scripts.mit.edu

Quentin Smith
scripts@mit.edu

Student Information Processing Board

October 29, 2019

Outline

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Apache

- Everyone wants Apache
- Apache's default configuration isn't safe for scripting
- Scripting *requires* code execution—mod_php, mod_perl, mod_python, mod_wsgi
- Apache normally runs everything as apache/nobody
- How to secure?

Apache

- Everyone wants Apache
- Apache's default configuration isn't safe for scripting
- Scripting *requires* code execution—mod_php, mod_perl, mod_python, mod_wsgi
- Apache normally runs everything as apache/nobody
- How to secure?
- suEXEC—allows Apache to spawn a process as the user...
- ...even for static content!

suEXEC

- setuid program
- Passed the request by Apache
- Verifies that the script is in the `web_scripts` directory
- Switches to the uid of the file and executes
- Even for static files!

Postfix

- Standard Postfix server
- No local mailboxes
- All mail is passed to procmail

```
  mailbox_command = /usr/bin/procmail -t -p \
-a "${EXTENSION}" ~/mail_scripts/procmailrc
```

procmail

- Reads `~/mail_scripts/procmailrc` from user's home directory
- Users can do whatever they want with messages
- AFS causes problems—No way to know if failure is temporary (file server is down) or permanent (user isn't signed up for mail scripts)
- All procmail failures are treated as temporary, so mail is queued

Cron (cronie)

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- `cronload` command loads the crontabs from `~/cron_scripts/crontab`

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- Crontabs are currently stored locally on scripts servers
- `cronload` command loads the crontabs from `~/cron_scripts/crontab`
- Needs improvement
- Cron does not fail over with Web and Mail

sql.mit.edu

Though scripts.mit.edu makes use of sql.mit.edu, it's a separate SIPB service with different maintainers.

- sql.mit.edu provides MySQL databases to scripts users and anyone else
- SQL data is stored locally, replicated across multiple servers
- Nightly backups go into AFS

SVN and Git hosting

- Not well documented
- svn://*username*.scripts.mit.edu/ and git://*username*.scripts.mit.edu/
- Uses suEXEC to run a svnserve / git-daemon as the user
- /mit/*username*/Scripts/{svn,git}
- git:// is read-only, so future plans for svn+ssh:// and git+ssh://

Outline

AFS access controls

- AFS enforces server side access controls.
- On Athena systems: user's password → Kerberos tickets → AFS tokens, which authenticate the client to the AFS server.
- On scripts, we don't have the user's password or tickets.
- User's scripts are not publicly readable.
- Access is controlled through a single `daemon.scripts` AFS user.

Isolating users on scripts

- If all users share `daemon.scripts` AFS tokens, how are they prevented from accessing each other's `web_scripts`?
- On scripts, we enforce additional restrictions in the AFS kernel module.
  - `afsAccessOK()` in `openafs/src/afs/VNOPS/afs_vnop_access.c`

You can only use `daemon.scripts` credentials to access files in a volume with volume ID equal to your UID,

```
 int
 afs_AccessOK(struct vcache *avc, afs_int32 arights,
              struct vrequest *areq, afs_int32 check_mode_bits)
 {
     ...
+    if (!(areq->realuid == avc->fid.Fid.Volume) &&
+        !((avc->anyAccess | arights) == avc->anyAccess) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == HTTPD_UID) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == POSTFIX_UID) &&
+        !(arights == PRSFS_READ && areq->realuid == HTTPD_UID &&
+          avc->m.Mode == 0100777 || avc->apache_access) &&
+        !(PRSFS_USR2 == afs_GetAccessBits(avc, PRSFS_USR2, areq)) &&
+        !(PRSFS_USR3 == afs_GetAccessBits(avc, PRSFS_USR3, areq) &&
+          areq->realuid == 0) &&
+        !(PRSFS_USR4 == afs_GetAccessBits(avc, PRSFS_USR4, areq) &&
+          (areq->realuid == 0 || areq->realuid == SIGNUP_UID))) {
```

