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**Welcome
To
Network for you
Access Control List**



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Access Control List:

- ACL stand for Access Control List.
- ACL is set of statement which **allow, deny network traffic** from one router to other router.
- In other words we can say it is **filters which allow us to control traffic** (Packets) flowing in network.
- It is Layer 3 security; we can control flow of traffic from one router to other router.
- ACLs are always processed from **top to down in sequential order.**
- A Packet is compared with ACL conditions until it finds a match.
- Once a match is found for packet, no further comparison will be done.
- Interface will take action based on match condition.
- There are two possible action permit and deny in ACL.
- If permit condition match, packet will be allowed to pass from interface.
- If deny condition match, packet will be destroyed immediately.
- **Every ACL has a default deny statement at end of it.**
- **If a packet does not meet with any conditions, it will be destroyed by default deny.**
- Empty ACL will permit all traffic by default.
- ACL can filter only the traffic passing from interface.
- **Standard ACL can filter only the source IP address.**
- **Standard ACL should be placed near the destination devices.**
- **Extended ACL should be placed near the source devices.**
- **First, create an Access-List globally and then assign it to an interface.**

Different Types of ACL as given below:

- Standard (again it is divided into two name or number).
- Extended (again it is divided into two name or number).
- Time-Based ACL.

Different between Standard and Extended ACL

Standard Access List	Extended Access List
The Access list number range from 1 to 99 or 1300-1999.	The Access list number range from 100 to 199 or 2000-2699.
Can block a host, network and subnet.	Can block a host, network, Subnet and Services.
Implemented Closest to the destination.	Implemented Closest to the Source.
Filtering is done based on only source IP address	Filtering can be done with source, destination, protocol, port number etc.
All Services are block	Selected Service can block.

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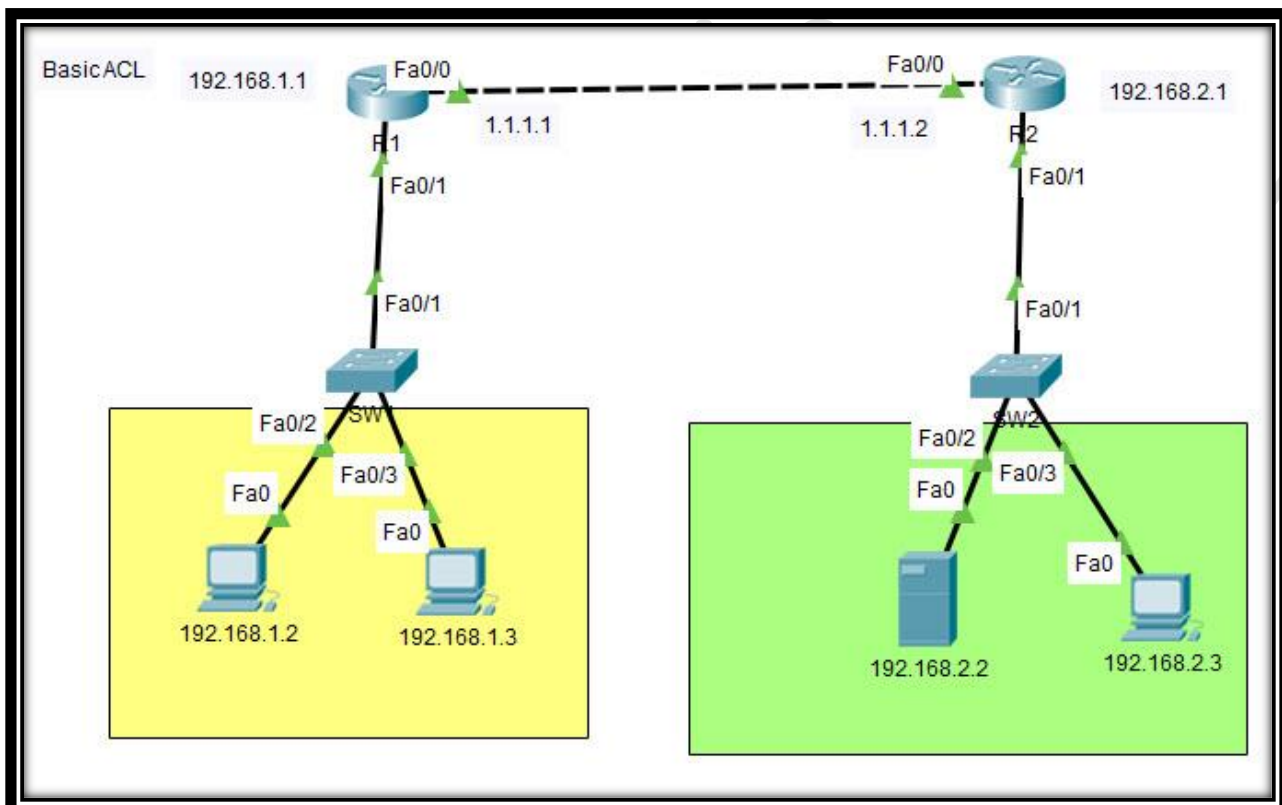
Numbered Access List:

- These are the access list which cannot be deleted specifically one created.
- That is if we want to remove any rule from an Access-List then this is not permitted in the case of numbered access list.
- If we try to delete a rule from access list then the whole access list will be deleted.
- The numbered access list can be used with both Standard and Extended access list.

Named Access List:

- In these types of access list, a name is assigned to identify an access list.
- It is allowed to delete a named access list unlike numbered access list.
- Like numbered ACL, these can be used with both standard and extended access list.

Lab time: Objective of Lab. :(Lab on Standard Access List Numbered)



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Configuration for Router1	Configuration for Router2
<pre>en Config t hostname R1 int f0/0 ip add 1.1.1.1 255.0.0.0 no sh int f0/1 ip add 192.168.1.1 255.255.255.0 no sh router rip ver 2 no auto-summary network 192.168.1.0 network 1.1.1.0</pre>	<pre>en Config t hostname R2 int f0/0 ip add 1.1.1.2 255.0.0.0 no sh int f0/1 ip add 192.168.2.1 255.255.255.0 no sh router rip ver 2 no auto-summary network 192.168.2.0 network 1.1.1.0</pre> <p>Standard ACL on R2 to deny PC1</p> <pre>access-list 10 deny host 192.168.1.2 access-list 10 permit any int f0/0 ip access-group 10 in</pre> <p>This is only for 1 PC if you need ACL with Complete Network then as given below.</p> <p>Standard ACL on R2 to deny Whole Network</p> <pre>access-list 10 deny 192.168.1.0 0.0.0.255 access-list 10 permit any int f0/0 ip access-group 10 in</pre>
To Check ACL we can type	Sh ip access list

PC1 (192.168.1.2 is not able to ping 192.168.2.2 Because we Apply ACL:

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```
C:\>ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:

Reply from 1.1.1.2: Destination host unreachable.
Reply from 1.1.1.2: Destination host unreachable.
Reply from 1.1.1.2: Destination host unreachable.
Reply from 1.1.1.2: Destination host unreachable.

Ping statistics for 192.168.2.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC 192.168.1.3 is able to ping 192.168.2.2:

```
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=1ms TTL=126
Reply from 192.168.2.2: bytes=32 time=1ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Reply from 192.168.2.2: bytes=32 time=13ms 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 = 0ms, Maximum = 13ms, Average = 3ms
```

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The Table below lists many of popular port numbers and their related transport layer protocol and applications.

Port Number(s)	Protocol	Application
20	TCP	FTP
21	TCP	FTP CONTROL
22	TCP	SSH
23	TCP	TELNET
25	TCP	SMTP
53	TCP,UDP	DNS
67,68	UDP	DHCP
69	UDP	TFTP
80	TCP	HTTP(WWW)
110	TCP	POP3
161	UDP	SNMP
443	TCP	SSL
16,384-32,767	UDP	RTP-BASED VOICE AND VIDEO

Extended ACLs:

- Check based on the protocol, source address, destination address and port number
- Cisco expanded the original ACL Ranges
- Standard:1-99,1300-1999
- Extended:100-199, 2000-2699

