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Using Open Source Software to Proxy, Authenticate, and Monitor User Web Habits

In today's corporate environment employee access to Internet resources is, for many, a daily job function. Fundamentally, the web is utilized for simple day-to-day operations including virus updates, software patches and hardware drivers and other network administrator duties. Other divisions of an organization may require the World Wide Web for resources such as market updates, company news, and general research on products or competitor's products. In today's business environment, access to the World Wide Web is no l...

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GSEC Practical Assignment

Version 1.2f

Using Open Source Software to Proxy, Authenticate, and Monitor User Web Habits

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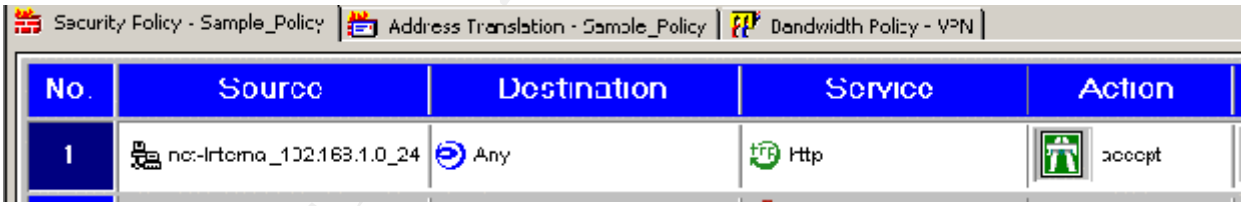
Introduction

In today's corporate environment employee access to Internet resources is, for many, a daily job function. Fundamentally, the web is utilized for simple day-to-day operations including virus updates, software patches and hardware drivers and other network administrator duties. Other divisions of an organization may require the World Wide Web for resources such as market updates, company news, and general research on products or competitor's products. In today's business environment, access to the World Wide Web is no longer an option for many companies, but instead a requirement. Such global World Wide Web access offered to employees raises issues and concerns over user web habits and issues with users utilizing the World Wide Web for business use during business hours. This paper will attempt to address what time and again is a problem for network and security administrators: monitoring user access to the Internet in an environment where blocking resources may not be ideal, cost effective, or in accordance with company policy.

The Issue with Stateful Inspection Firewalls

A large number of organizations today have replaced the more traditional proxy firewall design for the performance and flexibility a stateful inspection design firewall[1]. Such a change has fundamentally altered the network services organizations are willing to allow into their corporate environment and have, in many cases, limited administrators abilities to quickly and easily access information related to user web habits. In a stateful inspection firewall such as Checkpoint Firewall-1[2], a standard web browsing rule might look like the following:



This rule would be logged just like any other rule in the ruleset with the source and destination IP address, service, protocol and various other relevant log data. The following screenshot illustrates Checkpoint's log entries:

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Log

Type	Action	Service	Source	Destination	Proto.
log	accept	www-http	192.168.1.60	209.133.65.45	tcp
log	accept	www-http	192.168.1.60	207.188.7.80	tcp
log	accept	www-http	192.168.1.60	209.133.65.45	tcp
log	accept	www-http	192.168.1.60	66.111.250.58	tcp
log	accept	www-http	192.168.1.60	66.111.250.58	tcp
log	accept	www-http	192.168.1.60	209.133.65.45	tcp
log	accept	www-http	192.168.1.60	209.15.178.121	tcp
log	accept	www-http	192.168.1.60	209.15.178.121	tcp

The issue at hand is the method that stateful inspection firewalls use to log packets that meet firewall ruleset criteria. In the Checkpoint case, the firewall has a proprietary log viewer that allows the selection of different criteria such as source and destination IP addresses, service port, protocol, and other relevant log data. The usefulness of this information becomes questionable when one is attempting to efficiently gain information about user web habits. By default, URL information is not logged in the Checkpoint logs. There is a feature to resolve IP addresses to names, but this option can seriously limit performance of the log viewer and its functionality is quite limited as the screenshot below shows:

Log

Type	Action	Service	Source	Destination	Proto.
log	accept	www-http	192.168.1.60	209.133.65.45	tcp
log	accept	www-http	192.168.1.60	chanrr1.real.com	tcp
log	accept	www-http	192.168.1.60	209.133.65.45	tcp
log	accept	www-http	192.168.1.60	66.111.250.58	tcp
log	accept	www-http	192.168.1.60	66.111.250.58	tcp
log	accept	www-http	192.168.1.60	209.133.65.45	tcp
log	accept	www-http	192.168.1.60	209.15.178.121	tcp
log	accept	www-http	192.168.1.60	209.15.178.121	tcp

This is not intended to dismiss the log functionality with a Checkpoint Firewall-1 product or stateful inspection firewalls, but to simply note that to utilize this product to gain individual user web access habits requires several changes and/or additions to the firewall. Such changes may involve setting up user accounts on the firewall, setting up the proxy functionality of the product, or incorporating a third party product to obtain this information for a fee. In many cases some or all of these requirements are effective, but

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still require manual review of the logs via a proprietary log viewer, or a process to export the logs into viewable format. In the Checkpoint Firewall-1 case, most of these changes require a firewall outage and many companies utilize the corporate firewall for much more than general purpose, employee computing. As a result other operations could be impacted to make such changes.

The Open Source Solution

This paper is intended to get network and security administrators thinking about using an open source proxy server to provide a solution to the problem of monitoring user web habits. With a little time and effort a Squid Web Proxy Cache with other freely available tools running on Linux can provide an organization with the resource necessary to achieve the intended goal. It goes without saying that other tools can be purchased to achieve this goal. The Cacheflow Accelerator and iPlanet Proxy are examples of products which offer enterprise class proxy solutions that meet the needs and requirements of organizations. Each of these products has various attributes and features that may make the open source solution less appealing for the enterprise, but it is always good practice to see alternatives to fee based products and support. This solution is intended to be built and tested in a lab environment and put in place without ever having to take a production firewall offline.

The Design

The design is of this proxy solution is geared around a single Linux server, with Apache and openSSL compiled and running with the following applications[3].

- Squid Web Cache Proxy (http://www.squid-cache.org)
- Apache httpd utilizing the htpasswd (username/password) utility (http://httpd.apache.org/docs/programs/htpasswd.html)
- SARG (Squid Analysis Report Generator) (http://web.onda.com.br/orso/sarg.htm)

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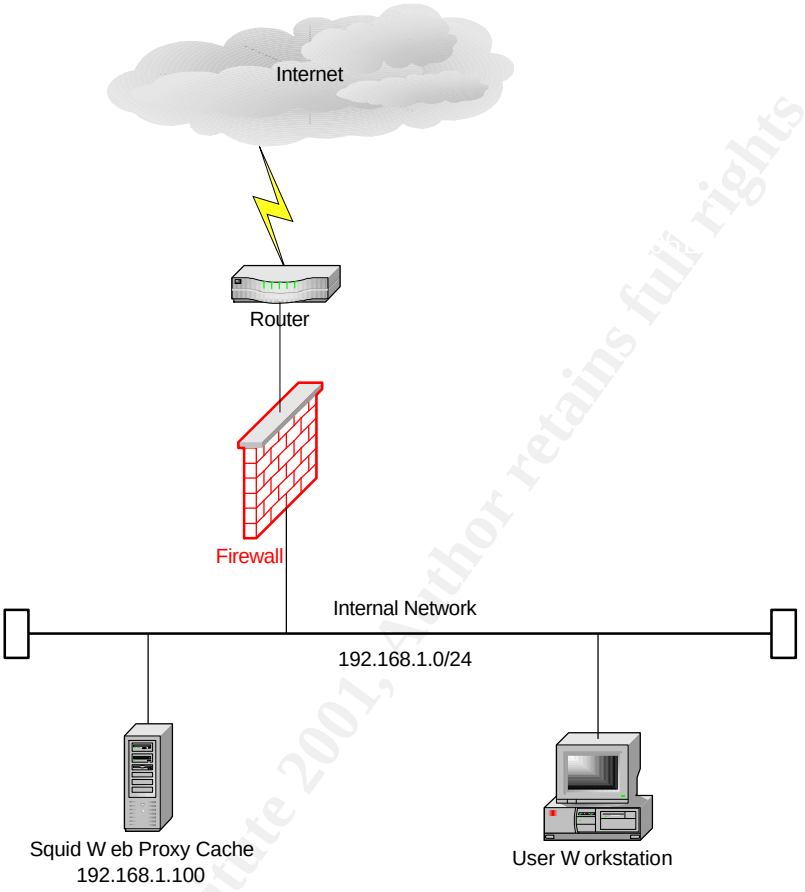
The design in this case requires the Squid server be built with a single network interface card and be installed onto a network relatively close to both the web users and the firewall, on the internal side of the network. This design assumes network address translation is performed at the firewall. See the following network diagram:



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Building the Squid Web Cache Proxy Server

To install Squid:

1. Download the Squid rpm file (and associated dependencies) from any rpm repository (i.e. rpmfind.net) (recommend the latest STABLE release for the Linux distribution utilized):

   `squid-2.4.STABLE1-6.i386.rpm`

2. Save the file to a temporary directory (i.e. /var/tmp)

3. Execute and install the Squid cache with the following command:

   `rpm --install --verbose --hash squid-2.4.STABLE1-6.i386.rpm`

   (this command is abbreviated using `'rpm –ivh squid-2.4.STABLE1-6.i386.rpm'`)

4. The installation builds several directories including:

   `/etc/squid` – squid configuration files
   `/etc/rc.d/init.d/squid` – squid daemon
   `/var/log/squid` – squid logs

5. Change directory to `/etc/squid` and use a text editor to edit the file `squid.conf`. This is the main configuration file and must be altered for the squid daemon to respond to requests. Squid is finely documented at http://squid.visolve.com/squid24s1/contents.htm. The minimum configuration options for the purposes of this document will be addressed here:

   By default Squid runs on tcp port 3128. For the sake of this document the default will be changed to tcp port 8080 under the 'TAG: http_port'.

   NETWORK OPTIONS

   `# TAG: http_port`
   `http port 8080` – port the Squid daemon will listen on.
   `icp_port 0` – disable icp for this document
   `htcp port 0` – disable htcp for this document

   To setup required proxy authentication, make the following bolded, blue changes[4]. The 'TAG: authenticate_program' determines what authenticator will

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be used to authenticate users. The rpm installs the ncsa_auth utility in a different directory than that of the example.

```
OPTIONS FOR EXTERNAL SUPPORT PROGRAMS

#  TAG: authenticate_program
#Default:
authenticate_program /usr/lib/squid/ncsa_auth
/etc/squid/squid_passwd
```

Squid access control lists (TAG: acl) are read from the top down (similar to Cisco IOS ACLs);however, they do not account for an implicit "deny all". By default the Squid configuration file denies all access via the 'http_access deny all' setting. In order to change this, ACLs for individual access must be added before the explicit "deny all" setting. It is highly recommend that access to the Squid engine be controlled in these settings.

A sample network ACL with its corresponding http_access entry is shown for additional information. The ACL 'proxy_auth REQUIRED' entry forces user authentication as defined in the 'authenticate program' tag and it's placement in at the top of the access control list.

```
ACCESS CONTROLS

#  TAG: acl
acl user_auth proxy_auth REQUIRED
#acl net_192.168.1.0 src 192.168.1.0/255.255.255.0
acl all src 0.0.0.0/0.0.0.0
http_access allow manager localhost
http_access deny manager
http_access deny !Safe_ports
http_access deny CONNECT !SSL_ports

# INSERT YOUR OWN RULE(S) HERE TO ALLOW ACCESS FROM YOUR
CLIENTS
#
# And finally deny all other access to this proxy
http_access allow localhost
http_access allow user_auth
#http_access allow net_192.168.1.0
http_access deny all
```

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In order to store a certain number of previously rotated logs, alter the 'TAG'logfile_rotate' entry from the default 0 to a preferred value. The value is the number of old log files Squid will store in the /var/log/squid directory.

```
MICELLANEOUS

#  TAG: logfile_rotate
logfile_rotate 10
```

6. Start Squid with the following command `'/usr/sbin/squid -d 1'`. This will enable debugging for review. It is a good idea to have Squid start up on default. Use `'/sbin/chkconfig'` or the command `'/usr/sbin/ntsysv'` to have Squid startup at boot time. Note that `'/usr/sbin/ntsysv'` must be changed per runlevel. By default `'/usr/sbin/ntsysv'` with no switches configures the daemon for the current run level only.