or the file is `system:anyuser` readable anyway,

```
 int
 afs_AccessOK(struct vcache *avc, afs_int32 arights,
              struct vrequest *areq, afs_int32 check_mode_bits)
 {
     ...
+    if (!(areq->realuid == avc->fid.Fid.Volume) &&
+        !((avc->anyAccess | arights) == avc->anyAccess) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == HTTPD_UID) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == POSTFIX_UID) &&
+        !(arights == PRSFS_READ && areq->realuid == HTTPD_UID &&
+          avc->m.Mode == 0100777 || avc->apache_access) &&
+        !(PRSFS_USR2 == afs_GetAccessBits(avc, PRSFS_USR2, areq)) &&
+        !(PRSFS_USR3 == afs_GetAccessBits(avc, PRSFS_USR3, areq) &&
+          areq->realuid == 0) &&
+        !(PRSFS_USR4 == afs_GetAccessBits(avc, PRSFS_USR4, areq) &&
+          (areq->realuid == 0 || areq->realuid == SIGNUP_UID))) {
```

or the apache or postfix users are doing a stat(),

```
 int
 afs_AccessOK(struct vcache *avc, afs_int32 arights,
              struct vrequest *areq, afs_int32 check_mode_bits)
 {
     ...
+    if (!(areq->realuid == avc->fid.Fid.Volume) &&
+        !((avc->anyAccess | arights) == avc->anyAccess) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == HTTPD_UID) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == POSTFIX_UID) &&
+        !(arights == PRSFS_READ && areq->realuid == HTTPD_UID &&
+          avc->m.Mode == 0100777 || avc->apache_access) &&
+        !(PRSFS_USR2 == afs_GetAccessBits(avc, PRSFS_USR2, areq)) &&
+        !(PRSFS_USR3 == afs_GetAccessBits(avc, PRSFS_USR3, areq) &&
+          areq->realuid == 0) &&
+        !(PRSFS_USR4 == afs_GetAccessBits(avc, PRSFS_USR4, areq) &&
+          (areq->realuid == 0 || areq->realuid == SIGNUP_UID))) {
```

or apache is trying to read a file with mode 777 or named ".ht*",

```
 int
 afs_AccessOK(struct vcache *avc, afs_int32 arights,
              struct vrequest *areq, afs_int32 check_mode_bits)
 {
     ...
+    if (!(areq->realuid == avc->fid.Fid.Volume) &&
+        !((avc->anyAccess | arights) == avc->anyAccess) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == HTTPD_UID) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == POSTFIX_UID) &&
+        !(arights == PRSFS_READ && areq->realuid == HTTPD_UID &&
+          avc->m.Mode == 0100777 || avc->apache_access) &&
+        !(PRSFS_USR2 == afs_GetAccessBits(avc, PRSFS_USR2, areq)) &&
+        !(PRSFS_USR3 == afs_GetAccessBits(avc, PRSFS_USR3, areq) &&
+          areq->realuid == 0) &&
+        !(PRSFS_USR4 == afs_GetAccessBits(avc, PRSFS_USR4, areq) &&
+          (areq->realuid == 0 || areq->realuid == SIGNUP_UID))) {
```

or the `root` or `signup` users are accessing file with the special `C`, `D`, or `E` bits.

```
 int
 afs_AccessOK(struct vcache *avc, afs_int32 arights,
              struct vrequest *areq, afs_int32 check_mode_bits)
 {
     ...
+    if (!(areq->realuid == avc->fid.Fid.Volume) &&
+        !((avc->anyAccess | arights) == avc->anyAccess) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == HTTPD_UID) &&
+        !(arights == PRSFS_LOOKUP && areq->realuid == POSTFIX_UID) &&
+        !(arights == PRSFS_READ && areq->realuid == HTTPD_UID &&
+          avc->m.Mode == 0100777 || avc->apache_access) &&
+        !(PRSFS_USR2 == afs_GetAccessBits(avc, PRSFS_USR2, areq)) &&
+        !(PRSFS_USR3 == afs_GetAccessBits(avc, PRSFS_USR3, areq) &&
+          areq->realuid == 0) &&
+        !(PRSFS_USR4 == afs_GetAccessBits(avc, PRSFS_USR4, areq) &&
+          (areq->realuid == 0 || areq->realuid == SIGNUP_UID))) {
```

Serving static content

- The `apache` user does not have permission to read the user's files directly.
- Both static and dynamic content is served through suEXEC.

