Puppet for Developers
-
“Intermediate” SOE

That other talk

- Setup an SOE based on:
  - Repo Server with Kickstart; and
  - Puppetmaster;
- Write some modules for every day things:
  - files, users, some templates, etc;
  - very simple fact;
- Discouragement of using define to create types.

This talk

- Leveraging existing SOE to help other teams;
- Puppet to assist in deployment and maintenance of developing/evolving projects;
- Manage "complex" Puppet installations;
- Creating a real fact;
- Leverage Puppet's programming features;
- Encouragement to use define for custom types.

Leveraging the existing SOE

- The SOE should allow quickly deployment of alike systems that meet a set specification.
- Others in organisation can benefit from access.
- Best to offer before "others" re-invent wheel.

Reuse, replicate and expand

- Kickstart environment:
  - build to closely matches yours;
  - but not so close that it restricts.
- Puppetmaster:
  - use environments; and
  - be involved in the evolution to production

The "Others"

- Primary focus is working with "Developers";
- Differ from most clients:
  - more than a handful of scripts;
  - not just a few service configuration;
  - not just one canned application;
  - bring own (custom) application(s) that need to integrate with the OS.

Help them!

- Developers are not System Administrators:
  - Trust system defaults:
    - Consistent UID / GID; and
    - Security (DAC) is optional or random;
      - Anything more serious (e.g.: SELinux and firewalls) are restrictive and thus disabled.
- SOE probably has preferences or policies.
- Changing their assumed settings late may break their work.

Assisting developing projects

- "Standard" Puppet is geared to make System Administrator work easier, right now;
- "Complex" Puppet is about making everyone's life a little harder (use puppet = change), with a longterm payoff.
- It will pay off: this is standardising how to deploy custom applications to SOE hosts;
- Results in "appliances".

“Standard” Puppet

- Puppet can easily manage:
  - servers that have a defined role;
  - adjustments to that role.
- ... and just as easily many different roles.
- Puppet maintains; it does not automatically evolve servers / projects.

“Complex” Puppet

- Supporting projects that are still evolving.
- Currently favours very dynamic practices.
- Virtual hosts can be rapidly:
  - modified;
  - multiplied;
  - torn down and
  - rebuilt.

Developers' needs

- Multiple stages or classes of hosts;
- The ability to rapidly test new builds;
- Progress builds from test through to production;

- Make things work.

Sys Admins' needs

- Hosts and services to keep running;
- Servers that can be maintained with confidence;
- Less people to have root access.

- Everything to keep running, no matter what.

These clearly conflict

- In short:
  - Developers need hosts that are flexible;
  - Sys Admins need hosts that are predictable.

Classes of hosts

- **testing -** anything goes, managed by "others";
- **development -** "manything" goes, used for dev work. Not mission critical...
  - ... though sometimes part of the DR strategy.
- **production -** hands off.

define “testing”

- Desktop VMs;
- Proof of concept;
- very disposable;
- internal use only;
- “not your problem”;

simplified kickstart

- Using the production kickstart environment is usually not simple:
  - Restricted access;
  - Limited customisation;
  - Not something responsive to individual needs.
- Thus, build a cut down kickstart system.

SOE-like Desktop VMs

- Ideally uses the same:
  - partitioning;
  - base packages; and
  - repositories;
- But might use:
  - DHCP rather than fixed IP;
  - (possibly) reduced security settings;
  - (possibly) local users only;

These are for them

- Remember everyone's expertise:
  - Developers' deliverables will need to work on production hosts one day.
  - Communicate and work together.

Our solution: differences

- kickstart via url (rather than ISO);
- mostly identical ks.cfg but uses php;
- relies on DHCP rather than fixed IP and hostname.

Our SOE-like Desktop VMs

- same partitioning, base packages and repos;
- uses LDAP for authentication;
  - service users are always local;
- optional iptables and SELinux (as in production);
- some disabled SOE Puppet modules;
  - own Puppet modules sub-tree;
- on-host network with PFsense, DHCP and NAT.

KS via http

- Requires:
  - PHP installed (on the repo server);
  - CentOS 6.2 netinstall ISO (on target desktop);
  - ks.cfg which is copied to somewhere httpd can serve it and named index.php
- remember to restart httpd after installing php.

index.php ... part 1

```
<?php
$hostname = $_GET['hostname'];
?>
install
#url --url http://192.168.1.5/mrepo/rhel6-server-x86_64/
url --url http://192.168.1.5/mrepo/CentOS6-x86_64/disc1
key --skip
lang en_US.UTF-8
keyboard us

network --device eth0 --bootproto dhcp --hostname <?php echo $hostname .
PHP_EOL ?>

# password is kickstart
rootpw --iscrypted $1$5YF630$HDlrn.VYFUvtPVwHDmdun0
firewall --enabled --port=22:tcp
authconfig --enableshadow --enablemd5
selinux --enforcing
timezone Australia/Brisbane
```

index.php ... part 2

```
bootloader --location=mbr --driveorder=sda --append=" rhgb crashkernel=auto
quiet"
clearpart --all --initlabel --drives=sda

part /boot --fstype ext4 --fsoptions "defaults,strictatime" --size=128 --
ondisk=sda
part pv.1 --size=100 --grow --ondisk=sda
volgroup VolGroup00 --pesize=32768 pv.1
logvol / --fstype ext4 --fsoptions "defaults,strictatime" --name=LogVol_root
--vgname=VolGroup00 --size=2048
logvol /usr --fstype ext4 --fsoptions "defaults,strictatime" --
name=LogVol_usr --vgname=VolGroup00 --size=3072
logvol /home --fstype ext4 --fsoptions "defaults,strictatime" --
name=LogVol_home --vgname=VolGroup00 --size=1024
logvol /var --fstype ext4 --fsoptions "defaults,strictatime" --
name=LogVol_var --vgname=VolGroup00 --size=100 --grow
```

index.php ... part 3

```
%packages
@Base
@Core
-NetworkManager
-NetworkManager-glib
-arts
%end

%post --nochroot
mkdir /mnt/sysimage/mnt/dvd
mkdir /mnt/sysimage/mnt/nfs
mkdir /mnt/sysimage/mnt/samba

%post
## Setup /opt
mkdir /var/root-opt  ; chmod 755 /var/root-opt
mkdir /opt           ; chmod 755 /opt
echo "/var/root-opt          /opt      none       bind" >> /etc/fstab
/bin/mount /opt

## Setup /tmp
mkdir /var/root-tmp  ; chmod 1777 /var/root-tmp
rm -fr /tmp          ; mkdir /tmp                ; chmod 1777 /tmp
echo "/var/root-tmp         /tmp        none        bind" >> /etc/fstab
/bin/mount /tmp
```

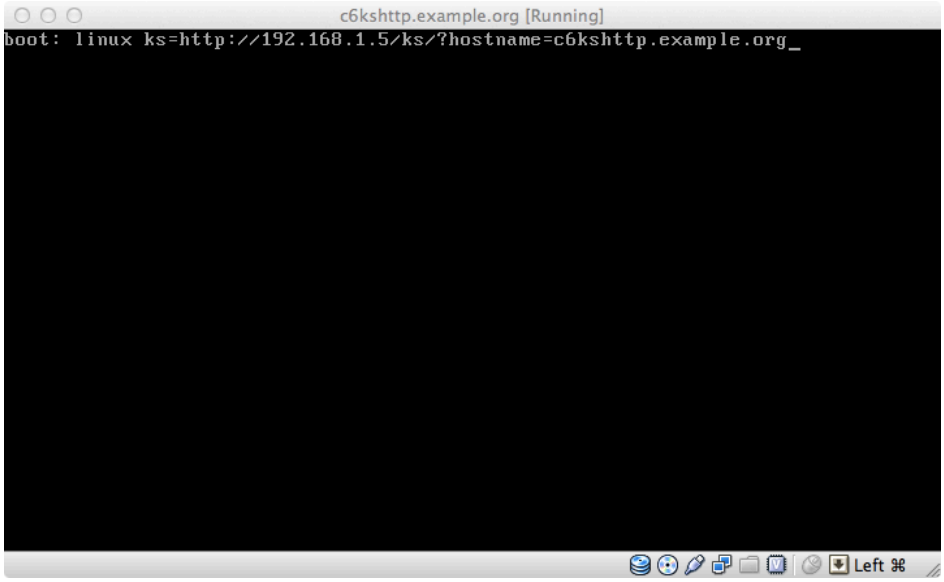
index.php ... part 4

```
# install repo releases (keys and repo files)
rpm -i http://192.168.1.5/mrepo/CentOS6-x86_64/RPMS.epel-x86_64/epel-
release-6-5.noarch.rpm
rpm -i http://192.168.1.5/mrepo/puppetlabs/puppetlabs-products/puppetlabs-
release-6-1.noarch.rpm

# disable repofiles
for repos in `ls /etc/yum.repos.d/` ; do > /etc/yum.repos.d/$repos ; done
chattr +i /etc/yum.repos.d/*repo

# get local configuration
wget http://192.168.1.5/local_repo/LocalMirror.repo -O /etc/yum.repos.d/
LocalMirror.repo
wget http://192.168.1.5/hosts/hosts -O /etc/hosts
wget http://192.168.1.5/resolv_conf/resolv.conf -O /etc/resolv.conf

# install puppet
yum clean all
yum clean metadata
yum install puppet -y

wget http://192.168.1.5/puppet/puppet.conf -O /etc/puppet/puppet.conf

echo "127.0.0.1  <?php echo $hostname . PHP_EOL ?>" >> /etc/hosts

# grub-install fails consistently
grub-install /dev/sda
```

network install - escape

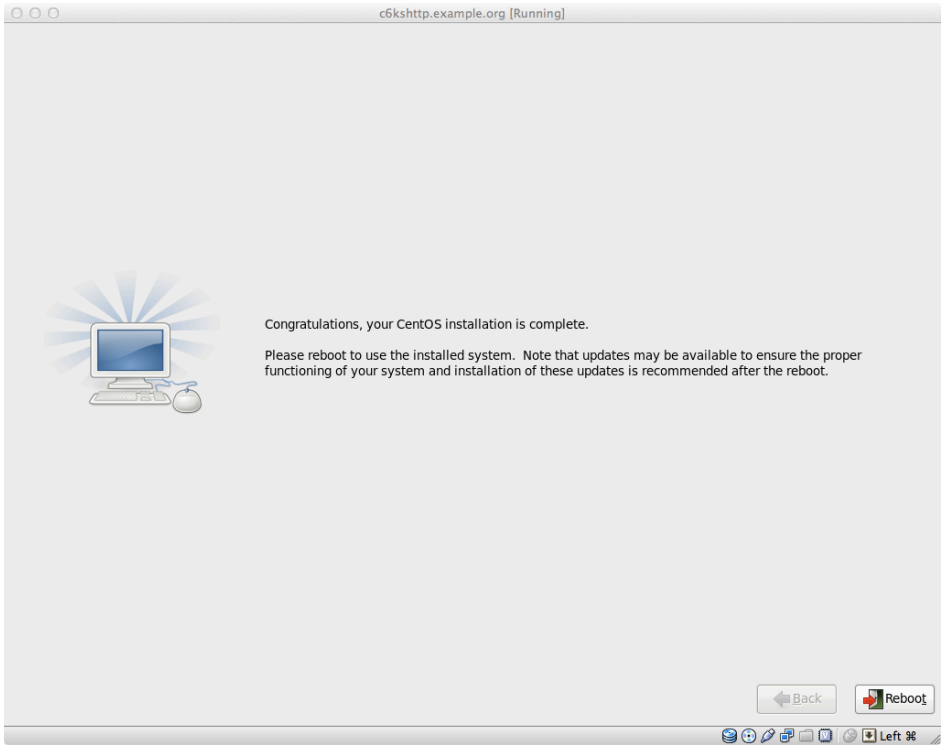
press “ESC”

network install - set ks.cfg



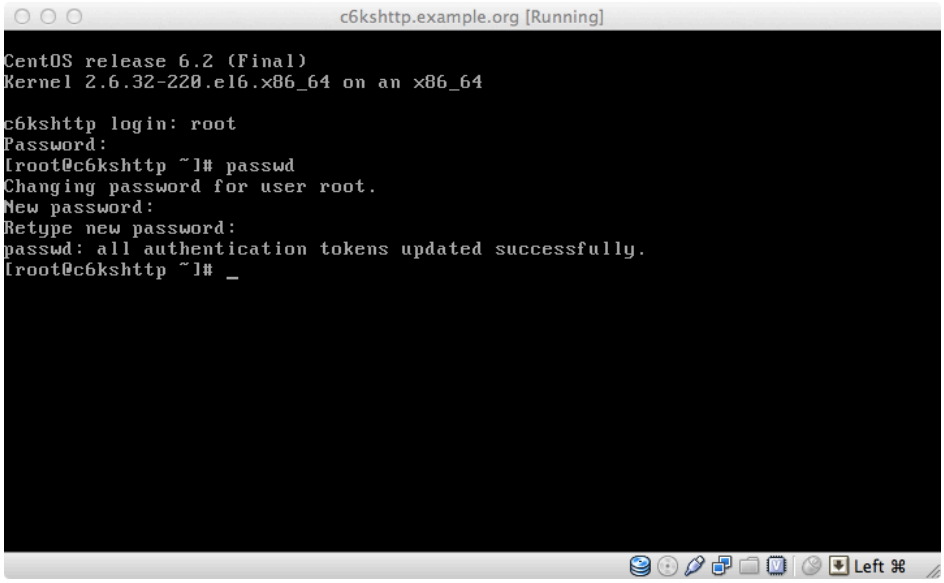
linux ks=http://<server>/<path>/?hostname=<hostname>

network install - finishing



remove disk and reboot.

network install - password



Encourage the user to change the root password.

