Chef Fundamentals

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Introductions

Introduce Yourselves

- Name
- Current job role
- Previous job roles/background
- Experience with Chef and/or config management
- Favorite Text Editor

Course Objectives and Style

Course Objectives

- Upon completion of this course you will be able to
  - Automate common infrastructure tasks with Chef
  - Describe Chef's architecture
  - Describe Chef's various tools
  - Apply Chef's primitives to solve your problems

How to learn Chef

- You bring the domain expertise about your business and problems
- Chef provides a framework for solving those problems
- Our job is to work together to teach you how to express solutions to your problems with Chef

Chef is a Language

- Learning Chef is like learning the basics of a language
- 80% fluency will be reached very quickly
- The remaining 20% just takes practice
- The best way to **learn** Chef is to ***use*** Chef

Training is really a discussion

- We will be doing things the **hard way**
- We're going to do **a lot** of typing
- You can't be:
  - Absent
  - Late
  - Left Behind
- We will troubleshoot and fix bugs on the spot
- The result is you reaching fluency fast

Training is really a discussion

- I'll post objectives at the beginning of a section
- Ask questions when they come to you
- Ask for help when you need it
- You'll get the slides **after** class

Fundamentals

- This course covers the fundamentals of Chef
- We likely will not have time to discuss the latest trends in the Chef ecosystem
- Any discussion items that are too far off topic will be captured
  - We'll return to these items as time permits

Stages of Learning - Shuhari

- Shuhari - first learn, then detach, and finally transcend
  - shu - "obey" - traditional wisdom
  - ha - "detach" - break with tradition
  - ri - "separate" - transcend

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Agenda

CHEF

Topics

- Overview of Chef
- Workstation Setup
- Organization Setup
- Test Node Setup
- Writing your first cookbook
- Dissecting your first Chef run
- Introducing the Node object
- Attributes, Templates, and Cookbook Dependencies

Topics

- Template Variables, Notifications, and Controlling Idempotency
- Data bags, search
- Roles
- Environments
- Using community cookbooks
- Further Resources

Breaks!

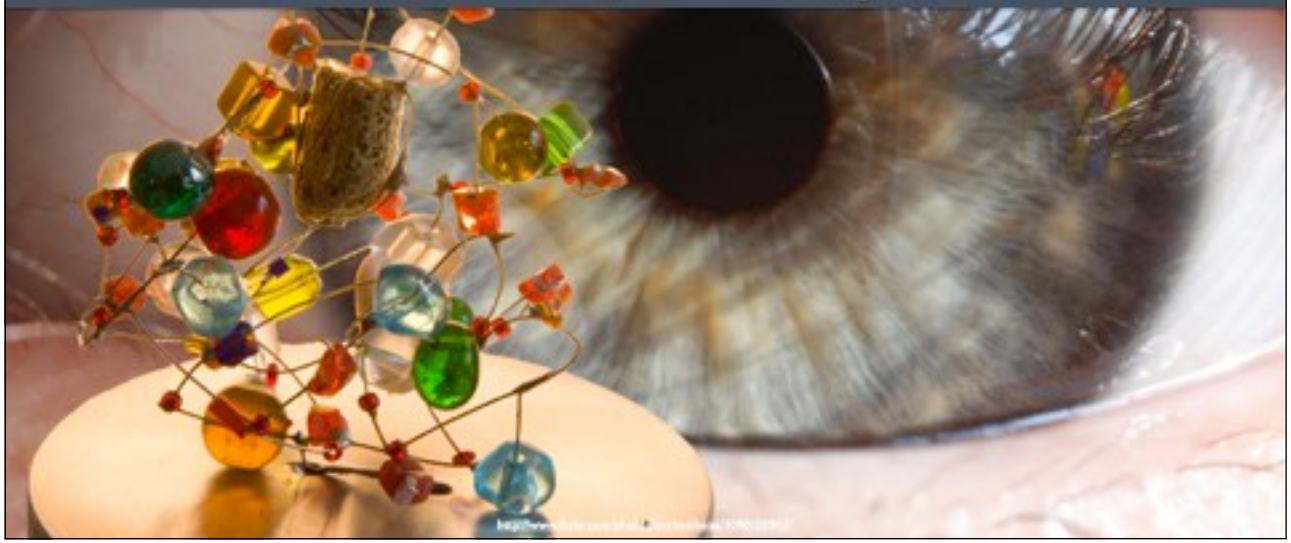
- We'll take a break between each section, or every hour, whichever comes first
- We'll obviously break for lunch :)

Overview of Chef

Lesson Objectives

- After completing the lesson, you will be able to
  - Describe how Chef thinks about Infrastructure Automation
  - Define the following terms:
    - Node
    - Resource
    - Recipe
    - Cookbook
    - Run List
    - Roles
    - Search

Complexity

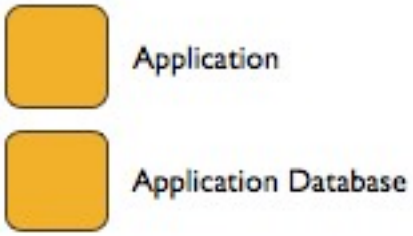


Items of Manipulation (Resources)

- Networking
- Files
- Directories
- Symlinks
- Mounts
- Registry Keys
- Powershell Scripts
- Users
- Groups
- Packages
- Services
- Filesystems

A tale of growth...

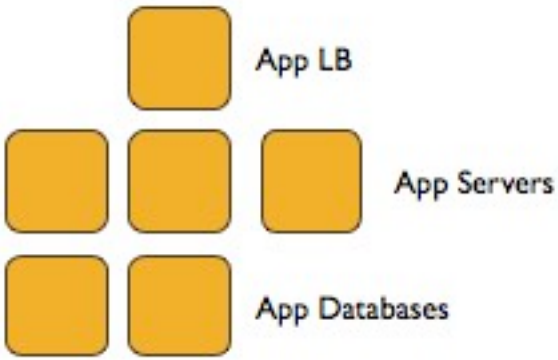
Add a database



Make database redundant

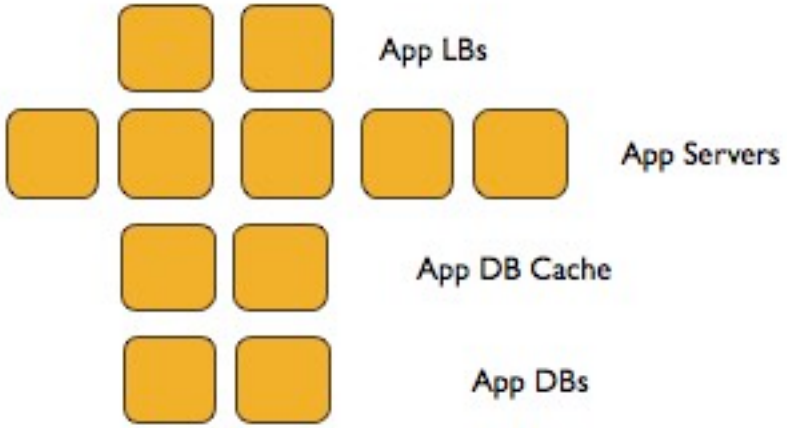
Application server redundancy

Add a load balancer

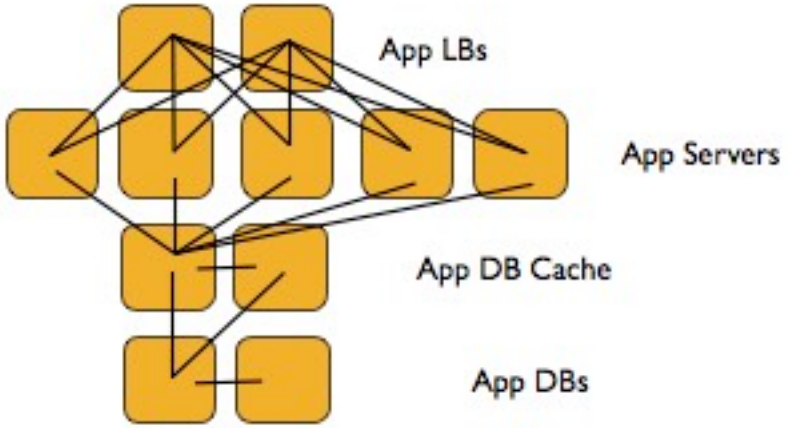


Webscale!

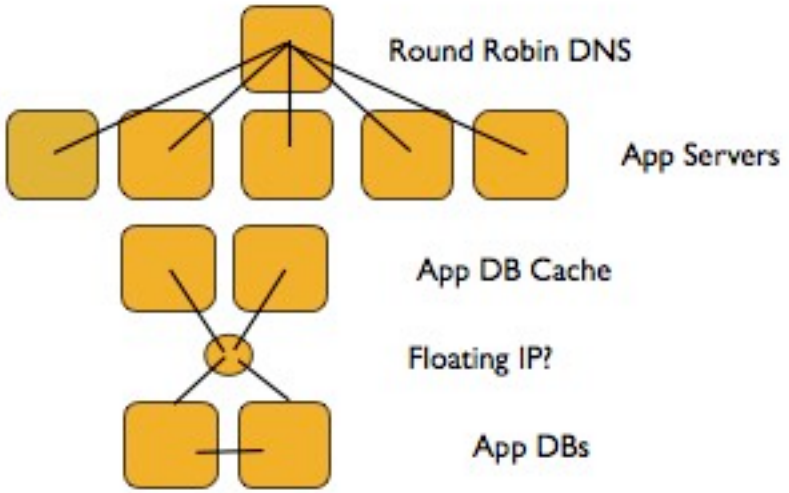
Now we need a caching layer



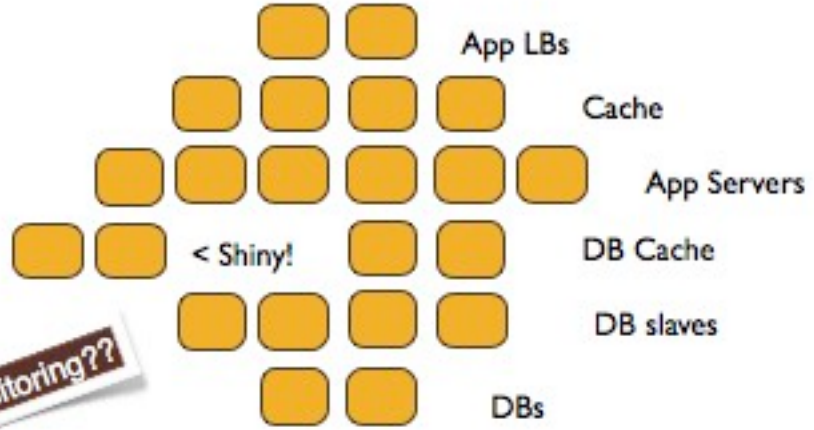
Infrastructure has a Topology



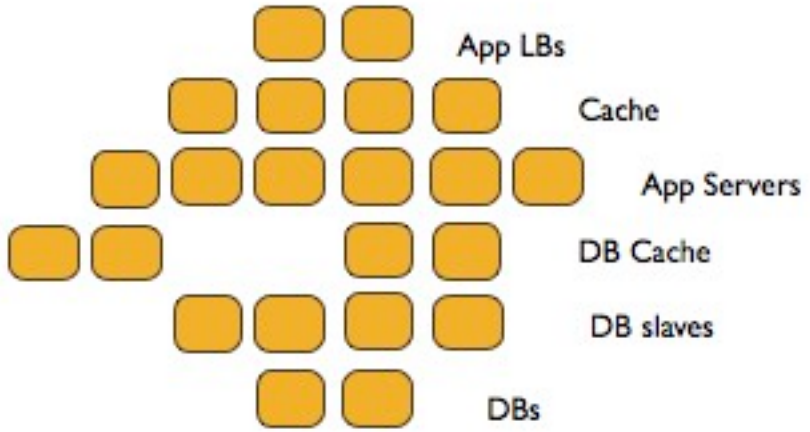
Your Infrastructure is a Snowflake



Complexity Increases Quickly



...and change happens!



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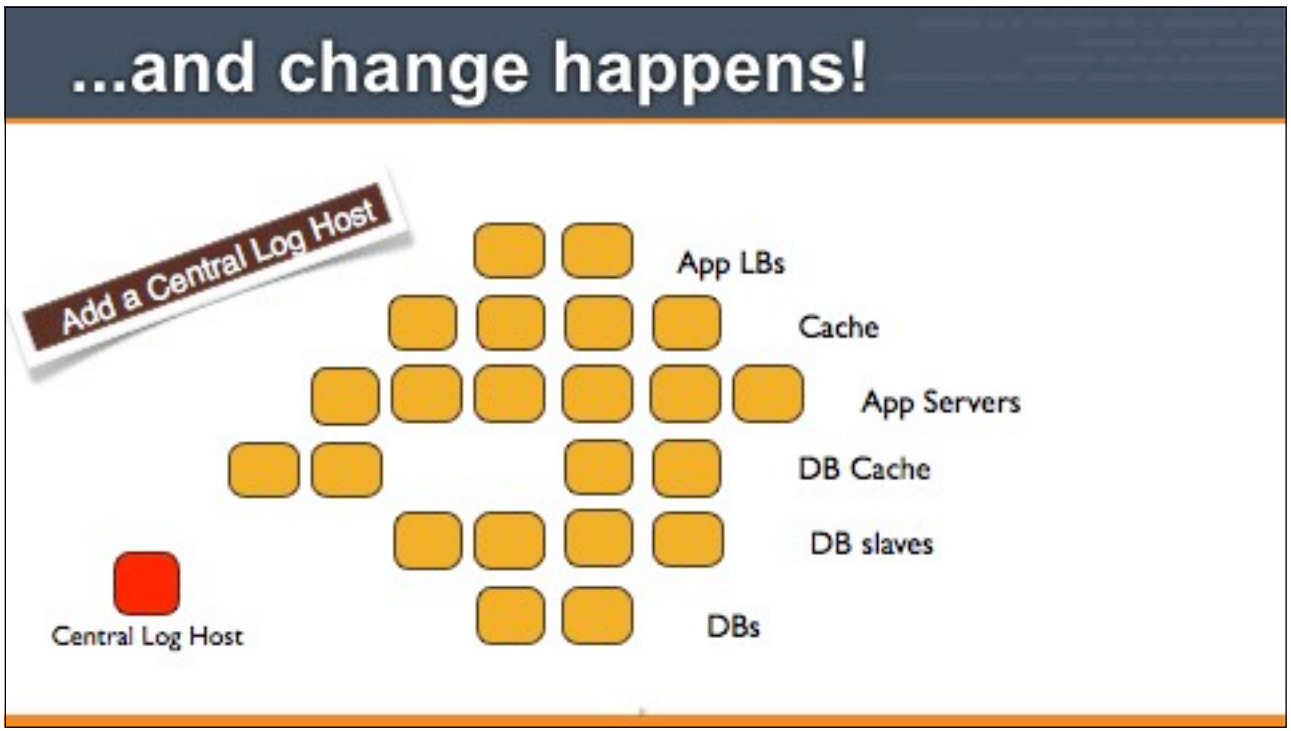

