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Bandwidth Management with the Squid Caching Proxy Server

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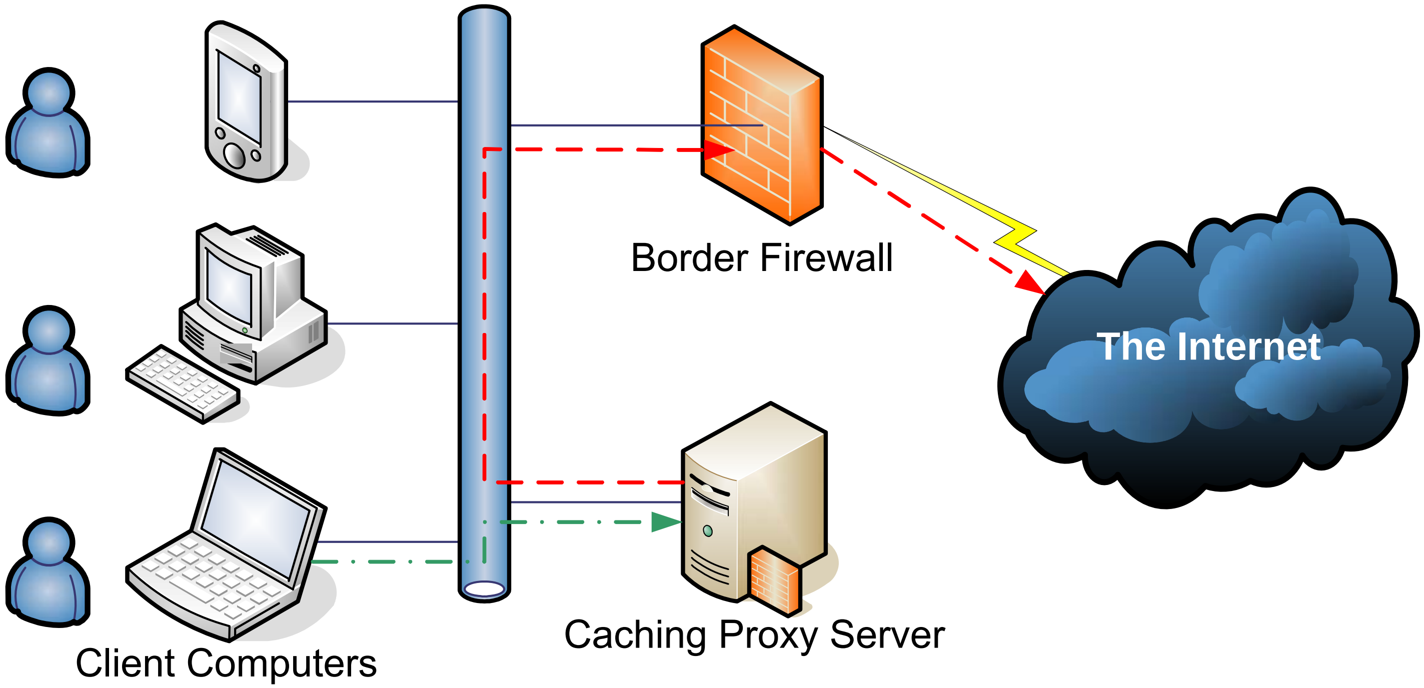
Quick Overview of Squid

- Squid is a caching proxy server.
- It’s the open-source equivalent of products like Novell’s BorderManager, Microsoft’s ISAS, and Cisco’s ACNS.
- You can download it for free at http://www.squid-cache.org/

How Squid Fits Into Your Network



Bandwidth Control Features in Squid

- Access Control Lists
- Redirectors
- Authenticators
- Delay Pools

We'll talk about each of these in turn, and then look at some examples that show how they can all fit together

Access Control Lists

- Traditionally used to define who can access what …

```
acl all src 0.0.0.0/0.0.0.0
acl RHODESIP src 146.231.0.0/16
acl RHODESDNS srcdomain .ru.ac.za
acl ACZADEST  dstdomain .ac.za

http_access deny all !RHODESIP !RHODESDNS
http_access allow ACZADEST
http_access deny all
```

