PARSHVANATH CHARITABLE TRUST'S

A. P. SHAH INSTITUTE OF TECHNOLOGY

Department of Information Technology

(NBA Accredited)

Academic Year: 2025-26 **Semester: V**
Class / Branch: TE IT Subject: Security Lab (SL)
Subject Lab Incharge: Prof. Apeksha Mohite

Experiment No. 2

1. **Aim: To study access control list by configuring SQUID proxy server.**

2. **Theory:**

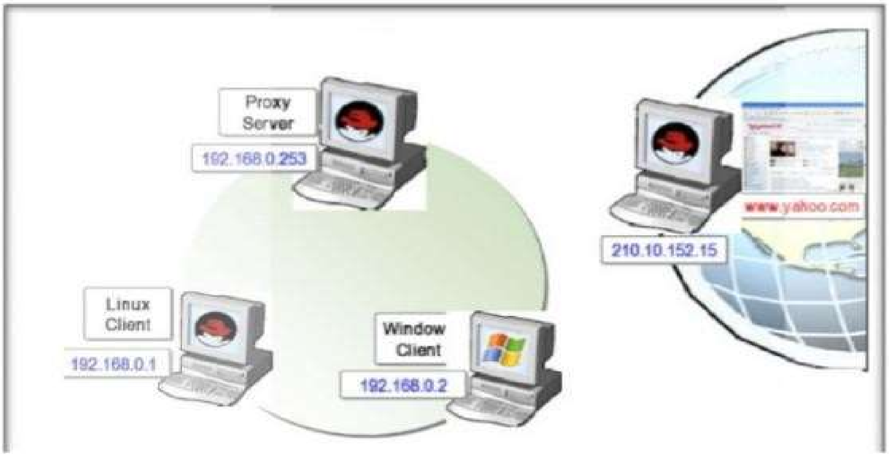
Proxy servers operate as an intermediary between a local network and services available on a larger one such as the Internet. Requests from local clients for web services can be handled by the proxy server, speeding transactions as well as controlling access. Proxy servers maintain current copies of commonly accessed web pages, speeding web access times by eliminating the need to access the original site constantly. They also perform security functions, protecting servers from unauthorized access. Squid is a free, open source, proxy-caching server for web clients, designed to speed Internet access and provide security controls for web servers. Copies of web pages accessed by users are kept in the Squid cache, and as requests are made, Squid checks to see if it has a current copy. If Squid does have a current copy, it returns the copy from its cache instead of querying the original site. If it does not have a current copy, it will retrieve one from the originalsite. In this way, web browsers can then use the local Squid cache as a proxy HTTP server. Squid currently handles web pages supporting the HTTP, FTP, and SSL protocols.

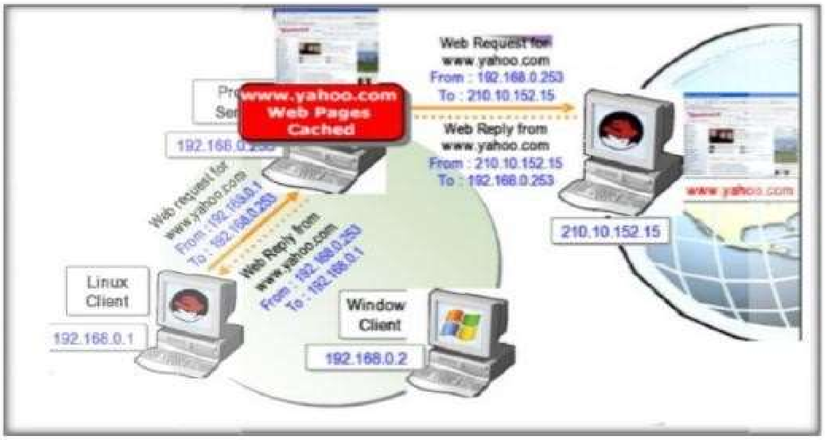
Requirement of squid proxy server can be summarized by following points:

1. Squid stores files from previous requests to speed up future transfers. For example, suppose client1downloads CentOS-7.0-1406-x86_64-DVD.iso from Internet. When client2 requests access to the same file, squid can transfer the file from its cache instead of downloading it again from the Internet. This feature can be used to speed up data transfers in a network of computers that require frequent updates of some kind.

2. ACLs (Access Control Lists) allow us to restrict the access to websites, and / or monitor the access on a per user basis. Access can be restricted based on day of week or time of day, or domain.

3. Bypassing web filters is made possible through the use of a web proxy to which requests are made and which returns requested content to a client, instead of having the client request it directly to the Internet.




www.yahoo.com Web Pages Cached
192.168.0.253
Web Request for www.yahoo.com From : 192.168.0.253 To : 210.10.152.15
Web Reply from www.yahoo.com From : 210.10.152.15 To : 192.168.0.253
www.yahoo.com
210.10.152.15
Web request for www.yahoo.com From : 192.168.0.1 To : 192.168.0.253
Web Reply from www.yahoo.com From : 192.168.0.253 To : 192.168.0.1
Linux Client
192.168.0.1
Window Client
192.168.0.2