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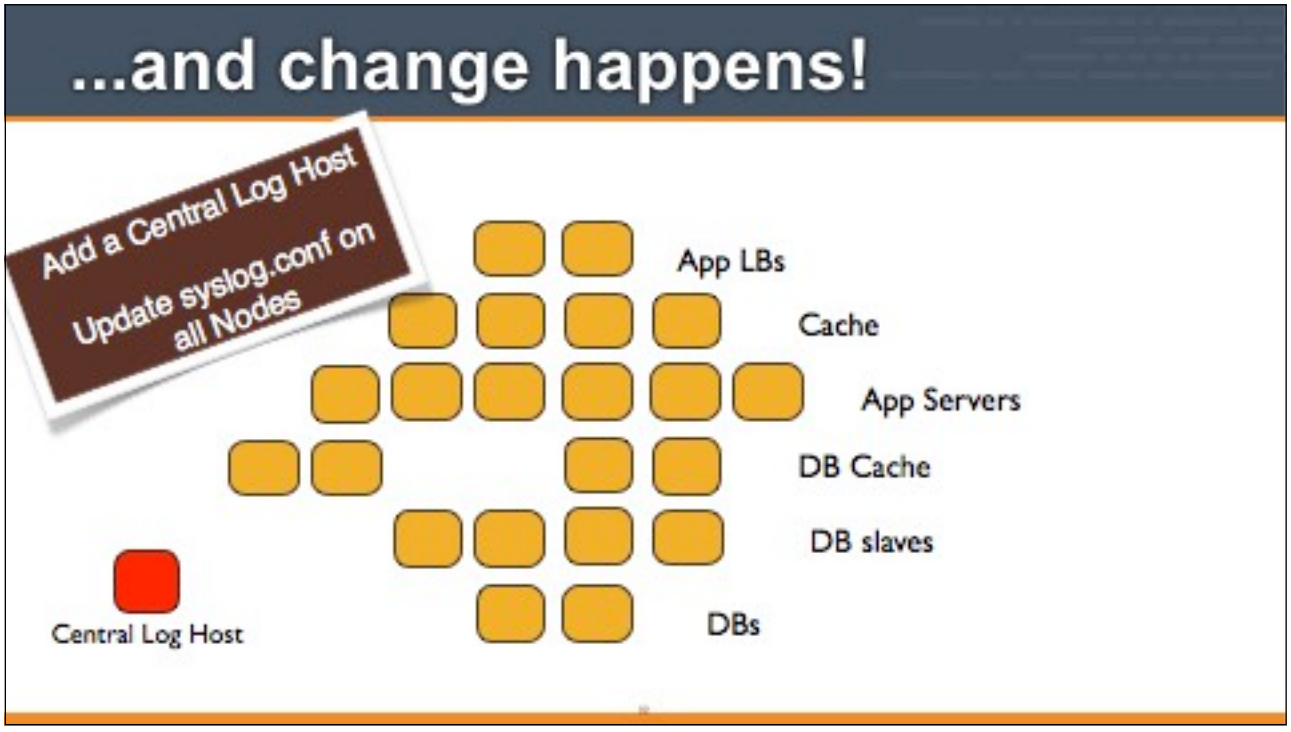

Chef Solves This Problem

CHEF™

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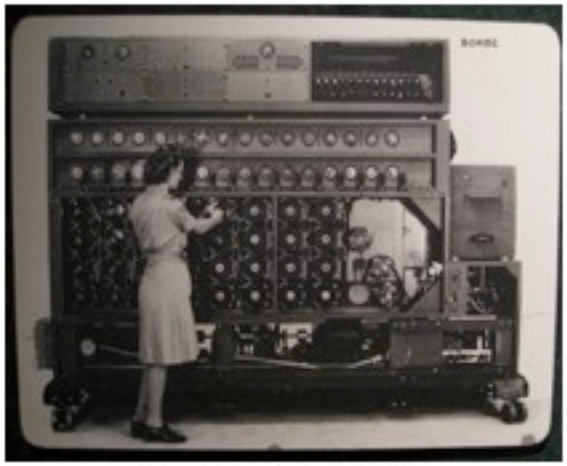
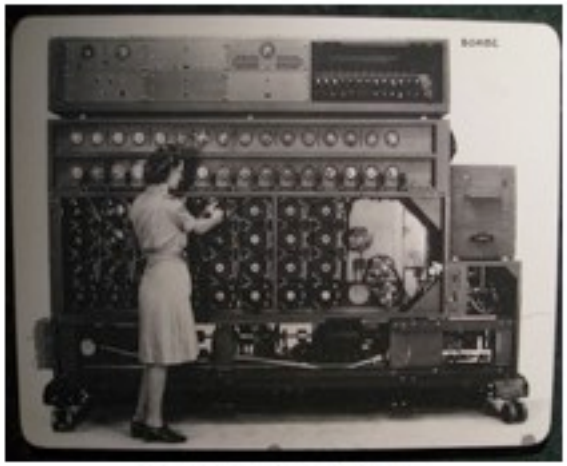
- But you already guessed that, didn't you?

Chef is Infrastructure as Code



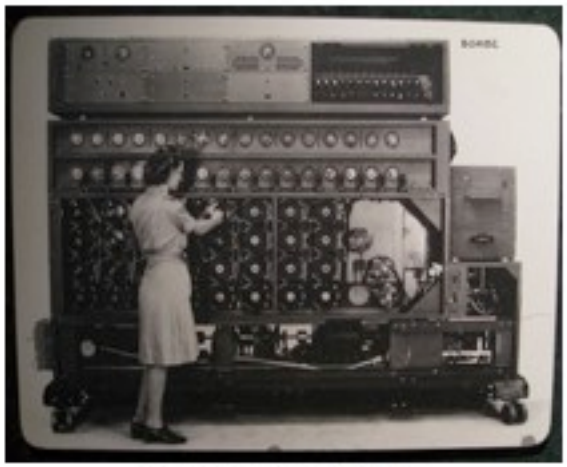
- Programmatically provision and configure components

Chef is Infrastructure as Code



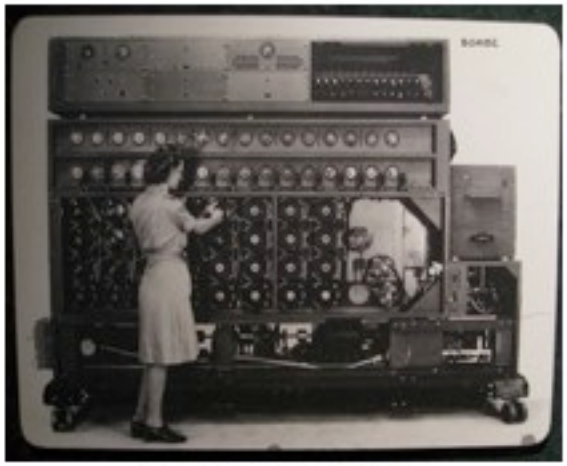
- Treat like any other code base

Chef is Infrastructure as Code



- Reconstruct business from **code repository**, **data backup**, and **compute resources**

Chef is Infrastructure as Code



- Programmatically provision and configure components
- Treat like any other code base
- Reconstruct business from **code repository**, **data backup**, and **compute resources**

Configuration Code

- Chef ensures each Node complies with the policy
- Policy is determined by the configurations in each Node's run list
- Reduce management complexity through abstraction
- Store the configuration of your infrastructure in version control

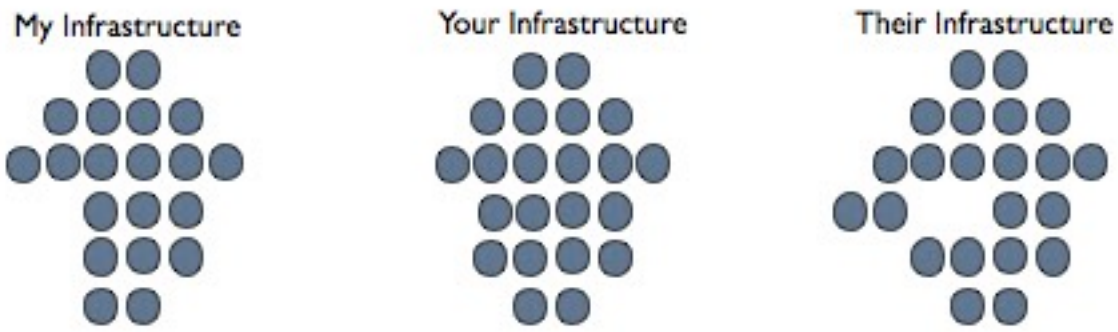
Declarative Interface to Resources

- You define the policy in your Chef configuration
- Your policy states what state each resource should be in, but not how to get there
- Chef-client will pull the policy from the Chef Server and enforce the policy on the Node

Managing Complexity

- Organizations
- Environments
- Roles
- Nodes
- Recipes
- Cookbooks
- Search

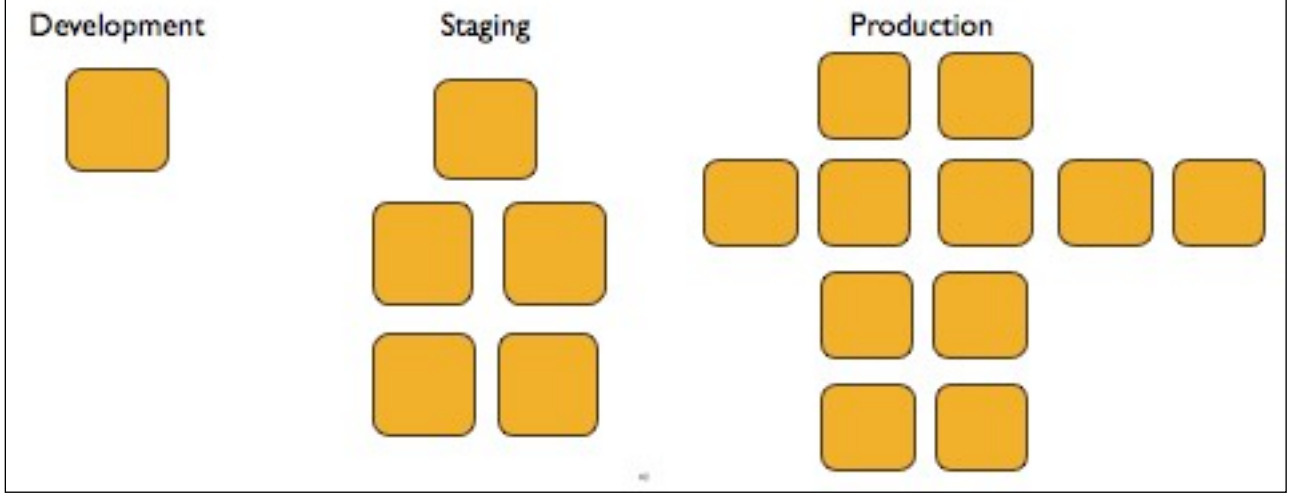
Organizations



Organizations

- Completely independent tenants of Enterprise Chef
- Share nothing with other organizations
- May represent different
  - Companies
  - Business Units
  - Departments

Environments



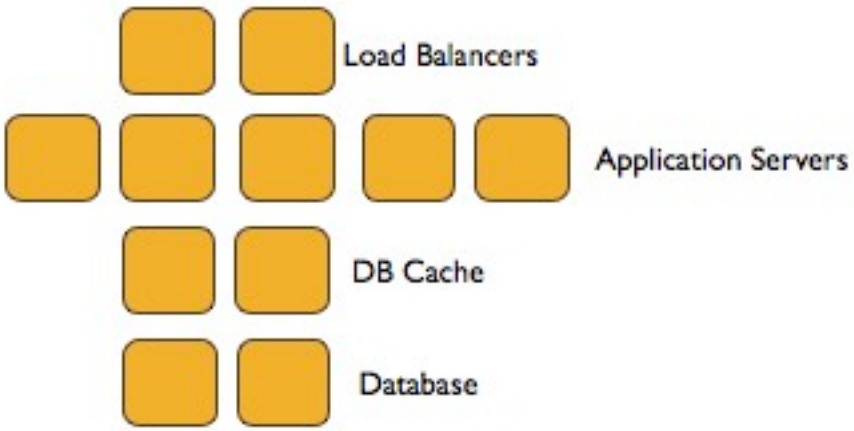
Environments

- Environments reflect your patterns and workflow, and can be used to model the life-stages of your applications
  - Development
  - Test
  - Staging
  - Production
  - etc.
- Every Organization starts with a single environment!

