

Secure WAN Connection between Ghana and Cape Verde Branch Offices Simulation Project Documentation

1. Project Overview

Objective:

To design and simulate a secure Wide Area Network (WAN) connection between the Ghana Office and the Cape Verde Office using Cisco Packet Tracer, enabling only HTTP and ICMP traffic while blocking all other traffic via Access Control Lists (ACLs).

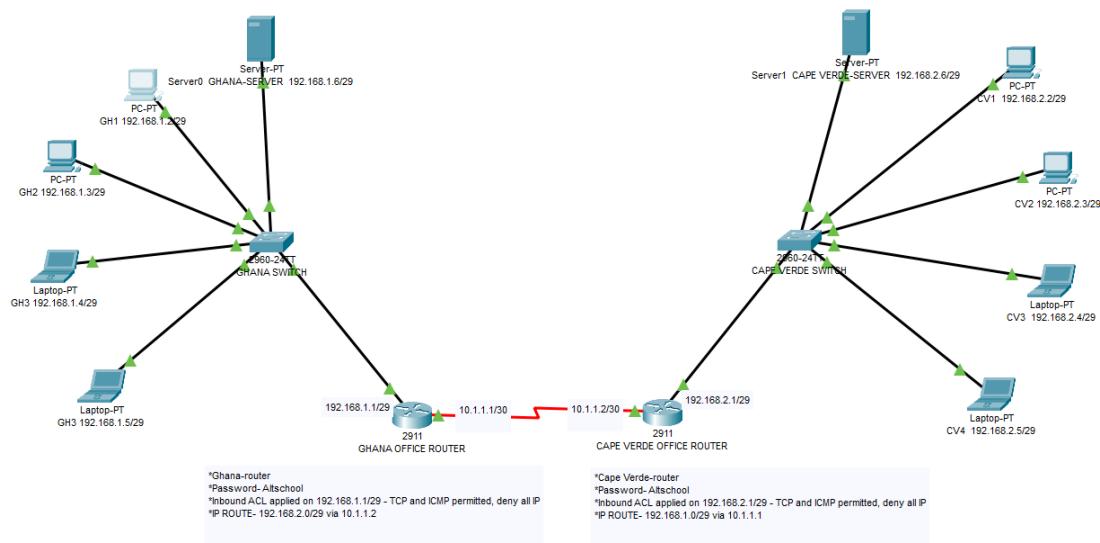
2. Network Topology Design

Branch Networks:

- Ghana Office: 4 End-user PCs, 1 Switch, 1 Server, 1 Router
- Cape Verde Office: 4 End-user PCs, 1 Switch, 1 Server, 1 Router

WAN Link: A direct WAN connection between the two routers.

Network Diagram: **Using STAR TOPOLOGY**



(Network diagram from Cisco Packet Tracer)

3. IP Addressing Scheme

CIDR-based Subnetting:

Subnet Scheme: [192.168.1.0/29 for Ghana, 192.168.2.0/29 for Cape Verde, 10.1.1.0/30 for WAN link]

IP Allocation Table:

Device	IP Address	Subnet Mask	Default Gateway	Description
Ghana Router(LAN)	192.168.1.1	255.255.255.248	192.168.1.1	Gateway
Ghana PC1	192.168.1.2	255.255.255.248	192.168.1.1	Host
Ghana PC2	192.168.1.3	255.255.255.248	192.168.1.1	Host
Ghana PC3	192.168.1.4	255.255.255.248	192.168.1.1	Host
Ghana PC4	192.168.1.5	255.255.255.248	192.168.1.1	Host
Ghana Server	192.168.1.6	255.255.255.248	192.168.1.1	Host
Cape Verde Router(LAN)	192.168.2.1	255.255.255.248	192.168.2.1	Gateway
Cape Verde PC1	192.168.2.2	255.255.255.248	192.168.2.1	Host
Cape Verde PC2	192.168.2.3	255.255.255.248	192.168.2.1	Host
Cape Verde PC3	192.168.2.4	255.255.255.248	192.168.2.1	Host
Cape Verde PC4	192.168.2.5	255.255.255.248	192.168.2.1	Host
Cape Verde Server	192.168.2.6	255.255.255.248	192.168.2.1	Host
Ghana Router (WAN)	10.1.1.1	255.255.255.252	10.1.1.1	Gateway
Cape Verde Router (WAN)	10.1.1.2	255.255.255.252	10.1.1.2	Gateway

4. Device Configuration Summary

Routers:

- Interface configuration (IP, subnet mask)

- Ghana Router(LAN)- 192.168.1.1 255.255.255.248
- Ghana Router(WAN)- 10.1.1.1 255.255.255.252

- Cape Verde(LAN)- 192.168.2.1 255.255.255.248
- Cape Verde(WAN)- 10.1.1.2 255.255.255.252