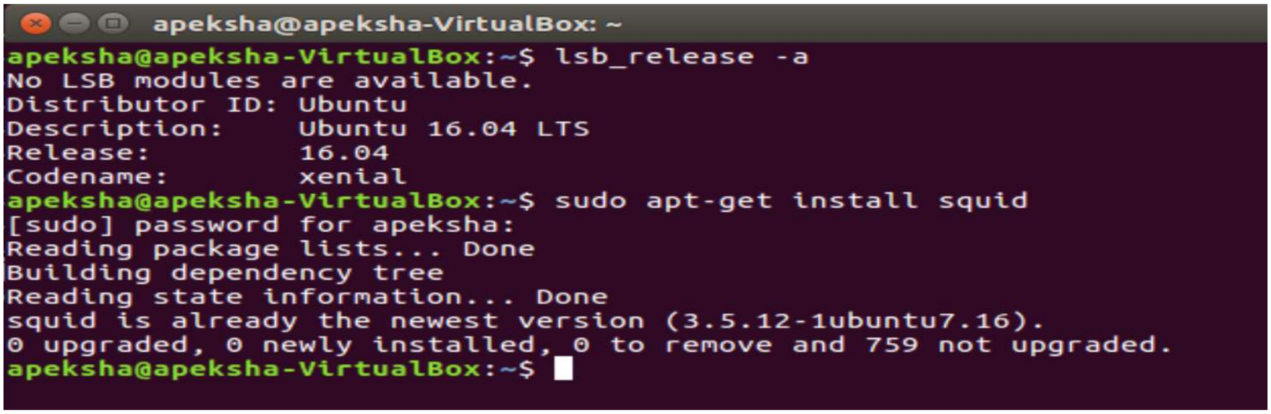
The access control scheme of the Squid web proxy server consists of two different components:

1. The ACL elements are directive lines that begin with the word “acl” and represent types of tests that are performed against any request transaction.
2. The access list rules consist of an allow or deny action followed by a number of ACL elements, and are used to indicate what action or limitation has to be enforced for a given request. They are checked in order, and list searching terminates as soon as one of the rules is a match. If a rule has multiple ACL elements, it is implemented as a boolean AND operation (all ACL elements of the rule must be a match in order for the rule to be a match).

Squid’s main configuration file is /etc/squid/squid.conf, which is 5000 lines long since it includes both configuration directives and documentation. For that reason, new squid.conf file can be created with only the lines that include configuration directives for our convenience, leaving out empty or commented lines. To do so, following commands can be used

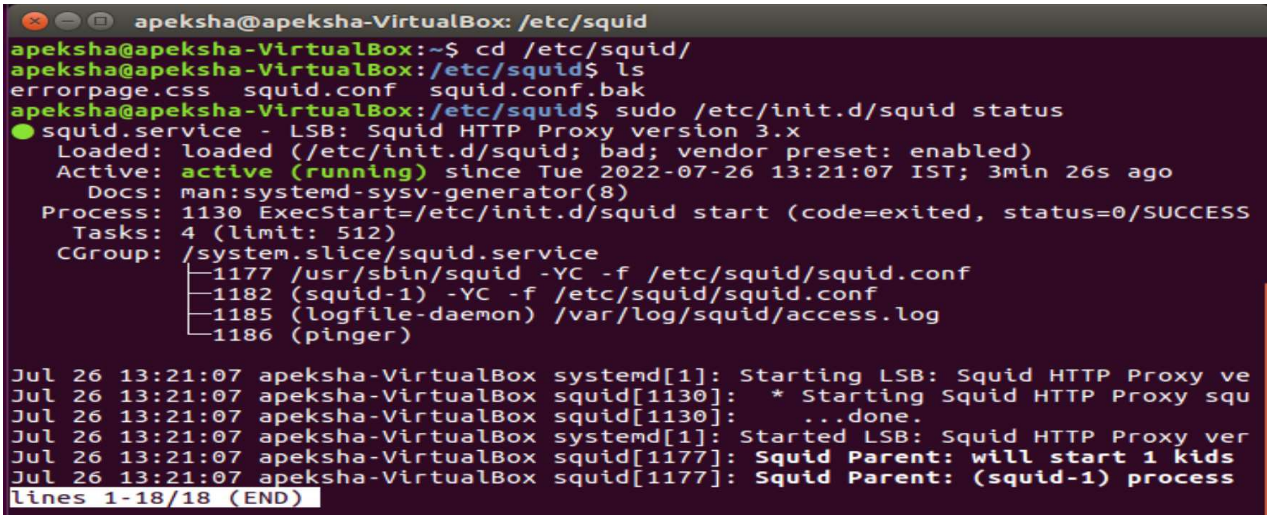
Installation of SQUID:

Command : sudo apt-get install squid



```
apeksha@apeksha-VirtualBox:~$ lsb_release -a
No LSB modules are available.
Distributor ID: Ubuntu
Description:    Ubuntu 16.04 LTS
Release:        16.04
Codename:       xenial
apeksha@apeksha-VirtualBox:~$ sudo apt-get install squid
[sudo] password for apeksha:
Reading package lists... Done
Building dependency tree
Reading state information... Done
squid is already the newest version (3.5.12-1ubuntu7.16).
0 upgraded, 0 newly installed, 0 to remove and 759 not upgraded.
apeksha@apeksha-VirtualBox:~$ 
```

Check status of SQUID :