Environments Define Policy

- Environments may include data attributes necessary for configuring your infrastructure, e.g.
  - The URL of your payment service's API
  - The location of your package repository
  - The version of the Chef configuration files that should be used

Roles



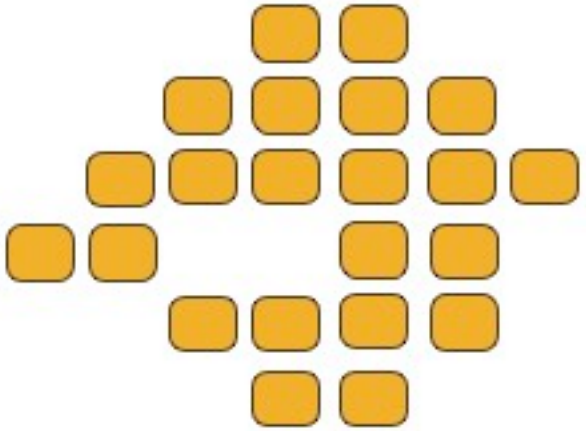
Roles

- Roles represent the types of servers in your infrastructure
  - Load Balancer
  - Application Server
  - Database Cache
  - Database
  - Monitoring

Roles Define Policy

- Roles may include an ordered list of Chef configuration files that should be applied
  - This list is called a Run List
  - Order is always important in the Run List
- Roles may include data attributes necessary for configuring your infrastructure, for example:
  - The port that the application server listens on
  - A list of applications that should be deployed

Nodes



Nodes

- Nodes represent the servers in your infrastructure
  - Could be physical servers or virtual servers
  - May represent hardware that you own or compute instances in a public or private cloud
- Could also be network hardware - switches, routers, etc

Node

- Each Node will
  - Belong to one Organization
  - Belong to one Environment
  - Have zero or more Roles

Nodes Adhere to Policy

- The chef-client application runs on each node, which
  - Gathers the current system configuration of the node
  - Downloads the desired system configuration policies from the Chef server for that node
  - Configures the node such that it adheres to those policies

Resources

- A Resource represents a piece of the system and its desired state
  - A package that should be installed
  - A service that should be running
  - A file that should be generated
  - A cron job that should be configured
  - A user that should be managed
  - and more

Resources in Recipes

- Resources are the fundamental building blocks of Chef configuration
- Resources are gathered into Recipes
- Recipes ensure the system is in the desired state

Recipes

- Configuration files that describe resources and their desired state
- Recipes can:
  - Install and configure software components
  - Manage files
  - Deploy applications
  - Execute other recipes
  - and more

Example Recipe

```
package "apache2"
```

```
template "/etc/apache2/apache2.conf" do
  source "apache2.conf.erb"
  owner "root"
  group "root"
  mode "0644"
  variables(:allow_override => "All")
  notifies :reload, "service[apache2]"
end
```

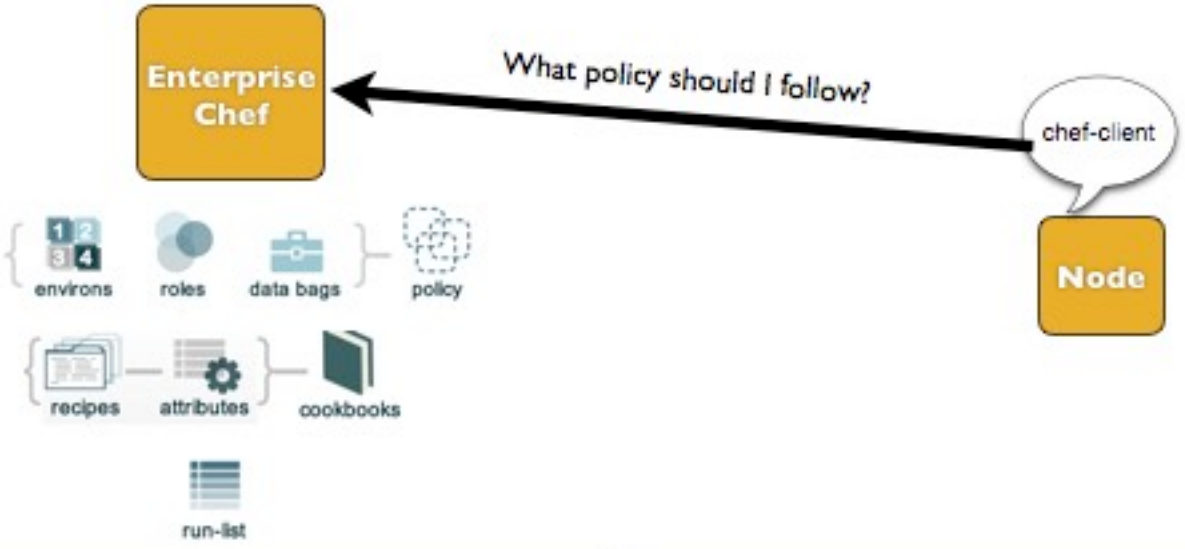
```
service "apache2" do
  action [:enable,:start]
  supports :reload => true
end
```

Cookbooks

- Recipes are stored in Cookbooks
- Cookbooks contain recipes, templates, files, custom resources, etc
- Code re-use and modularity

http://www.flickr.com/photos/shutterhacks/4474421855/

Run List



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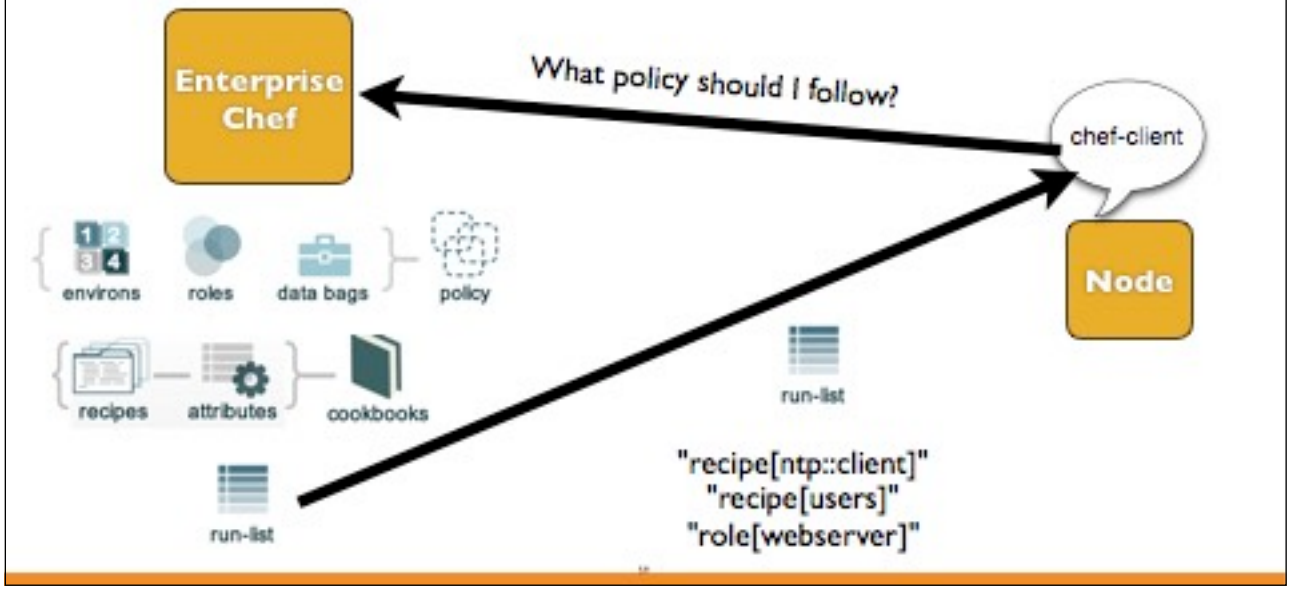
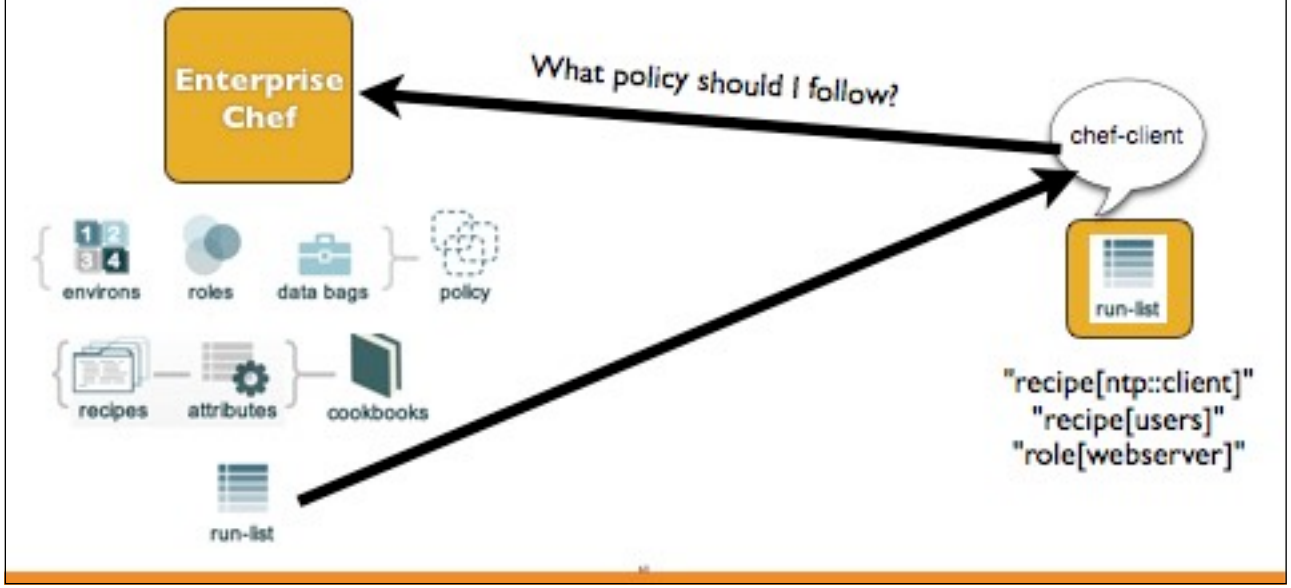


Run List



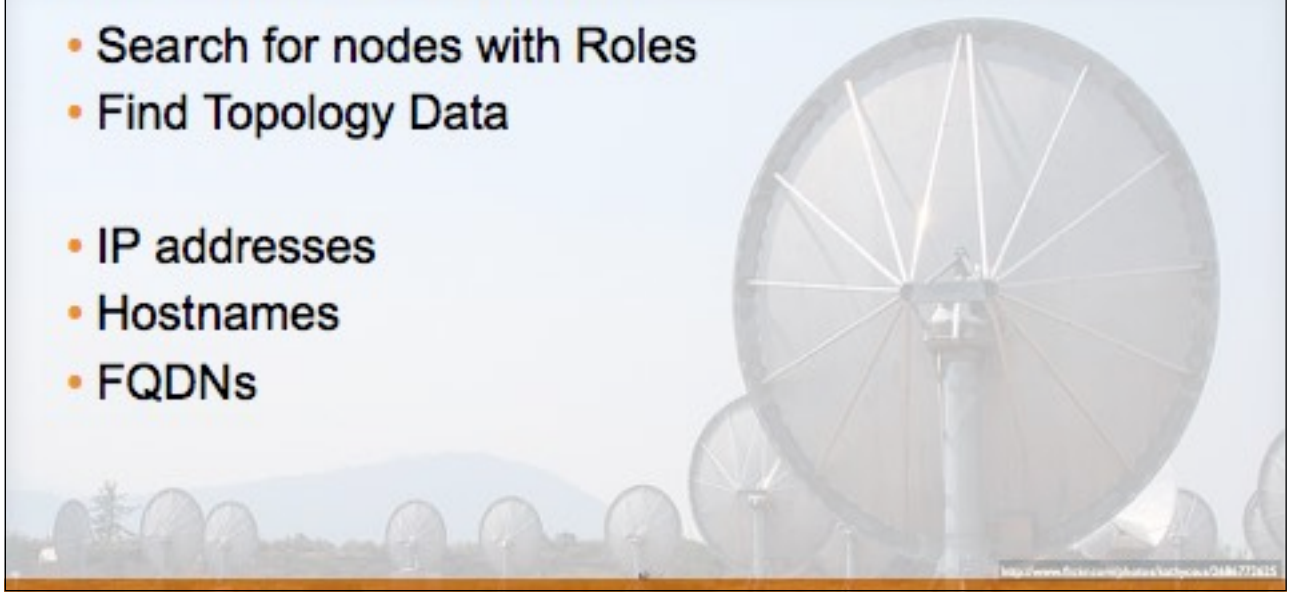
Run List Specifies Policy

- The Run List is an ordered collection of policies that the Node should follow
- Chef-client obtains the Run List from the Chef Server
- Chef-client ensures the Node complies with the policy in the Run List

Search

- Search for nodes with Roles
- Find Topology Data

- IP addresses
- Hostnames
- FQDNs

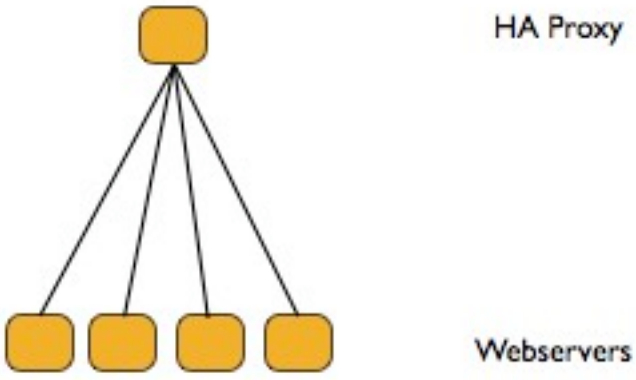


Search for Nodes

```
pool_members = search("node","role:webserver")

template "/etc/haproxy/haproxy.cfg" do
  source "haproxy-app_lb.cfg.erb"
  owner "root"
  group "root"
  mode 0644
  variables :pool_members => pool_members.uniq
  notifies :restart, "service[haproxy]"
end
```

HAProxy Configuration



HAProxy Load Balancer

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pool_members = search("node","role:webserver")
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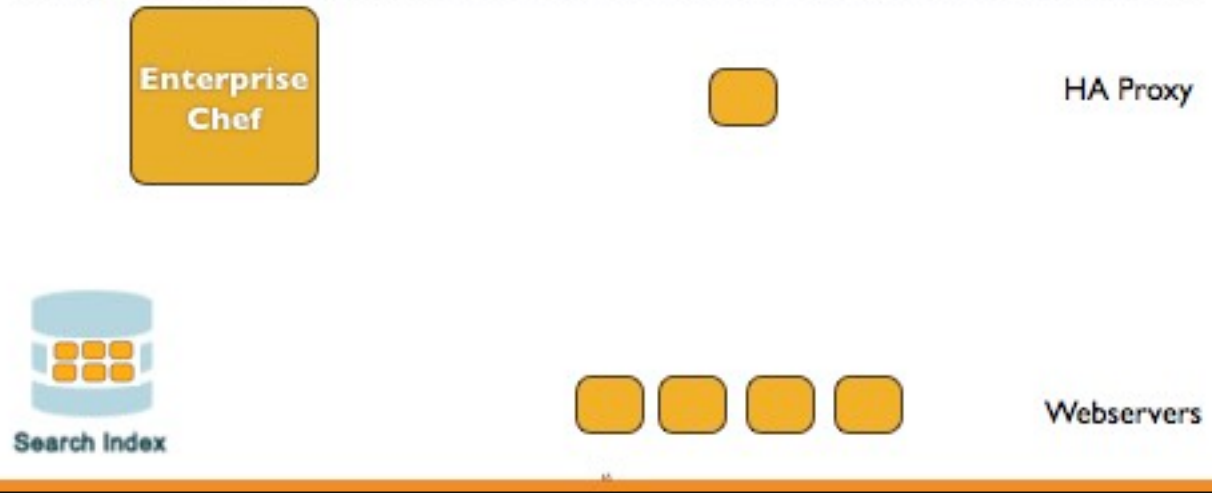

