

DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE & ISO 9001:2008 Certified)

Accredited by National Assessment & Accreditation Council (NAAC) with ‘A’
grade, Shavige Malleshwara Hills, Kumaraswamy Layout, Bengaluru-560078.



Minor Project Report

on

“Design & Implementation of 15 Subnets with BGP”

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in

Computer Networks Laboratory with Mini-project 18CS5DLCNL

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ABSTRACT

We are going to Design and Implement 15 subnets with BGP.

To achieve this we are going to use Class B IP with 16 systems/subnet, where first two octets represent network while the last two octets represent the host. In our project we are making use of the address 172.0.0.0. We will be using 15 routers, 15 switches and 240 pcs to get the desired result. The router we will be using 2620XM Router and switch 2960-24TT. We also make use of DNS & HTTP server to integrate our project with an application. Block size is 4,096. Number of bits borrowed by host is 4 bits. So using all these conditions we are going to design and implement our project.

INTRODUCTION

A routing protocol specifies how routers communicate with each other to distribute information that enables them to select routes between any two nodes on a computer network.

So the routing protocol we will be using in our project is Dynamic Routing Protocol. Dynamic Routing: Dynamic routing makes automatic adjustment of the routes according to the current state of the route in the routing table. So we are going to be using BGP which is an example of dynamic routing protocol. Border Gateway Protocol (BGP) advertises, learns, and chooses the best paths inside the Internet. When two ISPs are connected, they typically use BGP to exchange routing information. The ISPs of the Internet exchange routing information with one or more ISPs. BGP defines two classes for neighbours:

Internal BGP (iBGP) operates within the same autonomous system.

External BGP (eBGP) operates in-between the multiple autonomous system. We will be using these concepts to work on our project.

DESIGN & CONFIGURATION

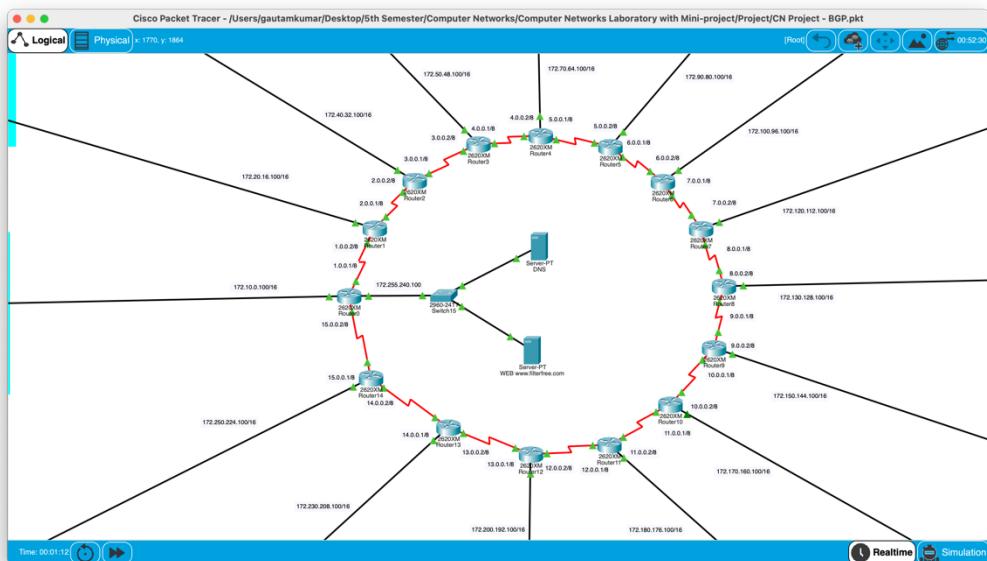


Figure: BGP Router Network

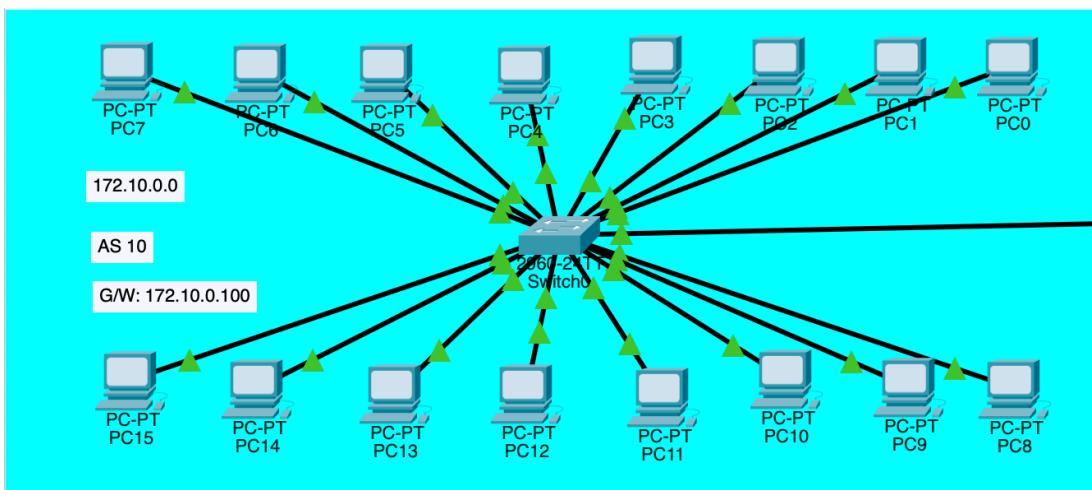


Figure: BGP Subnet

```

Project Subnetting.txt ~

Class B :
IP Address: N.N.H/16
Subnet Mask: 255.255.0.0/16
No of Subnets: 15

No of bits borrowed from Host: 4 bits

New Subnet Mask: 255.255.11110000.0
                  255.255.240.0/20

Block Size: 2^12 = 4,096

Network Address          Usable Host Range          Broadcast Address:
N.N.0.0                  N.N.0.1 - N.N.15.254      N.N.15.255
N.N.16.0                 N.N.16.1 - N.N.31.254      N.N.31.255
N.N.32.0                 N.N.32.1 - N.N.47.254      N.N.47.255
N.N.48.0                 N.N.48.1 - N.N.63.254      N.N.63.255
N.N.64.0                 N.N.64.1 - N.N.79.254      N.N.79.255
N.N.80.0                 N.N.80.1 - N.N.95.254      N.N.95.255
N.N.96.0                 N.N.96.1 - N.N.111.254     N.N.111.255
N.N.112.0                N.N.112.1 - N.N.127.254    N.N.127.255
N.N.128.0                N.N.128.1 - N.N.143.254    N.N.143.255
N.N.144.0                N.N.144.1 - N.N.159.254    N.N.159.255
N.N.160.0                N.N.160.1 - N.N.175.254    N.N.175.255
N.N.176.0                N.N.176.1 - N.N.191.254    N.N.191.255
N.N.192.0                N.N.192.1 - N.N.207.254    N.N.207.255
N.N.208.0                N.N.208.1 - N.N.223.254    N.N.223.255
N.N.224.0                N.N.224.1 - N.N.239.254    N.N.239.255
N.N.240.0                N.N.240.1 - N.N.255.254    N.N.255.255

