

Misconfiguration or Ineffectiveness of Time-Based ACLs for Web Access Restriction in Cisco Networks

Problem Description

Time-Based Access Control Lists (Time-Based ACLs), which are defined to control and restrict internet traffic at certain time intervals in the corporate network infrastructure, cannot fulfil the expected filtering function despite the configuration accuracy. This technical failure allows unauthorised web access by users outside working hours, creating a situation that contradicts information security principles, network policies and access management strategies. The aim is to ensure that users have internet access only during certain time periods in corporate networks and to prevent web traffic during off-hours.

Prerequisites

CLI (command-line) access to the Cisco router

The NTP server is correctly configured and accessible

Command of IP access control list (ACL) logic

Affected OSI Layers

Layer 3 (Network Layer): IP-based access controls are performed by ACL (Access Control List) rules defined on the router or switch.

Layer 7 (Application Layer): For application protocols such as HTTP/HTTPS, filtering can be done based on the destination domain address or port.

Diagnosis

If feedback is received that users continue to access the web on the corporate network outside working hours, it is understood that time-based access control lists (Time-Based ACL) are not activated in the defined time periods.

The technical review carried out to analyse this situation includes the following steps:

Firstly, access control rules were examined with the `show access-lists` command; it was evaluated whether IP address and port-based restrictions were defined appropriately.

-The `show time-range` command was then used to check whether the relevant time ranges had been defined and correctly associated with the ACL rules. In most cases, it was observed that the definition of time-range was missing or incorrect, or that it was not associated with the ACL.

-Finally, the system clock on the router was checked with the `show clock` command; it was determined that synchronisation with the NTP server could not be achieved or the clock information was manually configured incorrectly.

As a result of these findings, it was assessed that the internet access problems observed at Layer 7 were caused by incomplete or incorrect implementation of the time-based access control mechanisms defined at Layer 3.

Root Cause: The root cause of the problem is that the time-range configuration, which enables access restrictions based on time periods, is missing or incorrectly defined. Even if the ACL rule is written correctly, these rules will not become active if they are not associated with a time range. In addition, incorrect router clock or failed NTP synchronisation can cause time-based rules not to work as expected.

Admin Guide:

1. Ensuring Clock Synchronisation

```
R1(config)# ntp server 192.168.1.10
```

```
R1# show clock
```

2. Defining the Time Interval

```
R1(config)# time-range MESAISAATI
```

```
R1(config-time-range)# periodic weekdays 08:00 to 18:00
```

3. Defining ACL Rules

```
R1(config)# access-list 100 deny tcp any any eq www time-range MESAISAATI
```

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

4. Applying ACL to the Interface

```
R1(config)# interface FastEthernet0/0
```

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

5. Validation Commands

R1# show access-lists 100

R1# show time-range

R1# show clock

Expected Result:

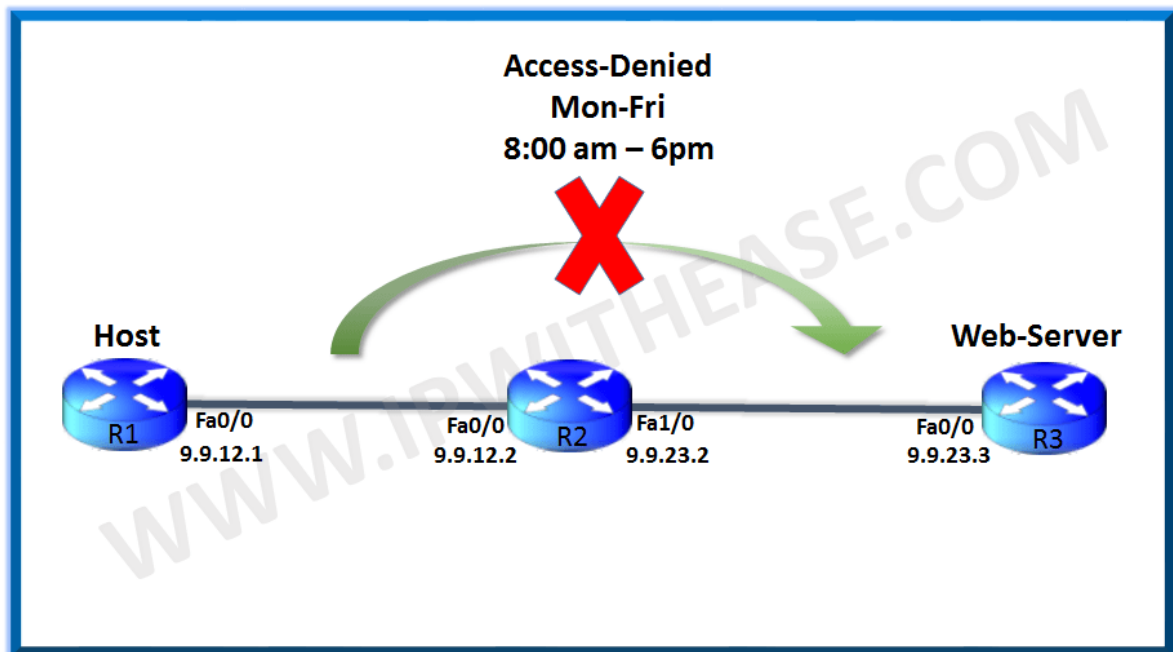
Outside office hours (18:00 - 08:00), users should be blocked from accessing the web; during office hours, access should be allowed. If the router clock is correct and ACLs are configured correctly, time-based filtering will work as expected.