Your solution

- glossed over networking;
  - or at least our DHCP / DNS management.
- (local) cloud with automatic provisioning;
- centrally hosted, full SOE;
- ... lots of options.

now back to the good part

- Manage "Complex" Puppet installations;
  - example server / service layout;
  - environments;
  - hazardous changes;
    - file overrides;
  - swapping Puppetmasters;
- a real example fact;
- programming in Puppet.

"Complex" Puppet

- Puppet can not solve the conflict between Sys Admins and their clients on its own;
- Communication and co-operation are key (in production AND on the road there).
- In testing and development, isolation can go a long way ...
  - but the closer to production the more involved other team members and teams need to be.

Assumptions

- Developers:
  - administer VMs on their desktop;
  - tweak development instances of their software on production hosts, possibly even have root access; but
  - do not (generally) touch production instances of their software;

Assumptions ... continued

- There needs to be a code repository;
- The developers should probably be the code repository administrators;
- The repository should be accessible from every host the developers work on.

Before we begin

- Node configurations are essential, irrespective of which of the following options will be implemented.
- Doing away with node files that make a (group of) server(s) unique is unlikely to be beneficial.
  - Easy to retrofit (see slides about migrating Puppetmasters).

Node configurations

- Node configurations are not enough to separate projects being actively managed with Puppet:
  - There is a risk of contaminating unrelated hosts because projects will need reusable modules;
  - Node files no longer affects unlisted hosts.
- Developers should be involved in tuning theirs hosts' node configurations;
  - ... but this is a Sys Admin area of expertise.

Working with Puppets

- Physically separate Puppetmasters:
  - Pro: others can have access to their own Puppetmaster instance;
  - Pro: little chance of cross contamination;
  - Con: more painful to migrate Puppet configuration from test through to production;
  - Con: if you lose a Puppetmaster, remaining can not "just" take over;

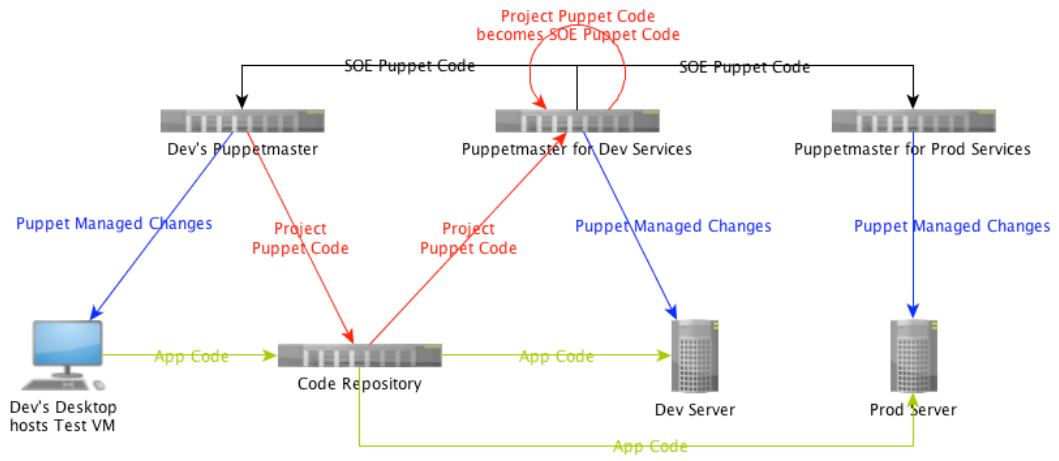
Shared Custody Puppets

- Same Puppetmaster, different "environments":
  - Pro: cheaper;
  - Pro: reasonably simple to maintain (to a point);
  - Con: best administered by a Puppet expert;
  - Con: reduces flexibility in maintaining the SOE;
  - Con: access to select files by select people;
  - Con: ...what is your Puppet DR strategy?

The best of both worlds

- Multiple hosts with multiple environments:
  - Pro: SOE system stays clean;
  - Pro: Easy to migrate changes;
  - Pro: Modules from one stage are unlikely to contaminate another stage;
  - Pro: if you lose a Puppetmaster any of the remaining can take over with a little tweaking;
  - Con: possible extra costs / definitely requires more resources;

The best of both worlds



The key is this:
Project Puppet Code becomes SOE Puppet Code.

Environments

- Ideally someone audits Puppet code before it becomes SOE / Production.
- Since code is in two filesystem locations any host can talk to the same Puppetmaster;
  - Preferably only in a DR situation.
- Requires environments and node files.
- "Environment" is a Puppet Agent (client) setting which allows deviation / override from standard configuration.

why won't this contaminate?

- Node files identify the hosts, and sets environment by affecting the client's puppet.conf;
- The puppet.conf sets environment and thus includes additional module path; and
- Module path contains different stages (on different Puppetmasters) of the project Puppet code;

better than just environments

- If anything breaks it will not impact:
  - other groups' projects;
  - other hosts at different stages;
  - when people get to go home;
    - especially the expert who has to make N systems not have a fault;
    - ...even though Puppet is not a critical service!
  - test hosts should not be (as) monitored.

Puppetmaster's puppet.conf

```
[main]
    logdir = /var/log/puppet
    rundir = /var/run/puppet
    ssldir = $vardir/ssl

[agent]
    classfile = $vardir/classes.txt
    localconfig = $vardir/localconfig

[development]
     modulepath = /etc/puppet/modules:/opt/dev/puppet-modules

[testing]
     modulepath = /etc/puppet/modules:/opt/test/puppet-modules
```

node files

- Sample test node file (used real life):

```
node /\.vm.test$/ {
   $puppetd_environment = "testing"

   include defaultnode
   include control
}
```

- what I used in testing:

```
node "c6pagent.example.org" {
   $puppetd_environment = "testing"

   include defaultnode
   include control
}
```

puppet.conf.erb

```
  [main]
      logdir = /var/log/puppet
      rundir = /var/run/puppet
      ssldir = $vardir/ssl
      pluginsync = true

  [agent]
      classfile = $vardir/classes.txt
      localconfig = $vardir/localconfig
      server = c6pmaster.example.org
      splay = true
      runinterval = 1800
      environment = <%= puppetd_environment %>
```

- deploy to puppet_conf/templates/puppet.conf.erb

new puppet_conf module

```
class puppet_conf {
    file { "/etc/puppet/puppet.conf":
        owner   => root,
        group   => 0,
        mode    => 644,
        content => template("puppet_conf/puppet.conf.erb"),
        notify  => Service["puppet"];
    }

    service { "puppet":
        name    => $operatingsystem ? {
            darwin  => "com.reductivelabs.puppet",
            default => "puppet",
        },
        ensure  => running,
        enable  => true;
    }
}
```

SELinux

```
[root@c6pmaster ~]# semanage fcontext -a -t puppet_etc_t /opt/dev/puppet-modules
\(/.*\)?
[root@c6pmaster ~]# semanage fcontext -a -t puppet_etc_t /opt/test/puppet-
modules\(/.*\)?
[root@c6pmaster ~]# semanage fcontext -a -t puppet_etc_t /var/root-opt/dev/
puppet-modules\(/.*\)?
[root@c6pmaster ~]# semanage fcontext -a -t puppet_etc_t /var/root-opt/test/
puppet-modules\(/.*\)?
[root@c6pmaster ~]# restorecon -Rv /opt/*/puppet*
restorecon reset /opt/dev/puppet-modules context unconfined_u:object_r:usr_t:s0-
>unconfined_u:object_r:puppet_etc_t:s0
restorecon reset /opt/test/puppet-modules context
unconfined_u:object_r:usr_t:s0->unconfined_u:object_r:puppet_etc_t:s0
restorecon reset /opt/test/puppet-modules/control context
unconfined_u:object_r:usr_t:s0->unconfined_u:object_r:puppet_etc_t:s0
restorecon reset /opt/test/puppet-modules/control/templates context
unconfined_u:object_r:usr_t:s0->unconfined_u:object_r:puppet_etc_t:s0
restorecon reset /opt/test/puppet-modules/control/files context
unconfined_u:object_r:usr_t:s0->unconfined_u:object_r:puppet_etc_t:s0
restorecon reset /opt/test/puppet-modules/control/manifests context
unconfined_u:object_r:usr_t:s0->unconfined_u:object_r:puppet_etc_t:s0
restorecon reset /opt/test/puppet-modules/control/manifests/init.pp context
unconfined_u:object_r:usr_t:s0->unconfined_u:object_r:puppet_etc_t:s0
[root@c6pmaster ~]#
```

Control

- Test module which echoes into /root/purpose

```
[root@c6pmaster ~]# vi /opt/test/puppet-modules/control/manifests/
init.pp
[root@c6pmaster ~]# cp -R /opt/test/puppet-modules/control /opt/dev/
puppet-modules/
[root@c6pmaster ~]# cat /opt/test/puppet-modules/control/manifests/
init.pp
class control {
    file {
        "/root/purpose":
            content    => $puppetd_environment;
    }
}
```

Control

- Can not use modules in new environment until the client configuration is updated:

```
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
err: Could not retrieve catalog from remote server: Error 400 on
SERVER: Could not parse for environment main: Syntax error at
'control' at /etc/puppet/manifests/nodes/c6pagent.node:1 on node
c6pagent.example.org
warning: Not using cache on failed catalog
err: Could not retrieve catalog; skipping run
[root@c6pagent ~]#
```

Deploy new puppet.conf

```
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6pagent.example.org
info: Applying configuration version '1333712437'
notice: /File[/etc/puppet/puppet.conf]/content:
--- /etc/puppet/puppet.conf    2012-04-06 02:57:21.259390010 +1000
+++ /tmp/puppet-file20120406-7723-1eph5x8-0   2012-04-06 02:58:14.175704006
+1000
@@ -10,4 +10,4 @@
    server = c6pmaster.example.org
    splay = true
    runinterval = 1800
-   environment = main
+   environment = testing

info: FileBucket adding {md5}4d6895c9ff7f6f45d042d04a5baef45f
info: /File[/etc/puppet/puppet.conf]: Filebucketed /etc/puppet/puppet.conf
to puppet with sum 4d6895c9ff7f6f45d042d04a5baef45f
notice: /File[/etc/puppet/puppet.conf]/content: content changed '{md5}
4d6895c9ff7f6f45d042d04a5baef45f' to '{md5}52d66941298f8abca8a3f4b8afca5cf3'
info: /File[/etc/puppet/puppet.conf]: Scheduling refresh of Service[puppet]
notice: /Stage[main]/Puppet_conf/Service[puppet]: Triggered 'refresh' from 1
events
notice: Finished catalog run in 7.27 seconds
[root@c6pagent ~]#
```

Deploy control

```
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6pagent.example.org
info: Applying configuration version '1333713217'
notice: /Stage[main]/Execute/Exec[echo top into /tmp/puppet.top]/
returns: executed successfully
notice: /File[/root/purpose]/ensure: defined content as '{md5}
ae2b1fca515949e5d54fb22b8ed95575'
notice: Finished catalog run in 3.02 seconds
[root@c6pagent ~]# cat /root/purpose
testing[root@c6pagent ~]#
```