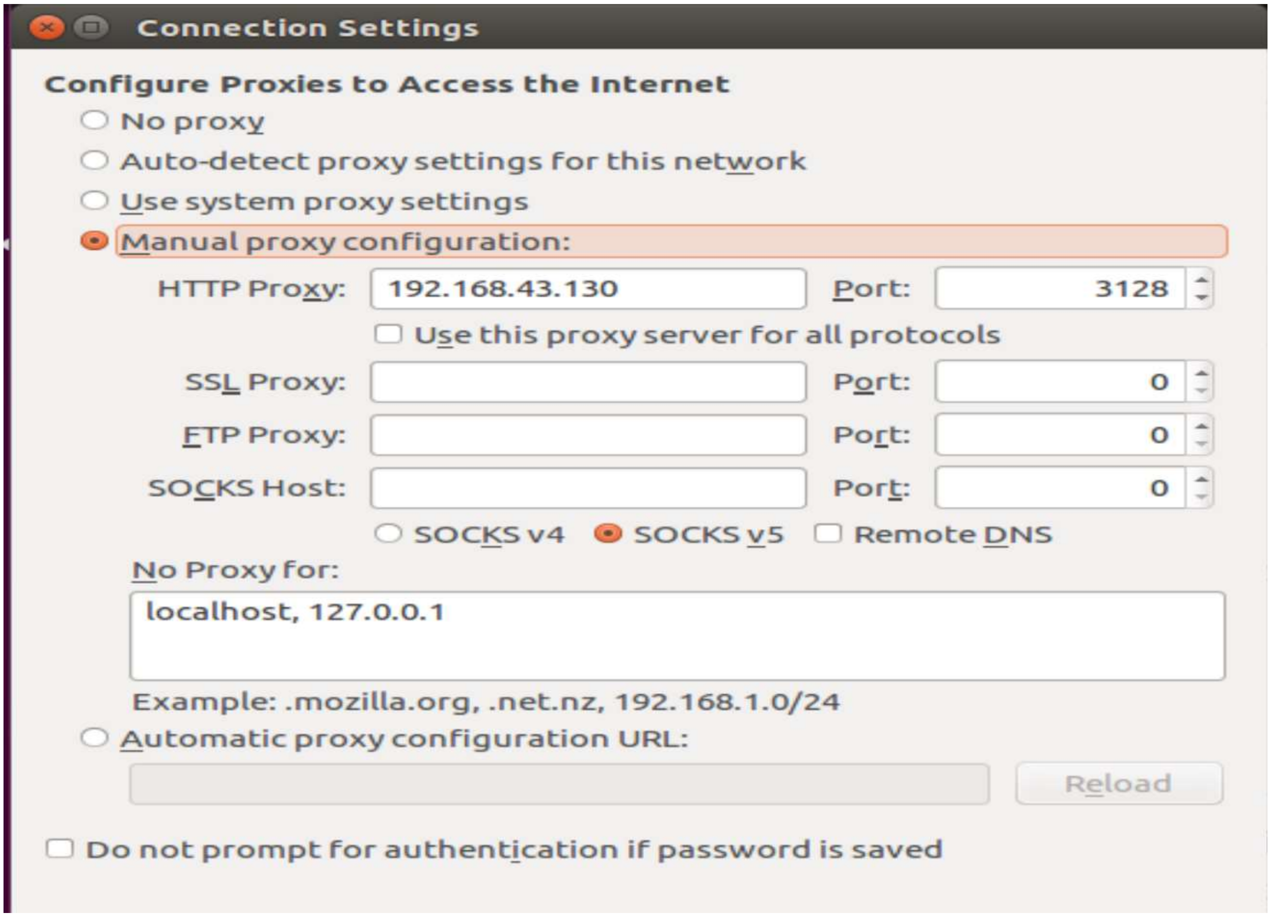


```
apeksha@apeksha-VirtualBox: /etc/squid
apeksha@apeksha-VirtualBox:~$ cd /etc/squid/
apeksha@apeksha-VirtualBox:/etc/squid$ ls
errorpage.css  squid.conf  squid.conf.bak
apeksha@apeksha-VirtualBox:/etc/squid$ sudo /etc/init.d/squid status
● squid.service - LSB: Squid HTTP Proxy version 3.x
   Loaded: loaded (/etc/init.d/squid; bad; vendor preset: enabled)
   Active: active (running) since Tue 2022-07-26 13:21:07 IST; 3min 26s ago
     Docs: man:systemd-sysv-generator(8)
  Process: 1130 ExecStart=/etc/init.d/squid start (code=exited, status=0/SUCCESS
    Tasks: 4 (limit: 512)
   CGroup: /system.slice/squid.service
           ├─1177 /usr/sbin/squid -YC -f /etc/squid/squid.conf
           ├─1182 (squid-1) -YC -f /etc/squid/squid.conf
           ├─1185 (logfile-daemon) /var/log/squid/access.log
           └─1186 (pinger)

Jul 26 13:21:07 apeksha-VirtualBox systemd[1]: Starting LSB: Squid HTTP Proxy ve
Jul 26 13:21:07 apeksha-VirtualBox squid[1130]:  * Starting Squid HTTP Proxy squ
Jul 26 13:21:07 apeksha-VirtualBox squid[1130]:    ...done.
Jul 26 13:21:07 apeksha-VirtualBox systemd[1]: Started LSB: Squid HTTP Proxy ver
Jul 26 13:21:07 apeksha-VirtualBox squid[1177]: Squid Parent: will start 1 kids
Jul 26 13:21:07 apeksha-VirtualBox squid[1177]: Squid Parent: (squid-1) process
lines 1-18/18 (END)
```

Firefox Proxy settings

1. Go to the Edit menu and choose the Preferences option.
2. Click on Advanced, then on the Network tab, and finally on Settings.
3. Check Manual proxy configuration and enter the IP address of the proxy server and the port where it is listening for connections. Click on OK to apply changes.