```

Figure: Subnetting

BGP Configurations.txt

```

1 Router 0
2 Router>en
3 Router#config t
4 Enter configuration commands, one per line. End with CNTL/Z.
5 Router(config)#router bgp 10
6 Router(config-router)#network 172.10.0.0
7 Router(config-router)#network 1.0.0.0
8 Router(config-router)#network 15.0.0.0
9 Router(config-router)#network 172.255.240.0
10 Router(config-router)#neighbor 1.0.0.2 remote-as 20
11 Router(config-router)#neighbor 172.20.16.100 remote-as 20
12 Router(config-router)#neighbor 15.0.0.1 remote-as 150
13 Router(config-router)#neighbor 172.250.224.100 remote-as 150
14 Router(config-router)#end
15
16 Router1
17 Router>en
18 Router#config t
19 Enter configuration commands, one per line. End with CNTL/Z.
20 Router(config)#router bgp 20
21 Router(config-router)#network 172.20.16.0
22 Router(config-router)#network 1.0.0.0
23 Router(config-router)#network 2.0.0.0
24 Router(config-router)#neighbor 2.0.0.2 remote-as 30
25 Router(config-router)#neighbor 172.40.32.100 remote-as 30
26 Router(config-router)#neighbor 1.0.0.1 remote-as 10
27 Router(config-router)%%BGP-5-ADJCHANGE: neighbor 1.0.0.1 Up
28 Router(config-router)#neighbor 172.10.0.100 remote-as 10
29 Router(config-router)#end

```

Line 1, Column 1 Tab Size: 4 Plain Text

BGP Configurations.txt

```

31 Router2
32 Router>en
33 Router#config t
34 Enter configuration commands, one per line. End with CNTL/Z.
35 Router(config)#router bgp 30
36 Router(config-router)#network 172.40.32.0
37 Router(config-router)#network 3.0.0.0
38 Router(config-router)#network 2.0.0.0
39 Router(config-router)#neighbor 3.0.0.2 remote-as 40
40 Router(config-router)#neighbor 172.50.48.100 remote-as 40
41 Router(config-router)#neighbor 2.0.0.1 remote-as 20
42 Router(config-router)%%BGP-5-ADJCHANGE: neighbor 2.0.0.1 Up
43 Router(config-router)#neighbor 172.20.16.100 remote-as 20
44 Router(config-router)#end
45
46 Router3
47 Router>en
48 Router#config t
49 Enter configuration commands, one per line. End with CNTL/Z.
50 Router(config)#router bgp 40
51 Router(config-router)#network 172.50.48.0
52 Router(config-router)#network 4.0.0.0
53 Router(config-router)#network 3.0.0.0
54 Router(config-router)#neighbor 4.0.0.2 remote-as 50
55 Router(config-router)#neighbor 172.70.64.100 remote-as 50
56 Router(config-router)#neighbor 3.0.0.1 remote-as 30
57 Router(config-router)%%BGP-5-ADJCHANGE: neighbor 3.0.0.1 Up
58 Router(config-router)#neighbor 172.40.32.100 remote-as 30
59 Router(config-router)#end
60

```

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BGP Configurations.txt

```

61 Router4
62 Router>en
63 Router#config t
64 Enter configuration commands, one per line. End with CNTL/Z.
65 Router(config)#router bgp 50
66 Router(config-router)#network 172.70.64.0
67 Router(config-router)#network 5.0.0.0
68 Router(config-router)#network 4.0.0.0
69 Router(config-router)#neighbor 5.0.0.2 remote-as 60
70 Router(config-router)#neighbor 172.90.80.100 remote-as 60
71 Router(config-router)#neighbor 4.0.0.1 remote-as 40
72 Router(config-router)##%BGP-5-ADJCHANGE: neighbor 4.0.0.1 Up
73 Router(config-router)#neighbor 172.50.48.100 remote-as 40
74 Router(config-router)#end
75
76 Router5
77 Router>en
78 Router#config t
79 Enter configuration commands, one per line. End with CNTL/Z.
80 Router(config)#router bgp 60
81 Router(config-router)#network 172.90.80.0
82 Router(config-router)#network 6.0.0.0
83 Router(config-router)#network 5.0.0.0
84 Router(config-router)#neighbor 6.0.0.2 remote-as 70
85 Router(config-router)#neighbor 172.100.96.100 remote-as 70
86 Router(config-router)#neighbor 5.0.0.1 remote-as 50
87 Router(config-router)##%BGP-5-ADJCHANGE: neighbor 5.0.0.1 Up
88 Router(config-router)#neighbor 172.70.64.100 remote-as 50
89 Router(config-router)#end

```

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BGP Configurations.txt

```

91 Router6
92 Router>en
93 Router#config t
94 Enter configuration commands, one per line. End with CNTL/Z.
95 Router(config)#router bgp 70
96 Router(config-router)#network 172.100.96.0
97 Router(config-router)#network 7.0.0.0
98 Router(config-router)#network 6.0.0.0
99 Router(config-router)#neighbor 7.0.0.2 remote-as 80
100 Router(config-router)#neighbor 172.120.112.100 remote-as 80
101 Router(config-router)#neighbor 6.0.0.1 remote-as 60
102 Router(config-router)##%BGP-5-ADJCHANGE: neighbor 6.0.0.1 Up
103 Router(config-router)#neighbor 172.90.80.100 remote-as 60
104 Router(config-router)#end
105
106 Router7
107 Router>en
108 Router#config t
109 Enter configuration commands, one per line. End with CNTL/Z.
110 Router(config)#router bgp 80
111 Router(config-router)#network 172.120.112.0
112 Router(config-router)#network 8.0.0.0
113 Router(config-router)#network 7.0.0.0
114 Router(config-router)#neighbor 8.0.0.2 remote-as 90
115 Router(config-router)#neighbor 172.130.128.100 remote-as 90
116 Router(config-router)#neighbor 7.0.0.1 remote-as 70
117 Router(config-router)##%BGP-5-ADJCHANGE: neighbor 7.0.0.1 Up
118 Router(config-router)#neighbor 172.100.96.100 remote-as 70
119 Router(config-router)#end