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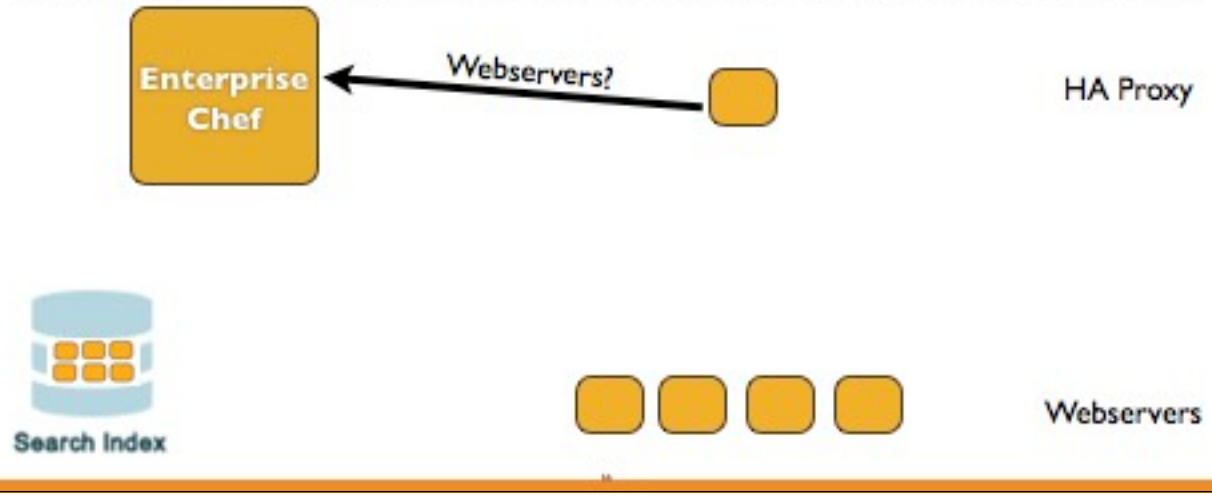

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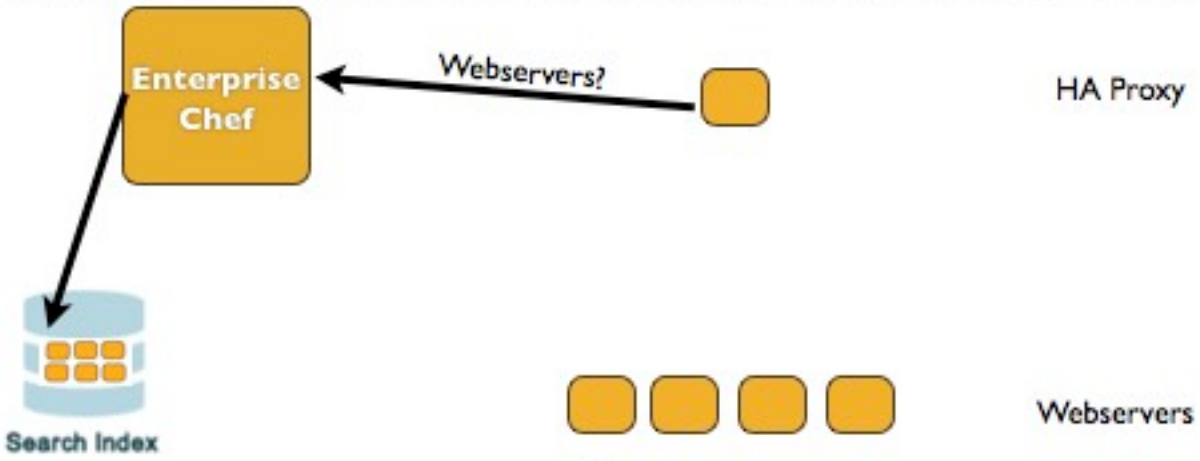

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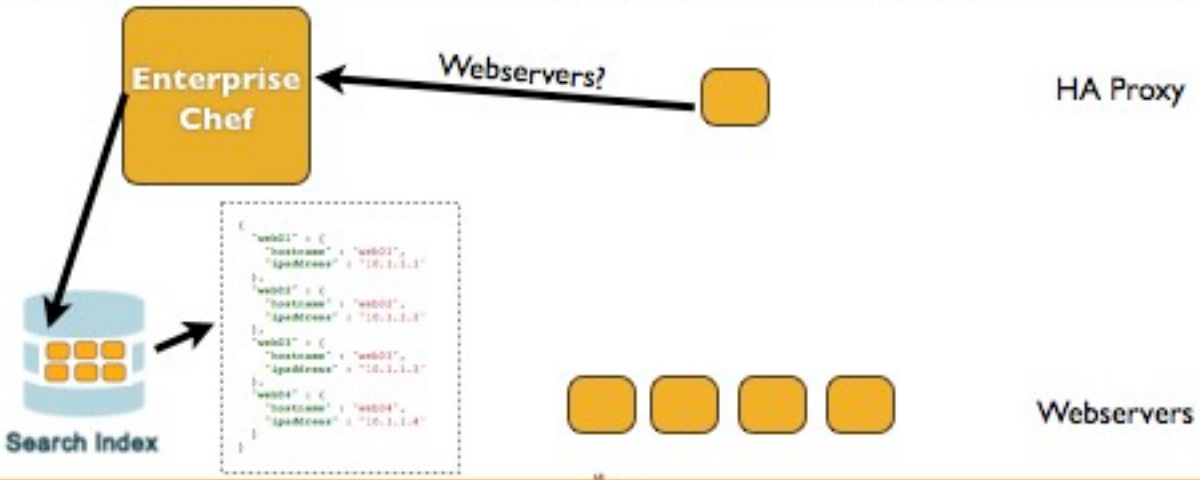

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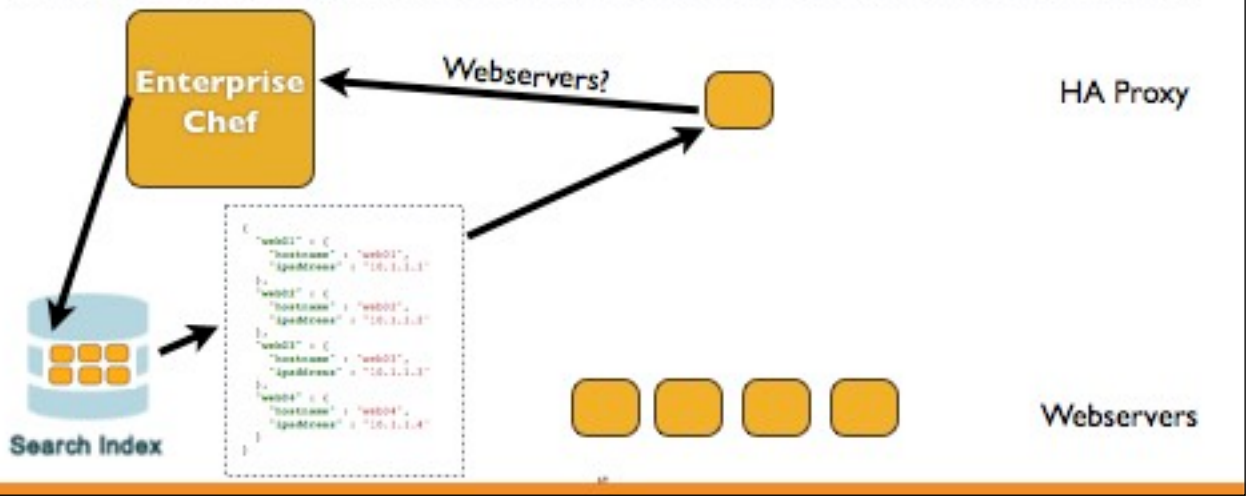

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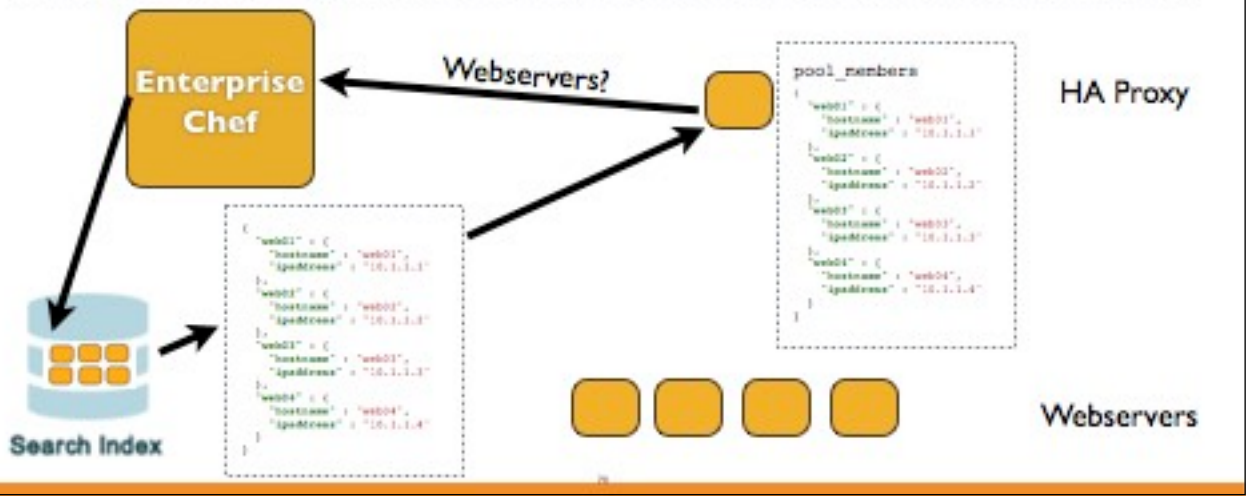

Search for Nodes

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  source "haproxy-app_lb.cfg.erb"
  owner "root"
  group "root"
  mode 0644
  variables :pool_members => pool_members.uniq
  notifies :restart, "service[haproxy]"
end
```

Pass results into Templates

```
 # Set up application listeners here.
listen application 0.0.0.0:80
  balance roundrobin
  <% @pool_members.each do |member| -%>
  server <%= member[:hostname] %> <%= member[:ipaddress] %>:> weight 1 maxconn 1 check
  <% end -%>
<% if node["haproxy"]["enable_admin"] -%>
listen admin 0.0.0.0:22002
  mode http
  stats uri /
<% end -%>
```

HAProxy Configuration

```
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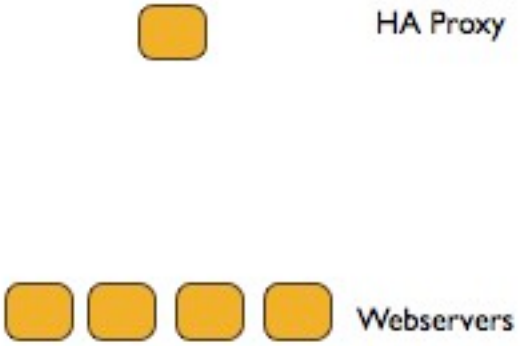
pool_members



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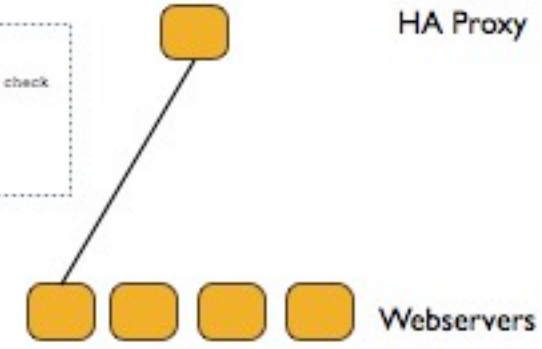
pool_members

haproxy.cfg

```
server web01 10.1.1.1 weight 1 maxconn 1 check
```



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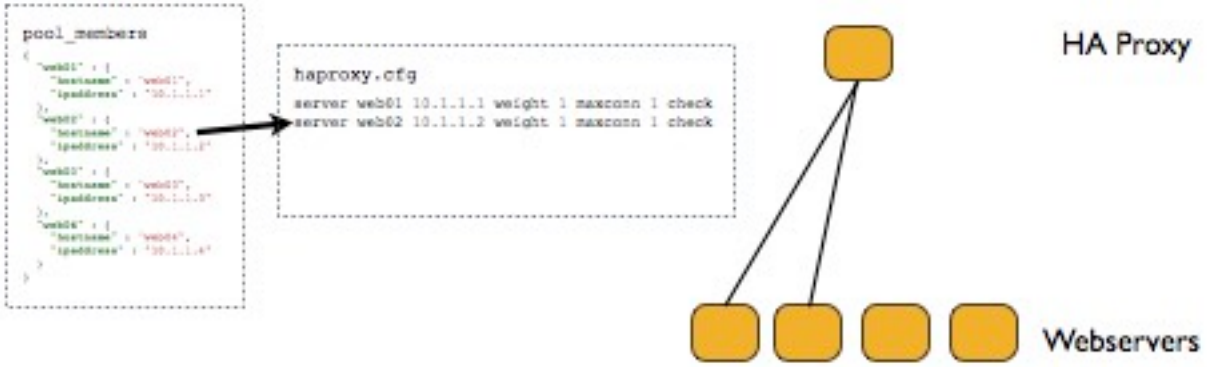

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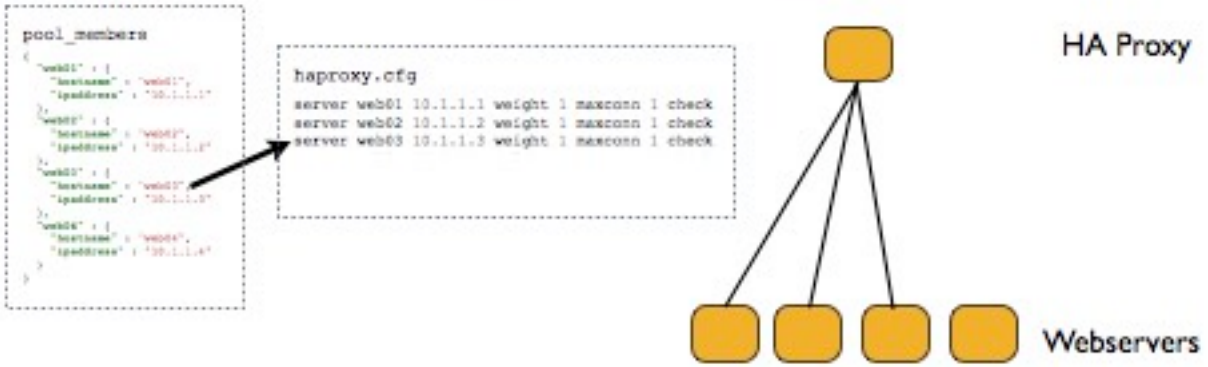