Configure Proxies to Access the Internet

○ No proxy
○ Auto-detect proxy settings for this network
○ Use system proxy settings
● Manual proxy configuration:

HTTP Proxy: 192.168.43.130 Port: 3128

□ Use this proxy server for all protocols

SSL Proxy: Port: 0

FTP Proxy: Port: 0

SOCKS Host: Port: 0

○ SOCKS v4 ● SOCKS v5 □ Remote DNS

No Proxy for:

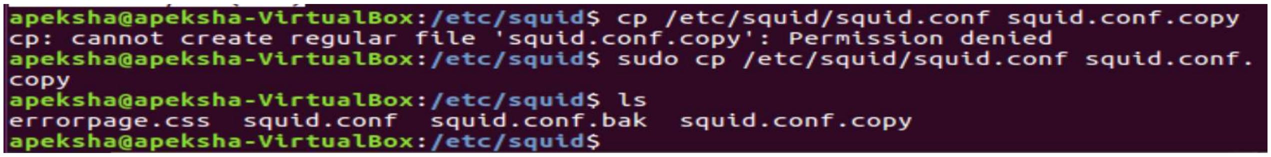
localhost, 127.0.0.1

Example: .mozilla.org, .net.nz, 192.168.1.0/24

○ Automatic proxy configuration URL:

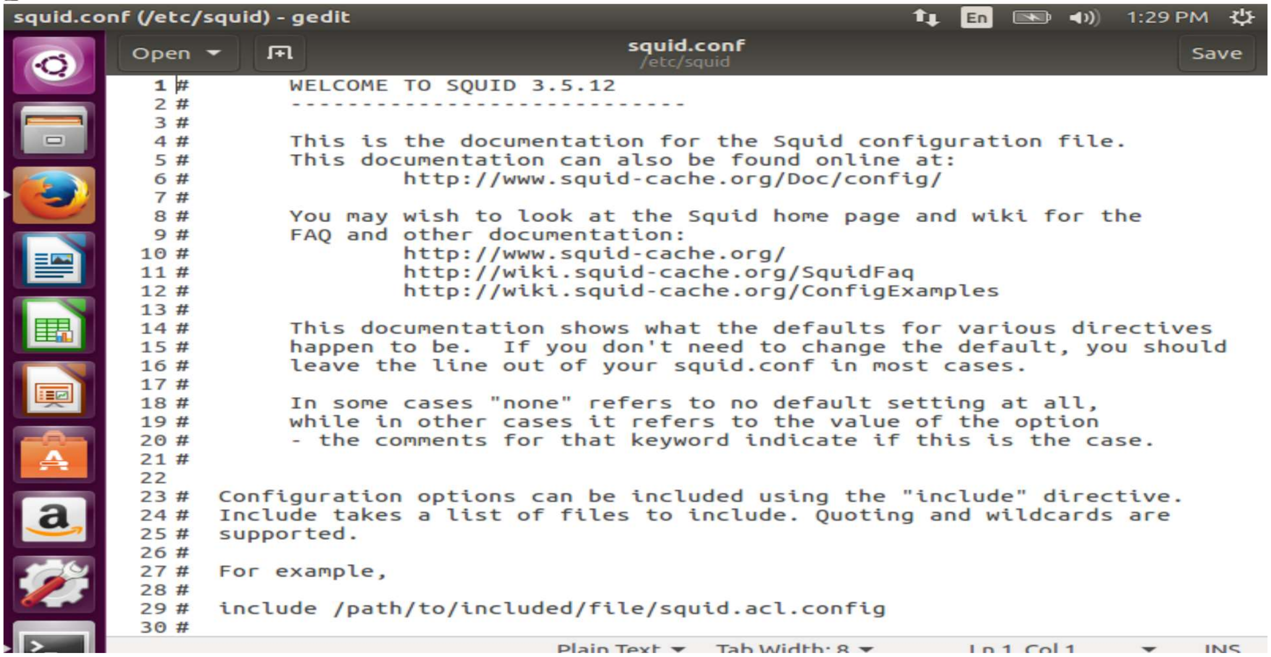
□ Do not prompt for authentication if password is saved

Backing up the Squid configuration file:



```
apeksha@apeksha-VirtualBox:/etc/squid$ cp /etc/squid/squid.conf squid.conf.copy
cp: cannot create regular file 'squid.conf.copy': Permission denied
apeksha@apeksha-VirtualBox:/etc/squid$ sudo cp /etc/squid/squid.conf squid.conf.
copy
apeksha@apeksha-VirtualBox:/etc/squid$ ls
errorpage.css  squid.conf  squid.conf.bak  squid.conf.copy
apeksha@apeksha-VirtualBox:/etc/squid$
```