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Example:

Creation of Extended Access List

```
Router(config)# access-list <acl no> <permit/deny> <protocol> <source address> <source wildcard mask> <destination address> < destination wildcard mask> <operator> <service>
```

```
R1(config)#access-list 100 deny tcp host 192.168.1.2 host 192.168.2.2 eq 80
```

```
R1(config)#access-list 100 deny tcp host 192.168.1.3 host 192.168.2.3 eq 80
```

```
R1(config)#access-list 100 permit IP any any
```

Implementation of Extended Access List:

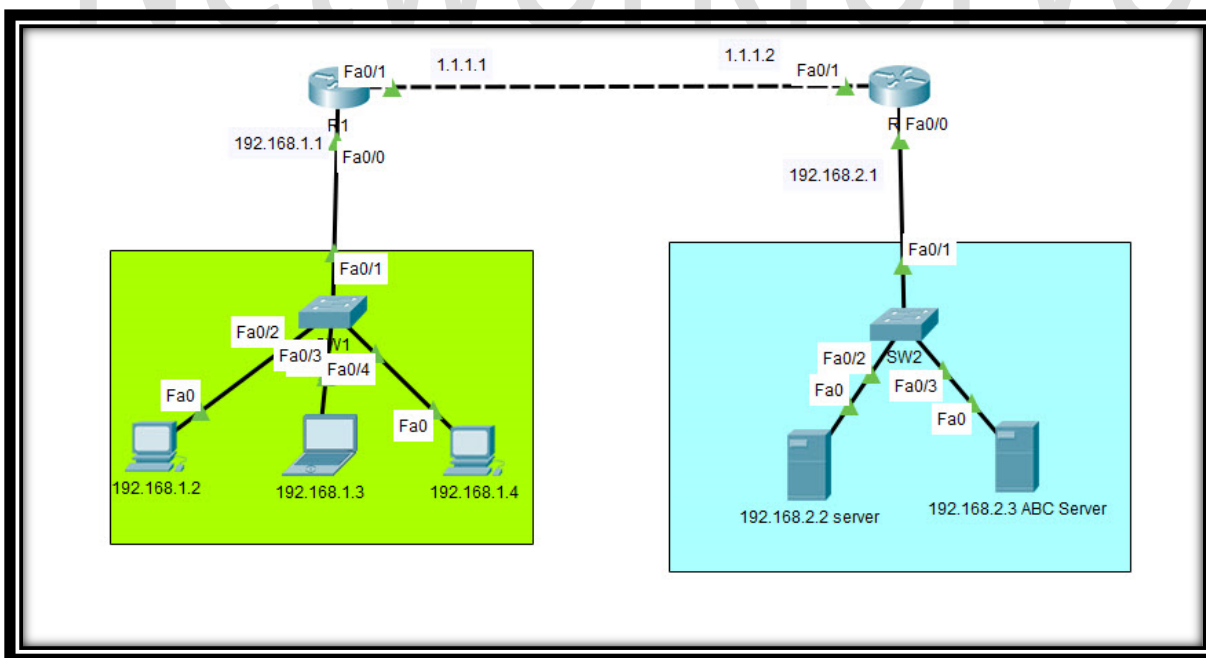
```
Router(config)#interface <interface type> <interface no>
```

```
Router(config-if)#ip access-group <number> <out/in>
```

```
R1(config)#int fa0/0
```

```
R1(config-if)#ip access-group 100 in
```