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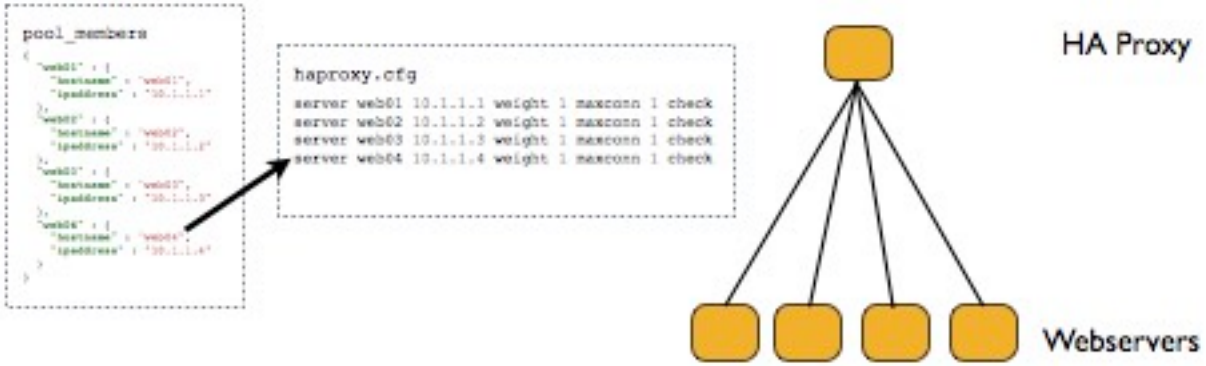
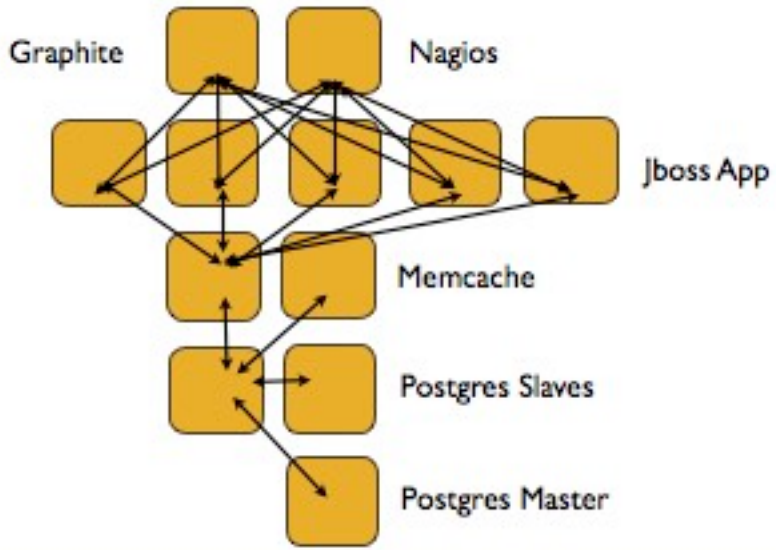
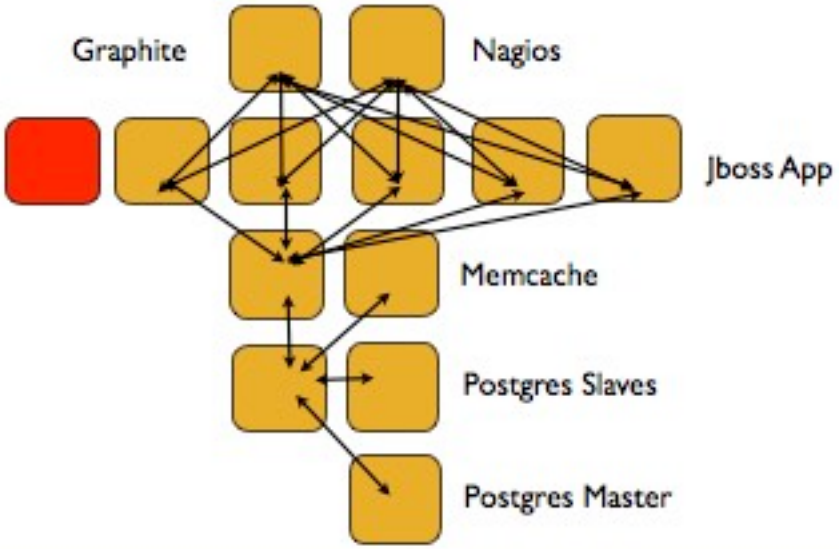


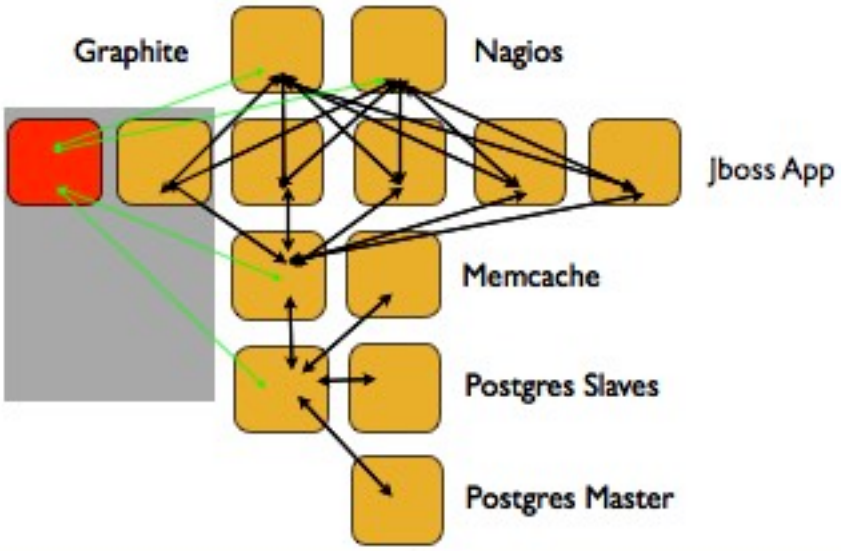
So when this...



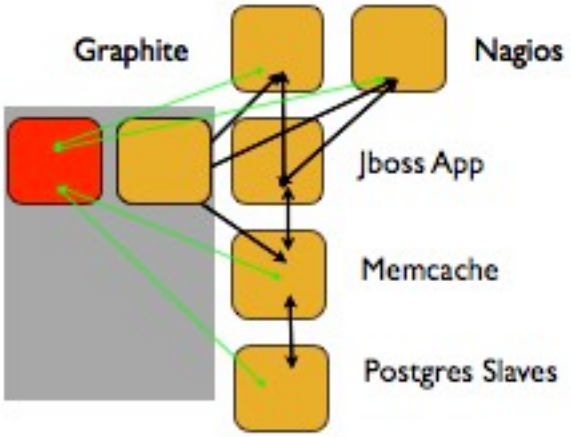
...becomes this



...this can happen automatically



Count the Resources



- 12+ resource changes for 1 node addition

- Load balancer config
- Nagios host ping
- Nagios host ssh
- Nagios host HTTP
- Nagios host app health
- Graphite CPU
- Graphite Memory
- Graphite Disk
- Graphite SNMP
- Memcache firewall
- Postgres firewall
- Postgres authZ config

Manage Complexity

- Determine the desired state of your infrastructure
- Identify the Resources required to meet that state
- Gather the Resources into Recipes
- Compose a Run List from Recipes and Roles
- Apply a Run List to each Node in your Environment
- Your infrastructure adheres to the policy modeled in Chef

Configuration Drift

- Configuration Drift happens when:
  - Your infrastructure requirements change
  - The configuration of a server falls out of policy
- Chef makes it easy to manage
  - Model the new requirements in your Chef configuration files
  - Run the chef-client to enforce your policies

Design Tenets of Chef

- Whipuptitude - aptitude for whipping things up
- Reasonability
- Sane defaults
- Flexibility
- Manipulexity - manipulation of complex things

Review Questions

- What is a Node?
- What is a Resource?
- What is a Recipe? How is it different from a Cookbook?
- What is a Run List?
- What is a Role?

Workstation Setup

Getting started

CHEF

Lesson Objectives

- After completing the lesson, you will be able to
  - Login to Enterprise Chef
  - View your Organization in Enterprise Chef
  - Describe Knife, the Chef command line utility
  - Use Knife on your Workstation

Legend

CHEF

Legend: Do I run that command on my workstation?

This is an example of a command to run on your workstation

```
$ whoami
i-am-a-workstation
```

This is an example of a command to run on your target node via SSH.

```
user@hostname:~$ whoami
i-am-a-chef-node
```

Legend: Example Terminal Command and Output

```
$ ifconfig
```

```
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
    options=3<RXCSUM,TXCSUM>
    inet6 fe80::1%lo0 prefixlen 64 scopeid 0x1
    inet 127.0.0.1 netmask 0xff000000
    inet6 ::1 prefixlen 128
gif0: flags=8010<POINTOPOINT,MULTICAST> mtu 1280
stf0: flags=0<> mtu 1280
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    ether 28:cf:e9:1f:79:a3
    inet6 fe80::2acf:e9ff:fe1f:79a3%en0 prefixlen 64 scopeid 0x4
    inet 10.100.0.84 netmask 0xffffff00 broadcast 10.100.0.255
    media: autoselect
    status: active
p2p0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 2304
    ether 0a:cf:e9:1f:79:a3
    media: autoselect
    status: inactive
```

Legend: Example of editing a file on your workstation

OPEN IN EDITOR: ~/hello_world

```
Hi!

I am a friendly file.
```

SAVE FILE!

Landscape of a Chef-managed Infrastructure

Landscape of a Chef-managed Infrastructure

Install Chef

- Install Chef (if not already installed)
- http://www.chef.io/chef/install

Install Chef

Download options

Chef Client | Chef Server

Installing the Chef Client

Select the kind of system you would like to install the Chef Client on. The versions listed have been tested and are supported.

[Select an Operating System]

[Select a Version]

[Select an Architecture]

Install on Mac OSX

Download options

Chef Client | Chef Server

Installing the Chef Client

Select the kind of system you would like to install the Chef Client on. The versions listed have been tested and are supported.

OS X

10.7

x86_64

Quick Install Instructions

Open a shell on the target system and run the following command to download and install the latest version of the Chef client:

```
curl -L https://www.opscode.com/chef/install.sh | sudo bash
```

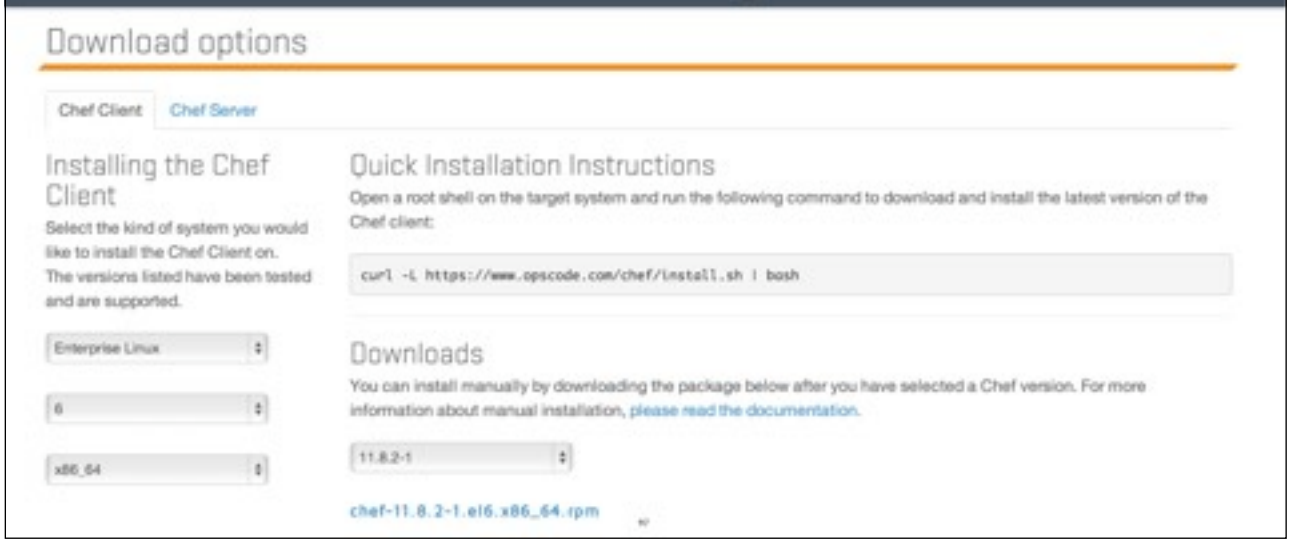
Downloads

You can install manually by downloading the package below after you have selected a Chef version. For more information about manual installation, please read the documentation.

11.8.2-1

chef-11.8.2_1.mac_os_x.10.7.2.sh

Install on Enterprise Linux



Workstation Setup - Mac OS X / Linux

```
$ curl -L http://www.chef.io/chef/install.sh | sudo bash
```