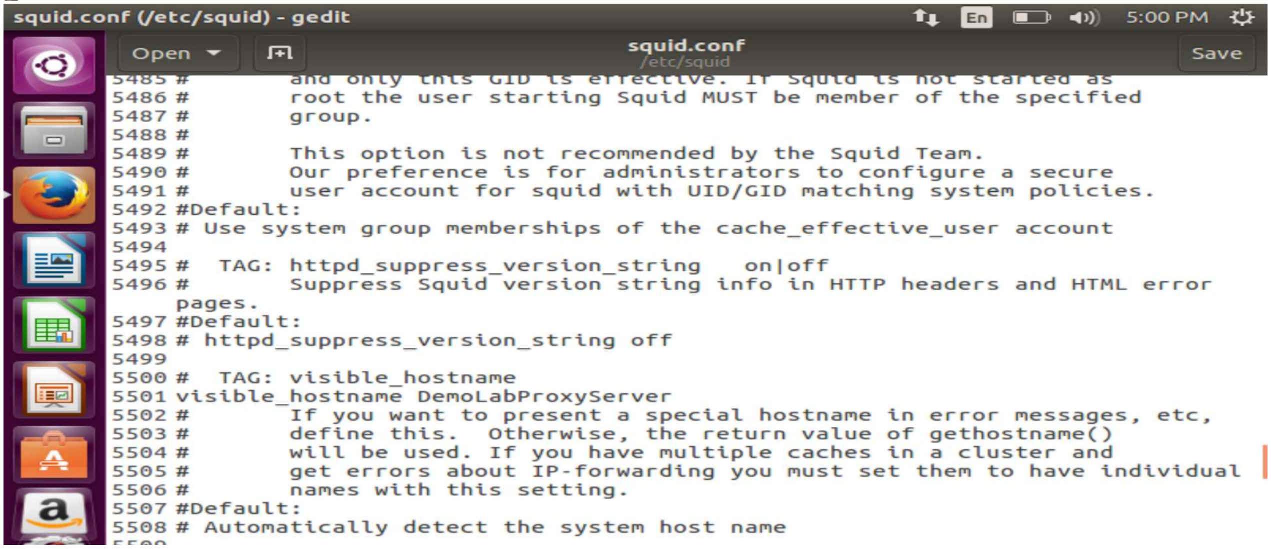
SQUID Configuration file:



```
#       WELCOME TO SQUID 3.5.12
#       ----------------------------
#
#       This is the documentation for the Squid configuration file.
#       This documentation can also be found online at:
#               http://www.squid-cache.org/Doc/config/
#
#       You may wish to look at the Squid home page and wiki for the
#       FAQ and other documentation:
#               http://www.squid-cache.org/
#               http://wiki.squid-cache.org/SquidFaq
#               http://wiki.squid-cache.org/ConfigExamples
#
#       This documentation shows what the defaults for various directives
#       happen to be.  If you don't need to change the default, you should
#       leave the line out of your squid.conf in most cases.
#
#       In some cases "none" refers to no default setting at all,
#       while in other cases it refers to the value of the option
#       - the comments for that keyword indicate if this is the case.
#

#  Configuration options can be included using the "include" directive.
#  Include takes a list of files to include. Quoting and wildcards are
#  supported.
#
#  For example,
#
#  include /path/to/included/file/squid.acl.config
#
```

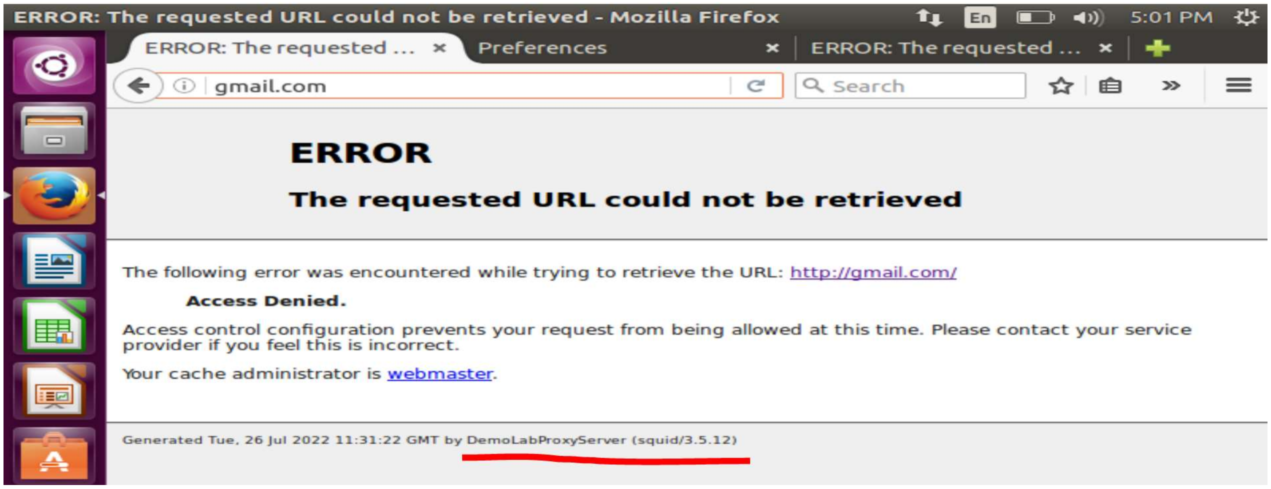
Change in visible proxy name:



```
#       and only this GID is effective. If Squid is not started as
#       root the user starting Squid MUST be member of the specified
#       group.
#
#       This option is not recommended by the Squid Team.
#       Our preference is for administrators to configure a secure
#       user account for squid with UID/GID matching system policies.
#Default:
# Use system group memberships of the cache_effective_user account

#  TAG: httpd_suppress_version_string   on|off
#       Suppress Squid version string info in HTTP headers and HTML error
pages.
#Default:
# httpd_suppress_version_string off

#  TAG: visible_hostname
visible_hostname DemoLabProxyServer
#       If you want to present a special hostname in error messages, etc,
#       define this.  Otherwise, the return value of gethostname()
#       will be used. If you have multiple caches in a cluster and
#       get errors about IP-forwarding you must set them to have individual
#       names with this setting.
#Default:
# Automatically detect the system host name
```



ERROR: The requested URL could not be retrieved - Mozilla Firefox

ERROR

The requested URL could not be retrieved

The following error was encountered while trying to retrieve the URL: http://gmail.com/

Access Denied.