So let see lab for this



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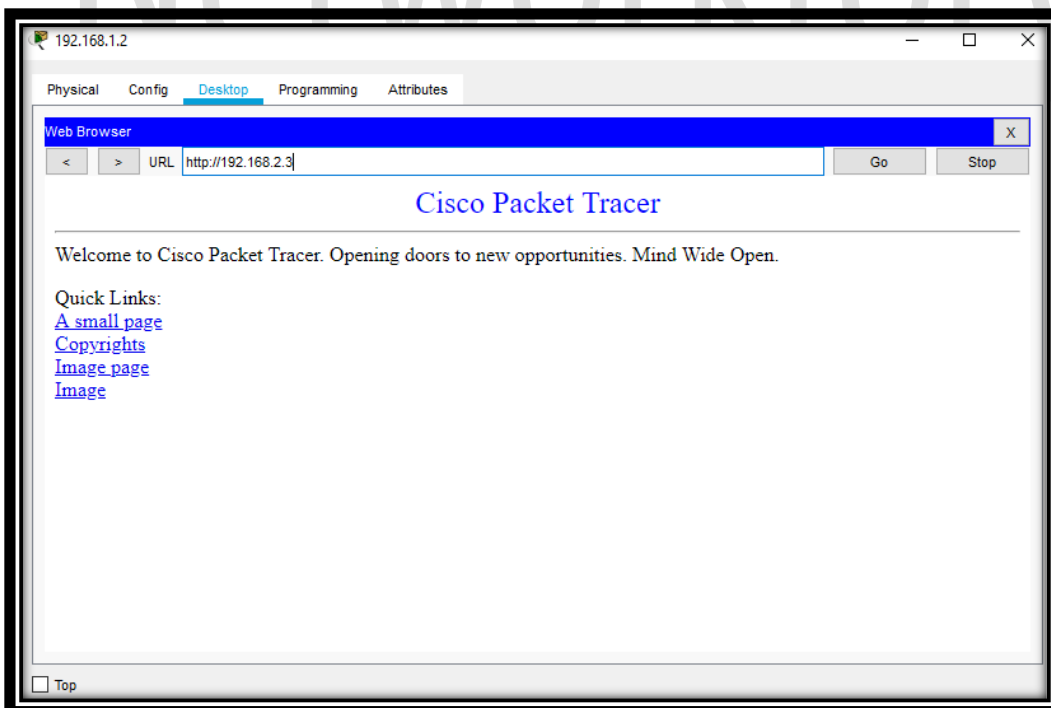
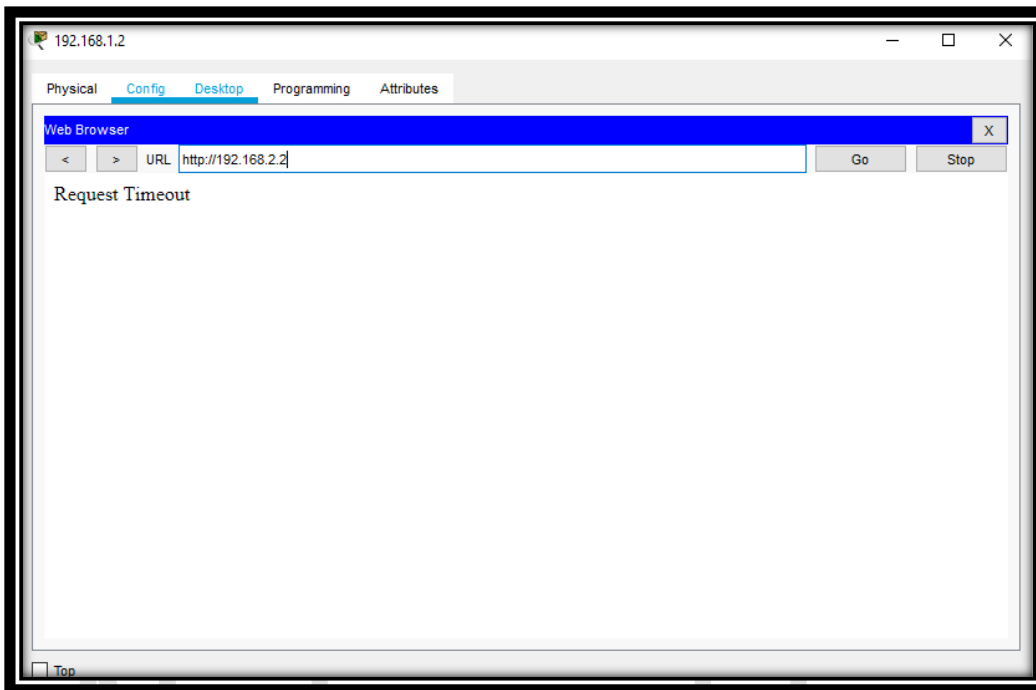
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R1 Configuraition:	R2 Configuration:
<pre>en config t hostname R1 int f0/0 ip add 192.168.1.1 255.255.255.0 no sh int f0/1 ip add 1.1.1.1 255.0.0.0 no sh router rip ver 2 no auto-summary network 192.168.1.0 network 1.1.1.0 access-list 100 deny tcp host 192.168.1.2 host 192.168.2.2 eq 80 access-list 100 deny tcp host 192.168.1.3 host 192.168.2.3 eq 80 access-list 100 permit IP any any int fa0/0 ip access-group 100 in</pre>	<pre>en config t hostname R2 int f0/0 ip add 192.168.2.1 255.255.255.0 no sh int f0/1 ip add 1.1.1.2 255.0.0.0 no sh router rip ver 2 no auto-summary network 192.168.2.0 network 1.1.1.0</pre>