- and switched to “development” ... :

```
info: Retrieving plugin
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6pagent.example.org
info: Applying configuration version '1333713788'
notice: /File[/etc/puppet/puppet.conf]/content:
--- /etc/puppet/puppet.conf   2012-04-06 02:58:14.315392554 +1000
+++ /tmp/puppet-file20120406-9116-1k14lue-0    2012-04-06 03:20:45.138387525 +1000
@@ -10,4 +10,4 @@
     server = c6pmaster.example.org
     splay = true
     runinterval = 1800
-    environment = testing
+    environment = development

info: FileBucket adding {md5}52d66941298f8abca8a3f4b8afca5cf3
info: /File[/etc/puppet/puppet.conf]: Filebucketed /etc/puppet/puppet.conf to puppet
with sum 52d66941298f8abca8a3f4b8afca5cf3
notice: /File[/etc/puppet/puppet.conf]/content: content changed '{md5}
52d66941298f8abca8a3f4b8afca5cf3' to '{md5}c1f49cb34e236b6186a05122f9830076'
info: /File[/etc/puppet/puppet.conf]: Scheduling refresh of Service[puppet]
notice: /Stage[main]/Puppet_conf/Service[puppet]: Triggered 'refresh' from 1 events
notice: /File[/root/purpose]/content:
--- /root/purpose2012-04-06 03:11:16.300395068 +1000
+++ /tmp/puppet-file20120406-9116-15ala1k-0    2012-04-06 03:20:51.683576911 +1000
@@ -1 +1 @@
-testing
\ No newline at end of file
+development
\ No newline at end of file

info: FileBucket adding {md5}ae2b1fca515949e5d54fb22b8ed95575
info: /File[/root/purpose]: Filebucketed /root/purpose to puppet with sum
ae2b1fca515949e5d54fb22b8ed95575
notice: /File[/root/purpose]/content: content changed '{md5}
ae2b1fca515949e5d54fb22b8ed95575' to '{md5}759b74ce43947f5f4c91aeddc3e5bad3'
notice: Finished catalog run in 7.02 seconds
```

That should not have worked

- The catalog is compiled before the new puppet.conf is deployed;
- Once Puppet is running it does not adjust to the new environment listed in the puppet.conf.

why'd that work?

- It actually did not:
  - used the original (testing) control module;
  - but both use a variable to set the content;
  - test it by changing the content to a string;
  - ... or just trust me.

more node files

- Sample development node file

```
node "wsadev1.example.org",  "wsadev2.example.org" {
   $service_group = "wsa_dev"
   $puppetd_environment = "development"

   include defaultnode
   include control
}
```

- Sample production node file:

```
node "wsaprod1.example.org",  "wsaprod2.example.org" {
   $service_group = "wsa_prod"

   include defaultnode
   include control
}
```

Automate Puppet Module Replication

- Two aspects:
  - SOE Puppet code - which is next;
  - Project Puppet code - not dealt with...
    - though our setup allows Developers to check project Puppet Code out to the development Puppetmaster without Sys Admin involvement.

Replicate SOE Puppet Code

- "Automatic" means "break everything at once";
- "Manual" means "a 'change' causing an 'incident'";
- "Delayed" means you have to wait before you break all Puppetmasters at once;
  - Though implementing a delay is neither simple;
  - ... nor will it help.

Automatic Replication

- Test your change;
- Fix your typos;
- Worst Case: affected nodes' catalogue will not build and thus change will not be applied until the next run.
- IF your change can cause worse, you should be following your hazardous change procedure (see "Hazardous Changes").

Auto Replicate module

- rsyncd.conf

```
[modules]
    use chroot = false
    read only = true
    path = /etc/puppet/modules

[manifests]
    use chroot = false
    read only = true
    path = /etc/puppet/manifests

[fileserver]
    use chroot = false
    read only = true
    path = /etc/puppet/fileserver
```

Auto Replicate module

- Cron Job

```
* * * * * root /usr/bin/rsync --delete --rsh="/usr/bin/ssh -2 -l puppetsync -i /opt/
puppetsync/.ssh/id_rsa" --exclude-from=/home/puppetsync/excludelist -a
c6pmaster.example.org::modules /etc/puppet/modules/ > /dev/null 2>&1

* * * * * root /usr/bin/rsync --delete --rsh="/usr/bin/ssh -2 -l puppetsync -i /opt/
puppetsync/.ssh/id_rsa" --exclude-from=/home/puppetsync/excludelist -a
c6pmaster.example.org::manifests /etc/puppet/manifests/ > /dev/null 2>&1

* * * * * root /usr/bin/rsync --delete --rsh="/usr/bin/ssh -2 -l puppetsync -i /opt/
puppetsync/.ssh/id_rsa" --exclude-from=/home/puppetsync/excludelist -a
c6pmaster.example.org::fileserver /etc/puppet/fileserver/ > /dev/null 2>&1
```

Auto Replicate module

- exclude list

```
##
## don't copy rsa keys or .svn
##
*id_rsa*
.svn
##
## Server & Cert name will be different
##
/shared-puppetd/templates/puppet.conf*
/shared-puppetd/files/puppet.conf*
```

Auto Replicate module

```
class auto_replicate_puppet {
    Group["puppetsync"] -> User["puppetsync"] -> File["/home/puppetsync"]
    File["/home/puppetsync"] -> File["/home/puppetsync/.ssh"]
    File["/home/puppetsync"] -> File["/home/puppetsync/excludelist"]
    File["/opt/dev"] -> File["/opt/dev/puppet-modules"] -> Exec["dev puppetmodules"]
-> Exec["dev puppetmodules real location"]
    File["/opt/test"] -> File["/opt/test/puppet-modules"] -> Exec["test
puppetmodules"] -> Exec["test puppetmodules real location"]

    user {
        "puppetsync":
            uid => 5000,
            gid => 5000,
            comment  => "Puppet synchronization user",
            shell    => "/bin/bash",
            home=> "/home/puppetsync";
    }

    group {  "puppetsync":        gid => 5000; }

# continued on next slide
```

Auto Replicate module

```
    file {
        ["/home/puppetsync","/home/puppetsync/.ssh"]:
            owner    => 5000,
            group    => 5000,
            mode     => 700,
            ensure   => directory;

        "/home/puppetsync/excludelist":
            owner    => 5000,
            group    => 5000,
            mode     => 700,
            source   => "puppet:///modules/auto_replicate_puppet/exclude";

        "/etc/cron.d/auto_replicate_puppet":
            owner    => root,
            group    => root,
            mode     => 644,
            source   => "puppet:///modules/auto_replicate_puppet/cronjob";

        ["/opt/dev","/opt/test","/opt/dev/puppet-modules","/opt/test/puppet-
modules"]:
            owner    => root,
            group    => root,
            mode     => 755,
            ensure   => directory;
    }

# continued on next slide
```

Auto Replicate module

```
    exec {
        "dev puppetmodules":
            command  => "/usr/sbin/semanage fcontext -a -t puppet_etc_t /opt/dev/puppet-
modules\(/.*\)?",
            cwd => "/",
            unless   => "/usr/sbin/semanage fcontext -l | grep '/opt/dev/puppet-modules'";

        "dev puppetmodules real location":
            command  => "/usr/sbin/semanage fcontext -a -t puppet_etc_t /var/root-opt/dev/
puppet-modules\(/.*\)?",
            cwd => "/",
            unless   => "/usr/sbin/semanage fcontext -l | grep '/var/root-opt/dev/puppet-
modules'";

        "test puppetmodules":
            command  => "/usr/sbin/semanage fcontext -a -t puppet_etc_t /opt/test/puppet-
modules\(/.*\)?",
            cwd => "/",
            unless   => "/usr/sbin/semanage fcontext -l | grep '/opt/test/puppet-modules'";

        "test puppetmodules real location":
            command  => "/usr/sbin/semanage fcontext -a -t puppet_etc_t /var/root-opt/test/
puppet-modules\(/.*\)?",
            cwd => "/",
            unless   => "/usr/sbin/semanage fcontext -l | grep '/var/root-opt/test/puppet-
modules'";
    }
}
```

returned ... nothing?

```
err: /Stage[main]/Auto_replicate_puppet/Exec[dev
puppetmodules]/returns: change from notrun to 0 failed: /usr/
sbin/semanage fcontext -a -t puppet_etc_t /opt/dev/puppet-
modules\(/.*\)? returned  instead of one of [0] at /etc/puppet/
modules/auto_replicate_puppet/manifests/init.pp:69
```

- commands / puppet can be very memory hungry;
- VM used for test testing could not cope on only 512MB.

Auto Replicate module

```
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6pagent.example.org
info: Applying configuration version '1333722948'
notice: /File[/opt/test]/ensure: created
notice: /Stage[main]/Auto_replicate_puppet/Group[puppetsync]/ensure: created
notice: /Stage[main]/Auto_replicate_puppet/User[puppetsync]/ensure: created
notice: /File[/home/puppetsync]/ensure: created
notice: /File[/home/puppetsync/excludelist]/ensure: defined content as '{md5}
737dadfe1586ed07603c849c71ce849e'
notice: /File[/etc/cron.d/auto_replicate_puppet]/ensure: defined content as '{md5}
c0e2cc2b6b05ce51242a6c4a5a0ec793'
notice: /File[/opt/test/puppet-modules]/ensure: created
notice: /Stage[main]/Auto_replicate_puppet/Exec[test puppetmodules]/returns:
executed successfully notice: /File[/home/puppetsync/.ssh]/ensure: created
notice: /File[/opt/dev]/ensure: created
notice: /Stage[main]/Auto_replicate_puppet/Exec[test puppetmodules real location]/
returns: executed successfully
notice: /File[/opt/dev/puppet-modules]/ensure: created
notice: /Stage[main]/Auto_replicate_puppet/Exec[dev puppetmodules]/returns: executed
successfully
notice: /Stage[main]/Auto_replicate_puppet/Exec[dev puppetmodules real location]/
returns: executed successfully
notice: Finished catalog run in 35.42 seconds
[root@c6pagent ~]#
```

manually on replicating host

```
[root@c6pagent ~]# su - puppetsync
-bash-4.1$ ssh-keygen -b 1024 -t rsa -f ./.ssh/id_rsa
Generating public/private rsa key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in ./.ssh/id_rsa.
Your public key has been saved in ./.ssh/id_rsa.pub.
The key fingerprint is:
83:9c:31:97:49:25:07:21:53:37:5e:ab:20:0e:b6:4d
puppetsync@c6pagent.example.org
The key's randomart image is:
+--[ RSA 1024]----+
|      o.*+= .    |
|       + B o .   |
|    o E = . .    |
|   . B B . .     |
|    . * S .      |
|         .       |
|                 |
|                 |
|                 |
+-----------------+
-bash-4.1$
```

manually on Puppetmaster

```
[root@c6pmaster ~]# groupadd -g 5000 puppetsync
[root@c6pmaster ~]# useradd -u 5000 -g 5000 -c "Puppet synchronization user"
-s "/bin/bash" -d "/home/puppetsync" -m puppetsync
[root@c6pmaster ~]# su - puppetsync
[puppetsync@c6pmaster ~]# vi ~puppetsync/rsyncd.conf
[puppetsync@c6pmaster ~]$ mkdir .ssh ; chmod 700 .ssh/
[puppetsync@c6pmaster ~]$ vi .ssh/authorized_keys
[puppetsync@c6pmaster ~]$ chmod 600 .ssh/authorized_keys
```

manually on replicating host

```
-bash-4.1$ ssh c6pmaster.example.org -i .ssh/id_rsa
The authenticity of host 'c6pmaster.example.org (192.168.1.9)' can't be established.
RSA key fingerprint is 14:18:de:92:d7:6d:80:58:f9:ae:c6:74:63:f2:a6:38.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'c6pmaster.example.org,192.168.1.9' (RSA) to the list of
known hosts.
[puppetsync@c6pmaster ~]$ exit
logout
Connection to c6pmaster.example.org closed.
```

automatically on replicating host

```
[root@c6pagent ~]# ls -l /opt/{dev,test}/puppet-modules/ /etc/puppet
/etc/puppet:
total 20
-rw-r--r--.  1 root   root   2552 Mar 13 02:30 auth.conf
drwxr-xr-x.  3 root   root   4096 Apr  6  2012 fileserver
drwxr-xr-x.  3 root   root   4096 Apr  6  2012 manifests
drwxr-xr-x. 13 puppet puppet 4096 Apr  6  2012 modules
-rw-r--r--.  1 root   root    266 Apr  6 03:26 puppet.conf

/opt/dev/puppet-modules/:
total 4
drwxr-xr-x. 5 puppet puppet 4096 Apr  6  2012 control

/opt/test/puppet-modules/:
total 4
drwxr-xr-x. 5 puppet puppet 4096 Apr  6  2012 control
[root@c6pagent ~]#
```

To make this a Puppetmaster

- install puppet-server;
  - set to start on boot;
- remove and recreate /var/lib/puppet;
  - restore the SELinux context;
  - this is a bad idea once host is a Puppetmaster;
- update firewall;
- Misc /etc/puppet configs are not explicitly replicated.