Access Control Lists

- But in reality have a lot more flexibility

`acl ACLNAME` *`keyword`* where keyword is one of:

```
   arp
   srcdomain, dstdomain, src, dst
   time
   url_regex, url_path, urllogin, port, proto, method
   brower, referer_regex
   proxy_auth, proxy_auth_regex, ident, ident_regex
   src_as, dst_as
   req_mime_type, req_header, rep_mime_type, rep_header
   myip, myport
   external
```

Access Control Lists

- Which allows us to write rich rule sets to match our needs
- e.g. All student public labs are only allowed to access academic sites during working hours.

```
acl PUBLICLAB src 146.231.104.0/21
acl WORKHOURS time MTWTF 08:00-17:00
acl ACADEMIC dstdomain .ac.za .edu .ac.uk
http_access deny PUBLICLAB WORKHOURS !ACADEMIC
http_access allow PUBLICLAB
```

Redirectors

- Redirectors allow us to re-write URLs before we fetch them
- For instance, we could rewrite a popular site to a local mirror:

http://www.php.net/ → http://za2.php.net/

Redirectors

- Redirectors are simple programs and can be easily customised:

```
#!/usr/bin/perl -w
while (<STDIN>) {
       s{^http://www.php.net}{http://za2.php.net};
       print;
}
```

- And added to Squid:

```
redirect_program /usr/local/bin/myredirector
redirector_access allow all
```

Redirectors

- Redirectors are commonly used to block adverts on web pages.
- There are lots of open-source packages that do this, for example AdZapper (http://adzapper.sourceforge.net/)
- Advert blocking saves bandwidth but is controversial because many sites rely on advertising for revenue.

Redirectors

- Redirectors offer a lot of control over content

  BUT

- You can only have one redirector, so you have to think carefully what you want to do with it

Authenticators

- Authenticators are external programs that define how the `proxy_auth` ACL works.
- This lets you force your clients to supply a username and password before granting them access – good for public access computers.
- Like redirectors, you can only have one authenticator. That's not usually a problem though.

Authenticators

- Authenticators are also simple programs that read from STDIN and write to STDOUT.

```
guy@walrus:~% ./sampleauthenticator
guy notmypassword
ERR
ghalse mypassword
ERR
guy mypassword
OK
```

Authenticators

- Squid comes with a lot of authenticators out-the-box: smb, ldap, pam, unix, ntlm, yp/nis, etc.
- Perhaps the most useful of these is `pam_auth` which uses the pluggable authentication module architecture.
- PAM allows you to chain authenticators and use multiple authentication sources.

Delay Pools

- Delay pools are Squid’s answer to bandwidth management.
- They allow you to control the amount of bandwidth a particular computer, subnet or proxy server may use.

Delay Pools

- Delay Pools work like a bucket and a tap.
- You can empty the bucket as fast as you like, but it can only fill as fast as the tap will let it.
- So important variables are the size of the bucket and the rate at which it refills.

Pic: http://www.wildlife-art.co.nz/

Delay Pools

- Squid defines three types of buckets
  - aggregate

    an aggregate bucket applies to the whole proxy server
  - network

    a network bucket applies to the user’s class C network (/24, i.e. third octet of IP address).
  - individual

    an individual bucket applies to the user’s PC (i.e. the fourth octet of an IP address)

Delay Pools

- These buckets combine into three classes of delay pool:
  - Class 1

    has only an aggregate bucket
  - Class 2

    has an aggregate bucket and an individual bucket
  - Class 3

    has aggregate, network and individual buckets

Delay Pools

- For each bucket we define a restore rate (B/s) and a maximum size (B).

```
delay_pools 1
delay_class 1 2
delay_parameters 1 -1/-1 8000/8000 600/8000
```

- We use -1 to signify “unlimited”
- The maximum size is important as it specifies the burst bandwidth available – this can be used to penalize only certain types of download.