```

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BGP Configurations.txt

```

121 Router8
122 Router>en
123 Router#config t
124 Enter configuration commands, one per line. End with CNTL/Z.
125 Router(config)#router bgp 90
126 Router(config-router)#network 172.130.128.0
127 Router(config-router)#network 9.0.0.0
128 Router(config-router)#network 8.0.0.0
129 Router(config-router)#neighbor 9.0.0.2 remote-as 100
130 Router(config-router)#neighbor 172.150.144.100 remote-as 100
131 Router(config-router)#neighbor 8.0.0.1 remote-as 80
132 Router(config-router)%%BGP-5-ADJCHANGE: neighbor 8.0.0.1 Up
133 Router(config-router)#neighbor 172.120.112.100 remote-as 80
134 Router(config-router)#end
135
136 Router9
137 Router>en
138 Router#config t
139 Enter configuration commands, one per line. End with CNTL/Z.
140 Router(config)#router bgp 100
141 Router(config-router)#network 172.150.144.0
142 Router(config-router)#network 10.0.0.0
143 Router(config-router)#network 9.0.0.0
144 Router(config-router)#neighbor 10.0.0.2 remote-as 110
145 Router(config-router)#neighbor 172.170.160.100 remote-as 110
146 Router(config-router)#neighbor 9.0.0.1 remote-as 90
147 Router(config-router)%%BGP-5-ADJCHANGE: neighbor 9.0.0.1 Up
148 Router(config-router)#neighbor 172.130.128.100 remote-as 90
149 Router(config-router)#end

```

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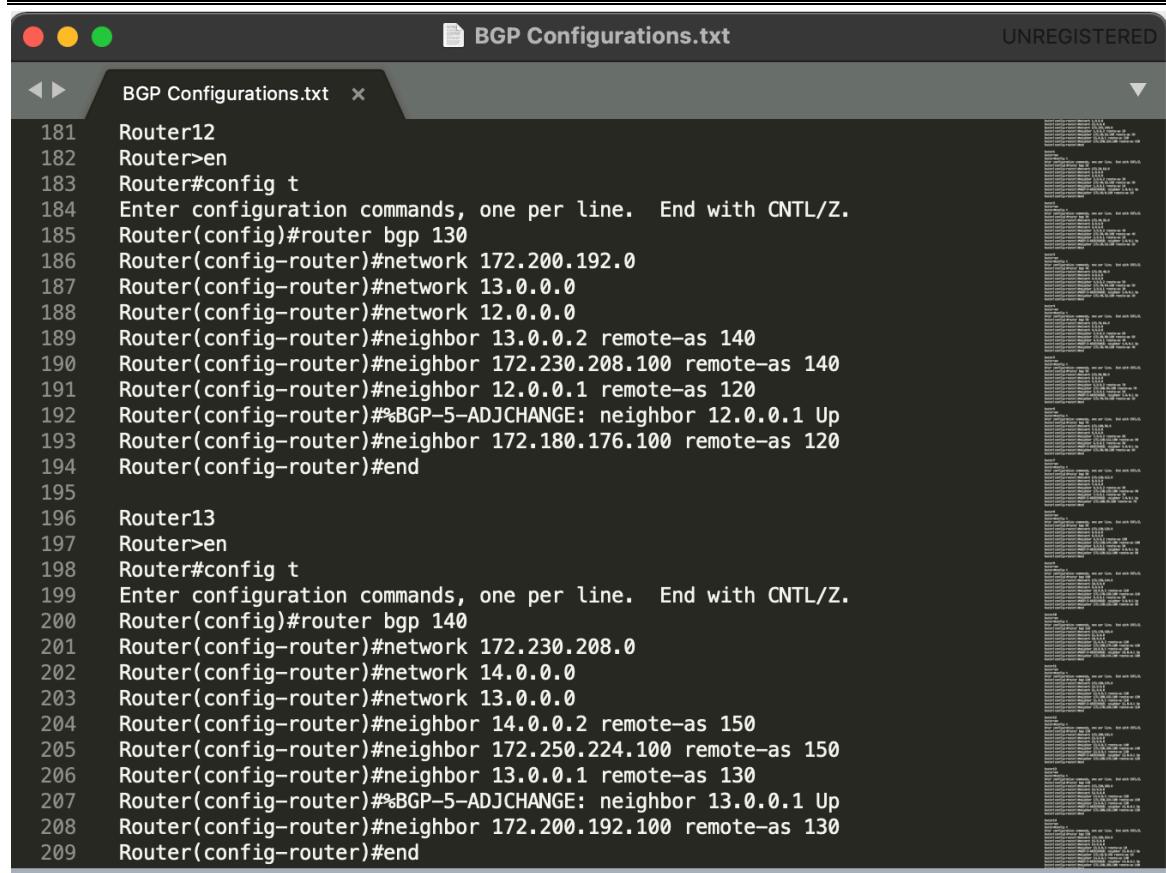
BGP Configurations.txt

```

151 Router10
152 Router>en
153 Router#config t
154 Enter configuration commands, one per line. End with CNTL/Z.
155 Router(config)#router bgp 110
156 Router(config-router)#network 172.170.160.0
157 Router(config-router)#network 11.0.0.0
158 Router(config-router)#network 10.0.0.0
159 Router(config-router)#neighbor 11.0.0.2 remote-as 120
160 Router(config-router)#neighbor 172.180.176.100 remote-as 120
161 Router(config-router)#neighbor 10.0.0.1 remote-as 100
162 Router(config-router)%%BGP-5-ADJCHANGE: neighbor 10.0.0.1 Up
163 Router(config-router)#neighbor 172.150.144.100 remote-as 100
164 Router(config-router)#end
165
166 Router11
167 Router>en
168 Router#config t
169 Enter configuration commands, one per line. End with CNTL/Z.
170 Router(config)#router bgp 120
171 Router(config-router)#network 172.180.176.0
172 Router(config-router)#network 12.0.0.0
173 Router(config-router)#network 11.0.0.0
174 Router(config-router)#neighbor 12.0.0.2 remote-as 130
175 Router(config-router)#neighbor 172.200.192.100 remote-as 130
176 Router(config-router)#neighbor 11.0.0.1 remote-as 110
177 Router(config-router)%%BGP-5-ADJCHANGE: neighbor 11.0.0.1 Up
178 Router(config-router)#neighbor 172.170.160.100 remote-as 110
179 Router(config-router)#end