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 14100  100 14100    0     0   8814      0  0:00:01  0:00:01 --:--:--  8812
Downloading Chef  for mac_os_x...
downloading http://www.getchef.com/chef/metadata?v=&prerelease=false&p=mac_os_x&pv=10.7&m=x86_64
  to file /tmp/install.sh.79770/metadata.txt
trying curl...
url http://opscode-omnibus-packages.s3.amazonaws.com/mac_os_x/10.7/x86_64/chef-11.8.2_1.mac_os_x.
10.7.2.sh
md5 af157c6ef941e52f69a9dd6a3b57f597
sha256 c003c0951d80245b1f02c4588f9157a55e7b94a00dd6ac163aed8ef2e854619a
downloaded metadata file looks valid...
downloading http://opscode-omnibus-packages.s3.amazonaws.com/mac_os_x/10.7/x86_64/
chef-11.8.2_1.mac_os_x.10.7.2.sh
  to file /tmp/install.sh.79770/chef--mac_os_x-10.7-x86_64.sh
trying curl...
........................................................................
Thank you for installing Chef!
```

Workstation Setup - Windows

- Windows
- 2008 (Windows 7) or 2012 (Windows 8)
- i686 (32-bit) or x86_64 (64-bit)
- 11.8.2

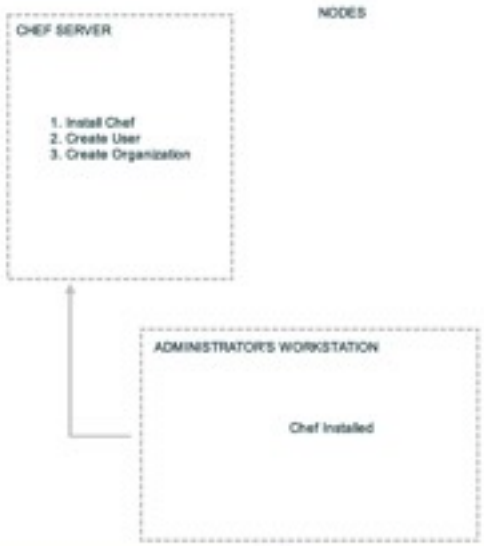
Install on Windows

What just happened?

- Chef and all of its dependencies installed via an operating system-specific package ("omnibus installer")
- Installation includes
  - The Ruby language - used by Chef
  - knife - Command line tool for administrators
  - chef-client - Client application
  - ohai - System profiler
  - ...and more

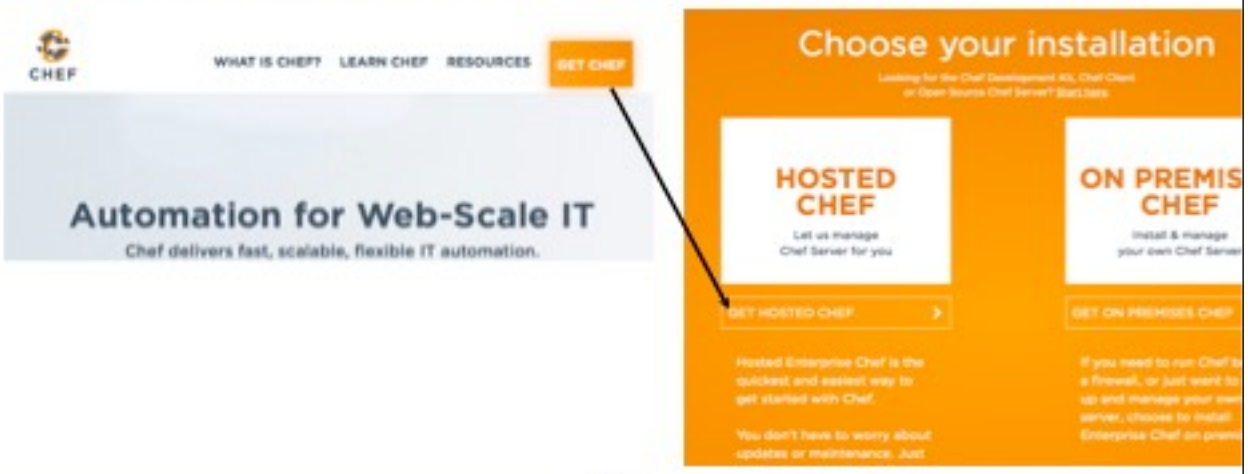
Workstation or Node?

Landscape of a Chef-managed Infrastructure



Your Chef Server for this class...

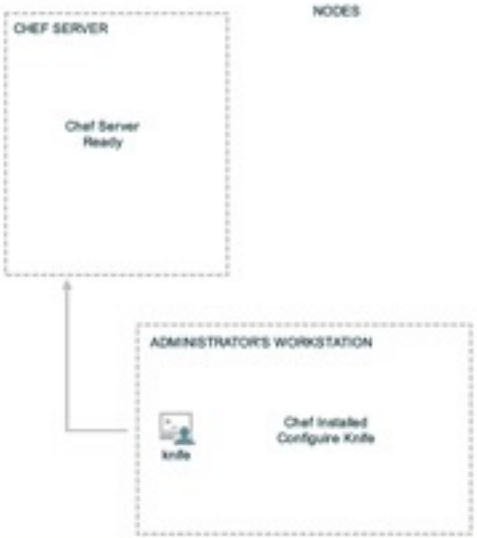
- Hosted Enterprise Chef http://www.chef.io



Create new account

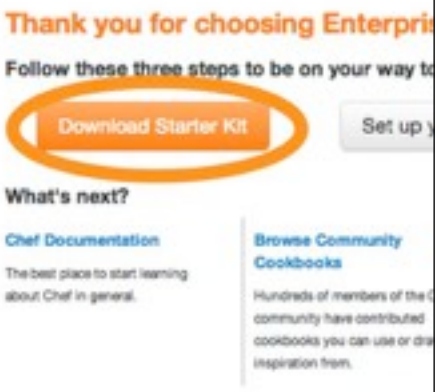
- Sign up for a new account
- Chef Organization
  - provides multi-tenancy
  - name must be globally unique

Landscape of a Chef-managed Infrastructure



Download "Starter Kit" for your Org

- You get a .zip file from clicking this
- Unzip the zipfile - you'll get a "chef-repo"
- Put the "chef-repo" somewhere, e.g.:
  - C:\Users\you\chef-repo (Win)
  - /Users/you/chef-repo (Mac)
  - /home/you/chef-repo (Linux)



What is the Starter Kit?

- The 'Starter Kit' is a archive file (e.g. chef-starter.zip) that contains
  - A sample chef repository with a sample 'starter' cookbook
  - Configuration files allowing the workstation to talk to the chef server using knife
  - We'll look at this in detail later...

Knife is the command-line tool for Chef

- Knife provides an API interface between a local Chef repository and the Chef Server, and lets you manage:
  - Nodes
  - Cookbooks and recipes
  - Roles
  - Stores of JSON data (data bags), including encrypted data
  - Environments
  - Cloud resources, including provisioning
  - The installation of Chef on management workstations
  - Searching of indexed data on the Chef Server

A quick tour of the chef-repo

- Every infrastructure managed with Chef has a Chef Repository ("chef-repo")
- Type **all** commands in this class from the chef-repo directory
- Let's see what's inside the chef-repo...

Tour the chef-repo

```
$ cd chef-repo
```

```
[~/chef-repo]$
```

Tour the chef-repo

```
$ ls -al
```

```
total 40
drwxr-xr-x@ 11 opscode  opscode   374 Dec 15 09:42 .
drwxr-xr-x+ 92 opscode  opscode  3128 Dec 15 09:43 ..
drwxr-xr-x@  3 opscode  opscode   102 Dec 15  2013 .berkshelf
drwxr-xr-x@  5 opscode  opscode   170 Dec 15  2013 .chef
-rw-r--r--@  1 opscode  opscode   495 Dec 15  2013 .gitignore
-rw-r--r--@  1 opscode  opscode  1433 Dec 15  2013 Berksfile
-rw-r--r--@  1 opscode  opscode  2416 Dec 15  2013 README.md
-rw-r--r--@  1 opscode  opscode  3567 Dec 15  2013 Vagrantfile
-rw-r--r--@  1 opscode  opscode   588 Dec 15  2013 chefignore
drwxr-xr-x@  3 opscode  opscode   102 Dec 15  2013 cookbooks
drwxr-xr-x@  3 opscode  opscode   102 Dec 15  2013 roles
```

What's inside the .chef directory?

```
$ ls .chef
```

```
ORGNAME-validator.pem
USERNAME.pem
knife.rb
```

What's inside the .chef directory?

- `knife.rb` is the configuration file for Knife.
- The other two files are certificates for authentication with the Chef Server
  - We'll talk more about that later.

knife.rb

- Default location
  - `~/.chef/knife.rb`
  - `c:\Users\You\.chef` (Windows)
- Use a project specific configuration
  - `.chef/knife.rb` of the current directory
    - `chef-repo/.chef/knife.rb`
- http://docs.chef.io/config_rb_knife.html

knife.rb

OPEN IN EDITOR: `chef-repo/.chef/knife.rb`

```
current_dir = File.dirname(__FILE__)
log_level                :info
log_location             STDOUT
node_name                "USERNAME"
client_key               "#{current_dir}/USERNAME.pem"
validation_client_name   "ORGNAME-validator"
validation_key           "#{current_dir}/ORGNAME-validator.pem"
chef_server_url          "https://api.opscode.com/organizations/ORGNAME"
cache_type               'BasicFile'
cache_options( :path => "#{ENV['HOME']}/.chef/checksums" )
cookbook_path            ["#{current_dir}/../cookbooks"]
```

Verify Knife

```
$ knife --version
Chef: 11.8.2
```

```
$ knife client list
ORGNAME-validator
```

- Your version may be different, that's ok!

knife client list

1. Reads the chef_server_url from knife.rb
2. Invokes HTTP GET to #{chef_server_url}/clients
3. Displays the result

Exercise: Run 'knife help list'