Delay Pools

- We use ACLs to define who gets put into which delay pools.
- e.g. All residence machines are subject to bandwidth controls

```
acl RESIDENCES src 146.231.136.0/20
acl all src 0.0.0.0/0

delay_pools 1
delay_class 1 2
delay_parameters 1 -1/-1 8000/8000 600/8000

delay_access 1 allow RESIDENCES
delay_access 1 deny all
```

Examples and Case Studies

Advert Blocking

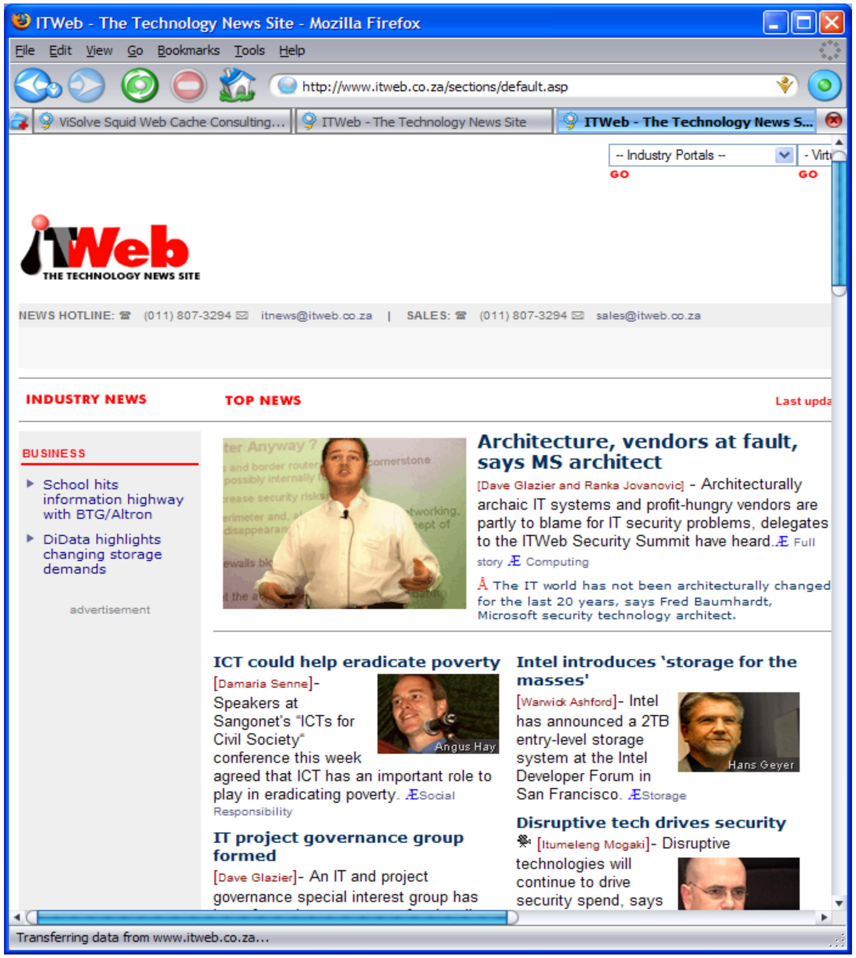
- Advert blocking saves bandwidth, but
- School of Journalism needs adverts to teach new media

```
http_port cache.ru.ac.za:3128
http_port adcache.ru.ac.za:3128

redirect_program /usr/local/bin/adzapper
acl ADCACHE myip adcache.ru.ac.za
redirector_access deny ADCACHE
redirector_access allow all
```

- Caches bind two IP addresses and only block adverts on one.
- Clients choose whether they want adverts or not.