Time-based ACLs

- To implement time-based ACLs:
 - Create a time range that defines specific times of the day and week.
 - Identify the time range with a name and then refer to it by a function.
 - The time restrictions are imposed on the function itself.

Step 1	<pre>R1(config)#time-range EVERYOTHERDAY R1(config-time-range)#periodic Monday Wednesday Friday 8:00 to 17:00</pre>
Step 2	<pre>R1(config)#access-list 101 permit tcp 192.168.10.0 0.0.0.255 any eq telnet time-range EVERYOTHERDAY</pre>
Step 3	<pre>R1(config)#interface s0/0/0 R1(config-if)#ip access-group 101 out</pre>

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R1

TELNET_HOST

ISP

EXTERNAL_CLIENT

```

no periodic      Negate a command or set its defaults
periodic         periodic time and date

R1(config-time-range)#periodic ?
Friday           Friday
Monday           Monday
Saturday         Saturday
Sunday           Sunday
Thursday         Thursday
Tuesday          Tuesday
Wednesday        Wednesday
daily            Every day of the week
weekdays        Monday thru Friday
weekend          Saturday and Sunday

R1(config-time-range)#periodic weekdays ?
hh:mm           Starting time

R1(config-time-range)#periodic weekdays 08:00 ?
to              ending day and time

R1(config-time-range)#periodic weekdays 08:00 to ?
hh:mm           Ending time - stays valid until beginning of next minute

R1(config-time-range)#periodic weekdays 08:00 to 17:00
R1(config-time-range)#exit
R1(config)#$ 100 permit tcp any host 10.1.1.2 eq telnet time-range WEEKDAYS
R1(config)#int s 1/0
R1(config-if)#ip access-group 100 in
R1(config-if)#end
R1#
Dec 20 13:11:04.311: %SYS-5-CONFIG_I: Configured from console by console
R1#clock set 12:00:00 18 Dec 2014
R1#
Dec 18 12:00:00.003: %SYS-6-CLOCKUPDATE: System clock has been updated from 13:11:32 UTC Sat Dec 20 2014 to 12:00:00 UT
C Thu Dec 18 2014, configured from console by console.
R1#

```

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R1

TELNET_HOST

ISP

EXTERNAL_CLIENT

```

R1(config-time-range)#periodic ?
Friday           Friday
Monday           Monday
Saturday         Saturday
Sunday           Sunday
Thursday         Thursday
Tuesday          Tuesday
Wednesday        Wednesday
daily            Every day of the week
weekdays        Monday thru Friday
weekend          Saturday and Sunday

R1(config-time-range)#periodic weekdays ?
hh:mm           Starting time

R1(config-time-range)#periodic weekdays 08:00 ?
to              ending day and time

R1(config-time-range)#periodic weekdays 08:00 to ?
hh:mm           Ending time - stays valid until beginning of next minute

R1(config-time-range)#periodic weekdays 08:00 to 17:00
R1(config-time-range)#exit
R1(config)#$ 100 permit tcp any host 10.1.1.2 eq telnet time-range WEEKDAYS
R1(config)#int s 1/0
R1(config-if)#ip access-group 100 in
R1(config-if)#end
R1#
Dec 20 13:11:04.311: %SYS-5-CONFIG_I: Configured from console by console
R1#clock set 12:00:00 18 Dec 2014
R1#
Dec 18 12:00:00.003: %SYS-6-CLOCKUPDATE: System clock has been updated from 13:11:32 UTC Sat Dec 20 2014 to 12:00:00 UT
C Thu Dec 18 2014, configured from console by console.
R1#show access-lists
Extended IP access list 100
  10 permit tcp any host 10.1.1.2 eq telnet time-range WEEKDAYS (active)
R1#

```

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```

EXTERNAL_CLIENT#
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EXTERNAL_CLIENT#
EXTERNAL_CLIENT#
EXTERNAL_CLIENT#
EXTERNAL_CLIENT#
EXTERNAL_CLIENT#telnet 10.1.1.2
Trying 10.1.1.2 ... Open

User Access Verification

Password:
TELNET_HOST>exit

[Connection to 10.1.1.2 closed by foreign host]
EXTERNAL_CLIENT#telnet 10.1.1.2
Trying 10.1.1.2 ... Open

User Access Verification

Password:
TELNET_HOST>exit

[Connection to 10.1.1.2 closed by foreign host]
EXTERNAL_CLIENT#telnet 10.1.1.2
Trying 10.1.1.2 ...
% Destination unreachable; gateway or host down

EXTERNAL_CLIENT#

```

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Conclusion

When the Time-Based ACL is successfully implemented:

Out of Time Slot (When Access is Free): When the defined time slot is not active, the access list (ACL) is not activated. Ping commands and web accesses (HTTP/HTTPS) from user devices to the target server are successfully executed. Network traffic continues uninterrupted.

Within Time Range (When Access is Restricted): ACL is activated automatically when the defined time-range becomes active. The rules specified in the access list are activated and prevent the related devices from accessing the target IP address. In this case, ping tests fail. Access via web browser fails (page cannot be displayed).

Verification and Monitoring Commands:

With the `-show access-lists` command, it can be checked whether the relevant ACL is active.

With the `-show time-range` command, it is observed whether the time range is valid or not.

When the ACL is activated by updating the clock, access is cut off immediately.

Access is restored when the clock is set back or out of the time interval.