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Creation of Extended Named Access List Syntax:

```
ip access-list extended <name>
```

```
<permit/deny> <protocol> <source address> <source wildcard mask> <destination address> <destination wildcard mask> <operator> <service>
```

```
permit IP any any
```

Then

Implementation of Extended Named Access List:

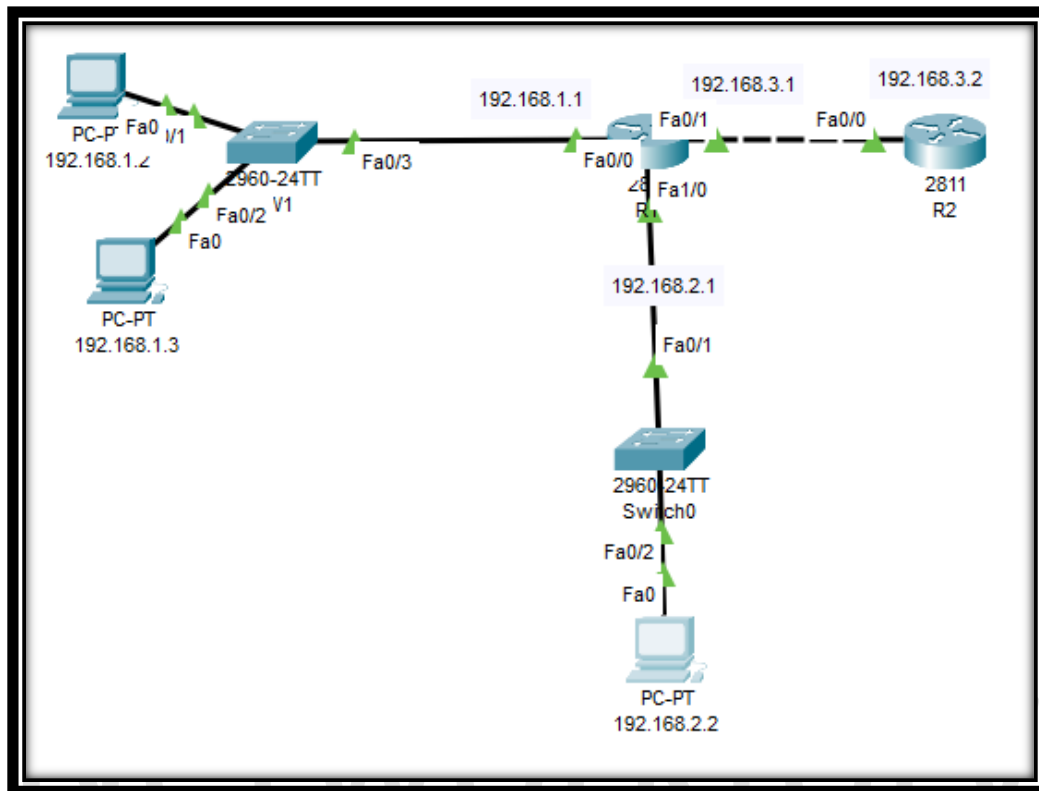
```
interface <interface type> <interface no>
```

```
ip access-group <ACL Name> <out/in>
```

Lab time:

ACL Configuration Lab Exercise:

1. Configure Telnet in R2
2. Check All PC can Telnet to R2 and Ping R1 and R2
3. Configure and Apply named extended ACL on R1 as follow
 - a) Permit Telnet from PC1 to R2. Telnet to R2 must be denied for all other pcs in the network.
 - b) Permit ping from PC2 to R2. Ping to R2 must be denied for all other pcs in the network.