```

Line 1, Column 1 Tab Size: 4 Plain Text

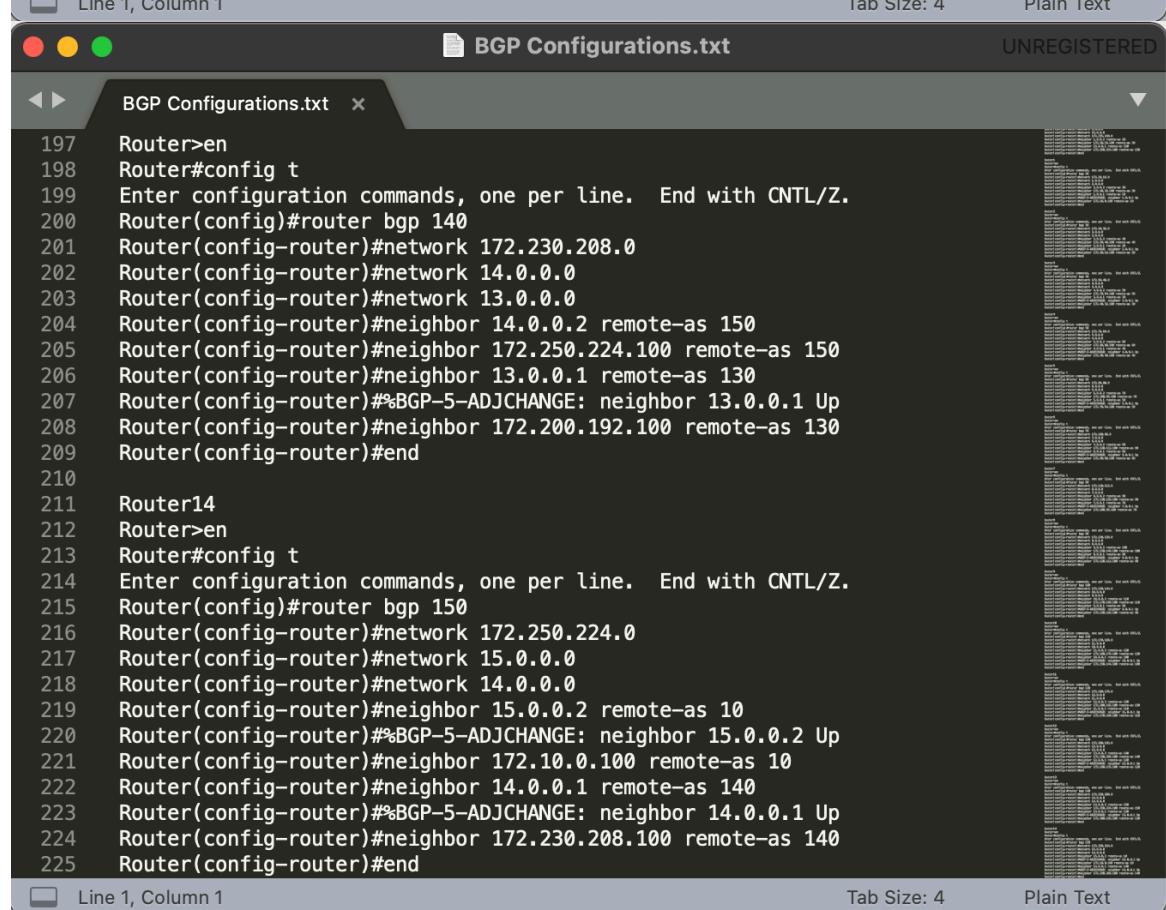


```

181 Router12
182 Router>en
183 Router#config t
184 Enter configuration commands, one per line. End with CNTL/Z.
185 Router(config)#router bgp 130
186 Router(config-router)#network 172.200.192.0
187 Router(config-router)#network 13.0.0.0
188 Router(config-router)#network 12.0.0.0
189 Router(config-router)#neighbor 13.0.0.2 remote-as 140
190 Router(config-router)#neighbor 172.230.208.100 remote-as 140
191 Router(config-router)#neighbor 12.0.0.1 remote-as 120
192 Router(config-router)##%BGP-5-ADJCHANGE: neighbor 12.0.0.1 Up
193 Router(config-router)#neighbor 172.180.176.100 remote-as 120
194 Router(config-router)#end
195
196 Router13
197 Router>en
198 Router#config t
199 Enter configuration commands, one per line. End with CNTL/Z.
200 Router(config)#router bgp 140
201 Router(config-router)#network 172.230.208.0
202 Router(config-router)#network 14.0.0.0
203 Router(config-router)#network 13.0.0.0
204 Router(config-router)#neighbor 14.0.0.2 remote-as 150
205 Router(config-router)#neighbor 172.250.224.100 remote-as 150
206 Router(config-router)#neighbor 13.0.0.1 remote-as 130
207 Router(config-router)##%BGP-5-ADJCHANGE: neighbor 13.0.0.1 Up
208 Router(config-router)#neighbor 172.200.192.100 remote-as 130
209 Router(config-router)#end

```

Line 1, Column 1 Tab Size: 4 Plain Text



```

197 Router>en
198 Router#config t
199 Enter configuration commands, one per line. End with CNTL/Z.
200 Router(config)#router bgp 140
201 Router(config-router)#network 172.230.208.0
202 Router(config-router)#network 14.0.0.0
203 Router(config-router)#network 13.0.0.0
204 Router(config-router)#neighbor 14.0.0.2 remote-as 150
205 Router(config-router)#neighbor 172.250.224.100 remote-as 150
206 Router(config-router)#neighbor 13.0.0.1 remote-as 130
207 Router(config-router)##%BGP-5-ADJCHANGE: neighbor 13.0.0.1 Up
208 Router(config-router)#neighbor 172.200.192.100 remote-as 130
209 Router(config-router)#end
210
211 Router14
212 Router>en
213 Router#config t
214 Enter configuration commands, one per line. End with CNTL/Z.
215 Router(config)#router bgp 150
216 Router(config-router)#network 172.250.224.0
217 Router(config-router)#network 15.0.0.0
218 Router(config-router)#network 14.0.0.0
219 Router(config-router)#neighbor 15.0.0.2 remote-as 10
220 Router(config-router)##%BGP-5-ADJCHANGE: neighbor 15.0.0.2 Up
221 Router(config-router)#neighbor 172.10.0.100 remote-as 10
222 Router(config-router)#neighbor 14.0.0.1 remote-as 140
223 Router(config-router)##%BGP-5-ADJCHANGE: neighbor 14.0.0.1 Up
224 Router(config-router)#neighbor 172.230.208.100 remote-as 140
225 Router(config-router)#end