Swapping Puppetmasters

- Setup new Puppetmaster;
- On the client to be moved:
  - delete /var/lib/puppet ;
  - run `puppetd -vt --server=<new master>` ;
- On the new master, sign certificates;
- On the client run puppetd again.

On the client

```
[root@c6repo ~]# puppetd -vt --server=c6pagent.example.org
info: Creating a new SSL key for c6repo.example.org
warning: peer certificate won't be verified in this SSL session
info: Caching certificate for ca
warning: peer certificate won't be verified in this SSL session
warning: peer certificate won't be verified in this SSL session
info: Creating a new SSL certificate request for c6repo.example.org
info: Certificate Request fingerprint (md5): 5A:90:5B:
38:63:78:96:21:99:8B:58:3E:D6:0B:03:59
warning: peer certificate won't be verified in this SSL session
warning: peer certificate won't be verified in this SSL session
warning: peer certificate won't be verified in this SSL session
Exiting; no certificate found and waitforcert is disabled
[root@c6repo ~]#
```

On the Puppetmaster

```
[root@c6pagent puppet]# puppetca --sign c6repo.example.org
notice: Signed certificate request for c6repo.example.org
notice: Removing file Puppet::SSL::CertificateRequest
c6repo.example.org at '/var/lib/puppet/ssl/ca/requests/
c6repo.example.org.pem'
[root@c6pagent puppet]#
```

On the client

```
[root@c6repo puppet]# puppetd -vt --server=c6pagent.example.org
info: Retrieving plugin
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6repo.example.org
info: Applying configuration version '1334642468'
notice: /File[/etc/pam.d/system-auth-local]/ensure: defined content
as '{md5}f1d3f40734136a98d16ade24066ee042'
info: FileBucket adding {md5}e8aee610b8f5de9b6a6cdba8a33a4833
info: /File[/etc/pam.d/system-auth]: Filebucketed /etc/pam.d/system-
auth to puppet with sum e8aee610b8f5de9b6a6cdba8a33a4833

### ... trust me, it worked

info: /File[/etc/puppet/puppet.conf]: Scheduling refresh of
Service[puppet]
notice: /Stage[main]/Puppet_conf/Service[puppet]/ensure: ensure
changed 'stopped' to 'running'
notice: /Stage[main]/Puppet_conf/Service[puppet]: Triggered 'refresh'
from 1 events
notice: /File[/home/t.durden]/ensure: created
notice: /Stage[main]/Local_users/Deploy_user[Tyler Durden]/
User[t.durden]/ensure: created
info: Creating state file /var/lib/puppet/state/state.yaml
notice: Finished catalog run in 12.90 seconds
[root@c6repo puppet]#
```

Swapping issues

- Most problems due to certificates:
  - Remove the client certificate from old master;
  - Ensure client certificate not on new master;
  - Stop puppetd before deleting /var/lib/puppet;
  - Time of hosts must be in sync;

Swapping issues ... continued

- Client should not be newer than master;
  - 2.7.x client talking to 2.6.x master likely to fail.
- Do NOT delete the puppet.conf ;
  - can affect the client's directory structure;

Hazardous Changes

- And thus file overrides

Hazardous Changes

- Always tell the service owner you are about to do something that may ruin their day.
- Occasionally things go wrong, if others do not know in advance it will be worse.
- Sometimes this might not be a scheduled outage or require a change request, but that depends on your site.

Sample Hazardous Change

- Imagine:
  - Using LDAP to look up and NSCD to cache user information on hosts.
  - (Service users are on host accounts);
  - What could go wrong?

Things go wrong

- Network could drop out; or
- LDAP service could disappear; or
- Power or hardware failure on any of the components;

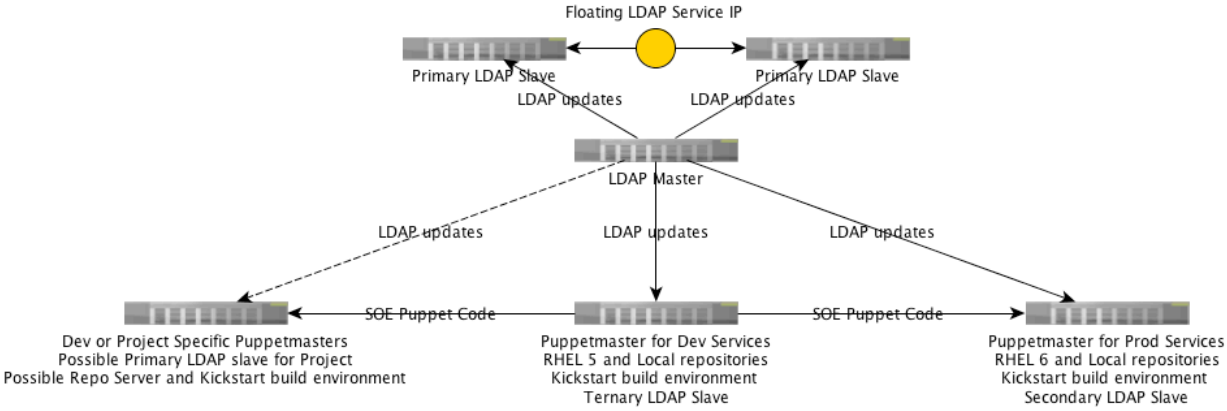
Pardon my paranoia

- In the past three years (2010 - 2012) UQ has had (at least) one of each:
  - DC fire;
  - 100 year (30 year?) flood;
  - DC power failure;
    - which badly affected the SAN.

... but the service is up ! ...

- Through all of these, LDAP stayed up.
- But at least:
  - one gateway failed (fire);
  - half of the VMware farm disappeared (SAN);
  - some intermittent networking issues arose (other than missing a gateway) (fire, SAN and changes).

Segue - SOE DR



LDAP Service revisions

- LDAP is not using Multi Master setup:
  - Version 2 of our setup went:
    - from one master and slave;
    - to one master, two primary slaves and ucarp;
  - Version 3
    - one master, two primary slaves and ucarp;
    - and LDAP on our other core DR hosts (Repositories and Puppet Masters);

LDAP Master

- LDAP master vulnerable because one of a kind;
- Can be rebuilt in ~20 minutes because deployed entirely automatically via Puppet;
- Slapcat backups are done daily;

designed for failure

- On host authentication used to comprise of:
  - LDAP +
  - NSCD +
  - pam_ssh (slightly hacked for on-host auth) +
  - two sets of centrally pushed out ssh keys:
    - one for pam_ssh; and
    - one for traditional ssh;

Not great because

- pam_ssh for on-host auth is flakey;
- NSCD times out; ...
  - PAM won't meet its configured requirements;
  - reconfiguring PAM's base requirements can be a bad idea;
- building tarballs of /home and ssh keys is:
  - CPU intensive;
  - does not deploy unless LDAP already works;

because ... continued

- NSCD does not:
  - cache authentication related information;
  - retain information indefinitely;
- Does (depending on version):
  - leak memory;
  - hang on network access if network is down;
- NSCD was not designed to be used this way.

meet SSSD

- Can use different authentication methods;
- Will cache:
  - passwd and group info for anything it sees;
  - shadow for users it has authenticated;
- pam_sss and sssd replaces pam_ssh + keys.

SSSD downsides

- Does not cache information it has not needed;
- Very occasionally the cache gets corrupted and needs to be reset;
- Server rebuild procedure does not include restores by default;
  - People who had logged into the destroyed server are not cached on the rebuilt one.

So, SSSD is great

- Thus, change all hosts to use it.
- This is a major change:
  - If it worked on a few hosts it should work every time;
  - sssd and nscd running together leads to a corrupt sssd's cache;
  - Bad idea to deploy to 100+ servers in one go.

Relax

- Probably would not spend a lot of effort tweaking NSCD's Puppet module;
- Ensuring absence of NSCD remnants is always good when deploying SSSD, so put this in the new SSSD Puppet module.

- Can you disable your modules?

disable modules?

```
class shared-USG_internal_ldap2010
{

   if ($skip_USG_internal_ldap2010 != "true") {

   ## Deploy client certificate - needed on all hosts
      file {
         ["/etc/ssl", "/etc/ssl/certs"]:
            owner   => root,
            group   => root,
            mode    => 755,
            ensure  => directory;

         "/etc/ssl/certs/cacert.pem":
            owner   => root,
            group   => root,
            mode    => 644,
            source  => "puppet:///modules/shared-
USG_internal_ldap2010/cacert2010.pem",
            require => File["/etc/ssl/certs"];
      }

###...
```

So then

- In the individual node files set:

```
$skip_USG_internal_ldap2010 = "true"
```

- when migrating them to the new SSSD based solution;
- If the Puppet modules are modular, may need to retrofit this to several ; or
- Work out which ones to disable and what dependencies this will affect.

Conversely

- In new modules set something like:

```
class redhat-sssd
{

   if ($deploy_sssd == "true") {
   #...
```

- ... to selectively enable for nodes being migrated;
- careful with that logic:
  - skip uses !=
  - deploy uses ==
  - might accidentally deploying something.

File Overrides

- Disabling the old method is a start;
- /etc/pam.d/system-auth also needs replacing.

system-auth module before

```
class system-auth {
    if ($skip_system_auth != "true") {




        file {
            "/etc/pam.d/system-auth-local":
                owner   => root,
                group   => root,
                mode    => 644,
                source  => "puppet:///modules/system-auth/system-auth.conf";

            "/etc/pam.d/system-auth":
                ensure  => "/etc/pam.d/system-auth-local",
                require => File["/etc/pam.d/system-auth-local"];
        }
    }
}
```

system-auth module after

```
class system-auth {
    if ($skip_system_auth != "true") {

        if ($file_system_auth == "") {
            $file_system_auth = "puppet:///modules/system-auth/system-auth"
        }

        file {
            "/etc/pam.d/system-auth-local":
                owner   => root,
                group   => root,
                mode    => 644,
                source  => $file_system_auth;

            "/etc/pam.d/system-auth":
                ensure  => "/etc/pam.d/system-auth-local",
                require => File["/etc/pam.d/system-auth-local"];
        }
    }
}
```

Caveat / Retraction

- Updated code allows override of files, configured in node file;
- Unless the configuration structure relies on inheritance:
  - 2011 talk included this.
  - If implemented, here is the required change:

defaultnode.node

- was:

```
node default {
## lots of includes
}
```

- now:

```
class defaultnode {
## lots of includes
}
```

- Remember:
  - can not name default class “default”;
  - do not need to change the file extension;

Individual node files

- was:

```
node "c6pagent.example.org" inherit default {

}
```

- now (including override):

```
node "c6pagent.example.org" {
    $file_system_auth = "puppet:///modules/system-auth/system-auth.sssd"

    include defaultnode
}
```

Where to store the file

- Sample system-auth file for using SSSD's will become default in system-auth module;
  - logical to keep in the module.
- Consider node specific overrides.

$service_group

- A site specific variable, can be called anything.
- Used to differentiate between:
  - individual hosts and
  - collections (i.e.: a “service group”);
- Set variable in every node file;

overrides and service groups

- Configure via /etc/puppet/fileserver.conf

```
[modules]
   allow *.example.org

[puppettest]
   path /etc/puppet/fileserver/puppettest
   allow c6pagent.example.org
```

- In the node file:

```
node "c6pagent.example.org" {
   $service_group = "puppettest"
   $file_system_auth = "puppet:///$service_group/system-auth"

   include defaultnode
}
```

Drop throughs

- The file resource type supports definition of multiple sources.
- Starts with first source, and stops on first match:

```
file {
    "/etc/sysconfig/iptables":
        owner   => root,
        group   => root,
        mode    => 600,
        source  => [
            "puppet:///modules/iptables/iptables.$fqdn",
            "puppet:///modules/iptables/iptables.$service_group",
            "puppet:///modules/iptables/iptables",
        ],
        notify  => Service["iptables"];
}
```

Be careful though

- Non-generic items in modules is generally bad:
  - decommissioned hosts' files linger;
- Divide:
  - Generic files via Modules;
  - Specific files and settings via Node file and custom fileserver shares.
- Things might remain but are out of the way.