Advert Blocking



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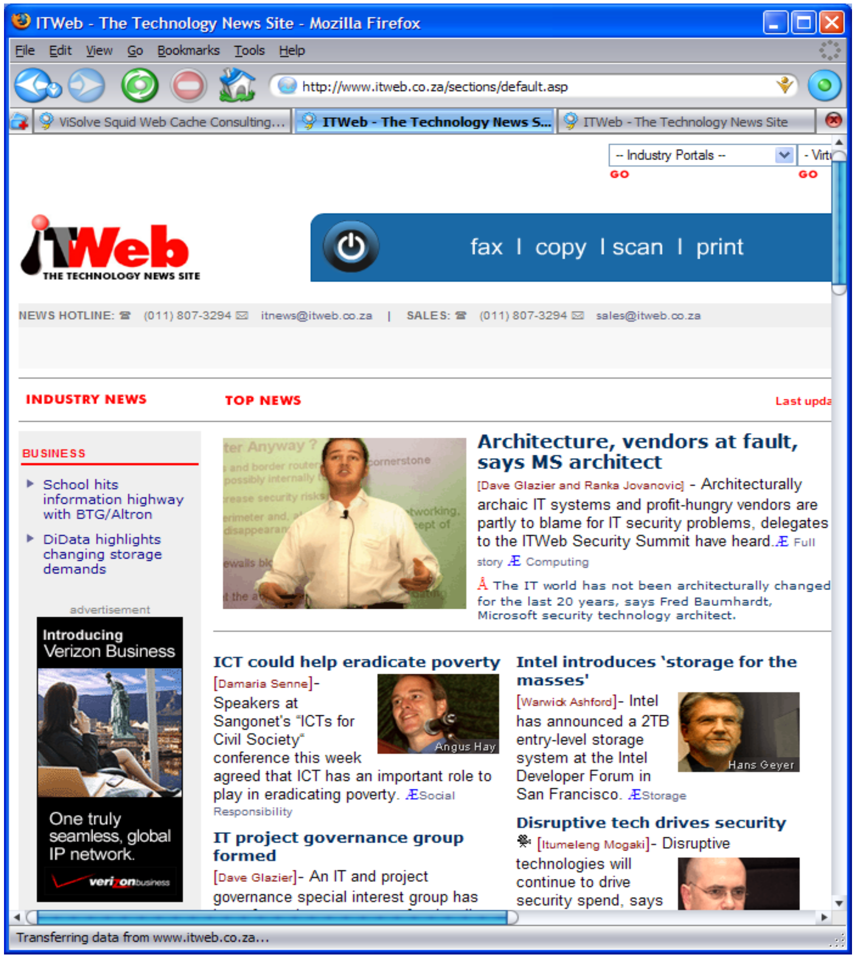

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adcache.ru.ac.za

Quota System @ Rhodes

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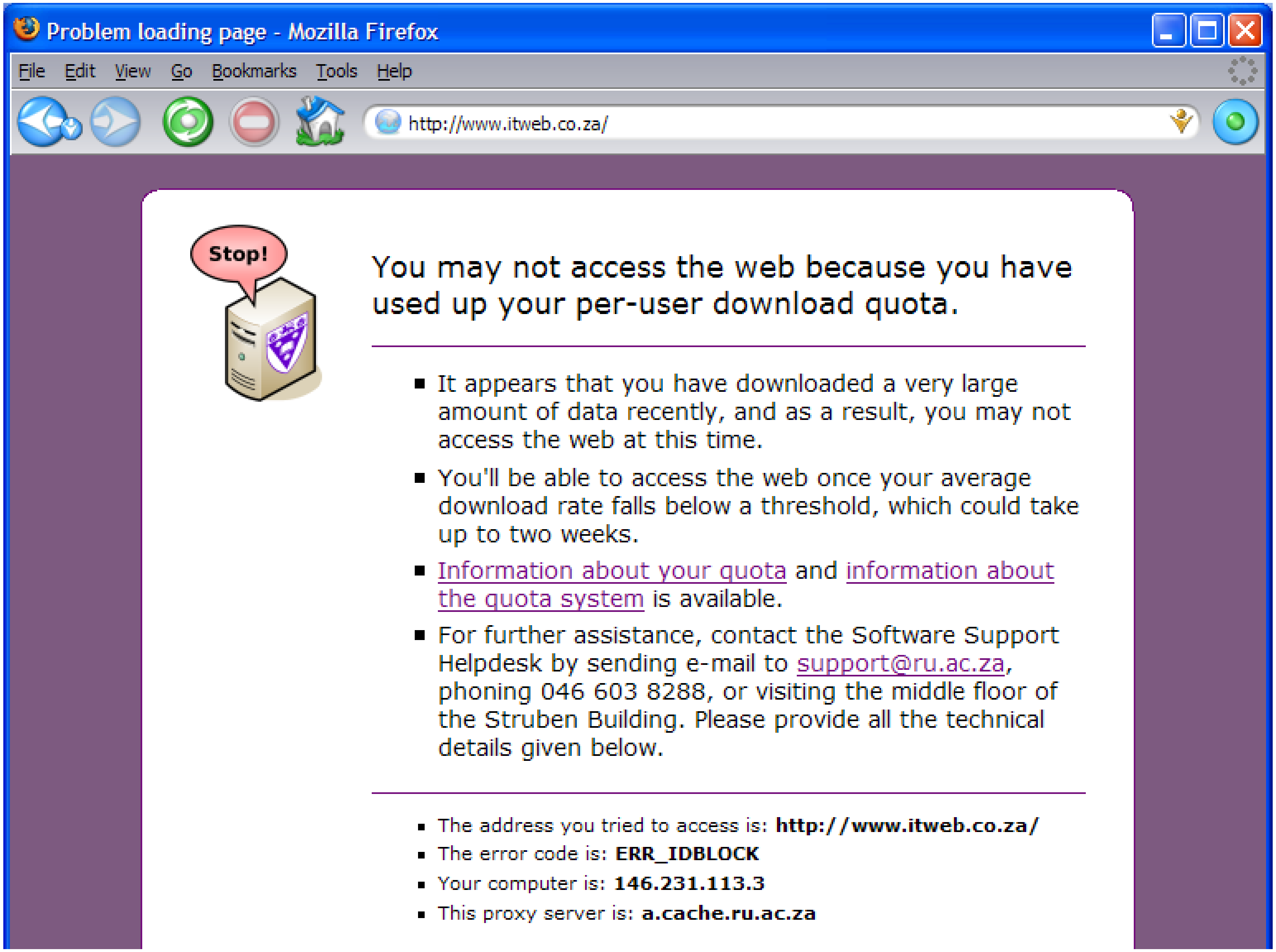
```
acl IDLOW        proxy_auth_regex -i "/idquotalow.acl"
acl IDHIGH       proxy_auth_regex -i "/idquotahigh.acl"
acl IDBLOCK      proxy_auth_regex –I "/squid/idquotablock.acl"
deny_info        ERR_IDBLOCK IDBLOCK

# SLOW = 0.5% * total PVC, rounded to nearest 0.5kBps
# V. SLOW = 0.5 * SLOW
delay_parameters 3 -1/-1 -1/-1 2560/20480
delay_parameters 4 -1/-1 -1/-1 1280/10240

# This MUST be the first rule that requests a username
http_access allow LOGIN !IDBLOCK !NOAUTH

# proxy auth based delay pools
delay_access    3 allow IDLOW
delay_access    3 deny all
delay_access    4 allow IDHIGH
delay_access    4 deny all
```