```
$ knife help list
```

```
Available help topics are:
  bootstrap
  chef-shell
  client
  configure
  cookbook
  cookbook-site
  data-bag
  delete
  deps
  diff
  download
  edit
  environment
  exec
  list
```

A few knife tips

- Commands are always structured as follows
  - knife
  - NOUN (client)
  - VERB (list)
- You can get more help with
  - knife NOUN help
  - `knife --help` just shows options

Best Practice: Use a text editor with a project drawer, or equivalent

- Chef is about Infrastructure as Code
- People who code for a living use text editors that are designed for the task
  - Vim, Emacs, Sublime Text, Notepad++, etc.

Benefits of a good text editor

- A good editor will
  - Show line numbers
  - Highlight syntax
  - Autocomplete commands
  - Allow you to open multiple files

If you do not have a preferred text editor on your workstation already...

- Download Sublime Text
  - Free trial, not time bound
  - Works on every platform
- sublimetext.com

Checkpoint

What's Next?

Source Code Repository

Review Questions

- What is the chef-repo?
- What is knife?
- What is name of the knife configuration file?
- Where is the knife configuration file located?
- What is your favorite text editor? :)

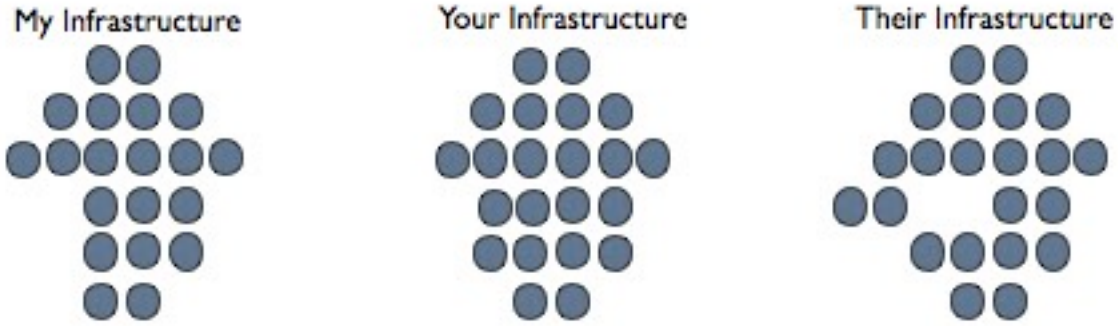
Organization Setup

Setup an Organization

Lesson Objectives

- After completing the lesson, you will be able to
  - Explain the purpose of Organizations
  - Manage your Chef Organization
  - Invite users into your organization
  - Accept invitations into other organizations

Organizations



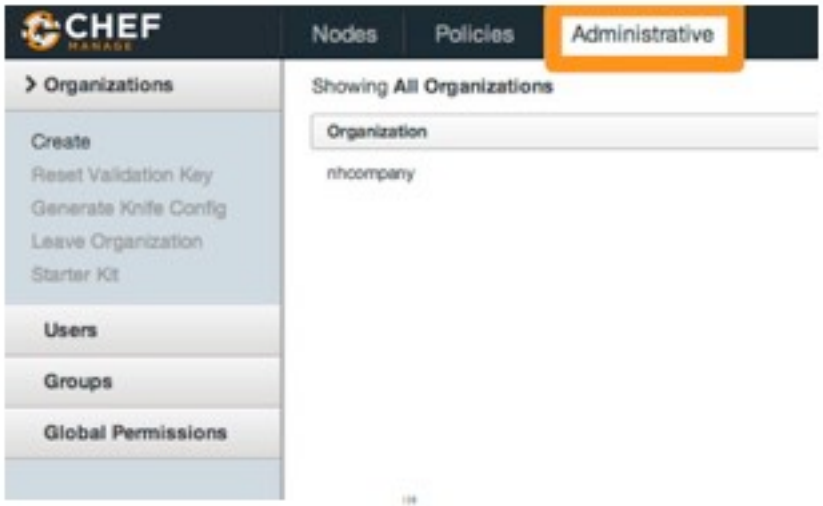
Organizations

- Provide multi-tenancy in Enterprise Chef
- Nothing is shared between Organizations - they're completely independent
- May represent different
  - Companies
  - Business Units
  - Departments

Manage Organizations

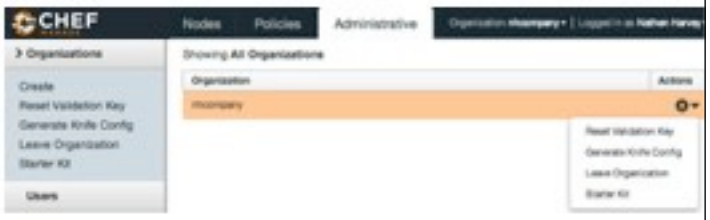
- Login to your Hosted Enterprise Chef

Organizations



Manage Organizations

- Reset Validation Key
- Generate Knife Config
- Leave Organization
- Download the 'Starter Kit'



Manage Organizations

- Each Organization may have multiple Users
- Manage an Organization's Users via the Enterprise Server interface
  - http://manage.opscode.com

Exercise: Invite users into your org

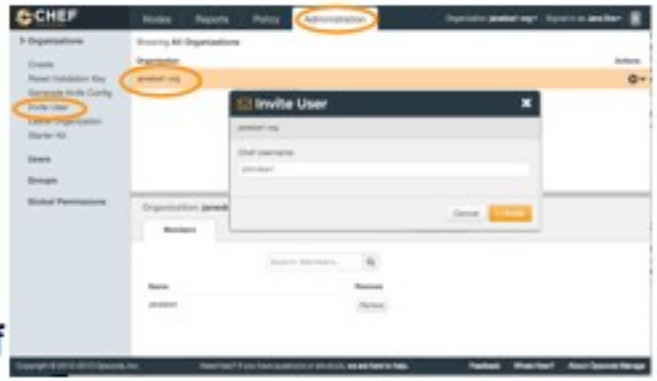
- **The Problem:** You need assistance from a colleague on one of your chef projects
- **Proposed Solution:** Invite the colleague into your organization so they can log into the chef server with **their own** credentials, but can see **your** organization

Exercise: Invite Users into your Org

- For the Lab Exercise you can team up with one other person in the class, then you will
  1. Invite your classmate into your organization
  2. Accept your classmate's invite into their org
  3. Look around your classmate's organization while they look around yours
  4. Finally remove your classmate's access from your account

Exercise: Invite a classmate into your org

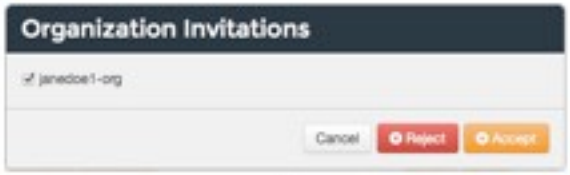
- Navigate to http://manage.opscode.com
- Click the "Administration" tab,
- Select the appropriate Organization
- Click "Invite User" from the left menu
- Enter your classmate's 'Chef Username' and click Invite



Exercise: Accept an invite

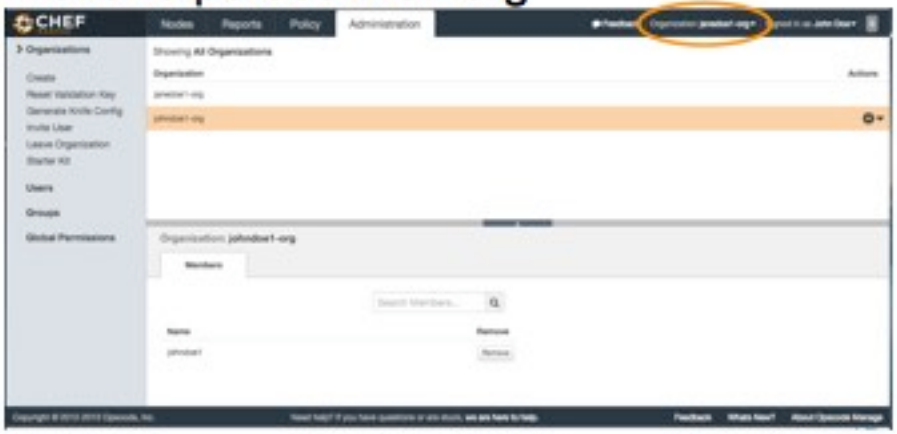
- You will get a notification once your classmate has invited you into their account

- Click the notification, select the Organization and click 'Accept'



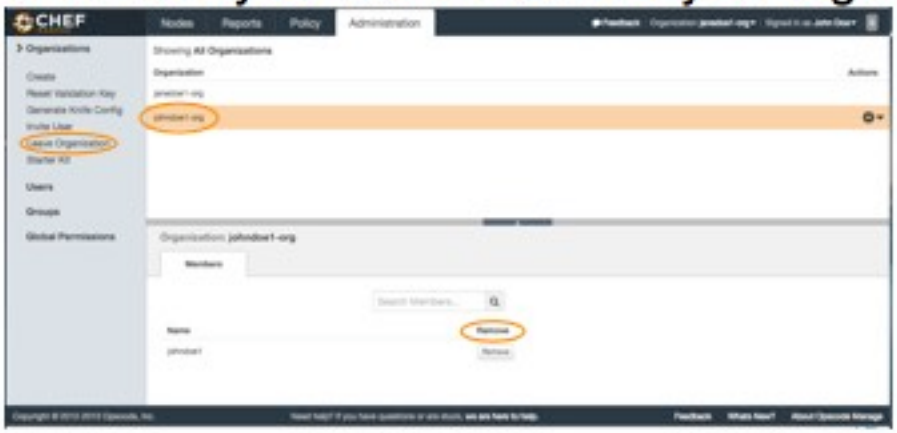
Exercise: View classmate's org

- Select your classmate's organization from the drop down list and peruse their org



Exercise: Revoke access

- Now either 'Leave Organization' you've been invited into, or remove your classmate from your organization



Review Questions

- What is an Organization?
- How do you regenerate the Starter Kit for your Organization?

Node Setup

Setup a Node to manage

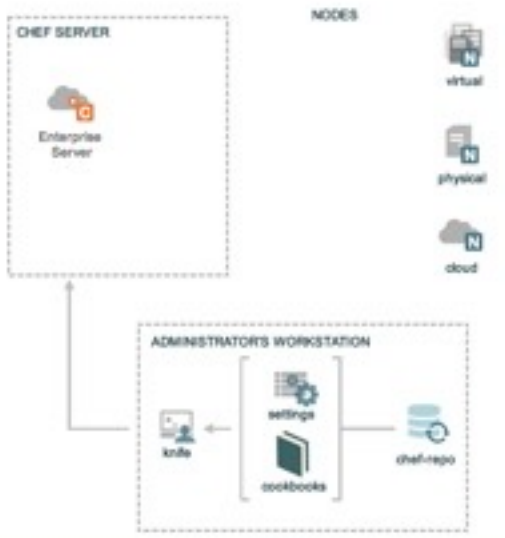
v2.1.6

CHEF

Lesson Objectives

- After completing the lesson, you will be able to
  - Install Chef nodes using "knife bootstrap"
  - Explain how knife bootstrap configures a node to use the Organization created in the previous section
  - Explain the basic configuration needed to run chef-client

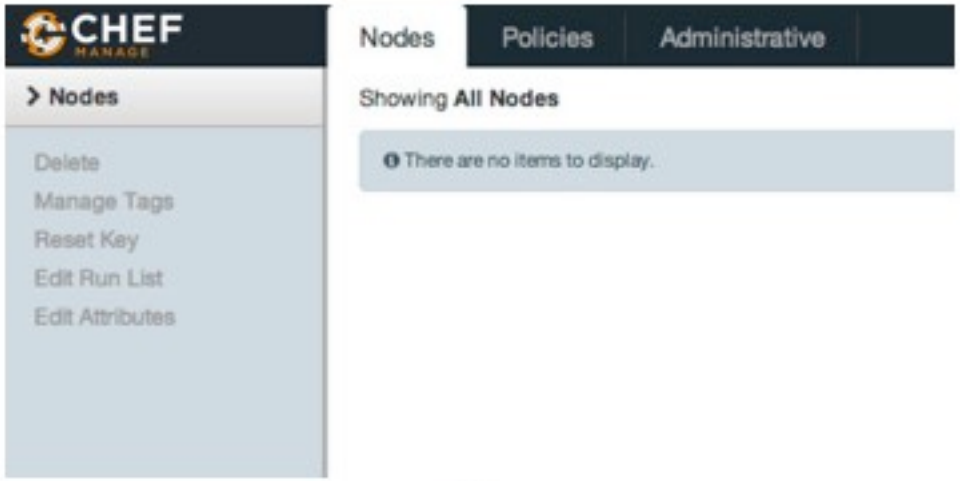
Nodes



Nodes

- Nodes represent the servers in your infrastructure these may be
  - Physical or virtual servers
  - Hardware that you own
  - Compute instances in a public or private cloud
- Could also be network hardware - switches, routers, etc

We Have No Nodes Yet



Training Node

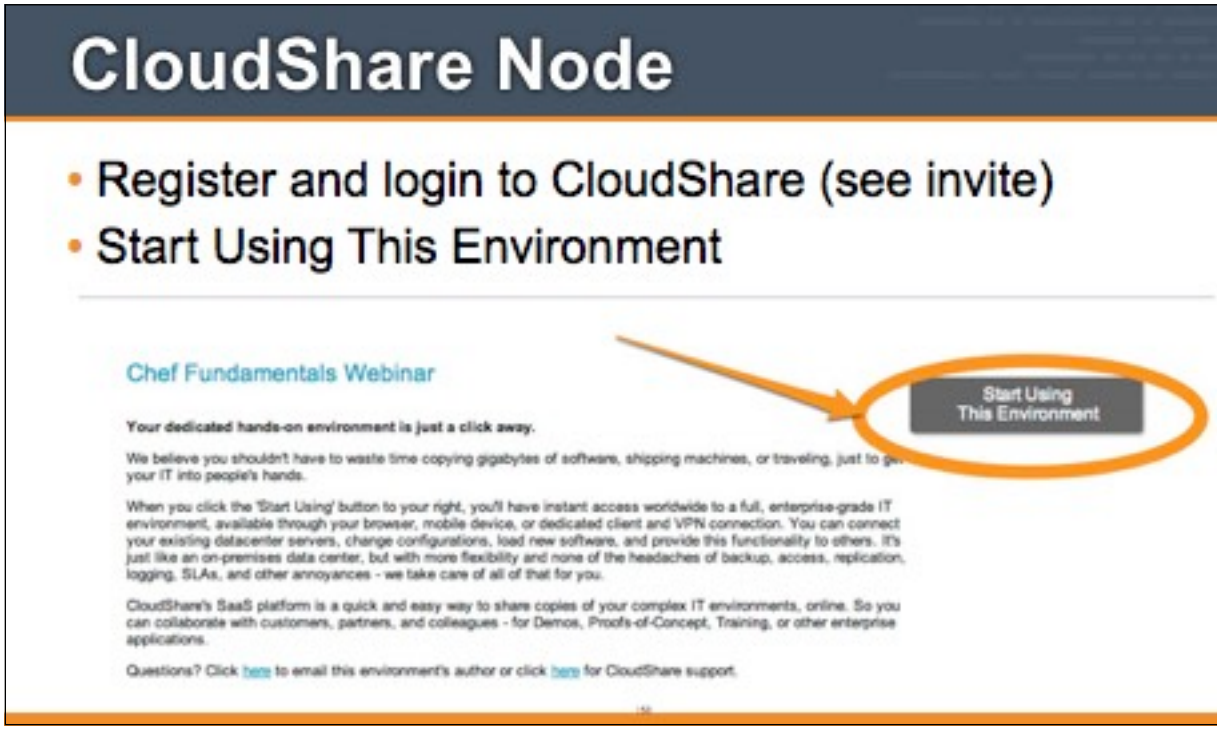
- The labs require a node to be managed
- We allow for two different options
  - Bring your own Node
  - Use the CloudShare training environment

Bring Your Own Node

- Use your own Virtual Machine (VM) or Server
- Required for the labs:
  - CentOS 6+
  - 512 MB RAM
  - 15 GB Disk
  - sudo or root level permissions

CloudShare Node

- Register and login to CloudShare (see invite)
- Start Using This Environment



CloudShare Node

Chef Fundamentals 2.x

CentOS 6

CentOS 6.3 Server
Description: OS: CentOS 6.3 x64
Spec: 16 GB HD / 1 GB RAM
OS: Linux
State: Running
More details ▶

View VM

Reboot VM Revert Delete

CloudShare Node

Lab - Login

```
$ ssh chef@<EXTERNAL_ADDRESS>
```

```
The authenticity of host 'uvo1qrwls0jdgs3blvt.vm.cld.sr
(69.195.232.110)' can't be established.
RSA key fingerprint is d9:95:a3:b9:02:27:e9:cd:
74:e4:a2:34:23:f5:a6:8b.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'uvo1qrwls0jdgs3blvt.vm.cld.sr,
69.195.232.110' (RSA) to the list of known hosts.
chef@uvo1qrwls0jdgs3blvt.vm.cld.sr's password:
Last login: Mon Jan  6 16:26:24 2014 from
host86-145-117-53.range86-145.btcentralplus.com
[chef@CentOS63 ~]$
```

Checkpoint

- At this point you should have
  - One virtual machine (VM) or server that you'll use for the lab exercises
  - The IP address or public hostname
  - An application for establishing an ssh connection
  - 'sudo' or 'root' permissions on the VM

Checkpoint

"Bootstrap" the Target Instance

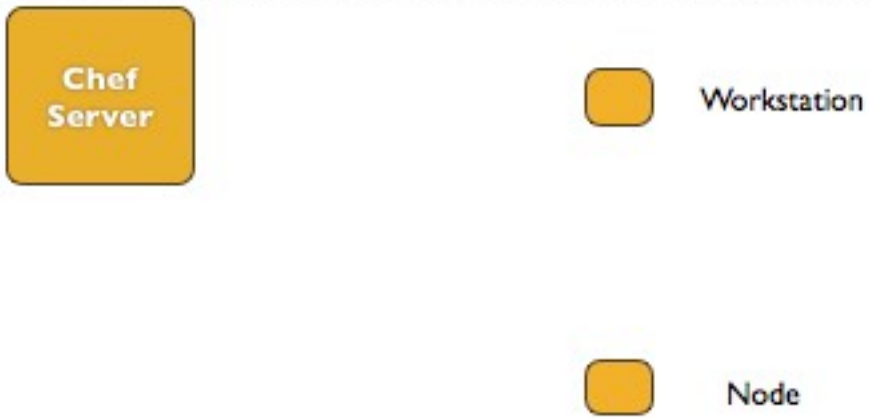
```
$ knife bootstrap <EXTERNAL_ADDRESS> --sudo -x chef -P chef -N "node1"
```

```
Bootstrapping Chef on uvolqrwls0jdgs3blvt.vm.cld.sr
uvolqrwls0jdgs3blvt.vm.cld.sr knife sudo password:
Enter your password:
...
...
uvolqrwls0jdgs3blvt.vm.cld.sr Creating a new client identity for node1 using the
validator key.
uvolqrwls0jdgs3blvt.vm.cld.sr resolving cookbooks for run list: []
uvolqrwls0jdgs3blvt.vm.cld.sr Synchronizing Cookbooks:
uvolqrwls0jdgs3blvt.vm.cld.sr Compiling Cookbooks...
uvolqrwls0jdgs3blvt.vm.cld.sr [2014-01-28T11:03:14-05:00] WARN: Node node2 has an
empty run list.
uvolqrwls0jdgs3blvt.vm.cld.sr Converging 0 resources
uvolqrwls0jdgs3blvt.vm.cld.sr Chef Client finished, 0 resources updated
```

knife bootstrap

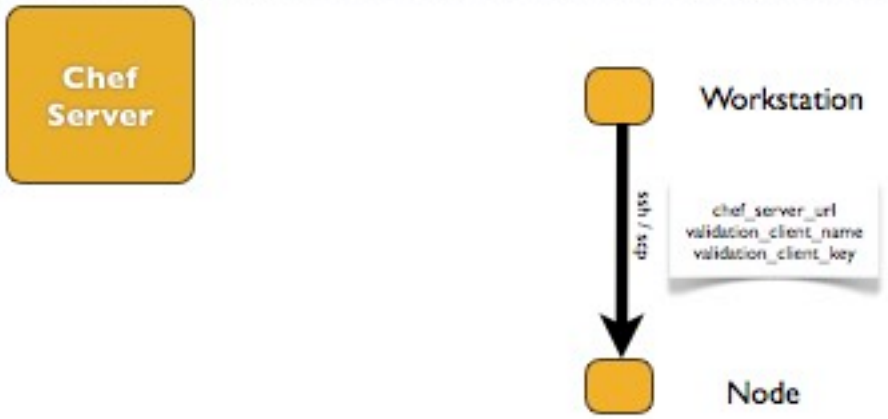
knife bootstrap

```
knife bootstrap HOSTNAME --sudo -x chef -P
```



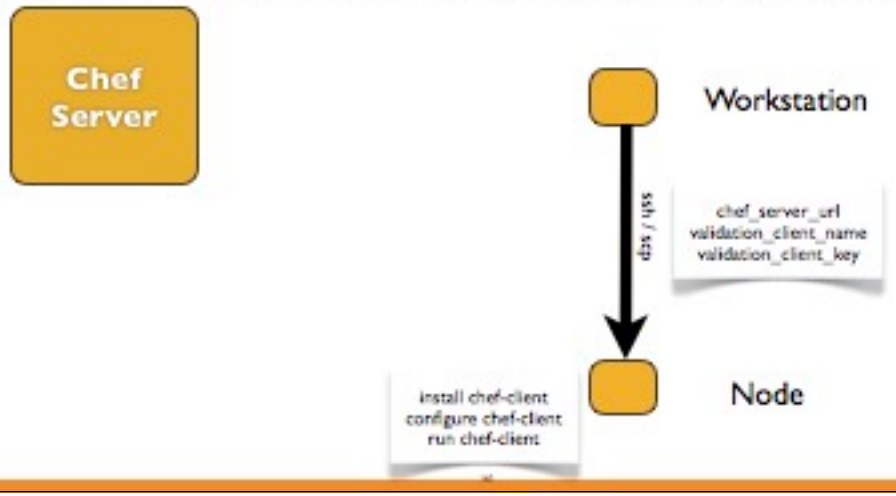
knife bootstrap