Drop Through a better way

- Check the service group's custom files first;
- or else deploy module default:

```
file {
    "/etc/sysconfig/iptables":
        owner   => root,
        group   => root,
        mode    => 600,
        source  => [
            "puppet:///$service_group/iptables",
            "puppet:///modules/iptables/iptables",
        ],
        notify  => Service["iptables"];
}
```

The story so far

- Manage "complex" Puppet installations;
  - Server / service layout and implementation;
  - Puppet configuration's environments;
  - Hazardous changes;
    - File overrides and
    - Drop through;
  - Swapping Puppet clients' Puppetmasters;

Next

- Puppet Configurations files revisited;
- A real fact using Ruby;
- Programming with Puppet;
- Creating Puppet configurations via Python;
- Adding Passenger to Puppetmaster;
- Lot's of SELinux related joy;
  - Classes to collect defines.

Config files ... revisited

- puppet.conf
- fileserver.conf
- autosign.conf
- auth.conf

fileserver.conf

- Discussed above in file overrides;
- Works with
  - FQDN (including * wildcard);
  - IP addresses, CIDR or * wildcard);
- Some changes require a Puppetmaster restart;
- http://docs.puppetlabs.com/guides/file_serving.html

fileserver.conf

- May break if it contains trailing spaces / tabs;

```
[root@c6pmaster ~]# service httpd stop
Stopping httpd:                                            [  OK  ]
[root@c6pmaster ~]# service puppetmaster start
Starting puppetmaster:                                     [  OK  ]
[root@c6pmaster ~]# service puppetmaster status
puppetmasterd (pid  7215) is running...
[root@c6pmaster ~]# vi /etc/puppet/fileserver.conf
[root@c6pmaster ~]# service puppetmaster restart
Stopping puppetmaster:                                     [  OK  ]
Starting puppetmaster:                                     [  OK  ]
[root@c6pmaster ~]# service puppetmaster status
puppetmasterd dead but pid file exists
[root@c6pmaster ~]#
```

autosign.conf

- Very handy for your Developer's Test VMs
- Tells Puppetmaster to always sign the client;
  - also updates the certificate if it changes;
- There are security issues;
- Might contain:

```
[root@c6pmaster ~]# cat /etc/puppet/autosign.conf
*.example.org
```

auth.conf

- Authentication config for REST API
- http://docs.puppetlabs.com/guides/rest_api.html
- http://docs.puppetlabs.com/guides/rest_auth_conf.html

Facts

- Collected before the main Puppet run and used in building the client specific catalog;
- Useful to extract information;
  - There are size constraints (e.g.: `rpm -qa | sort` returns too much);
- simple fact that executes a bash script:

```
Facter.add("rh_release") do
    setcode do
        %x{/bin/cat /etc/redhat-release | /bin/sed 's/[^0-9.]*//g' | /
bin/cut -d . -f 1}.chomp
    end
end
```

A real fact

- As discussed, LDAP used for managing groups;
- Dev's needed to get some information for deploying mercurial configurations;

getGIDs.rb

```
# getGIDs.rb
require 'ldap'

$HOST = 'usgldap.example.org'
$PORT = LDAP::LDAP_PORT
$SSLPORT = LDAP::LDAPS_PORT
$BIND = 'cn=unprivuser,dc=example,dc=org'
$PASSWORD = '!53cr37'

groups = {
    'usg' => 'nsysadm',
    'ss' => 'wdu',
}

myfilter = '(|'
groups.each { |key, val|
    myfilter += "(cn=#{val})"
}
myfilter += ')'

## to be continued next slide
```

getGIDs.rb ... continued

```
base = 'ou=Group,dc=example,dc=org'
scope = LDAP::LDAP_SCOPE_SUBTREE
attrs = ['cn', 'gidNumber']
results = {}

begin
    conn = LDAP::Conn.new($HOST, $PORT)
    conn.bind($BIND, $PASSWORD)

# this preserves the existing mappings, a single query
    group_lookup = groups.invert
    conn.search(base, scope, myfilter, attrs) { |entry|
        results[group_lookup[entry.vals('cn')[0]]] = entry.vals('gidNumber')
    }

    conn.unbind
rescue
    LDAP::ResultError
    conn.perror("search")
    exit
end

results.each { |key, val|
    Facter.add("#{key}_gid") { setcode { val[0] } }
}
```

resulting facts

```
[root@c6pmaster node]# pwd
/var/lib/puppet/yaml/node
[root@c6pmaster node]# grep gid something.example.org.yaml
    usg_gid: "902"
    ss_gid: "923"
[root@c6pmaster node]#
```

- rather than hard code the GID, use the fact:

```
   file {
       "/home/chakkerz":
           ensure => directory,
           owner  => chakkerz,
##         group  => 902,
           group  => $usg_gid,
           mode   => 700,
           require    => User["chakkerz"];
   }
```

Programming with Puppet

- Why Puppet?
- What went wrong?
- What went right?
- What are the trade-offs?

Why Puppet?

- Already existed and better understood than the older CCMS;
- No installation scripts;
- No installation procedures;
- No packaging applications;
- Just a configuration of what to do...
  - and lots of support from friendly SysAdmins.

What is Puppet (again)?

- Puppet tries hard to offer features developers are familiar with:
  - branching execution;
  - inheritance;
  - scope; but
  - sequential execution is limited;
  - variables are constants / different; and
  - for loops are only sort-of do-able.

Let's re-word that

- Puppet offers:
  - an uncertain execution path; and
  - an unfamiliar approach to loops;
  - with variable constants where you:
    - define how they are set;
    - can append to already set values;
  - a familiar concept of scope for "functions" / "variables"; and
  - inheritance (with overrides).

Segue inheritance

- http://docs.puppetlabs.com/guides/language_guide.html lists the following (abridged):

```
class unix {
    file {
        "/etc/passwd":
            owner   => root,
            group   => root,
            mode    => 0644;
    }
}

class freebsd inherits unix {
    File['/etc/passwd']  { group    => wheel }
}
```

system-auth revisited

```
class system-auth {
    if ($skip_system_auth != "true") {

        if ($file_system_auth == "") {
            $file_system_auth = "puppet:///modules/system-auth/system-auth"
        }

        file {
            "/etc/pam.d/system-auth-local":
                owner   => root,
                group   => root,
                mode    => 644,
                source  => $file_system_auth;

            "/etc/pam.d/system-auth":
                ensure  => "/etc/pam.d/system-auth-local",
                require => File["/etc/pam.d/system-auth-local"];
        }
    }
}
```

system-auth module

```
class system-auth {





        file {
            "/etc/pam.d/system-auth-local":
                owner   => root,
                group   => root,
                mode    => 644,
                source  => "puppet:///modules/system-auth/system-auth";

            "/etc/pam.d/system-auth":
                ensure  => "/etc/pam.d/system-auth-local",
                require => File["/etc/pam.d/system-auth-local"];
        }

}

class sssd-system-auth inherits system-auth {
    File['/etc/pam.d/system-auth-local'] {
        source  => "puppet:///modules/system-auth/system-auth.sssd"
    }
}
```

Our way

```
node "c6pagent.example.org" {
    $file_system_auth = "puppet:///modules/system-auth/system-auth.sssd"

    include defaultnode









}
```

Inheritance's way

```
node "c6pagent.example.org" {



    include execute
    include local_users
    include packages
    include puppet_conf
    include rh_release_if
    include sshd_config
    include sysadmins
    include sssd-system-auth
}
```

Disclaimer

- Did not test the inheritance code;
- Default node would still be a node (rather than a class; see “File Overrides”);

Puppet is first and foremost

- A system administrator’s tool.
- Deploy various bits and pieces;
- ... not necessarily in a particular order;
  - though that can be achieved;
- Configuration is mostly applied again and again.
- Programmability is handy, but code visually differs from configuration.

What went wrong?

- Both developers who wrote this code moved on;
- Other developers had never become familiar with Puppet, or the modules the project relied on;

Top three issues

- Order of execution;
  - inter-dependencies defined wrong or not at all;
- Defines;
  - some identical “functions” in every module;
  - some four levels of indirection removed;
- Extremely slow;

Extremely slow

- Obvious:
  - every run Puppet would reset permissions;
- Red herring:
  - recursive directory deployments - already stopped using built-in file server in favour of mongrel and passenger.

Defines

- N modules implementing the same function;
- giving N implementations of the same function in N files;
- where N = ...

```
[root@tangelo]# ls -dc1 ss-app* | wc -l
28
[root@tangelo]# grep "define environment" ss-app*/manifests/init.pp |
wc -l
13
```

Let me show you

```
class ss-application-<something> {
    ## ... snip ...
    $user = <something>
    ## ... snip ...

    ss-application-<something>::environment {
        ["local","development","test","staging","production",]:
    }

    define environment() {
        include ss-platform-php
        $type = $name

        ss-platform-php::zend_environment { "${user}_env_$type":
            basedir => $home,
            type => $type,
            user => $user,
            require => [File[$home],Ss-util::Set_group_facl["$home-wdu"],],
        }

        # this bit ties us to the repo layout
        file { "$home/www/$type":
            target => "$home/$type/php",
            ensure => "link",
            require => [Ss-platform-php::Zend_environment["${user}_env_$type"],],
    }
}
```

(slightly formatted to fit on slide)

Things to note

- This is about showing that different mindsets resulting in different code.
- Yes, that is a for loop;
- $type is set to each element of the array;

Order of execution

```
[root@tangelo]# grep -A3 require */manifests/*pp | grep Class | wc -l
19
```

- Puppet looks for chaining statements to determine order;
  - Wrong or missing chaining means Puppet needs to run repeatedly / does not run at all;
- Requiring an entire Class means everything in the class AND their requirements must be satisfied;
- This is calculated every time.

You're not alone

- It is bad when your code depends on someone else's;
  - you require nscd service being configured;
  - and they switch from nscd to sssd.
  - ...and they don't know that you depend on it...
- Better to use a fact that talks to LDAP directly, irrespective of the host's running configuration.
- Not always an option.

classes requiring classes

```
class shared-users::create_home_link {
    if ($operatingsystem == "solaris") {
        file {
            "/export/home":
                ensure  => directory;

            "home_directory":
                path    => "/home",
                force   => true,
                ensure  => "/export/home",
                require => File["/export/home"];
        }
    } elsif ($operatingsystem == "freebsd") {
        file {
            "/var/home":
                ensure  => directory;

            "home_directory":
                path    => "/home",
                force   => true,
                ensure  => "/var/home",
                require => File["/var/home"];
        }
    }
}
```

shared-users's init.pp (continued)

```
class shared-users {
    require shared-users::create_home_link

    if ($skip_shared_users != "true") {

    ## Always deploy USG, IRT and SB
        include shared-users::nsysadm
        include shared-users::nirtadm
        include shared-users::nsbadm

        if ($enable_un == "true") {
            include shared-users::ndnadm
        }

        if ($enable_wdu == "true") {
            include shared-users::wdu
        }

        if ($enable_is == "true") {
            include shared-users::nsiadm
        }
    }
}
```

nsysadm.pp

```
class shared-users::nsysadm {
    if ($no_sssd_available == "true") {
        group {
            "nsysadm":
                gid => 902;
        }

        user {
            "chakkerz":
                uid    => 750,
                gid    => 902,
                home   => "/home/chakkerz",
                comment => "Christian Unger",
                shell  => $operatingsystem ? {
                    freebsd    => "/bin/sh",
                    default    => "/bin/bash",
                },
                password   => '$1$S.tAd0$wLUZe8egCOnyxSIZiLv.M.',
                require    => Group["nsysadm"];
        }
    }
```

nsysadm.pp

```
    file {
        "/home/chakkerz":
            owner  => 750,
            group  => 902,
            mode   => 700,
            ensure => directory;

        "/home/chakkerz/.ssh":
            owner  => 750,
            group  => 902,
            mode   => 700,
            ensure => directory,
            require    => File["/home/chakkerz"];

        "/home/chakkerz/.ssh/authorized_keys":
            owner  => 750,
            group  => 902,
            mode   => 600,
            content    => 'ssh-rsa .....',
            require    => File["/home/chakkerz/.ssh"];
    }
}
```