```

Line 1, Column 1 Tab Size: 4 Plain Text

Figure: BGP Configurations

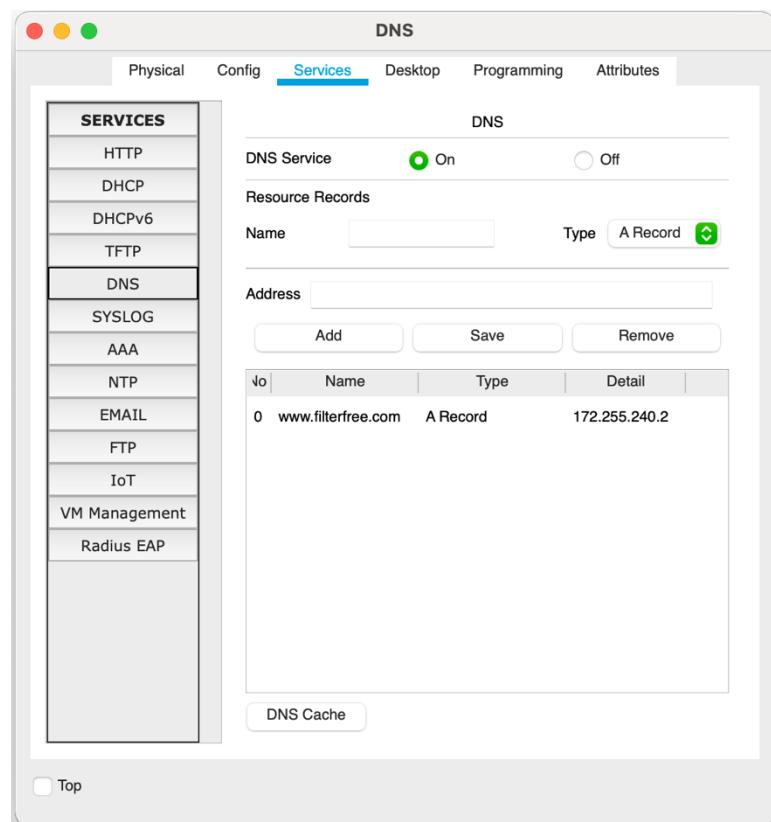


Figure: DNS Server

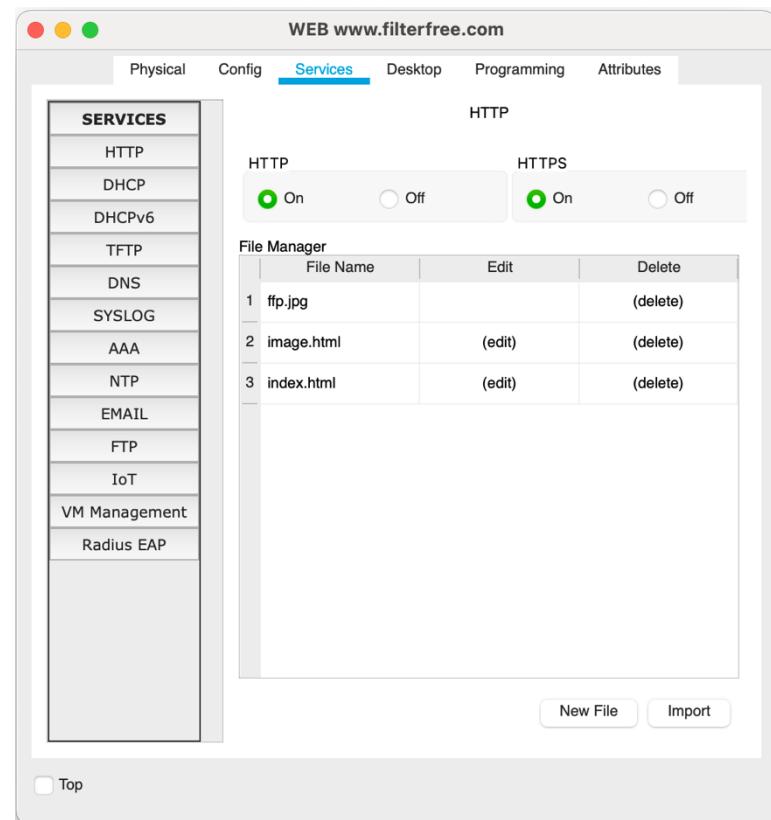


Figure: WEB Server

TOPOLOGY

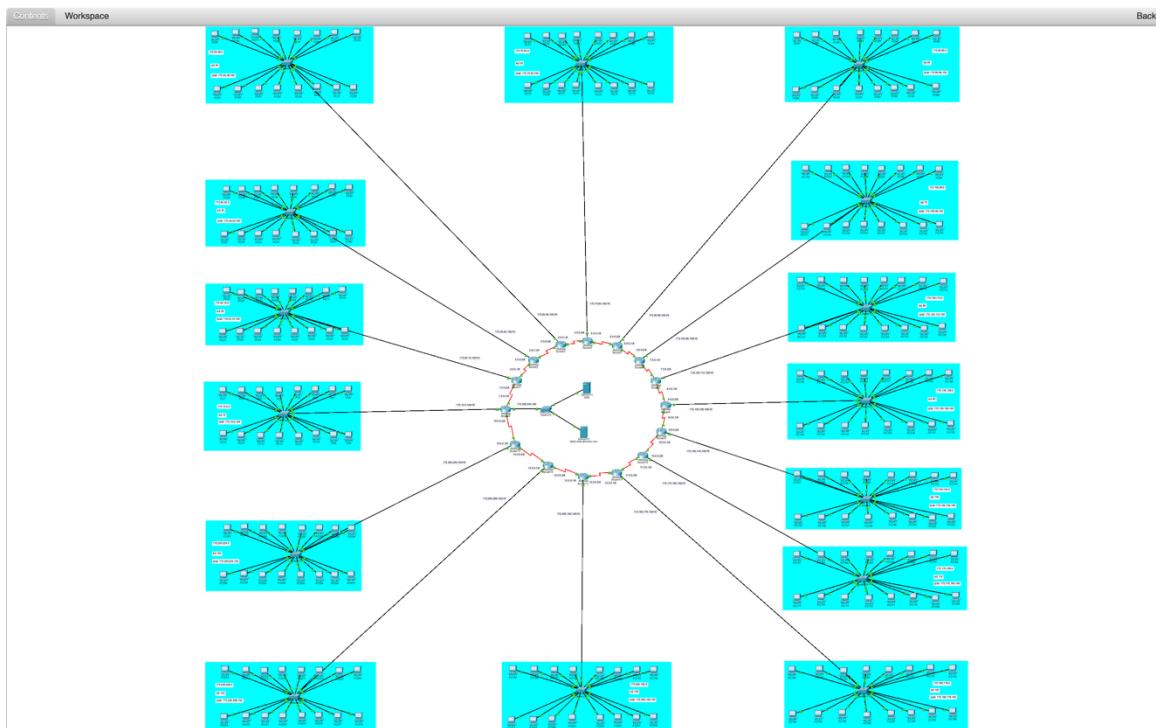


Figure: BGP Topology

RESULTS

Realtime Mode

The screenshot shows a 'Command Prompt' window titled 'PC111'. The window has tabs at the top: Physical, Config, Desktop (which is selected), Programming, and Attributes. The command entered is 'C:\>ping 172.10.0.16'. The output shows the ping results:

```

Packet Tracer PC Command Line 1.0
C:\>ping 172.10.0.16

Pinging 172.10.0.16 with 32 bytes of data:

Reply from 172.10.0.16: bytes=32 time=14ms TTL=121
Reply from 172.10.0.16: bytes=32 time=6ms TTL=121
Reply from 172.10.0.16: bytes=32 time=6ms TTL=121
Reply from 172.10.0.16: bytes=32 time=6ms TTL=121

Ping statistics for 172.10.0.16:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 6ms, Maximum = 14ms, Average = 8ms

C:\>

```

Figure: Ping Test PC111 to PC15

The screenshot shows a 'Web Browser' window titled 'Web Browser'. The URL bar shows 'http://www.filterfree.com'. The main content area displays the homepage of 'Filter Free Photography & Deliberate Studios'.

Filter Free Photography

- Showcasing true #photography talents
- We post every Monday
- #Travel Video
- Follow to join our growing community!
- Tag us @filterfreephotography
- Follow us on:
- <https://www.youtube.com/channel/UC8kSTyjewER64AckE72Mgpg>
- <https://instagram.com/filterfreephotography?igshid=1bvy9993d0y5>

Deliberate Studios

- Artist
- We Do Things Deliberately To Deliver You The Best!
- Music Film Making Photography
- Follow us on:
- https://www.youtube.com/channel/UCzyXENcO06TjgSQLbe_aUNg
- https://instagram.com/deliberate_studios?igshid=304ggis4zl8f
- <https://vignesh-82coder.github.io/deliberatestudios./Coming Soon!>

Quick Links:

- [Image page](#)
- [Image](#)