1. `/etc/httpd/conf.d/execsys.conf` is configured to serve static content with the `cgi-script` handler.

```
<FilesMatch ‘‘(?i)\.(cgi|exe|php|pl|py|scm)$’’>
        SetHandler cgi-script
        Options +ExecCGI
</FilesMatch>
<FilesMatch ‘‘(?i)\.(avi|css|doc|docm|docx|...|zip)$’’>
        SetHandler cgi-script
        Options +ExecCGI
</FilesMatch>
...
```

3. httpd/support/suexec.c is modified to dispatch static content to /usr/local/bin/static-cat.

```
+#define STATIC_CAT_PATH "/usr/bin/static-cat"
+static const char *static_extensions[] = {
+    "html",
+    "css",
+    ...
+}
+
 int main(int argc, char *argv[])
 { ...
+
+    if (is_static_extension(cmd)) {
+        if (setenv("PATH_TRANSLATED", cmd, 1) != 0) {
+            log_err("setenv failed\n");
+            exit(255);
+        }
+        execl(STATIC_CAT_PATH, STATIC_CAT_PATH, (const char *)NULL);
```


HAGER

Group locker support

- “Users” on scripts are actually lockers.
- User IDs are actually locker volume IDs.

Group locker support

- "Users" on scripts are actually lockers.
- User IDs are actually locker volume IDs.
- Kerberos is modified to let users SSH in as any locker they administrate.
  - Replaced the `.k5login` mechanism: `krb5_kuserok()` in `krb5/src/lib/krb5/os/kuserok.c`
  - Calls a Perl script `/usr/local/sbin/admof` to do the actual check.

```
 krb5_boolean KRB5_CALLCONV
 krb5_kuserok(krb5_context context, krb5_principal principal,
              const char *luser)
 {
      ...
+     if ((pid = fork()) == -1)
+        goto cleanup;
+     if (pid == 0) {
+#define ADMOF_PATH "/usr/local/sbin/ssh-admof"
+         exec(ADMOF_PATH, ADMOF_PATH, (char *) luser, princname, NULL);
+         exit(1);
+     }
+     if (waitpid(pid, &status, 0) > 0 && WIFEXITED(status) &&
+         WEXITSTATUS(status) == 33) {
+         result = ACCEPT;
+     }
      ...
 }
```

LDAP architecture

- All user-specific information is stored in LDAP records
- `scripts-ldap-1` through `scripts-ldap-3` run LDAP daemons with multi-master replication
- Each realserver runs a read-only local caching LDAP daemon

LDAP data

- Each user has a `scriptsAccount` and at least one `scriptsVhost`
- Users can request additional virtual hosts using "pony"
- scriptsAccount is consulted by Postfix for mail routing (so accounts can be blocked)
- scriptsVhost is consulted by a cron job for SSL certificates

Apache modules

- We make it easy to do authentication against MIT certificates.
- Both `https://scripts-cert.mit.edu`, and port `444` on any scripts hostname, are configured to request client certificates.
- `mod_ssl` provides the `SSL_CLIENT_S_DN_Email` environment variable, but does not integrate with the Apache authentication and authorization framework.
- Wrote a collection of Apache modules to make this cleaner.

mod_auth_sslcert

- mod_auth_sslcert passes the SSL_CLIENT_S_DN_Email variable to the Apache authorization handlers.

```
AuthType SSLCert
AuthSSLCertVar SSL_CLIENT_S_DN_Email
AuthSSLCertStripSuffix "@MIT.EDU"
```

mod_authz_afsgroup

- mod_authz_afsgroup does Apache authorization based on AFS groups.

```
Require afsgroup system:scripts-team
```