   Examples:

   `/sbin/chkconfig -levels 2345 squid on`

   (turns daemon on for runlevels 2,3,4,5)

   `/usr/sbin/ntsysv -level 2345`

   (spawns graphical interface to change daemon startup for specified runlevels 2,3,4,5)

   Use `'/sbin/chkconfig -list squid'` squid to verify what runlevels squid is set to startup in.

Adding Users

In order to define users and user passwords, utilize the '`htpasswd`' command compiled with Apache. `Htpasswd` is a simple utility for creating and storing usernames and encrypted passwords, in a single file, on the system. The initial command to create the password file and populate it with the first user is as follows:

```
/usr/bin/htpasswd -c [password_file] [username]

/usr/bin/htpasswd -c /etc/squid/squid_passwd jdoe
New password:
Re-type new password:
Adding password for user jdoe
```

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Subsequent passwords can be created. Ensure that the `'-c'` switch is removed as this switch will overwrite the existing file with a new file. For example:

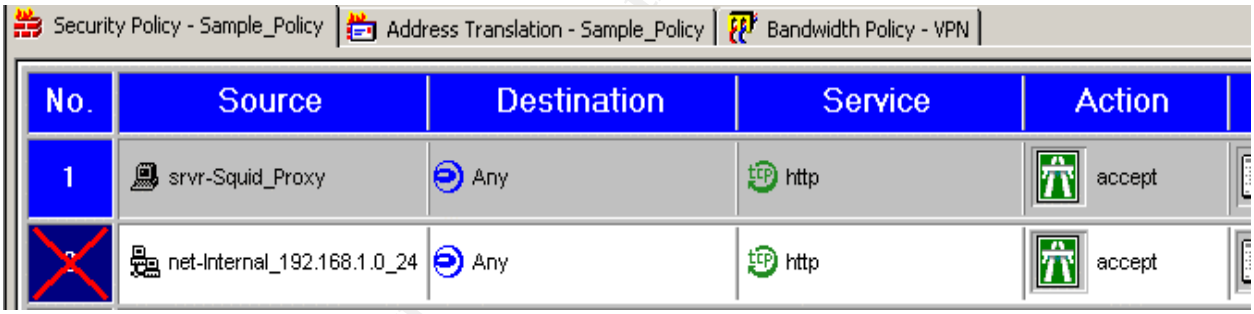
```
/usr/bin/htpasswd /etc/squid/squid_passwd jdgregg
New password:
Re-type new password:
Adding password for user jdgregg
```

In order for new usernames to take effect squid must be reconfigured with the following command:

```
/usr/sbin/squid -k reconfigure
```

Firewall Changes

If a stateful inspection firewall is utilized, some changes to only allow the Squid server to access the Internet for http services will need to be made. Since the Squid box is proxying client sessions to the Internet, eliminating client access directly through the firewall for http accesss is recommended. An altered Checkpoint FW-1 rule may look as follows:



(Note: the large red "X" indicates old http access rule is disabled and once a policy is installed will no longer pass traffic)

Browser Settings

Browser settings need to be altered for all http and browser ftp traffic to redirect to the Squid server. The settings for individual browsers can typically be found in the network options.

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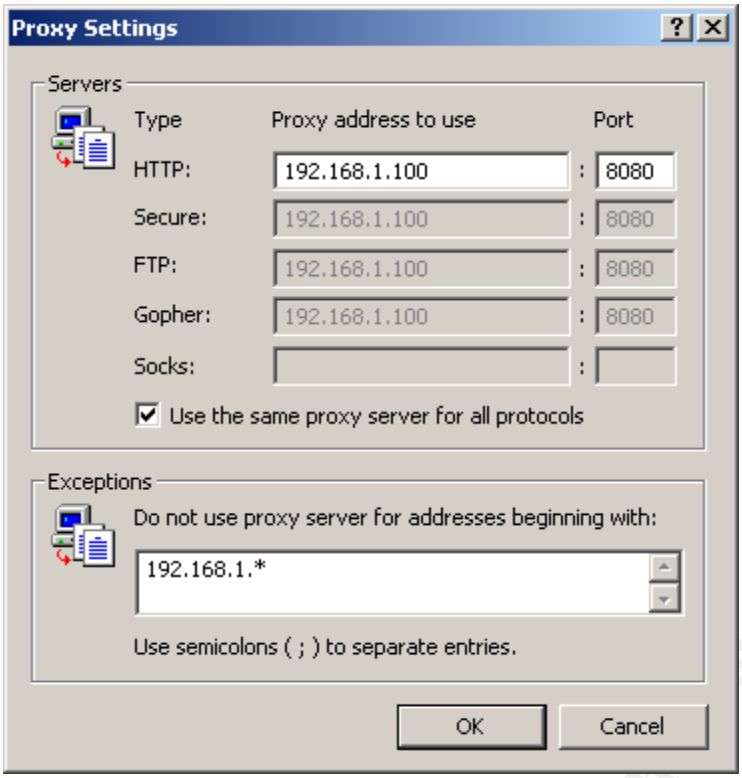