Access control configuration prevents your request from being allowed at this time. Please contact your service provider if you feel this is incorrect.

Your cache administrator is webmaster.

Generated Tue, 26 Jul 2022 11:31:22 GMT by DemoLabProxyServer (squid/3.5.12)

root@apsit-HP-245-G4-Notebook-PC:~$ mv /etc/squid/squid.conf /etc/squid/squid.conf.bkp root@apsit-HP-245-G4-Notebook-PC:~$ grep -ve ^# -ve ^$ /etc/squid/squid.conf.bkp > /etc/squid/squid.conf

Now, open the newly created squid.conf file, and look for (or add) the following ACLelements and access lists.

```
acl localhost src 127.0.0.1/32
acl localnet src 192.168.0.40/24 192.168.0.0./16
```

The two lines above represent a basic example of the usage of ACL elements.

1. **The first word, acl, indicates that this is a ACL element directive line.**

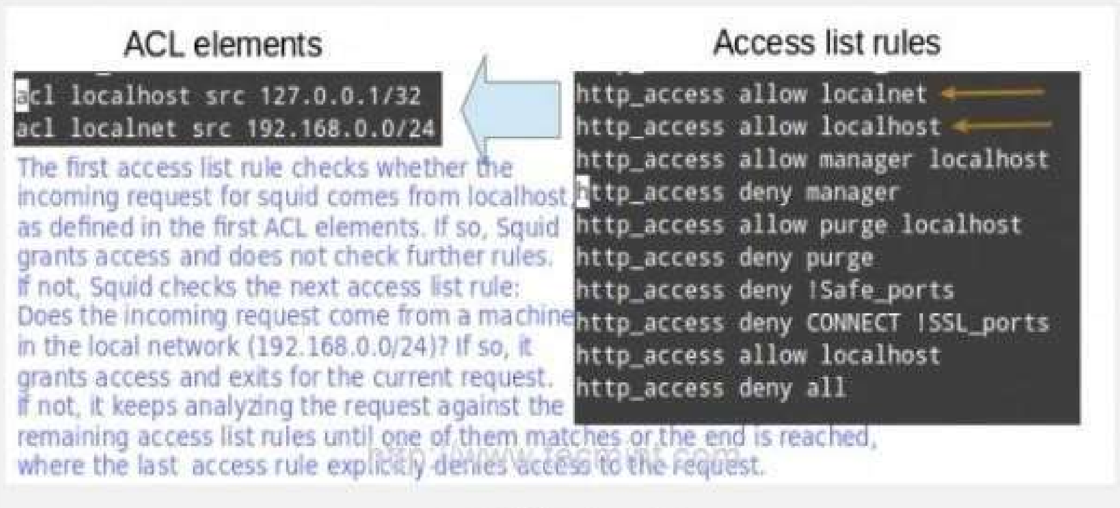
2. The second word, localhost or localnet, specify a name for the directive.

3. The third word, src in this case, is an ACL element type that is used to represent a client IPaddress or range of addresses, respectively. Administrator can specify a single host by IP (or hostname, if you have some sort of DNS resolution implemented) or by network address.4.The fourth parameter is a filtering argument that is "fed" to the directive.

The two lines below are access list rules and represent an explicit implementation of theACL directives mentioned earlier. In few words, they indicate that http access should be granted if the request comes from the local network (localnet), or from localhost.

http_access allow localnet

http_access allow localnet



ACL elements

```
acl localhost src 127.0.0.1/32
acl localnet src 192.168.0.0/24
```

Access list rules

```
http_access allow localnet
http_access allow localhost
http_access allow manager localhost
http_access deny manager
http_access allow purge localhost
http_access deny purge
http_access deny !Safe_ports
http_access deny CONNECT !SSL_ports
http_access allow localhost
http_access deny all
```

The first access list rule checks whether the incoming request for squid comes from localhost as defined in the first ACL elements. If so, Squid grants access and does not check further rules. If not, Squid checks the next access list rule: Does the incoming request come from a machine in the local network (192.168.0.0/24)? If so, it grants access and exits for the current request. If not, it keeps analyzing the request against the remaining access list rules until one of them matches or the end is reached, where the last access rule explicitly denies access to the request.

Squid ACL Allow Access List

At this point restart Squid in order to apply any pending changes .and then configure a client browser in the local network (192.168.3.140 in our case) to access the Internet through your proxy as follows