Quota System @ Rhodes


Problem loading page - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://www.itweb.co.za/
Stop!

You may not access the web because you have used up your per-user download quota.

- It appears that you have downloaded a very large amount of data recently, and as a result, you may not access the web at this time.
- You'll be able to access the web once your average download rate falls below a threshold, which could take up to two weeks.
- Information about your quota and information about the quota system is available.
- For further assistance, contact the Software Support Helpdesk by sending e-mail to support@ru.ac.za, phoning 046 603 8288, or visiting the middle floor of the Struben Building. Please provide all the technical details given below.

- The address you tried to access is: **http://www.itweb.co.za/**
- The error code is: **ERR_IDBLOCK**
- Your computer is: **146.231.113.3**
- This proxy server is: **a.cache.ru.ac.za**

Dynamic Delay Pools @ UKZN

- All TENET sites have bandwidth that's categorized into national/international traffic, and this is displayed on graphs at http://www.tenet.ac.za/
- The problem is how to make most efficient use of this bandwidth – how to allow users to download as fast as possible without impacting usability

This is the work of

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at the University of Kwazulu Natal.

Dynamic Delay Pools @ UKZN

Unauthenticated Requests

- One of the biggest bandwidth users these days is software updates. In particular, software that polls for updates every time it detects a network connection
- One way to keep some degree of control over this is to enable proxy authentication – to require a username and password to use the web.

Unauthenticated Requests

- The down side of this is that some software goes mad when it gets an HTTP 407 response. Software developers don’t implement incremental back-off algorithms.
- How do we let users know what’s going on?

Unauthenticated Requests

- Our solution forms part of the quota system you just heard about. It's just another quota.
- Users lose access when they've exceeded 1440 TCP_DENIED/407 messages a day, and regain it automatically when they drop below this.
- Just another file-based ACL list.