- Routing method: [Static Routing]

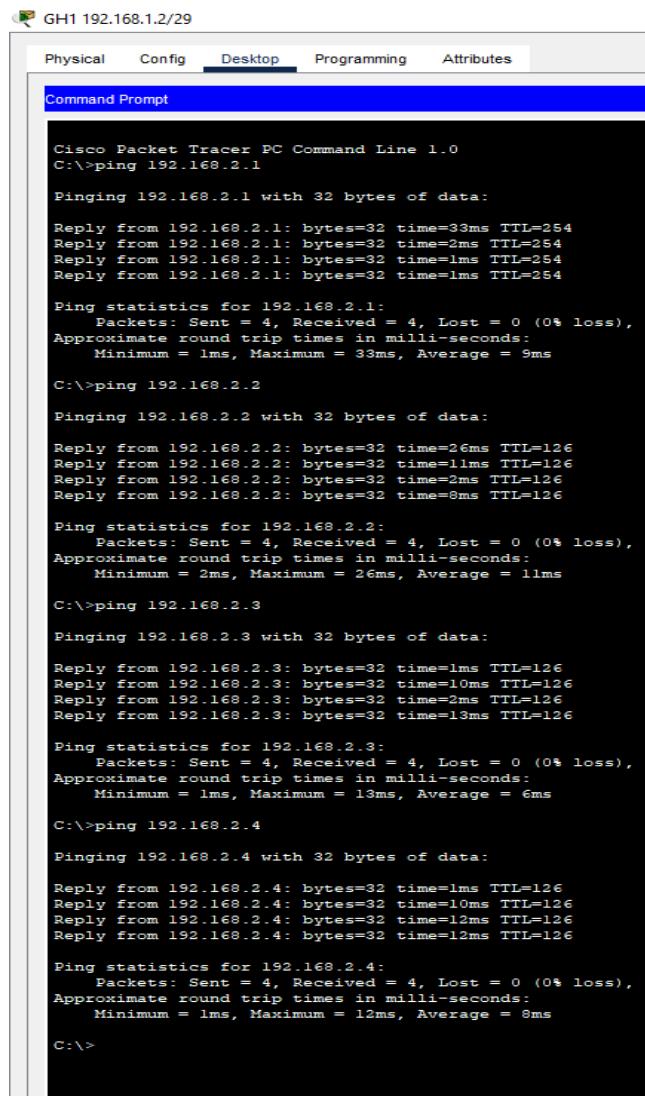
- Ghana Router – ip route 192.168.2.0 255.255.255.248 10.1.1.2
- Cape Verde Router- ip route 192.168.1.0 255.255.255.248 10.1.1.1

5. Connectivity and Services

Verified Services:

- ICMP (Ping)

Ping from Ghana PC to PCS, Router and Server in Cape Verde



The screenshot shows a Cisco Packet Tracer Command Line interface window titled "GH1 192.168.1.2/29". The "Desktop" tab is selected. The command prompt shows the following ping results:

```

Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.2.1

Pinging 192.168.2.1 with 32 bytes of data:

Reply from 192.168.2.1: bytes=32 time=3ms TTL=254
Reply from 192.168.2.1: bytes=32 time=2ms TTL=254
Reply from 192.168.2.1: bytes=32 time=1ms TTL=254
Reply from 192.168.2.1: bytes=32 time=1ms TTL=254

Ping statistics for 192.168.2.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 33ms, Average = 9ms

C:\>ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:

Reply from 192.168.2.2: bytes=32 time=26ms TTL=126
Reply from 192.168.2.2: bytes=32 time=11ms TTL=126
Reply from 192.168.2.2: bytes=32 time=2ms TTL=126
Reply from 192.168.2.2: bytes=32 time=8ms TTL=126

Ping statistics for 192.168.2.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 26ms, Average = 11ms

C:\>ping 192.168.2.3

Pinging 192.168.2.3 with 32 bytes of data:

Reply from 192.168.2.3: bytes=32 time=1ms TTL=126
Reply from 192.168.2.3: bytes=32 time=10ms TTL=126
Reply from 192.168.2.3: bytes=32 time=2ms TTL=126
Reply from 192.168.2.3: bytes=32 time=13ms TTL=126

Ping statistics for 192.168.2.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 13ms, Average = 6ms

C:\>ping 192.168.2.4

Pinging 192.168.2.4 with 32 bytes of data:

Reply from 192.168.2.4: bytes=32 time=1ms TTL=126
Reply from 192.168.2.4: bytes=32 time=10ms TTL=126
Reply from 192.168.2.4: bytes=32 time=12ms TTL=126
Reply from 192.168.2.4: bytes=32 time=12ms TTL=126

Ping statistics for 192.168.2.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 12ms, Average = 8ms