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Browser Authentication Interface

With `'proxy_auth REQUIRED'` set in squid.conf, the user interface for authenticating is prompted upon opening the browser and attempting to access a site off of the local network.

Users attempting to authenticate without a valid user account will receive an error message from the Squid server. These error messages can be altered to meet the needs of an individual organization. Squid error messages can be found in `/etc/squid/errors`

User Monitoring Tool

In order to begin generating reports on user web access, a report generator will need to be installed. Many Squid reporting tools are available, but SARG (Squid Analysis Report Generator) was chosen due to its clean reporting style, completeness, and ease of use. The `'/var/log/squid/access.log'` is the log that stores individual user web access and is most important for the purposes of this document.

1. Install the SARG rpm with the following command;

   ```
   rpm -ivh sarg-1.1-1.i386.rpm
   ```

2. Change to the configuration directory `'/etc/sarg'`. Edit the `sarg.conf` file.

3. The defaults can be accepted in most cases except where changes meet the specific requirements of an organization. A change to the default directory where

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squid reports are kept may be necessary to match the default html directory of the Apache server.

```
# TAG:  output_dir
#       Where is the reports will be stored.
#       sarg -o dir
#
#output_dir /usr/local/etc/httpd/htdocs/squid-reports
output_dir /var/www/html/squid-reports
```

4. To rotate the squid logs use the command:

   ```
   /usr/sbin/squid -k rotate
   ```

   This will generate a new log and rename the previous access.log (i.e. access.log.0)

5. The command to run a set of reports for a given access.log file is as follows.

   ```
   /usr/sbin/sarg -l /var/log/squid/access.log.0

   SARG: Successful report generated on /var/www/html/squid-
   reports/2001Nov19-2001Nov19
   ```

   The '-l' switch is the location of the input log that SARG will run a report against.

6. Once the reports are generated they are stored in the output directory specified in the `sarg.conf` file. The httpd and sarg directories need to be the same if remote access of the reports is desired[5]. A cron entry that rotates the logs then runs a sarg report against those logs is recommended.

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Analyzing SARG Reports

The report structure is simple and contains quite a bit of useful information. The initial page shows the dated report:

Squid User Access Report

FILE/PERIOD	CREATION DATE	USERS	BYTES	AVERAGE
2001Nov19-2001Nov19	Mon Nov 19 16:29:38 CST 2001	4	4.647.624	1.161.906

Generated by sarg-1.1.15Mar2001 on Nov19/2001 16:29

The report is simply organized with useful links. The primary page gives a concise listing of users who have utilized the proxy server as well as the time a user spent accessing the proxy and other relevant data.

Squid User Access Report
Period: 2001Nov19-2001Nov19
Sort: BYTES, reverse
Topuser Report

Topsites Report
Sites & Users Report

NUM		USERID	CONNECT	BYTES	%BYTES	IN-CACHE-OUT		USED TIME	MILISEC	%TIME
1	date/time	jdgregg	720	2.159.696	46.47%	7.14%	92.86%	00:04:18	258.724	43.20%
2	date/time	jdoe	399	1.372.438	29.53%	1.93%	98.07%	00:03:33	213.194	35.59%
3	date/time	bsmith	384	1.111.382	23.91%	1.73%	98.27%	00:02:07	127.031	21.21%
4	date/time	192.168.1.11	3	4.108	0.09%	100.00%	0.00%	00:00:00	6	0.00%
	TOTAL		**1.506**	**4.647.624**		**4.39%**	**95.61%**	**00:09:58**	**598.955**	
	AVERAGE		**376**	**1.161.906**				**00:02:29**	**149.738**	