Firefox Proxy settings

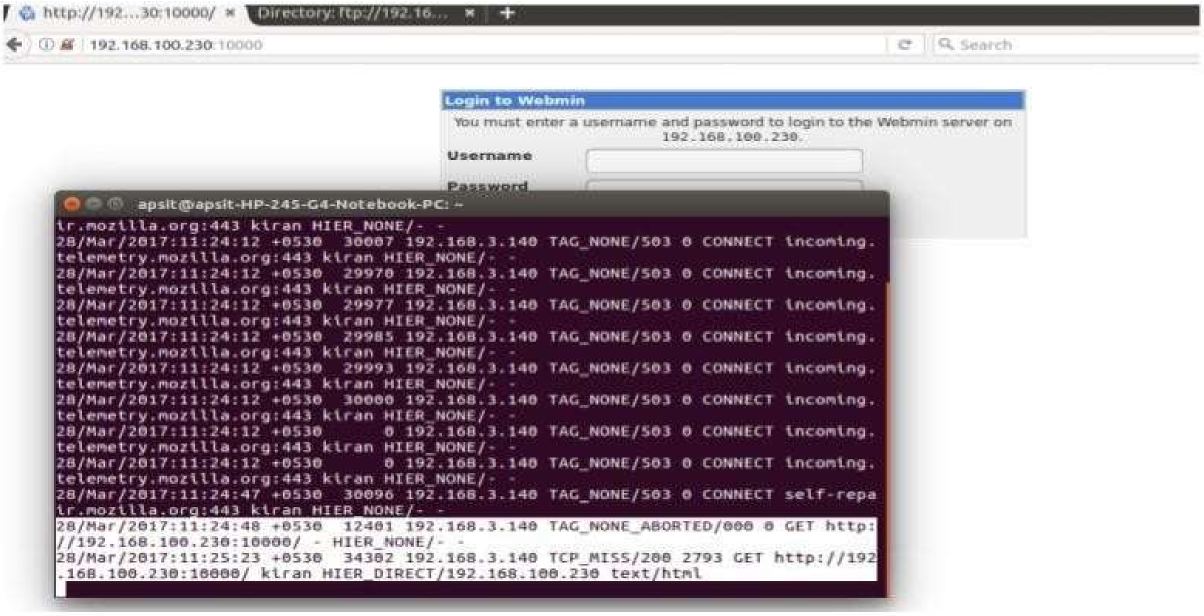
4. Go to the Edit menu and choose the Preferences option.
5. Click on Advanced, then on the Network tab, and finally on Settings.
6. Check Manual proxy configuration and enter the IP address of the proxy server and the port where it is listening for connections. Click on OK toapply changes.

Verifying that a Client is Accessing the Internet

1. In your client, use a web browser to open any web site .

2. In the server, run following command line to view requests being served through Squid.

```
root@apsit-HP-245-G4-Notebook-PC:/etc/squid$ sudo tail -f /var/log/squid/access.log
```



You must enter a username and password to login to the Webmin server on 192.168.100.230.

```
ir.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:12 +0530  30007 192.168.3.140 TAG_NONE/503 0 CONNECT incoming.
telemetry.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:12 +0530  29970 192.168.3.140 TAG_NONE/503 0 CONNECT incoming.
telemetry.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:12 +0530  29977 192.168.3.140 TAG_NONE/503 0 CONNECT incoming.
telemetry.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:12 +0530  29985 192.168.3.140 TAG_NONE/503 0 CONNECT incoming.
telemetry.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:12 +0530  29993 192.168.3.140 TAG_NONE/503 0 CONNECT incoming.
telemetry.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:12 +0530  30000 192.168.3.140 TAG_NONE/503 0 CONNECT incoming.
telemetry.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:12 +0530      0 192.168.3.140 TAG_NONE/503 0 CONNECT incoming.
telemetry.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:12 +0530      0 192.168.3.140 TAG_NONE/503 0 CONNECT incoming.
telemetry.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:47 +0530  30096 192.168.3.140 TAG_NONE/503 0 CONNECT self-repa
ir.mozilla.org:443 kiran HIER_NONE/- -
28/Mar/2017:11:24:48 +0530  12401 192.168.3.140 TAG_NONE_ABORTED/000 0 GET http:
//192.168.100.230:10000/ - HIER_NONE/- -
28/Mar/2017:11:25:23 +0530  34302 192.168.3.140 TCP_MISS/200 2793 GET http://192
.168.100.230:10000/ kiran HIER_DIRECT/192.168.100.230 text/html
```

Restricting Access By Client

To deny access to that particular client IP address, while yet maintaining access forthe rest of the local network.

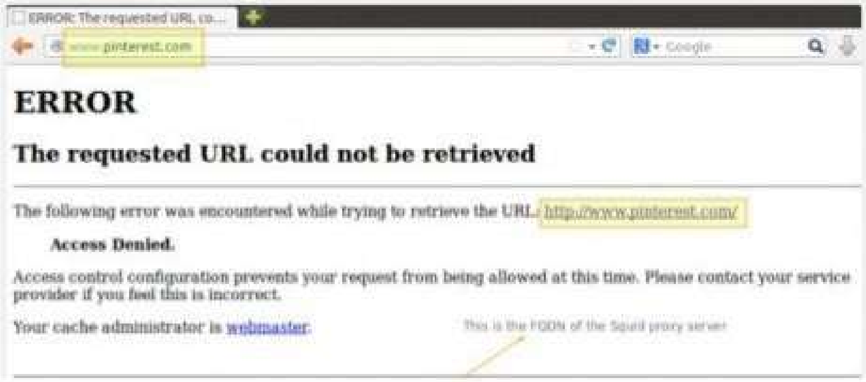
1. **Define a new ACL directive as follows**

```
acl resclient src 192.168.0.104
```

2. Add the ACL directive to the localnet access list that is already in place, but prefacing it with an exclamation sign. This means, “Allow Internet access to clients matching the localnet ACL directive except to the one that matches the resclient directive”.

```
http_access allow localnet !resclient
```

3. Now restart Squid in order to apply changes. Then if client try to browse to anysite we will find that access is denied now.