R1 Configuration	R2 Configuraiton
<pre>en config t hostname R1 int f0/0 ip add 192.168.1.1 255.255.255.0 no sh int f0/1 ip add 192.168.3.1 255.255.255.0 no sh int f1/0 ip add 192.168.2.1 255.255.255.0 no sh</pre>	<pre>en config t hostname R2 int f0/0 ip add 192.168.3.2 255.255.255.0 no sh enable secret cisco username admin password admin line vty 0 4 login local router ospf 1</pre>

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<pre>username admin password admin router ospf 1 int f0/0 ip ospf 1 area 0 int f1/0 ip ospf 1 area 0 int f0/1 ip ospf 1 area 0 IP access list Extended abc permit tcp host 192.168.1.2 host 192.168.3.2 eq telnet deny tcp 192.168.1.0 0.0.0.255 host 192.168.3.2 eq telnet deny tcp 192.168.2.0 0.0.0.255 host 192.168.3.2 eq telnet permit icmp host 192.168.1.3 host 192.168.3.2 echo permit icmp host 192.168.1.3 host 192.168.3.2 echo-reply deny icmp 192.168.1.0 0.0.0.255 host 192.168.3.2 echo deny icmp host 192.168.2.2 host 192.168.3.2 echo permit ip any any int f0/1 ip access-group abc out</pre>	<pre>int f0/0 ip ospf 1 area 0</pre>
--	--------------------------------------

PC1 (192.168.1.2) is not able to ping 192.168.3.2 After ACL apply but he can telnet.

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```
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 192.168.3.2: bytes=32 time<1ms TTL=254
Reply from 192.168.3.2: bytes=32 time<1ms TTL=254

Ping statistics for 192.168.3.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.3.2

Pinging 192.168.3.2 with 32 bytes of data:

Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.

Ping statistics for 192.168.3.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

```
C:\>telnet 192.168.3.2
Trying 192.168.3.2 ...Open

User Access Verification

Username: adminUsername:
Password:
R2>
```

Ps: If you want to resequence ACL then use below command.

```
ip access-list resequence abc 10 20
```