```

```
C:\>ping 192.168.2.5

Pinging 192.168.2.5 with 32 bytes of data:

Reply from 192.168.2.5: bytes=32 time=10ms TTL=126
Reply from 192.168.2.5: bytes=32 time=21ms TTL=126
Reply from 192.168.2.5: bytes=32 time=2ms TTL=126
Reply from 192.168.2.5: bytes=32 time=4ms TTL=126

Ping statistics for 192.168.2.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 21ms, Average = 9ms

C:\>ping 192.168.2.6

Pinging 192.168.2.6 with 32 bytes of data:

Reply from 192.168.2.6: bytes=32 time=1ms TTL=126
Reply from 192.168.2.6: bytes=32 time=10ms TTL=126
Reply from 192.168.2.6: bytes=32 time=10ms TTL=126
Reply from 192.168.2.6: bytes=32 time=9ms TTL=126

Ping statistics for 192.168.2.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 7ms

C:\>
```

Ping from Cape Verde PC to PCS, Router and Server in Ghana

```
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=14ms TTL=254
Reply from 192.168.1.1: bytes=32 time=21ms TTL=254
Reply from 192.168.1.1: bytes=32 time=1ms TTL=254
Reply from 192.168.1.1: bytes=32 time=1ms TTL=254

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 21ms, Average = 9ms

C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=29ms TTL=126
Reply from 192.168.1.2: bytes=32 time=10ms TTL=126
Reply from 192.168.1.2: bytes=32 time=4ms TTL=126
Reply from 192.168.1.2: bytes=32 time=10ms TTL=126

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 4ms, Maximum = 29ms, Average = 13ms

C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=28ms TTL=126
Reply from 192.168.1.3: bytes=32 time=26ms TTL=126
Reply from 192.168.1.3: bytes=32 time=41ms TTL=126
Reply from 192.168.1.3: bytes=32 time=37ms TTL=126

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 26ms, Maximum = 41ms, Average = 33ms

C:\>ping 192.168.1.4

Pinging 192.168.1.4 with 32 bytes of data:

Reply from 192.168.1.4: bytes=32 time=2ms TTL=126
Reply from 192.168.1.4: bytes=32 time=28ms TTL=126
Reply from 192.168.1.4: bytes=32 time=15ms TTL=126
Reply from 192.168.1.4: bytes=32 time=2ms TTL=126

Ping statistics for 192.168.1.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 28ms, Average = 11ms
```

```
C:\>ping 192.168.1.5

Pinging 192.168.1.5 with 32 bytes of data:

Reply from 192.168.1.5: bytes=32 time=1ms TTL=126
Reply from 192.168.1.5: bytes=32 time=1ms TTL=126
Reply from 192.168.1.5: bytes=32 time=12ms TTL=126
Reply from 192.168.1.5: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.1.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 12ms, Average = 3ms

C:\>ping 192.168.1.6

Pinging 192.168.1.6 with 32 bytes of data:

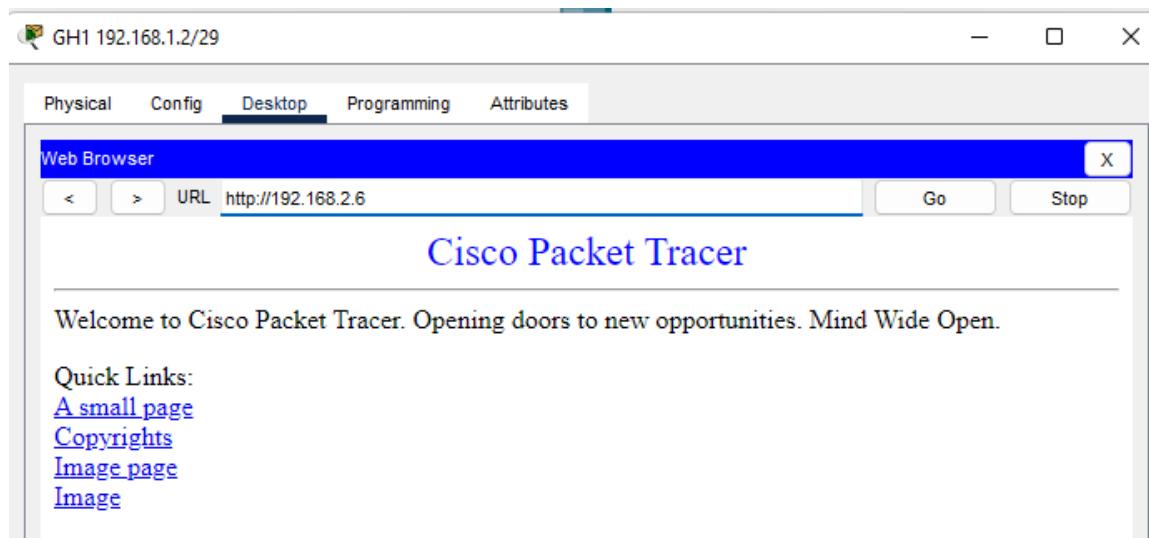
Reply from 192.168.1.6: bytes=32 time=39ms TTL=126
Reply from 192.168.1.6: bytes=32 time=1ms TTL=126
Reply from 192.168.1.6: bytes=32 time=15ms TTL=126
Reply from 192.168.1.6: bytes=32 time=10ms TTL=126

Ping statistics for 192.168.1.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 39ms, Average = 16ms
```