Generating classes

- If sssd is not available on a client host it is still possible to rely on LDAP to centrally manage users;
- Ruby DSL on the client is one way;
- Getting a script to generate class files is another;

ldap-group_based.py

```
#!/usr/bin/python

# source http://www.grotan.com/ldap/python-ldap-samples.html

import ldap

## first you must open a connection to the server
try:

     l = ldap.initialize("ldaps://ldap.example.org:636/")
     l.protocol_version = ldap.VERSION3

     l.simple_bind_s("cn=auth_LDAP,dc=usg,dc=example,dc=org ","7h3$3cr37")

except ldap.LDAPError, e:
     print e
     # handle error however you like


## The next lines will also need to be changed to support your search requirements and directory
searchItem = "ou=group,"
baseDN = "dc=usg,dc=example,dc=org"
searchScope = ldap.SCOPE_SUBTREE
retrieveAttributes = ['memberUid', 'gidNumber', 'cn']
searchFilter = "cn=*"

groups = []
```

ldap-group_based.py ... 2

```
try:
     ldap_result_id = l.search(searchItem + baseDN, searchScope, searchFilter, retrieveAttributes)
     result_set = []
     while 1:
          result_type, result_data = l.result(ldap_result_id, 0)
          if (result_data == []):
               break
          else:
               ## here you don't have to append to a list
               ## you could do whatever you want with the individual entry
               ## The appending to list is just for illustration.
               if result_type == ldap.RES_SEARCH_ENTRY:
                    result_set.append(result_data)
               groups.append(result_data)
except ldap.LDAPError, e:
     print e

# now, based on the retrievedAttributes split the result:
for group in groups:
     try:
          group_name = group[0][1].get('cn')[0]
          group_gid = group[0][1].get('gidNumber')[0]
          group_members = group[0][1].get('memberUid')
          group_users = ""
          group_homes = ""
          group_useremail = ""
          group_email = ""

     except TypeError:
          print "## Error on", group
```

ldap-group_based.py ... 3

```
     if group_members != None:
          for member in group_members:
               # now we need:
               # - Real Name
               # - their password
               # - ssh public key
               # - shell
               # - email address (not on every account right now)
               searchItem = "ou=People,"
               retrieveAttributes = ['uid', 'loginShell', 'uidNumber', 'gecos', 'homeDirectory',
'userPassword', 'mail', 'sshPublicKey', 'description']
               searchFilter = "uid=" + member

               try:
                    ldap_result_id = l.search(searchItem + baseDN, searchScope, searchFilter,
retrieveAttributes)
                    result_set = []
                    while 1:
                         result_type, result_data = l.result(ldap_result_id, 0)
                         if (result_data == []):
                              break
                         else:
                              ## here you don't have to append to a list
                              ## you could do whatever you want with the individual entry
                              ## The appending to list is just for illustration.
                              if result_type == ldap.RES_SEARCH_ENTRY:
                                   result_set.append(result_data)
```

ldap-group_based.py ... 4

```
for user in result_data:
     try:
          username = result_data[0][1].get('uid')[0]
          uid = result_data[0][1].get('uidNumber')[0]
          gid = group[0][1].get('gidNumber')[0]
          groupname = group[0][1].get('cn')[0]
          home = result_data[0][1].get('homeDirectory')[0]
          comment = result_data[0][1].get('gecos')[0]
          shell = result_data[0][1].get('loginShell')[0]

     except TypeError:
          print "## ERROR ON ", user, "\n"

     try:
          keys = ""
          for publicKey in result_data[0][1].get('sshPublicKey'):
               keys += publicKey + "\n"

     except TypeError:
          keys += "\n issue with key(s) \n"

     try:
          password = "!!"
          passwords = result_data[0][1].get('description')
          for password_temp in passwords:
               if password_temp.startswith("$1$"):
                    password = password_temp
                    break
     except TypeError:
          password += "issue with password"
```

ldap-group_based.py ... 5

```
     group_homes += '\n\t\t"' + home + '":\n'
     group_homes += '\t\t\towner\t=> ' + uid + ',\n'
     group_homes += '\t\t\tgroup\t=> ' + gid + ',\n'
     group_homes += '\t\t\tmode\t=> 700,\n'
     group_homes += '\t\t\tensure\t=> directory;\n'

     group_homes += '\n\t\t"' + home + '/.ssh":\n'
     group_homes += '\t\t\towner\t=> ' + uid + ',\n'
     group_homes += '\t\t\tgroup\t=> ' + gid + ',\n'
     group_homes += '\t\t\tmode\t=> 700,\n'
     group_homes += '\t\t\tensure\t=> directory,\n'
     group_homes += '\t\t\trequire\t=> File["' + home + '"];\n'
     group_homes += '\n\t\t"' + home + '/.ssh/authorized_keys":\n'
     group_homes += '\t\t\towner\t=> ' + uid + ',\n'
     group_homes += '\t\t\tgroup\t=> ' + gid + ',\n'
     group_homes += '\t\t\tmode\t=> 600,\n'
     group_homes += "\t\t\tcontent\t=> '" + keys + "',\n"
     group_homes += '\t\t\trequire\t=> File["' + home + '/.ssh"];\n'

     group_users += '\n\t\t\t"' + username + '":\n'
     group_users += '\t\t\t\tuid\t=> ' + uid + ',\n'
     group_users += '\t\t\t\tgid\t=> ' + gid + ',\n'
     group_users += '\t\t\t\thome\t=> "' + home + '",\n'
     group_users += '\t\t\t\tcomment\t=> "' + comment + '",\n'
     group_users += '\t\t\t\tshell\t=> $operatingsystem ? {\n'
     group_users += '\t\t\t\t\tfreebsd => "/bin/sh",\n'
     group_users += '\t\t\t\t\tdefault => "' + shell + '",\n'
     group_users += '\t\t\t\t},\n'
     group_users += "\t\t\t\tpassword => '" + password + "',\n"
     group_users += '\t\t\t\trequire\t=> Group["' + groupname + '"];\n'

except ldap.LDAPError, e:
     print e
```

ldap-group_based.py ... 6

```
    filename = "/tmp/shared-users/" + group_name + ".pp"
    file = open(filename, 'w')

    file.write("class shared-users::" + group_name + " {\n")

    file.write('\tif ($no_sssd_available == "true") {\n')

    file.write("\t\tgroup {\n" + '\t\t\t"' + group_name + '":\n' + "\t\t\t\tgid\t=> " + group_gid
+ ";\n" + "\t\t}\n\n")

    if group_users != "":
        file.write("\t\tuser {" + group_users + "\t\t}\n")

    file.write('\t}\n\n')

    if group_homes != "":
        file.write("\tfile {" + group_homes + "\t}\n\n")

    file.write("}\n")
    file.close()
```

- Probably not the best example of how to do this.
- Not tested in production just yet.

What went right?

- The ground work (not just Puppet, but Load Balancer configuration etc) made deploying new applications extremely easy and flexible;
- Puppet was (relatively) easy to use to deploy new applications.
- Most issues were not Puppet related, but with generic issues of how to interact with a SOE or Unix in general;
  - primarily `sudo` or `su - <application user>` and thus resulting issues.

What went right ... continued

- The basic framework was good, but:
  - badly documented;
  - clearly rushed;
  - under-used because hard to follow.
- The overall project was clearly NOT a failure, but Puppet required attention.

Trade-offs

- Communication is the biggest issue:
  - Both SysAdmins and Developers need to work together.
- Need to come to an arrangement where both can work autonomously;

Getting it right(er)

- The original code worked, but had issues;
  - Structure was good: e.g.: php applications included php platform module, which contained re-usable functions and shared requirements;
- Retrofitting fixes == very time consuming:
  - Five days to rewrite 38 modules;
    - and end up with 32.
  - versus hundreds of hours to assist with unfamiliar code.

So, what changed?

- Coding style;
- Naming conventions;
- Duplicated types moved to parent module;
- Chaining much more targeted and pervasive;
- Permissions:
  - set to what the service itself was enforcing;
  - FACLs used more extensively and at a higher level (rather than per application);

What else changed?

- Application modules:
  - call shared parent functions;
  - contain application specific settings only;
- Master control module calls global functions always, instead of using Virtual Resources.

Segue Virtual Resources

- Puppet will let most types be defined only once;
  - Imagine: tomcat is needed for two application;
  - Can only install tomcat in one of them;
    - Or install tomcat with neither application;
    - OR create a virtual function and "realise" it in both application modules.

virtual_tomcat

```
class virtual_tomcat {
    @deploy_service { "tomcat6":    service => "tomcat6";   }
}

define deploy_service($service) {
    package { "$service":           ensure  => installed;   }

    service {
        "$service":
            enable  => true;
            ensure  => running;
    }
}
```

Note the @

realize

- realize it in another module / node file:

```
node "c6pagent.example.org" {
    $service_group = "puppettest"

    realize Deploy_service["tomcat6"]

    include defaultnode
}
```

... and deploy

```
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6pagent.example.org
info: Applying configuration version '1333677567'
notice: /Stage[main]/Virtual_tomcat/Deploy_service[tomcat6]/
Package[tomcat6]/ensure: created
notice: /Stage[main]/Virtual_tomcat/Deploy_service[tomcat6]/
Service[tomcat6]/ensure: ensure changed 'stopped' to 'running'
notice: Finished catalog run in 197.08 seconds
[root@c6pagent ~]#
```

- There is a little more to this, see:
- http://docs.puppetlabs.com/guides/virtual_resources.html

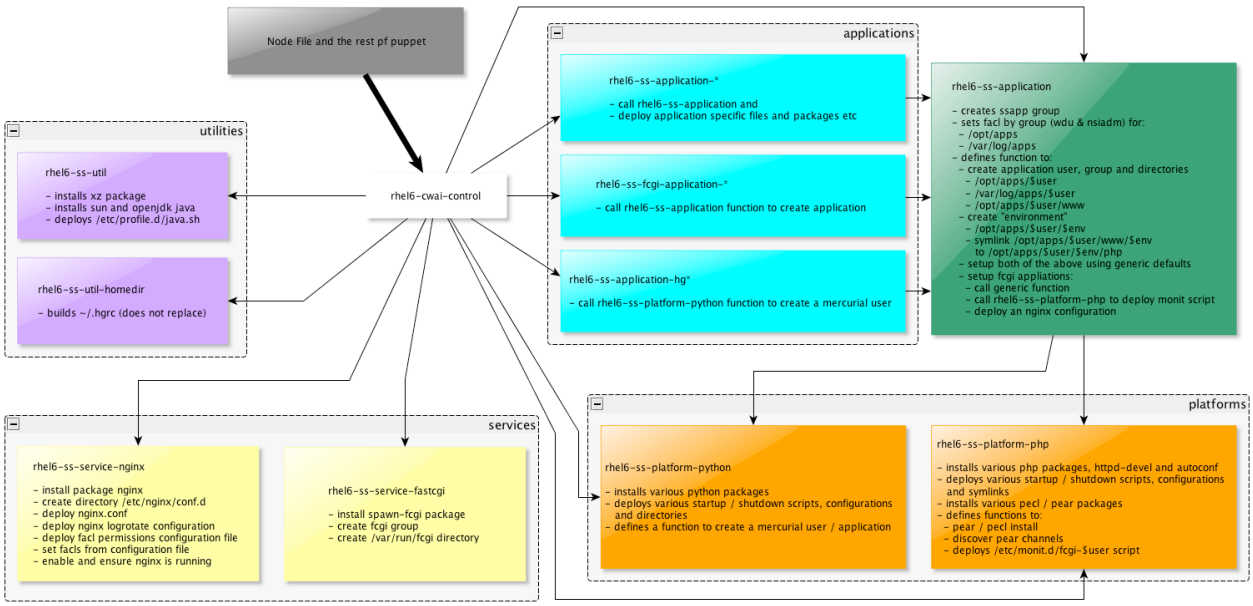
Should you virtualize?

- Never seen a Virtual Resources that was not realized.
  - For example: a web servers hosting PHP applications will always want PHP installed.
- Virtual Resources offer alternative to on/off switches, though with semantic difference:
  - default off, selective on, multiple invocations in various places;
  - skip_ (default on) or deploy_ (default off) in node file only.

Any other changes?

- Documentation of the overall layout generated;
  - Developers maintain the modules, so they should maintain their documentation.

