**

Current configuration : 2044 bytes

!

version 15.0

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Floor-3-Switch

!

enable password thirdfloor

!

!

!

ip ssh version 2

!

username Admin privilege 1 password 0 cisco

!

!

!

spanning-tree mode pvst

spanning-tree extend system-id

!

interface FastEthernet0/1

description Connected to Admin-Printer

switchport access vlan 30

switchport mode access

!

interface FastEthernet0/2

description Connected to Admin-AP

switchport access vlan 30

switchport mode access

!

interface FastEthernet0/3

!

interface FastEthernet0/4

!

interface FastEthernet0/5

!

interface FastEthernet0/6

!

interface FastEthernet0/7

!

interface FastEthernet0/8

!

interface FastEthernet0/9

description Connected to IT-PC1

switchport access vlan 31

switchport mode access

!

interface FastEthernet0/10

description Connected to IT-PC2

switchport access vlan 31

switchport mode access

!

interface FastEthernet0/11

description Connected to IT-Printer

switchport access vlan 31

switchport mode access

!

interface FastEthernet0/12

description Connected to Main Server

switchport access vlan 31

switchport mode access

!

interface FastEthernet0/13

description Connected to IT-AP

switchport access vlan 31

switchport mode access

!

interface FastEthernet0/14

!

interface FastEthernet0/15

!

interface FastEthernet0/16

!

interface FastEthernet0/17

!

interface FastEthernet0/18

!

interface FastEthernet0/19

!

interface FastEthernet0/20

!

interface FastEthernet0/21

!

interface FastEthernet0/22

!

interface FastEthernet0/23

!

interface FastEthernet0/24

!

interface GigabitEthernet0/1

description Connected to Floor-3-Router

switchport mode trunk

!

interface GigabitEthernet0/2

!

interface Vlan1

no ip address

shutdown

!

interface Vlan30

description Connected to Admin LAN

ip address dhcp

!

interface Vlan31

description Connected to IT LAN

ip address dhcp

!

!

!

!

line con 0

!

line vty 0 4

login local

transport input ssh

line vty 5 15

login local

transport input ssh

!

!

!

!

end