Figure: WEB & DNS Main Page

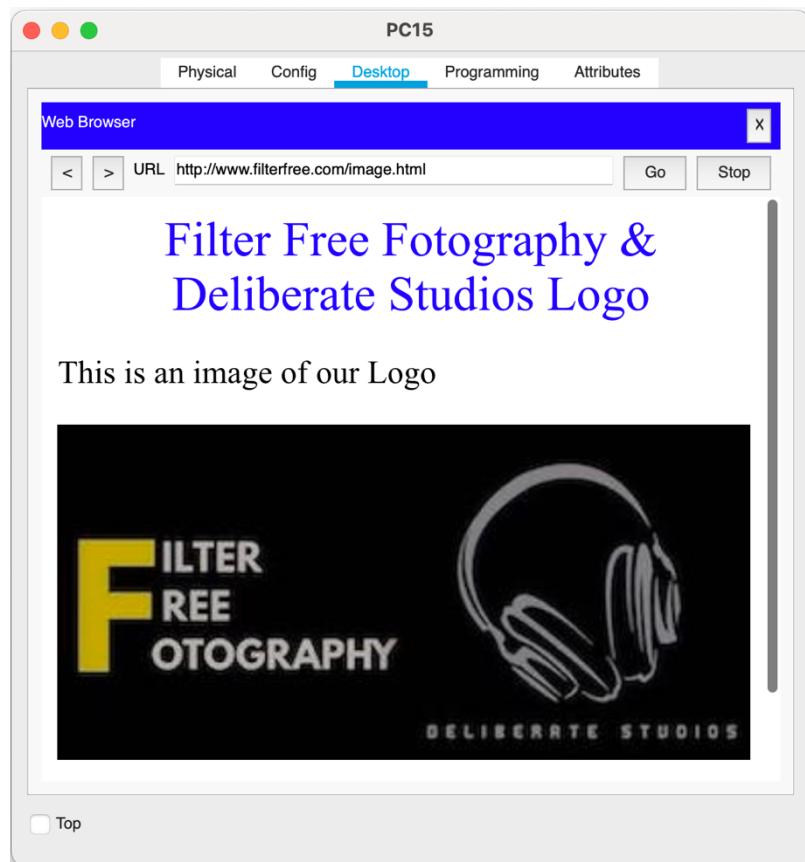


Figure: WEB & DNS Image Page

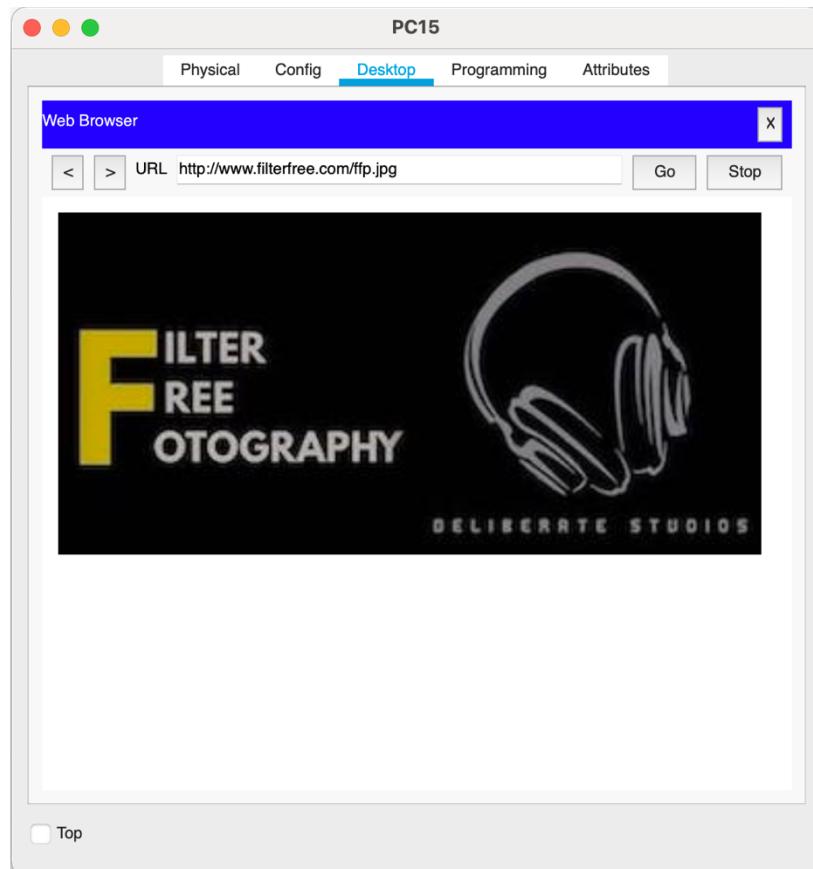


Figure: WEB & DNS Image

Simulation Mode

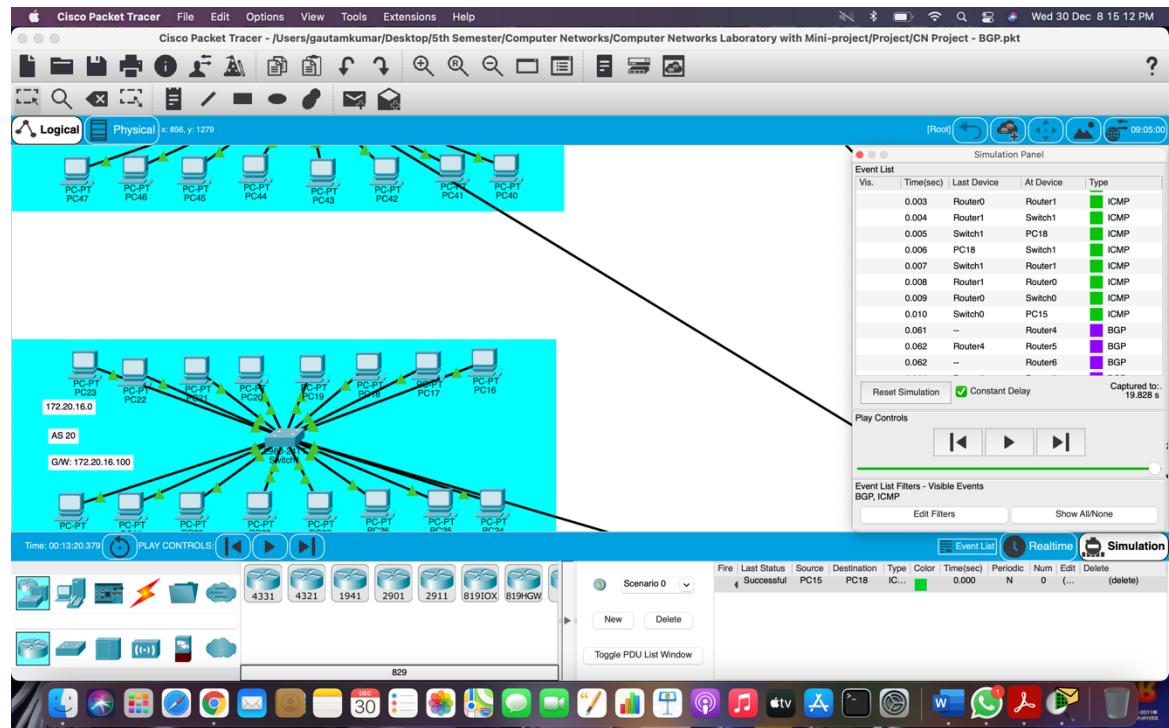


Figure: BGP Simulation Test

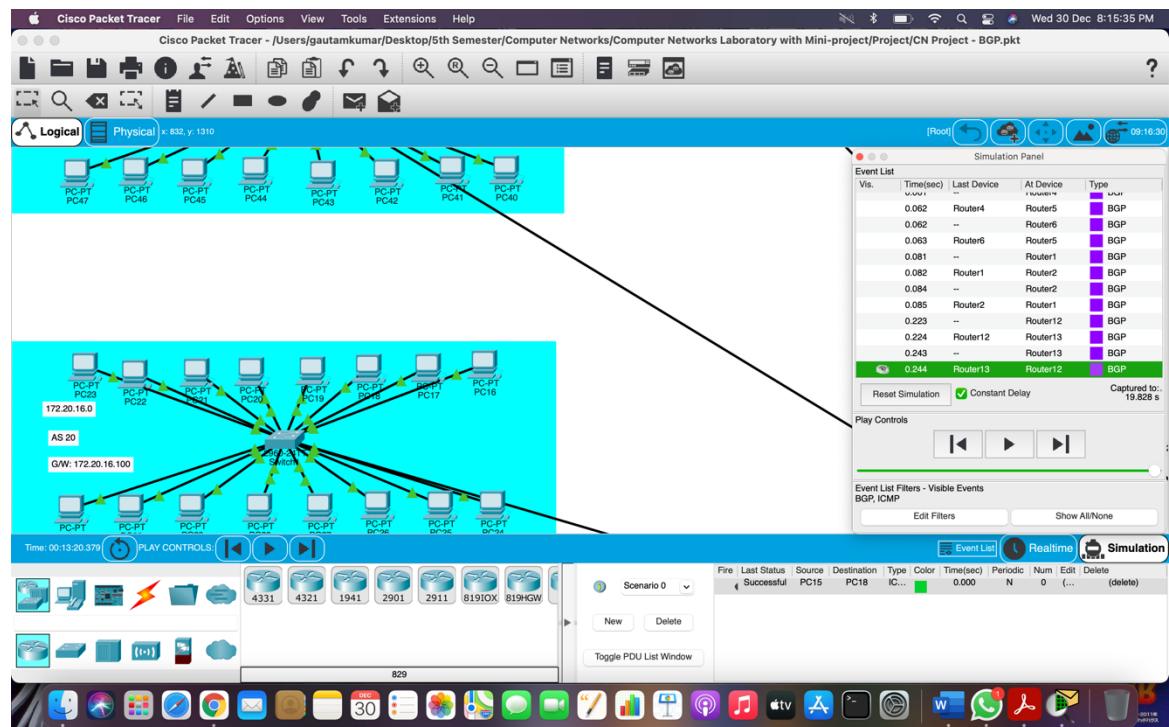


Figure: BGP Simulation Test

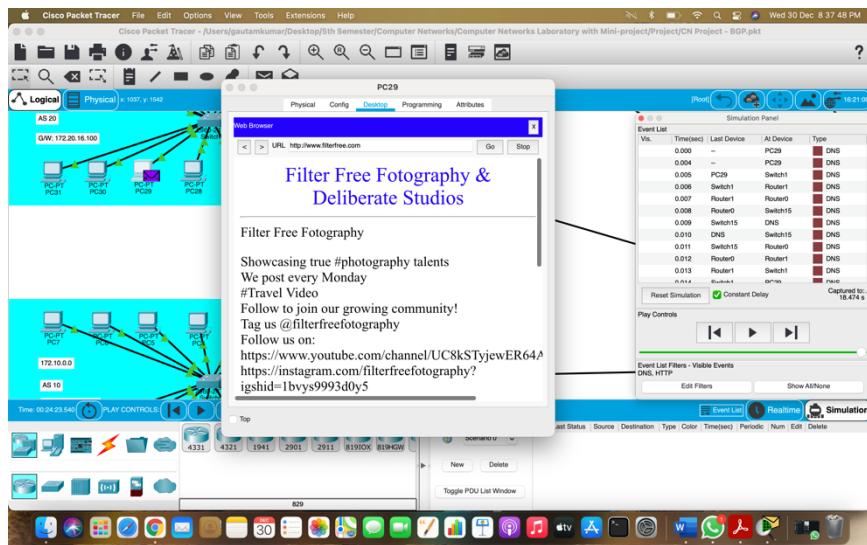


Figure: Web & DNS Simulation Test

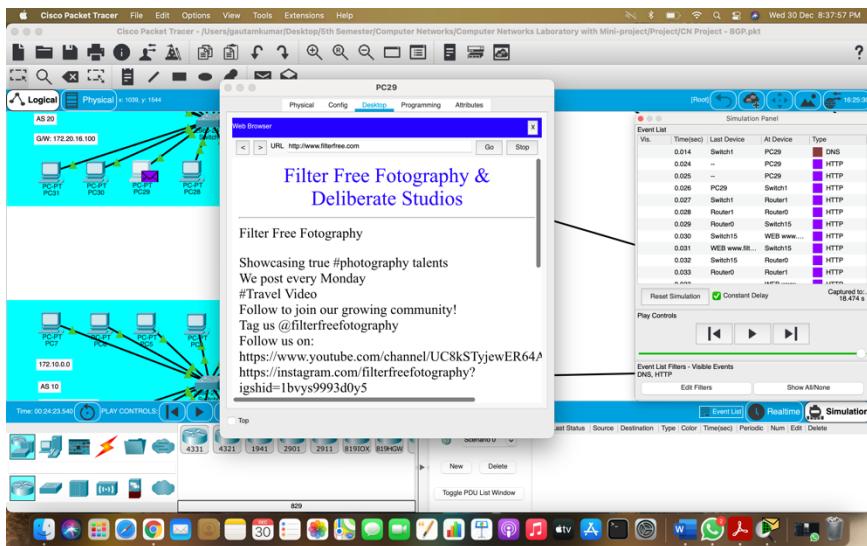