mod_auth_optional

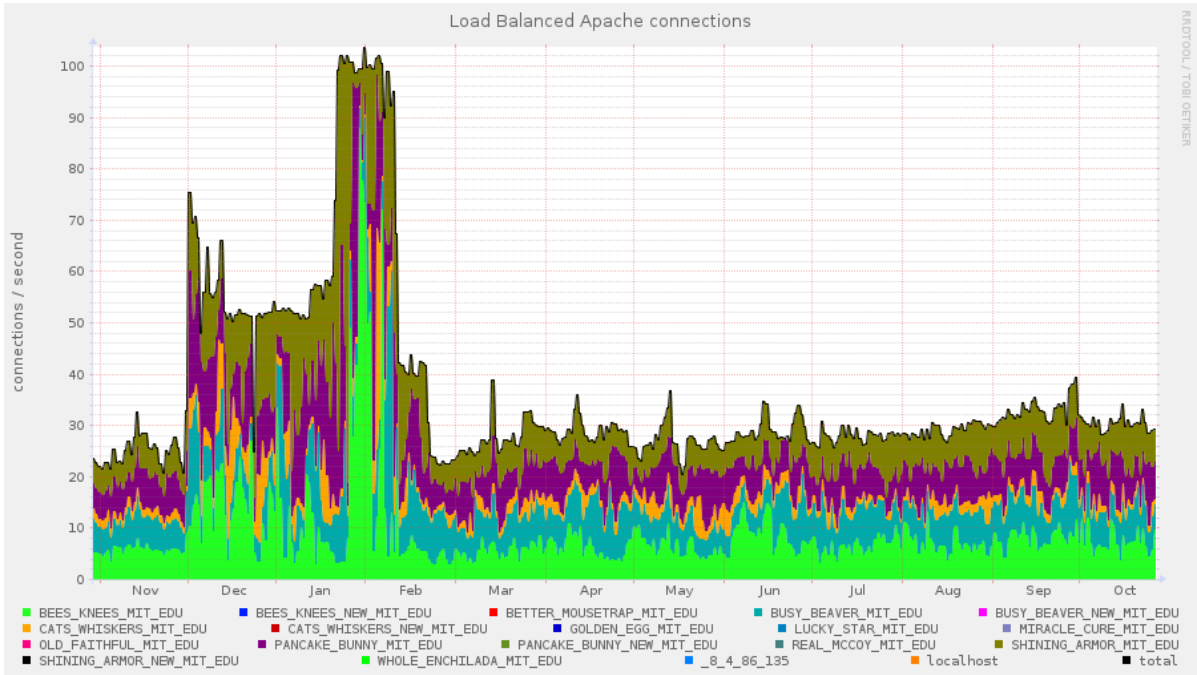
- mod_auth_optional subverts the authorization process to allow you to serve different pages to users with certificates and users without certificates.

Linux Virtual Server

- Provides high availability and load balancing
- `Pacemaker` provides failover between LVS "directors"
- `ldirectord` keeps track of online scripts servers and chooses destination server for each request

Load Balancing

- Users are assigned to scripts servers based on IP
- Works around bugs in scripts that assume a single web server



Load Balancing status

- `http://scripts.mit.edu:78/` shows the current load
- Or you can `finger @scripts.mit.edu` for more detail

```
$ finger @scripts
[scripts.mit.edu]
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
  -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
FWM  1 wrr
  -> CATS-WHISKERS.MIT.EDU:0      Route   1      13         6
FWM  2 wlc persistent 600
  -> SHINING-ARMOR.MIT.EDU:0      Route   4096   53         855
  -> BEES-KNEES.MIT.EDU:0         Route   4096   50         2140
  -> CATS-WHISKERS.MIT.EDU:0      Route   1024   17         53
  -> BUSY-BEAVER.MIT.EDU:0        Route   4096   54         641
  -> PANCAKE-BUNNY.MIT.EDU:0      Route   4096   52         1039
FWM  3 wlc persistent 600
  -> SHINING-ARMOR.MIT.EDU:25     Route   4096   0          0
  -> BEES-KNEES.MIT.EDU:25        Route   4096   0          1
  -> CATS-WHISKERS.MIT.EDU:25     Route   1024   0          1
  -> BUSY-BEAVER.MIT.EDU:25       Route   4096   0          1
  -> PANCAKE-BUNNY.MIT.EDU:25     Route   4096   0          2
```

Configuration Management

- Ansible is a tool for declarative configuration management
- We can install LVS, syslog, and real servers using Ansible
- Server configuration is modular, so each feature can be separately developed
- Hopefully will make future version upgrades easier

Example Role - real-fuse

```
- name: Install fuse.conf
  copy:
    dest: /etc/fuse.conf
    content: |
      user_allow_other
- name: Load fuse kernel module
  copy:
    dest: /etc/modules-load.d/fuse.conf
    content: |
      fuse
  notify: load modules
- name: Immediately load new modules
  meta: flush_handlers
```

Outline

Further Info

- Trac: `https://scripts.mit.edu/trac/wiki/StarterTickets`
- GitHub: `https://github.com/mit-scripts/`
- Zephyr: `-c scripts` (`http://sipb.mit.edu/doc/zephyr/`)
- These slides: `https://web.mit.edu/scripts/doc/cluedump/slides.pdf`