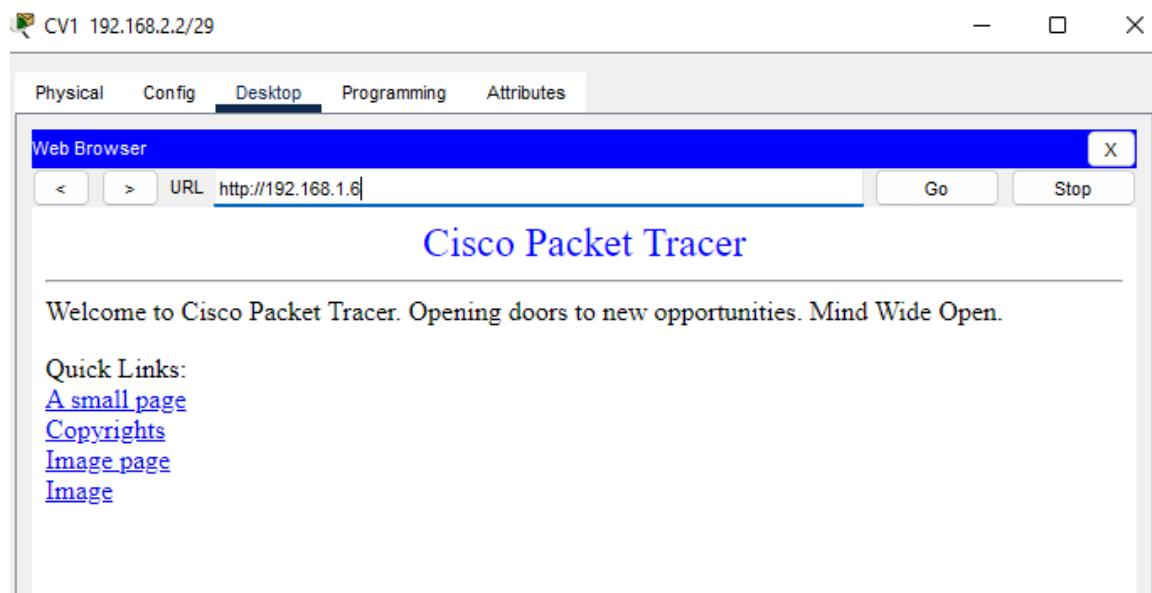
- HTTP (Port 80)

- Open web browser and enter destination IP

Accessing Cape Verde Server from a PC in Ghana via HTTP port 80



Accessing Ghana Server from a PC in Cape Verde via HTTP port 80



Denied FTP and TELNET on Cape Verde branch

```
C:\>ftp 192.168.1.6
Trying to connect...192.168.1.6

%Error opening ftp://192.168.1.6/ (Timed out)

.
.

(Disconnecting from ftp server)
```

```
C:\>telnet 192.168.2.1
Trying 192.168.2.1 ...
% Connection timed out; remote host not responding
C:\>telnet 192.168.1.1
Trying 192.168.1.1 ...
% Connection timed out; remote host not responding
C:\>
```

Denied FTP and TELNET on Ghana branch

```
C:\>
C:\>ftp 192.168.2.6
Trying to connect...192.168.2.6

%Error opening ftp://192.168.2.6/ (Timed out)
.

.

(Disconnecting from ftp server)

C:\>telnet 192.168.1.1
Trying 192.168.1.1 ...
% Connection timed out; remote host not responding
C:\>telnet 192.168.1.2
Trying 192.168.1.2 ...
% Connection refused by remote host
C:\>telnet 192.168.2.1
Trying 192.168.2.1 ...
% Connection timed out; remote host not responding
.
```

6. Security & ACL Configuration

ACL Objectives:

- Allow only ICMP and HTTP port 80 traffic across the WAN
- Deny all other types of traffic

ACL Logic:

- *access-list 100 permit tcp any any eq 80*
- *access-list 100 permit tcp any any established*
- *access-list 100 permit icmp any any*
- *access-list 100 deny ip any any*

Applied to Interfaces:

- On Inbound interface of both routers' WAN link