ERROR

The requested URL could not be retrieved

The following error was encountered while trying to retrieve the URL: http://www.pinterest.com/

Access Denied.

Access control configuration prevents your request from being allowed at this time. Please contact your service provider if you feel this is incorrect.

Your cache administrator is webmaster.

This is the FQDN of the Squid proxy server

Restricting access by domain and / or by time of day / day of week

To restrict access to Squid by domain dstdomain keyword can be used in a ACL directive, as follows.Where forbidden_domains is a plain text file that contains the domains to deny access to.

```
acl forbidden dstdomain "/etc/squid/forbidden_domains"
```

```
root@apsit-HP-245-G4-Notebook-PC:/etc/squid$ cat forbidden_domains
.facebook.com
localhost
```

To grant access to Squid for requests not matching the directive above.

```
http_access allow localnet ! forbidden
```

To allow access to those sites during a certain time of the day (10:00 until 11:00 am)only on Monday (M), Wednesday (W), and Friday (F).

```
acl workingHour time MWFA 10:00-11:00
http_access allow forbidden workingHour
http_access deny forbidden
```

Restricting access by user authentication

Squid support several authentication mechanisms. To use Basic authentication withNCSA.

Add the following lines to your /etc/squid/squid.conf file.

```
auth_param basic program /usr/lib/squid3/basic_ncsa_auth
/etc/squid/passwd

auth_param basic credentialsttl 30 minutes

auth_param basic casesensitive on
auth_param basic realm Squid proxy-caching web server for APSITacl
ncsa proxy_auth REQUIRED
http_access allow ncsa
```

Details of acl and acl directives used:

1. To tell Squid which authentication helper program to use with the auth_param directive byspecifying the name of the program plus any command line options (/etc/squid/passwd in this

case) if necessary.

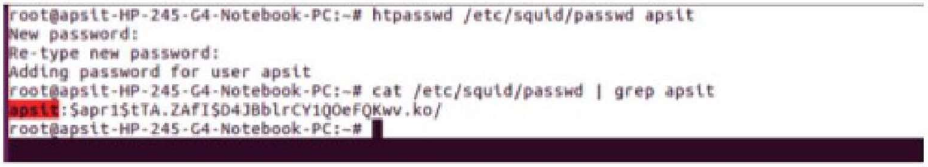
2. The /etc/squid/passwd file is created through htpasswd, a tool to manage basic authentication through files. It will allow us to add a list of usernames (and their corresponding passwords) that will be allowed to use Squid.

3. Credentialsttl 30 minutes will require entering your username and password every 30 minutes

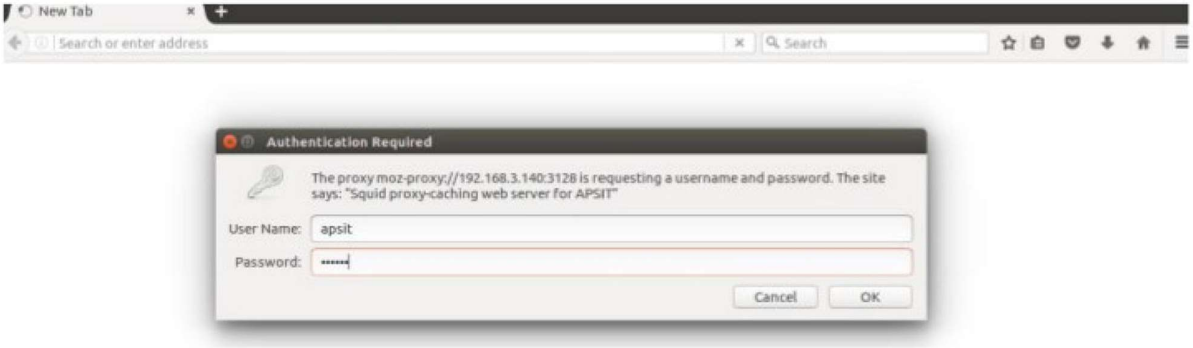
4. Casesensitive on indicates that usernames and passwords are case sensitive. 5.Realm represents the text of the authentication dialog that will be used toauthenticate to squid.

6.Finally, access is granted only when proxy authentication (proxy_auth REQUIRED) succeeds.

Run the following command to create the file and to add credentials for user apsit (omit the -c flag if the file already exists) and Open a web browser in the client machine and try to browse to any given site.



```
root@apsit-HP-245-G4-Notebook-PC:~# htpasswd /etc/squid/passwd apsit
New password:
Re-type new password:
Adding password for user apsit
root@apsit-HP-245-G4-Notebook-PC:~# cat /etc/squid/passwd | grep apsit
apsit:$apr1$tTA.ZAfI$D4JBblrCY1QOeFQKwv.ko/
root@apsit-HP-245-G4-Notebook-PC:~#
```



Authentication Required

The proxy moz-proxy://192.168.3.140:3128 is requesting a username and password. The site says: "Squid proxy-caching web server for APSIT"

User Name: apsit

Password: ••••••

Note : By default, Squid listens on port 3128, but administrator can override this behavior by editing the access list rule that begins with http_port (by default it reads http_port 3128). Alsoafter any updation squid daemon has to be restarted to make changes permanent.

Conclusion: Conclusion: Hence we have successfully studied how Squid Proxy server can be used for providing security controls for web servers & protecting servers from unauthorised access by using Access Control Lists(ACLs). As well as we have studied how squid can be used to filter traffic on HTTP, FTP, and HTTPS, and increase the speed (thus lower the response time) for a web server via caching