Figure: Web & DNS Simulation Test

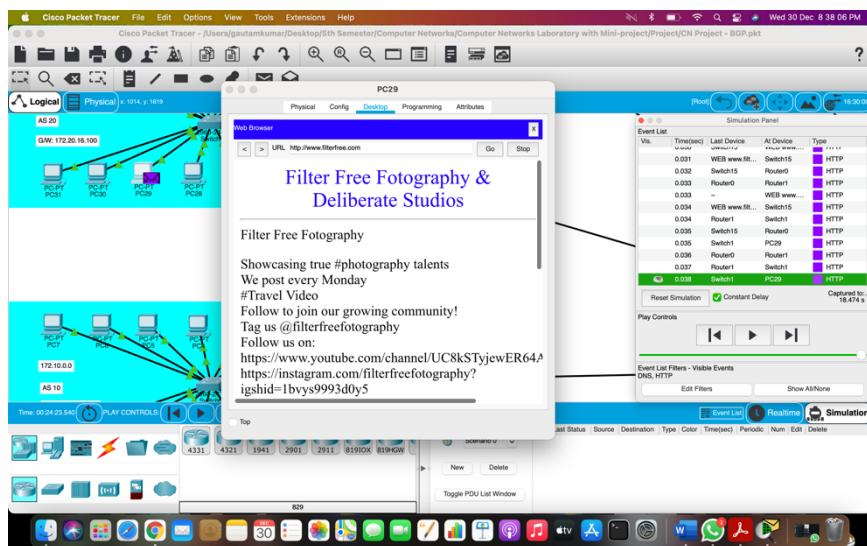


Figure: Web & DNS Simulation Test

CONCLUSION

BGP is standard for Internet routing and required of most Internet service providers (ISPs) to establish routing between one another. Very large private IP networks use BGP internally.

Another reason to use BGP is multihoming a network for better redundancy, either to multiple access points of a single ISP or to multiple ISPs.

Thus, BGP allows an AS to collect all the routing information from its neighbouring autonomous systems and “advertise” that information further. Each peer transfers the information internally inside its own autonomous system.

Just like in real life, usually more than one route exists to reach a given destination. BGP is responsible for determining the most suitable route according to the information collected and an organization’s routing policy, which is based on cost, reliability, speed, etc.