Resulting structure



Finally ... some code

- Application modules (eg fcgi, mercurial and tomcat)
- Platform modules (eg php and python)
- Service modules (eg nginx)
- Test VM's limited deployment

deploy hgrc to /home

- ${homedir_chakkerz} and ${fullname_chakkerz} are custom facts filled by querying LDAP;
- $hgUsername, $realName and $email are used in the template;
- replace => false
- require targets specifically what needs to exist (rather than an entire class),
  - homedir_deployment; the "usg" should be a passed argument;

deploy hgrc to /home

```
class rhel6-ss-util-homedirs {
    hgrc {
        "chakkerz":
            home       => "${homedir_chakkerz}",
            username   => "chakkerz",
            hgUsername => "uqcunge2",
            realName   => "${fullname_chakkerz}",
            email      => "c.unger@its.uq.edu.au";
    }

    define hgrc($home, $username, $hgUsername, $realName, $email) {
        file { "${home}/.hgrc":
            content => template("ss-util-homedirs/hgrc.erb"),
            owner   => $username,
            replace => false,
            require => [Homedir_deployment["usg"], Service["sssd"],];
        }
    }
}
```

parts of php-platform 1 & 2

- package using an array to install;
- specific require;
- exec chaining;
- returns to avoid failed dependencies;

parts of platform-php ... 1

```
class rhel6-ss-platform-php {
    package {
        ["php-5.3-pdo-oci-zend-server",
        "php-5.3-oci8-zend-server",
        "php-5.3-pdo-mysql-zend-server",
        "php-5.3-mysqli-zend-server",
        "php-5.3-mbstring-zend-server",
        "php-5.3-gd-zend-server",
        "php-5.3-ctype-zend-server",
        "php-5.3-curl-zend-server",
        "php-5.3-memcached-zend-server"]:
           ensure  => installed,
           require => [ File["/etc/yum.repos.d/ITS-Zend6.repo"],
File["/etc/pki/rpm-gpg/RPM-GPG-KEY-zend"], ],
           before  => Exec["fix zend extensions"];

        "httpd-devel.$arch":                    ensure  => installed;
        "autoconf.noarch":                      ensure  => installed;
    }
```

parts of platform-php ... 2

```
   exec {
       "fix zend extensions":
           command => "${variables::sed_cmd} -i -e 's|^extension=\\([^/]\
\+.so\\)|extension=/usr/local/zend/lib/php_extensions/\\1|' /usr/local/
zend/etc/conf.d/*.ini";
   }

   exec {
       "clear php-5.3 pear cache":
           command => "/usr/local/zend/bin/pear clear-cache",
           require => Package["php-5.3-dev-zend-server"],
           returns => [ 0, 1 ]; # returns 1 when there was no cache

       "php-5.3-pear":
           command => "/usr/local/zend/bin/pear update-channels",
           require => Exec["clear php-5.3 pear cache"];
   }
```

parts of php-platform 3,4 & 5

- $name (pear_channel_discover)
- unless attribute
- one way of avoiding gcc is installed permanently
  - though probably not the best way

parts of platform-php ... 3

```
define pear_channel_discover($channel = "") {
    if $channel == ""                { $ch = $name           }
    else                             { $ch = $channel        }

    exec {
        "php-5.3 pear channel $ch":
            command => "/usr/local/zend/bin/pear channel-discover $ch",
            unless  => "/usr/local/zend/bin/pear channel-info $ch",
            require => Exec["php-5.3-pear"];
    }
}

pear_channel_discover { "pear.phpunit.de":          }
pear_channel_discover { "components.ez.no":         }
pear_channel_discover { "pear.symfony-project.com": }
```

parts of platform-php ... 4

```
define pear_install($package = "") {
    if $package == ""               { $p = $name            }
    else                            { $p = $package         }

    exec {
        "php-5.3 pear package $p":
            command => "/usr/local/zend/bin/pear install $p",
            unless => "/usr/local/zend/bin/pear info $p",
            require => Exec["php-5.3-pear"];
    }
}

pear_install {
    "php-5.3-XML_Serializer":
        package => "XML_Serializer-beta";

    "php-5.3-PHPUnit":
        package => "phpunit/PHPUnit",
        require => [
            Pear_channel_discover["pear.phpunit.de"],
            Pear_channel_discover["pear.symfony-project.com"],
            Pear_channel_discover["components.ez.no"],
        ];
}
```

parts of platform-php ... 5

```
define pecl_install($package = "") {
    if $package == ""    { $p = $name            }
    else                 { $p = $package         }

    exec { "php-5.3 pecl package $p":
        command => "${variables::yum_cmd} install -y gcc.$arch && /
usr/bin/yes '' | /usr/local/zend/bin/pecl install $p && $
{variables::yum_cmd} remove -y gcc.$arch",
        unless => "/usr/local/zend/bin/pecl info $p",
        require => Exec["php-5.3-pear"];
    }
}

pecl_install { "php-5.3-apc":           package => "APC-3.1.9"; }
}
```

service-nginx

- targeted require's
- refreshonly attribute
- setfacl from a restore file;

parts of service-nginx ... I

```
class rhel6-ss-service-nginx {
   if ($skip_service_nginx != "true") {
      package { "nginx.x86_64":          ensure => installed; }

      file {
         "/etc/nginx/conf.d":
            owner   => root,
            group   => root,
            mode    => 755,
            ensure  => directory,
            require => Package["nginx.x86_64"];

         "/etc/nginx/nginx.conf":
            owner   => root,
            group   => root,
            mode    => 644,
            source  => "puppet:///modules/rhel6-ss-service-nginx/
nginx.conf",
            require => Package["nginx.x86_64"];
```

parts of service-nginx ... 2

```
        "nginx_log.perms":
            path    => "/etc/nginx/nginx_log.perms",
            owner   => root,
            group   => root,
            mode    => 644,
            require => [ Package["nginx.x86_64"], Service["sssd"],
Group["ssapp"], ],
            source  => "puppet:///modules/rhel6-ss-service-nginx/
nginx_log.perms";
        }

    exec {
        "restore_nginx_log_perms":
            command => "${variables::setfacl_cmd} --restore=/etc/nginx/
nginx_log.perms",
            cwd     => "/var/log/nginx",
            subscribe => File["nginx_log.perms"],
            refreshonly => true;
    }
```

parts of service-nginx ... 3

```
    service {
        "nginx":
            ensure  => running,
            enable  => true,
            subscribe => File["/etc/nginx/nginx.conf"];
    }
  }
}
```

contents of nginx_log.perms:

```
# file: .
# owner: nginx
# group: root
user::rwx
user:nginx:rwx
group::r-x
group:wdu:r-x
group:ssapp:rwx
mask::rwx
other::r-x
default:user::rwx
default:user:nginx:rwx
default:group::r-x
default:group:wdu:r-x
default:group:ssapp:rwx
default:mask::r-x
default:other::r-x
```

ss-application

- argument passing with default arguments;
  - including using passed arguments to act as defaults;
- define calling other defines;
  - including from another scope;

parts of ss-application ... I

```
class rhel6-ss-application {
    ##
    ## Setup group, parent directories and facls on parent directories
    ##
    group{ "ssapp":             gid    => 765; }

    file {
        ["/opt/apps","/var/log/apps"]:
            owner  => root,
            group  => root,
            mode   => 755,
            ensure     => directory;
    }

    exec {
        "set group facl for wdu on /opt/apps/":
            command => "${variables::setfacl_cmd} -R -m
default:group:wdu:rwx /opt/apps && ${variables::setfacl_cmd} -R -m
group:wdu:rwx /opt/apps",
            cwd => "/opt/apps";
    }
```

parts of ss-application ... 2

```
    define setup_application_account($uid, $gid, $user, $comment, $groups
= [ "fcgi", "ssapp"], $log_uid = $uid, $log_gid = $gid) {
        user {
            $user:
                uid    => $uid,
                gid    => $gid,
                groups => $groups,
                comment => $comment,
                home   => "/opt/apps/$user",
                shell  => "/bin/true",
        }

        group { $user:       gid    => $gid; }
```

parts of ss-application ... 3

```
        file {
            "/opt/apps/$user":
                owner  => $uid,
                group  => $gid,
                mode   => 775,
                ensure => directory,
                require => File["/opt/apps"];

            "/var/log/apps/$user":
                owner  => $log_uid,
                group  => $log_gid,
                mode   => 755,
                ensure => directory,
                require => File["/var/log/apps"];

            "/opt/apps/$user/www":
                owner  => $uid,
                group  => nginx,
                mode   => 770,
                ensure => directory,
                require => [ Package["nginx.$arch"], File["/var/log/apps/
$user"], ];
        }
    }
```

parts of ss-application ... 4

```
   define setup_mercurial_application($uid, $gid, $user, $comment,
$path) {
       setup_application_account {
           "mercurial setup $user":
               uid     => $uid,
               gid     => $gid,
               user    => $user,
               comment => $comment;
       }

        rhel6-ss-platform-python::setup_mercurial_configs {
           "mercurial configs for $user":
               uid    => $uid,
               user   => $user,
               path   => $path;
       }
   }
}
```

Selective App deploy

- The biggest issue for the developers using Puppet has been speed;
  - Obvious way to speed things up is only deploy what is needed on a particular VM.
  - VM's name matches the application being developed on it.
    - e.g.: academicportal-ckz.vm.test

the control module

```
class rhel6-dev-control {
   $apps = [
      # JAVA
      'rhel6-ss-application-cas',
      'rhel6-ss-application-grouper',
      # PHP
      'rhel6-ss-fcgi-application-academicportal',
      'rhel6-ss-fcgi-application-accountactivation',
      'rhel6-ss-fcgi-application-drupaltest',
      # Python
      'rhel6-ss-application-hgitsss',
      'rhel6-ss-application-hgitsusg',
   ]

   define setupApp() {
      notice "requesting ${name}"
      include "${name}"
   }

   if ($skip_rhel6_dev_control != "true") {
      include rhel6-ss-application
      include rhel6-ss-util
      include rhel6-ss-util-homedirs
      include rhel6-ss-service-nginx
      include rhel6-ss-service-fastcgi
      include rhel6-ss-platform-python
      include rhel6-ss-platform-php
```

the control module ... fin

```
      if ($domain == 'vm.test' and $hostname =~ /^(\w+)-(\w+)$/) {
         $app = $1
         if !("rhel6-ss-fcgi-application-$app" in $apps) and !("rhel6-ss-application-$app"
in $apps) {
            notice "No app match VM name, setup all applications"
            setupApp { $apps :}
         } else {
            if ("rhel6-ss-fcgi-application-$app" in $apps) {
               setupApp { ["rhel6-ss-fcgi-application-${app}"] :}
            }
            if ("rhel6-ss-application-$app" in $apps) {
               setupApp { ["rhel6-ss-application-${app}"] :}
            }
         }
      } else {
         notice "General setup for all applications"
         setupApp { $apps :}
      }
   }
}
```

naming conventions

- Production bits code so they clash with the clean examples.
- Everything new starts with “rhel6”
- Application naming:
  - fcgi are PHP apps;
  - things ending in hg* are Mercurial repo apps;
  - everything else is Java.
- Still needs attention and is still evolving to suite.

Execution Order

- include location matters:
  - variables defined below an include, which should use them, notoriously do not work;
  - dependencies also fail;
- have not tried this extensively in 2.7.x

A better example

- http://riffraff169.wordpress.com/2012/03/09/add-file-contexts-with-puppet/
- Highlights:
  - “unless” parameter
  - great use of define
  - fail (function call)
    - see http://docs.puppetlabs.com/references/2.6.8/function.html

classes/selinux.class

- in /etc/puppet/manifests create classes/selinux.class

```
class selinux {

    define fcontext($context, $pathname) {
        if ($context == "") or ($pathname == "") {
            fail ("Context and Pathname must not be empty")
        }

        $semf_cmd = "/usr/sbin/semanage fcontext"

        exec {
            "add $context $pathname":
                command   => "$semf_cmd -a -t $context \"$pathname\"",
                unless => "$semf_cmd -l | /bin/grep \"^$pathname.*:
$context:\"";
        }
    }
}
```

include in site.pp

```
[root@c6pmaster manifests]# cat site.pp
import "nodes/*.node"
import "classes/*.class"
```

old auto_replicate_puppet

```
    exec {
        "dev puppetmodules":
            command  => "/usr/sbin/semanage fcontext -a -t puppet_etc_t /opt/dev/puppet-
modules\(/.*\)?",
            cwd => "/",
            unless   => "/usr/sbin/semanage fcontext -l | grep '/opt/dev/puppet-modules'";

        "dev puppetmodules real location":
            command  => "/usr/sbin/semanage fcontext -a -t puppet_etc_t /var/root-opt/dev/
puppet-modules\(/.*\)?",
            cwd => "/",
            unless   => "/usr/sbin/semanage fcontext -l | grep '/var/root-opt/dev/puppet-
modules'";

        "test puppetmodules":
            command  => "/usr/sbin/semanage fcontext -a -t puppet_etc_t /opt/test/puppet-
modules\(/.*\)?",
            cwd => "/",
            unless   => "/usr/sbin/semanage fcontext -l | grep '/opt/test/puppet-modules'";

        "test puppetmodules real location":
            command  => "/usr/sbin/semanage fcontext -a -t puppet_etc_t /var/root-opt/test/
puppet-modules\(/.*\)?",
            cwd => "/",
            unless   => "/usr/sbin/semanage fcontext -l | grep '/var/root-opt/test/puppet-
modules'";
    }
}
```

new auto_replicate_puppet

```
    selinux::fcontext {
        "dev puppetmodules":
            context  => "puppet_etc_t",
            pathname => "/opt/dev/puppet-modules(/.*)?";

        "dev puppetmodules real location":
            context  => "puppet_etc_t",
            pathname => "/var/root-opt/dev/puppet-modules(/.*)?";

        "test puppetmodules":
            context  => "puppet_etc_t",
            pathname => "/opt/test/puppet-modules(/.*)?";

        "test puppetmodules real location":
            context  => "puppet_etc_t",
            pathname => "/var/root-opt/test/puppet-modules(/.*)?";
    }
}
```

chaining updated

- old :

```
File["/opt/dev"] -> File["/opt/dev/puppet-modules"] -> Exec["dev
puppetmodules"] -> Exec["dev puppetmodules real location"]

File["/opt/test"] -> File["/opt/test/puppet-modules"] -> Exec["test
puppetmodules"] -> Exec["test puppetmodules real location"]
```