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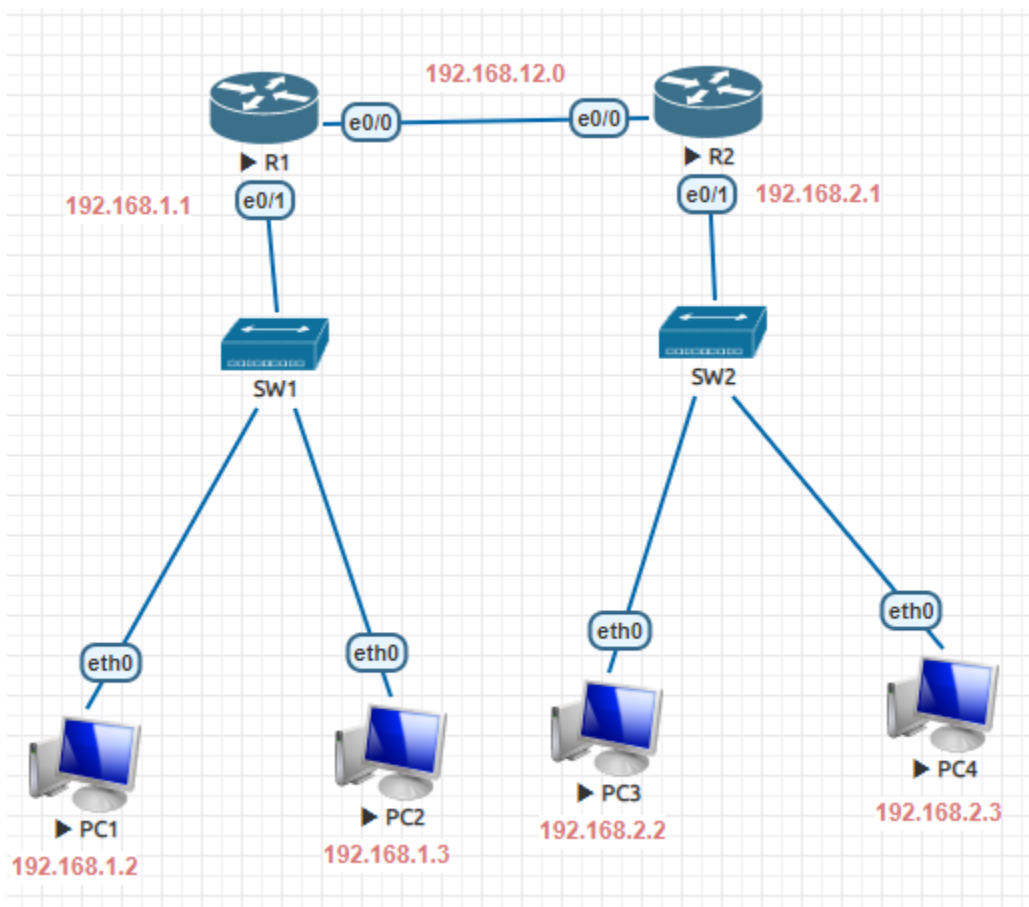
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Time-Based ACL:

- Time-based ACLs that allow for network access based on time or day.
- Time-based ACLs are only active during a specified time range.
- For TACL set the time range to be either periodic or absolute.
- Configure time-based ACL, specify time range & then apply ACL.
- To verify, run show access-lists and check if the ACL is active.
- If it is in the time range and the ACL is filtering traffic.

Time Base ACL:



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Basic R1 and R2 Configuration:

R1 Configuration	R2 Configuration
en config t hostname R1 int e0/0 ip add 192.168.12.1 255.255.255.0 no sh int e0/1 ip add 192.168.1.1 255.255.255.0 no sh router ospf 1 int e0/0 ip ospf 1 area 0 int e0/1 ip ospf 1 area 0	en config t hostname R2 int e0/0 ip add 192.168.12.2 255.255.255.0 no sh int e0/1 ip add 192.168.2.1 255.255.255.0 no sh router ospf 1 int e0/0 ip ospf 1 area 0 int e0/1 ip ospf 1 area 0

Time ACL Configuration on R1

```
R1(config)# time-range ABC
R1(config-time-range)# periodic weekend 12:00 to 23:00
R1(config-time-range)# exit
R1(config)# access-list 100 permit ip 192.168.1.0 0.0.0.255 any time-range ABC
R1(config)# access-list 100 deny ip any any
R1(config)# interface Ethernet 0/1
R1(config-if)# ip access-group 100 in
```

```
R1#sh access-lists
Extended IP access list 100
 10 permit ip 192.168.1.0 0.0.0.255 any time-range ABC (active) (10 matches)
 20 deny ip any any (15 matches)
R1#
```

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To troubleshoot router security features, you can use the following steps:

- Use the **show ip access-lists** command to view the current ACLs on the router.
- Use the **debug ip packet command to enable packet debugging**. This will allow you to see all of the traffic that is being denied by the ACLs.
- Use the **show ip interface** command to view the interface statistics. This will help you to identify which interfaces are being affected by the ACLs.
- Once you have identified the problem, you can then troubleshoot the ACLs to determine why they are denying traffic. You may need to modify the ACLs to allow the desired traffic.

Here are some additional troubleshooting tips for IPv4 ACLs:

- Make sure that the ACLs are applied to the correct interfaces.
- Make sure that the ACLs are configured correctly.
- Check for typos in the ACLs.
- Use the **show ip access-lists detail** command to view the detailed configuration of the ACLs.

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