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A drilldown into the html links in the report of a specific user gives an administrator an excellent view of web habits. For example a drilldown of user ***jdgregg*** shows web habits focused around sports themes that may or may not be condoned while at work:

Squid User Access Report

Period: 2001Nov19-2001Nov19
User: jdgregg
Sort: BYTES, reverse
User Report

ACCESSED SITE	CONNECT	BYTES	%BYTES	IN-CACHE-OUT		USED TIME	MILISEC	%TIME
www.clevelandbrowns.com	63	308.976	14.31%	0.00%	100.00%	00:00:26	26.174	10.12%
www.miamidolphins.com	40	214.990	9.95%	0.00%	100.00%	00:00:26	26.836	10.37%
www.buffalobills.com	111	204.621	9.47%	54.97%	45.03%	00:00:07	7.135	2.76%
www.bengals.com	48	175.482	8.13%	0.12%	99.88%	00:00:17	17.322	6.70%
www.colts.com	36	173.016	8.01%	0.12%	99.88%	00:00:15	15.702	6.07%
www.jaguars.com	45	159.508	7.39%	0.00%	100.00%	00:00:14	14.424	5.58%
games.espn.go.com	57	141.778	6.56%	0.00%	100.00%	00:00:21	21.160	8.18%
www.newyorkjets.com	23	138.804	6.43%	0.00%	100.00%	00:00:12	12.139	4.69%
sports.espn.go.com	2	79.366	3.67%	0.00%	100.00%	00:00:02	2.818	1.09%
www.burstnet.com	16	59.683	2.76%	1.40%	98.60%	00:00:04	4.199	1.62%
football.weblogs.com	1	54.163	2.51%	0.00%	100.00%	00:00:15	15.552	6.01%
www.itradecards.com	1	41.245	1.91%	0.00%	100.00%	00:00:01	1.408	0.54%
www.packers.com	2	38.699	1.79%	0.00%	100.00%	00:00:04	4.500	1.74%
www.tackls.com	5	38.249	1.77%	2.19%	97.81%	00:00:01	1.219	0.47%
www.geocities.com	48	37.256	1.73%	25.84%	74.16%	00:00:01	1.758	0.68%
bannerads.miamidolphins.com	3	36.942	1.71%	0.00%	100.00%	00:00:04	4.902	1.89%
www.e-jocks.com	3	33.378	1.55%	0.00%	100.00%	00:00:02	2.175	0.84%
www.youthfantasyfootball.com	1	25.885	1.20%	0.00%	100.00%	00:00:01	1.030	0.40%
static.userland.com	14	24.773	1.15%	0.00%	100.00%	00:00:03	3.929	1.52%
downloads.weblogger.com	17	17.884	0.83%	0.00%	100.00%	00:00:05	5.981	2.31%
ad.espn.starwave.com	4	16.252	0.75%	0.00%	100.00%	00:00:01	1.520	0.59%
www2.miamidolphins.com	13	16.100	0.75%	0.00%	100.00%	00:00:06	6.060	2.34%
www.krause.com	30	15.737	0.73%	100.00%	0.00%	00:00:00	301	0.12%
espn.go.com	6	13.543	0.63%	0.00%	100.00%	00:00:04	4.469	1.73%
proshop.bengals.com	1	11.575	0.54%	0.00%	100.00%	00:00:00	973	0.38%
www.zoneswap.com	3	9.281	0.43%	0.00%	100.00%	00:00:17	17.743	6.86%
www.nfl.com	6	7.593	0.35%	2.77%	97.23%	00:00:02	2.882	1.11%
www.toughguy.com	35	7.330	0.34%	100.00%	0.00%	00:00:00	320	0.12%
images.nfl.com	4	6.745	0.31%	9.30%	90.70%	00:00:00	360	0.14%
stats.hitbox.com	1	5.269	0.24%	0.00%	100.00%	00:00:01	1.320	0.51%

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Further drilldowns show other interesting and questionable web habits. User ***jdoe*** in particular is utilizing work hours accessing sites that could be deemed highly suspect and in some cases illegal or dangerous:

Squid User Access Report

Period: 2001Nov19-2001Nov19
User: jdoe
Sort: BYTES, reverse
User Report

ACCESSED SITE	CONNECT	BYTES	%BYTES	IN-CACHE-OUT		USED TIME	MILISEC	%TIME
www.casino.net	36	166.201	12.11%	0.00%	100.00%	00:00:20	20.938	9.82%
www2.warnerbros.com	18	151.887	11.07%	0.00%	100.00%	00:00:13	13.132	6.16%
www.penthouse.com	4	140.518	10.24%	0.00%	100.00%	00:00:04	4.871	2.28%
www.2600.com	21	126.263	9.20%	0.00%	100.00%	00:00:11	11.934	5.60%
genres.mp3.com	3	125.272	9.13%	0.00%	100.00%	00:00:04	4.600	2.16%
grfx.mp3.com	11	68.750	5.01%	0.00%	100.00%	00:00:11	11.833	5.55%
play.games.com	69	62.713	4.57%	22.90%	77.10%	00:00:02	2.141	1.00%
download.cnet.com	10	62.376	4.54%	0.00%	100.00%	00:00:09	9.778	4.59%
www.astalavista.com	13	57.587	4.20%	3.78%	96.22%	00:00:04	4.097	1.92%
www.mp3.com	12	51.377	3.74%	0.00%	100.00%	00:00:05	5.678	2.66%
img.napster.com	38	50.403	3.67%	0.00%	100.00%	00:00:15	15.517	7.28%
images.mp3.com	16	30.240	2.20%	0.00%	100.00%	00:00:14	14.734	6.91%
a.r.tv.com	9	28.600	2.08%	0.00%	100.00%	00:00:02	2.645	1.24%
www.icq.cracks.ru	13	27.819	2.03%	0.00%	100.00%	00:00:27	27.121	12.72%
www.napster.com	4	27.603	2.01%	0.00%	100.00%	00:00:02	2.366	1.11%
ad.pbs.bb.ru	6	27.280	1.99%	0.00%	100.00%	00:00:04	4.127	1.94%
login.mp3.com:443	6	20.928	1.52%	0.00%	100.00%	00:00:04	4.194	1.97%
www.cracks.ru	11	17.151	1.25%	5.06%	94.94%	00:00:19	19.896	9.33%
lc2.law5.hotmail.passport.com	2	15.930	1.16%	0.00%	100.00%	00:00:01	1.830	0.86%
www.anonymizer.org	35	15.634	1.14%	45.89%	54.11%	00:00:00	698	0.33%
ng3.ads.warnerbros.com	4	13.553	0.99%	0.00%	100.00%	00:00:02	2.388	1.12%
217.170.71.61	1	12.266	0.89%	0.00%	100.00%	00:00:00	976	0.46%
toolbar.netscape.com	9	10.504	0.77%	12.05%	87.95%	00:00:01	1.334	0.63%
m.doubleclick.net	1	9.692	0.71%	0.00%	100.00%	00:00:00	685	0.32%
www.playboy.com	2	6.958	0.51%	3.31%	96.69%	00:00:00	487	0.23%
mozg.hobot.ru	7	6.814	0.50%	3.08%	96.92%	00:00:06	6.061	2.84%
216.32.242.251	5	6.620	0.48%	0.00%	100.00%	00:00:02	2.031	0.95%
includes.mp3.com	3	6.542	0.48%	0.00%	100.00%	00:00:03	3.905	1.83%
www.wb.com	2	5.892	0.43%	0.00%	100.00%	00:00:00	652	0.31%
u118.35.spylog.com	2	3.711	0.27%	0.00%	100.00%	00:00:01	1.092	0.51%

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A look at user ***bsmith*** shows what may be deemed acceptable, expected web habits during working hours:

Squid User Access Report

Period: 2001Nov19-2001Nov19
User: bsmith
Sort: BYTES, reverse
User Report

ACCESSED SITE	CONNECT	BYTES	%BYTES	IN-CACHE-OUT		USED TIME	MILISEC	%TIME
www.netgear.com	65	185.166	16.66%	0.00%	100.00%	00:00:21	21.806	17.17%
www.netiq.com	55	163.842	14.74%	0.61%	99.39%	00:00:19	19.551	15.39%
www.foundrynetworks.com	29	147.318	13.26%	2.99%	97.01%	00:00:05	5.299	4.17%
www.redhat.com	41	128.577	11.57%	0.00%	100.00%	00:00:10	10.210	8.04%
www.be.com	32	114.321	10.29%	0.00%	100.00%	00:00:11	11.305	8.90%
www.snort.org	6	103.600	9.32%	0.00%	100.00%	00:00:12	12.763	10.05%
www.rsa.com	43	89.393	8.04%	0.00%	100.00%	00:00:14	14.767	11.62%
www.ibm.com	21	69.405	6.24%	0.00%	100.00%	00:00:06	6.245	4.92%
www.microsoft.com	21	55.833	5.02%	4.28%	95.72%	00:00:05	5.490	4.32%
www.cisco.com	24	24.702	2.22%	19.74%	80.26%	00:00:00	837	0.66%
m.doubleclick.net	1	7.405	0.67%	0.00%	100.00%	00:00:00	474	0.37%
cco-sj-1.cisco.com	1	5.825	0.52%	0.00%	100.00%	00:00:00	357	0.28%
www.sans.org	25	5.611	0.50%	90.25%	9.75%	00:00:00	582	0.46%
www.redhat.com:443	2	3.497	0.31%	0.00%	100.00%	00:00:02	2.783	2.19%
stats.klsoft.com	3	1.834	0.17%	0.00%	100.00%	00:00:01	1.016	0.80%
www.rpmfind.net.com	1	1.131	0.10%	0.00%	100.00%	00:00:00	109	0.09%
www.rpmfind.net	5	1.056	0.10%	100.00%	0.00%	00:00:00	106	0.08%
statse.webtrendslive.com	1	782	0.07%	0.00%	100.00%	00:00:00	841	0.66%
ng-prod1.cisco.com	2	581	0.05%	0.00%	100.00%	00:00:00	345	0.27%
c.microsoft.com	1	423	0.04%	0.00%	100.00%	00:00:00	336	0.26%
www.foundrynet.com	2	420	0.04%	100.00%	0.00%	00:00:00	9	0.01%
www.dotmumble.com	1	399	0.04%	0.00%	100.00%	00:00:00	345	0.27%
ad.doubleclick.net	1	261	0.02%	0.00%	100.00%	00:00:00	235	0.18%
sans.org	1	0	0.00%	0.00%	0.00%	00:00:11	11.220	8.83%

Finally, other informative reports are generated and accessible from the initial page. These include the Top 100 Visited Web sites and a Web Site to User correlation. These reports can be altered in the `sarg.conf` file to meet the needs of individual organizations.

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Conclusion

With the a little time and effort, a system administrator can utilize a Squid Proxy solution to monitor user web habits for little to no cost outside of the hardware expenses. This document only touches on some of the functionality that Squid and the other open source software discussed in this document can provide for an organization. Over time the solution presented here could grow into a geographically diverse design that provides transparent caching, third-party authentication, and a multi-tier caching hierarchy. The beauty is Squid, and the those that support it, will continue to meet the needs of the community that presents these challenges.

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1 Both proxy based firewalls as well as stateful inspection platforms have their positives and negatives and such a discussion is outside the scope of this paper. For the purposes of this document, CERT's definition of stateful inspection is utilized to differentiate between vendor discrepancies http://www.cert.org/security-improvement/practices/p053.html

2 This document will use Checkpoint's Firewall-1 product for discussing the stateful inspection URL logging limitations

3 Installing and hardening a Linux server falls outside of the scope of this document. For the purposes of this document `squid-2.4.STABLE1-6.i386` is used on a Red Hat Linux 7.2 distribution (Linux Kernel 2.4.7-10). Other distributions may require different squid daemons and setup of these Squid daemons could be different than the Squid 2.4 version described in this document. Apache version 1.3.20 was utilized for the purposes of this document.

4 The Squid rpm file automatically compiles the ncsa authenticator. Various other methods of authentication can be compiled and setup with Squid. More information can be found at http://www.squid-cache.org/related-software.html.

5 It is necessary to control access to these files as they may contain sensitive information.

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