- new :

```
File["/opt/dev"] -> File["/opt/dev/puppet-modules"] ->
Selinux::Fcontext["dev puppetmodules"] -> Selinux::Fcontext["dev
puppetmodules real location"]

File["/opt/test"] -> File["/opt/test/puppet-modules"] ->
Selinux::Fcontext["test puppetmodules"] -> Selinux::Fcontext["test
puppetmodules real location"]
```

deployed

```
[root@c6pagent ~]# semanage fcontext -l | grep puppet-modules
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
info: Loading facts in /etc/puppet/modules/custom/lib/facter/
rh_release.rb
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6pagent.example.org
info: Applying configuration version '1337245374'
notice: /Stage[main]/Execute/Exec[echo top into /tmp/puppet.top]/
returns: executed successfully
notice: /Stage[main]/Auto_replicate_puppet/Selinux::Fcontext[test
puppetmodules]/Exec[add puppet_etc_t /opt/test/puppet-modules(/.*)?]/
returns: executed successfully
notice: /Stage[main]/Auto_replicate_puppet/Selinux::Fcontext[test
puppetmodules real location]/Exec[add puppet_etc_t /var/root-opt/
test/puppet-modules(/.*)?]/returns: executed successfully
notice: /Stage[main]/Execute/Exec[touch a file just once]/returns:
executed successfully
notice: /Stage[main]/Auto_replicate_puppet/Selinux::Fcontext[dev
puppetmodules]/Exec[add puppet_etc_t /opt/dev/puppet-modules(/.*)?]/
returns: executed successfully
notice: /Stage[main]/Auto_replicate_puppet/Selinux::Fcontext[dev
puppetmodules real location]/Exec[add puppet_etc_t /var/root-opt/dev/
puppet-modules(/.*)?]/returns: executed successfully
notice: Finished catalog run in 33.98 seconds
```

tested

```
[root@c6pagent ~]# semanage fcontext -l | grep puppet-modules
/opt/dev/puppet-modules(/.*)?                      all files
system_u:object_r:puppet_etc_t:s0
/opt/test/puppet-modules(/.*)?                     all files
system_u:object_r:puppet_etc_t:s0
/var/root-opt/dev/puppet-modules(/.*)?             all files
system_u:object_r:puppet_etc_t:s0
/var/root-opt/test/puppet-modules(/.*)?            all files
system_u:object_r:puppet_etc_t:s0
[root@c6pagent ~]#
```

fail

- fail acts only on empty $context or $pathname :

```
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
info: Loading facts in /etc/puppet/modules/custom/lib/facter/
rh_release.rb
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
err: Could not retrieve catalog from remote server: Error 400 on
SERVER: Context and Pathname must not be empty at /etc/puppet/
manifests/classes/selinux.class:5 on node c6pagent.example.org
warning: Not using cache on failed catalog
err: Could not retrieve catalog; skipping run
[root@c6pagent ~]#
```

- omitting either will cause different (built in) error.

Passenger

- see http://projects.puppetlabs.com/projects/1/wiki/Using_Passenger
- Crash course to follow ...

Prepare for Passenger

- Update the puppet.conf

```
[puppetmasterd]
  ssl_client_header = SSL_CLIENT_S_DN
  ssl_client_verify_header = SSL_CLIENT_VERIFY
```

- Install a bunch of packages

```
[root@c6pmaster ~]# yum install httpd httpd-devel ruby-devel rubygems
gcc mod_ssl
## ...
[root@c6pmaster ~]# yum install mod_passenger
## ...
```

Segue mod_passenger

- Need to mirror a new repo;
  - create /etc/yum.repos.d/passenger.reposync

```
[root@c6repo etc]# cat yum.repos.d/passenger.reposync
[passenger-x86_64]
name=Passenger repository for EL6
baseurl=http://passenger.stealthymonkeys.com/rhel/6/$basearch
enabled=1
gpgcheck=1
[root@c6repo etc]#
```

- mirror the repository (cronjob)

```
15 3 * * * root reposync -n -c /etc/yum.repos.d/passenger.reposync -
p /var/www/mrepo/passenger -a x86_64 -r passenger-x86_64 &&
createrepo /var/www/mrepo/passenger/passenger-x86_64
```

- update LocalMirror.repo on the client.

rack.conf and config.ru

- deploy and update rack.conf and config.ru

```
[root@c6pmaster ~]# cp /usr/share/puppet/ext/rack/files/
apache2.conf /etc/httpd/conf.d/rack.conf
[root@c6pmaster ~]# vi /etc/httpd/conf.d/rack.conf
[root@c6pmaster ~]# mkdir -p /etc/puppet/rack/public
[root@c6pmaster ~]# mkdir -p /etc/puppet/rack/tmp
[root@c6pmaster ~]# cp /usr/share/puppet/ext/rack/files/config.ru /
etc/puppet/rack
[root@c6pmaster ~]# chown puppet /etc/puppet/rack/config.ru
```

- restart httpd

```
PassengerHighPerformance on
PassengerMaxPoolSize 12
PassengerPoolIdleTime 1500
PassengerStatThrottleRate 120
RackAutoDetect Off
RailsAutoDetect Off

Listen 8140

<VirtualHost *:8140>
        SSLEngine on
        SSLProtocol -ALL +SSLv3 +TLSv1
        SSLCipherSuite ALL:!ADH:RC4+RSA:+HIGH:+MEDIUM:-LOW:-SSLv2:-EXP

        SSLCertificateFile      /var/lib/puppet/ssl/certs/c6pmaster.example.org.pem
        SSLCertificateKeyFile   /var/lib/puppet/ssl/private_keys/c6pmaster.example.org.pem
        SSLCertificateChainFile /var/lib/puppet/ssl/ca/ca_crt.pem
        SSLCACertificateFile    /var/lib/puppet/ssl/ca/ca_crt.pem
        SSLCARevocationFile    /var/lib/puppet/ssl/ca/ca_crl.pem
        SSLVerifyClient optional
        SSLVerifyDepth  1
        SSLOptions +StdEnvVars

        RequestHeader set X-SSL-Subject %{SSL_CLIENT_S_DN}e
        RequestHeader set X-Client-DN %{SSL_CLIENT_S_DN}e
        RequestHeader set X-Client-Verify %{SSL_CLIENT_VERIFY}e

        DocumentRoot /etc/puppet/rack/public/
        RackBaseURI /
        <Directory /etc/puppet/rack/>
                Options None
                AllowOverride None
                Order allow,deny
                allow from all
        </Directory>
</VirtualHost>
```

SELinux

- semodule -i /usr/share/selinux/packages/rubygem-passenger/rubygem-passenger.pp
- touch /.autorelabel ; reboot

```
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
err: /File[/var/lib/puppet/lib]: Failed to generate additional resources using
'eval_generate: Error 500 on SERVER: <!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//
EN">
<html><head>
<title>500 Internal Server Error</title>
</head><body>
<h1>Internal Server Error</h1>
<p>The server encountered an internal error or
misconfiguration and was unable to complete
your request.</p>
<p>Please contact the server administrator,
 root@localhost and inform them of the time the error occurred,
and anything you might have done that may have
caused the error.</p>
<p>More information about this error may be available
in the server error log.</p>
<hr>
<address>Apache/2.2.15 (CentOS) Server at c6pmaster.example.org Port 8140</address>
</body></html>
```

no, not SELinux

- error on 2.7.12-1 ; downgraded to 2.7.11-2
- restart httpd and:

```
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
info: Loading facts in /etc/puppet/modules/custom/lib/facter/rh_release.rb
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6pagent.example.org
info: Applying configuration version '1334677530'
notice: /Stage[main]/Execute/Exec[echo top into /tmp/puppet.top]/returns: executed
successfully
notice: Finished catalog run in 36.32 seconds
[root@c6pagent ~]#
```

maniacal laughter

- standard SELinux troubleshooting
- follow sealert tickets in /var/log/messages

```
[root@c6pmaster ~]# cat ruby_puppet.te
module ruby_puppet 1.0.9;

require {
   type httpd_t;
   type puppet_var_run_t;
   type puppet_var_lib_t;
   class file { write rename create unlink setattr };
   class dir { search read create write getattr rmdir remove_name add_name };
}

#============= httpd_t ==============
allow httpd_t puppet_var_lib_t:dir read;
allow httpd_t puppet_var_lib_t:dir { write remove_name create add_name rmdir };
allow httpd_t puppet_var_lib_t:file { write rename create unlink setattr };
allow httpd_t puppet_var_run_t:dir { search getattr };
[root@c6pmaster ~]# checkmodule -M -m -o ruby_puppet.mod ruby_puppet.te
checkmodule:  loading policy configuration from ruby_puppet.te
checkmodule:  policy configuration loaded
checkmodule:  writing binary representation (version 10) to ruby_puppet.mod
[root@c6pmaster ~]# semodule_package -o ruby_puppet.pp -m ruby_puppet.mod
[root@c6pmaster ~]# semodule -i ruby_puppet.pp
```

test entire process

- signing a new agent and standard run:

```
[root@c6pagent ~]# puppetd -vt --server=c6pmaster.example.org
info: Retrieving plugin
notice: /File[/var/lib/puppet/lib/facter]/ensure: created
notice: /File[/var/lib/puppet/lib/facter/rh_release.rb]/ensure: defined content as
'{md5}c872f6c6d50139da8034661183d7e1b1'
info: Loading downloaded plugin /var/lib/puppet/lib/facter/rh_release.rb
info: Loading facts in /etc/puppet/modules/custom/lib/facter/rh_release.rb
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6pagent.example.org
info: Applying configuration version '1334679591'
notice: /Stage[main]/Execute/Exec[echo top into /tmp/puppet.top]/returns: executed
successfully
notice: /Stage[main]/Puppet_conf/Service[puppet]/ensure: ensure changed 'stopped' to
'running'
info: Creating state file /var/lib/puppet/state/state.yaml
notice: Finished catalog run in 9.24 seconds
[root@c6pagent ~]# puppetd -vt
info: Retrieving plugin
info: Loading facts in /etc/puppet/modules/custom/lib/facter/rh_release.rb
info: Loading facts in /var/lib/puppet/lib/facter/rh_release.rb
info: Caching catalog for c6pagent.example.org
info: Applying configuration version '1334679591'
notice: /Stage[main]/Execute/Exec[echo top into /tmp/puppet.top]/returns: executed
successfully
notice: Finished catalog run in 5.67 seconds
[root@c6pagent ~]#
```

Choices

- clearly you can keep SELinux on:

```
[root@c6pmaster ~]# getenforce
Enforcing
```

- it is a bit of effort;
- ultimately worth it.
- see also: http://wiki.centos.org/HowTos/SELinux

restop

- Some config changes occasionally do not get picked up;
- Problems with Puppet configuration do not prevent httpd from working. Starting puppetmaster can provide insight into what's wrong.
- service httpd stop; service puppetmaster start; service puppetmaster stop; service httpd start

Conclusion

- Many different ways to do everything covered;
- Remember everyone's expertise;
  - Sys Admin's built the SOE;
  - Developers build on it;
- Everyone needs to be happy;
  - Achieved through honest communication and co-operation.