```
knife bootstrap HOSTNAME --sudo -x chef -P
```



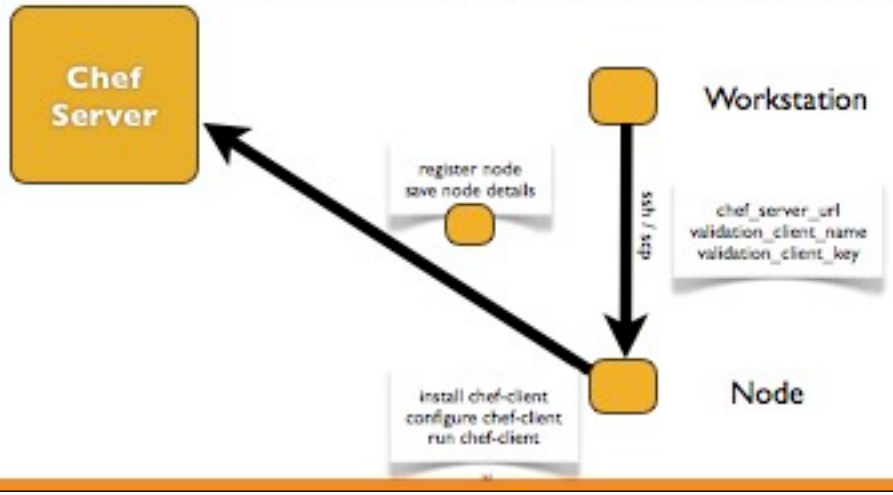
knife bootstrap

```
knife bootstrap HOSTNAME --sudo -x chef -P
```



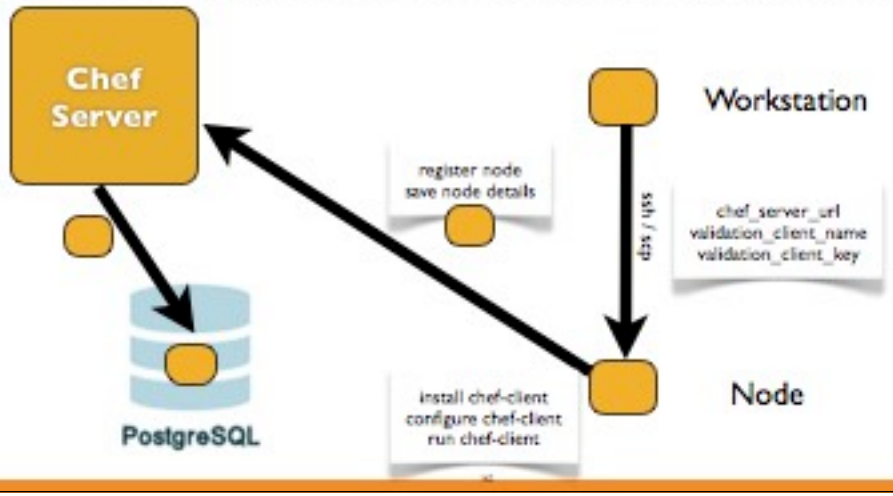
knife bootstrap

```
knife bootstrap HOSTNAME --sudo -x chef -P
```



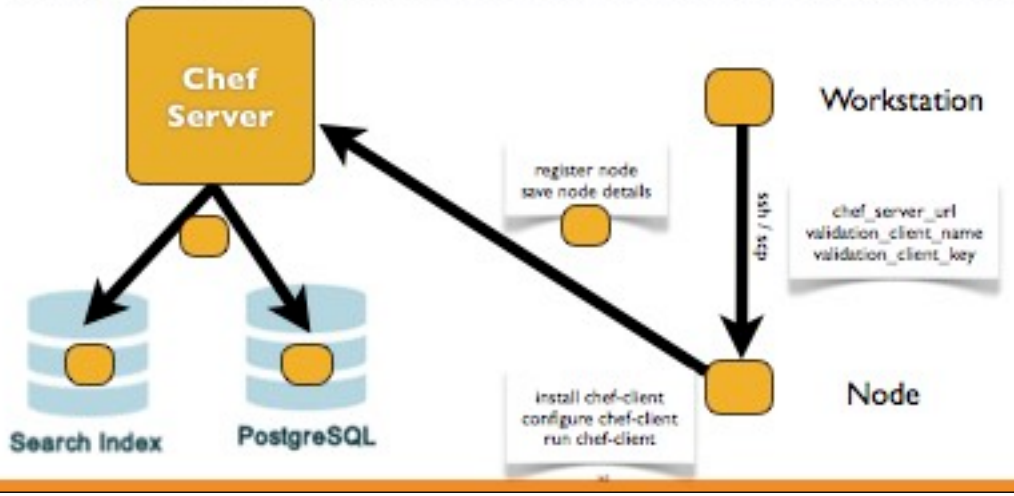
knife bootstrap

```
knife bootstrap HOSTNAME --sudo -x chef -P
```



knife bootstrap

```
knife bootstrap HOSTNAME --sudo -x chef -P
```



What just happened?

- Chef and all of its dependencies installed via an operating system-specific package ("omnibus installer")
- Installation includes
  - The Ruby language - used by Chef
  - knife - Command line tool for administrators
  - chef-client - Client application
  - ohai - System profiler
  - ...and more

Workstation or Node?

Verify Your Target Instance's Chef-Client is Configured Properly

```
$ ssh chef@<EXTERNAL_ADDRESS>

chef@node1:~$ ls /etc/chef
client.pem  client.rb  first-boot.json validation.pem

chef@node1:~$ which chef-client
/usr/bin/chef-client
```

Examine /etc/chef/client.rb

```
chef@node1:~$ cat /etc/chef/client.rb
```

```
log_location     STDOUT
chef_server_url  "https://api.opscode.com/organizations/ORGNAME"
validation_client_name "ORGNAME-validator"
node_name "node1"
```

Exercise: Change the log level on your test node

```
chef@node1:~$ sudo vim /etc/chef/client.rb
```

```
log_level        :info
log_location     STDOUT
chef_server_url  "https://api.opscode.com/organizations/ORGNAME"
validation_client_name "ORGNAME-validator"
node_name "node1"
```

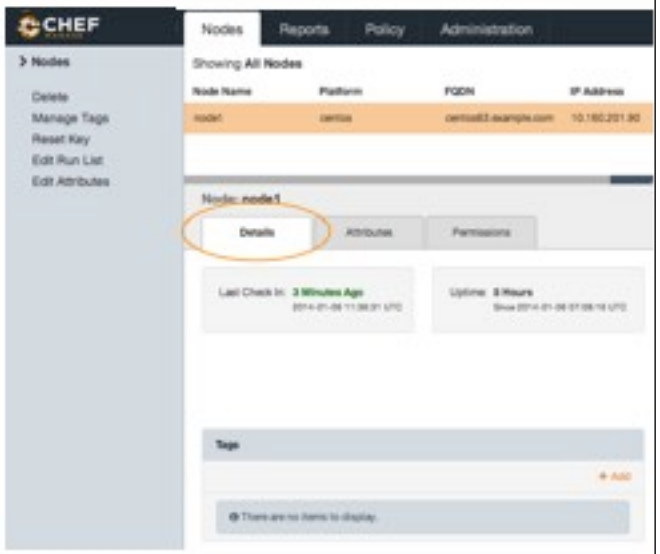
- Set the default log level for chef-client to **`:info`**
- More configuration options can be found on the docs site: http://docs.chef.io/config_rb_client.html

View Node on Chef Server

- Login to your Hosted Enterprise Chef

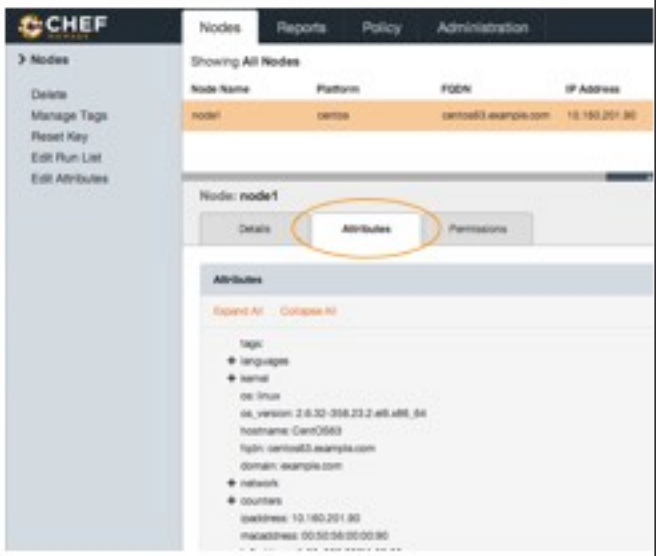
View Node on Chef Server

- Click the 'Details' tab



View Node on Chef Server

- Click the 'Attributes' tab



Node

- The node is registered with Chef Server
- The Chef Server displays information about the node
- This information comes from Ohai - we'll see Ohai later.....

Checkpoint

Review Questions

- Where is the chef-client configuration file?
- What is the command to run chef?
- What does a knife bootstrap do?

Chef Resources and Recipes

Writing an Apache cookbook

v2.1.6

CHEF

Lesson Objectives

- After completing the lesson, you will be able to
  - Describe in detail what a **cookbook** is
  - Create a new cookbook
  - Explain what a **recipe** is
  - Describe how to use the **package**, **service**, and **cookbook_file** resources
  - **Upload a cookbook** to the Chef Server
  - Explain what a **run list** is, and how to set it for a node via knife
  - Explain the output of a chef-client run

What is a cookbook?

- A cookbook is like a “package” for Chef recipes.
  - It contains all the recipes, files, templates, libraries, etc. required to configure a portion of your infrastructure
- Typically they map 1:1 to a piece of software or functionality.

The Problem and the Success Criteria

- **The Problem:** We need a web server configured to serve up our home page.
- **Success Criteria:** We can see the homepage in a web browser.

Required steps

- Install Apache
- Start the service, and make sure it will start when the machine boots
- Write out the home page

- Please note in this course we're teaching Chef primitives, not web server management
- This is probably not the Apache HTTP server configuration you would use in production

Exercise: Create a new Cookbook

```
$ knife cookbook create apache
```

```
** Creating cookbook apache
** Creating README for cookbook: apache
** Creating CHANGELOG for cookbook: apache
** Creating metadata for cookbook: apache
```

Exercise: Explore the cookbook

```
$ ls -la cookbooks/apache
```

```
total 24
drwxr-xr-x  13 opscode  opscode   442 Jan 24 21:25 .
drwxr-xr-x   5 opscode  opscode   170 Jan 24 21:25 ..
-rw-r--r--   1 opscode  opscode   412 Jan 24 21:25 CHANGELOG.md
-rw-r--r--   1 opscode  opscode  1447 Jan 24 21:25 README.md
drwxr-xr-x   2 opscode  opscode    68 Jan 24 21:25 attributes
drwxr-xr-x   2 opscode  opscode    68 Jan 24 21:25 definitions
drwxr-xr-x   3 opscode  opscode   102 Jan 24 21:25 files
drwxr-xr-x   2 opscode  opscode    68 Jan 24 21:25 libraries
-rw-r--r--   1 opscode  opscode   276 Jan 24 21:25 metadata.rb
drwxr-xr-x   2 opscode  opscode    68 Jan 24 21:25 providers
drwxr-xr-x   3 opscode  opscode   102 Jan 24 21:25 recipes
drwxr-xr-x   2 opscode  opscode    68 Jan 24 21:25 resources
drwxr-xr-x   3 opscode  opscode   102 Jan 24 21:25 templates
```

Exercise: Edit the default recipe

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
#
# Cookbook Name:: apache
# Recipe:: default
#
# Copyright 2013, YOUR_COMPANY_NAME
#
# All rights reserved - Do Not Redistribute
#
```

Chef Resources

```
package "haproxy" do
  action :install
end

template "/etc/haproxy/haproxy.cfg" do
  source "haproxy.cfg.erb"
  owner "root"
  group "root"
  mode "0644"
  notifies :restart, "service[haproxy]"
end

service "haproxy" do
  supports :restart => true
  action [:enable, :start]
end
```

Chef Resources

- Have a **type**


```
package "haproxy" do
  action :install
end

template "/etc/haproxy/haproxy.cfg" do
  source "haproxy.cfg.erb"
  owner "root"
  group "root"
  mode "0644"
  notifies :restart, "service[haproxy]"
end

service "haproxy" do
  supports :restart => true
  action [:enable, :start]
end
```

Chef Resources

- Have a type
- Have a **name**

```
package "haproxy" do
  action :install
end

template "/etc/haproxy/haproxy.cfg" do
  source "haproxy.cfg.erb"
  owner "root"
  group "root"
  mode "0644"
  notifies :restart, "service[haproxy]"
end

service "haproxy" do
  supports :restart => true
  action [:enable, :start]
end
```

Chef Resources

- Have a type
- Have a name
- Have **parameters**

```
package "haproxy" do
  action :install
end

template "/etc/haproxy/haproxy.cfg" do
  source "haproxy.cfg.erb"
  owner "root"
  group "root"
  mode "0644"
  notifies :restart, "service[haproxy]"
end

service "haproxy" do
  supports :restart => true
  action [:enable, :start]
end
```

Chef Resources

- Have a type
- Have a name
- Have parameters
- Take **action** to put the resource into the desired state

```
package "haproxy" do
  action :install
end

template "/etc/haproxy/haproxy.cfg" do
  source "haproxy.cfg.erb"
  owner "root"
  group "root"
  mode "0644"
  notifies :restart, "service[haproxy]"
end

service "haproxy" do
  supports :restart => true
  action [:enable, :start]
end
```

Chef Resources

- Have a type
- Have a name
- Have parameters
- Take action to put the resource into the desired state
- Can send **notifications** to other resources

```
package "haproxy" do
  action :install
end

template "/etc/haproxy/haproxy.cfg" do
  source "haproxy.cfg.erb"
  owner "root"
  group "root"
  mode "0644"
  notifies :restart, "service[haproxy]"
end

service "haproxy" do
  supports :restart => true
  action [:enable, :start]
end
```

Exercise: Add a package resource to install Apache to the default recipe

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
#
# Cookbook Name:: apache
# Recipe:: default
#
# Copyright 2013, YOUR_COMPANY_NAME
#
# All rights reserved - Do Not Redistribute
#

package "httpd" do
  action :install
end
```

SAVE FILE!

So the resource we just wrote...

```
package "httpd" do
  action :install
end
```

So the resource we just wrote...

- Is a **package** resource

```
package "httpd" do
  action :install
end
```

So the resource we just wrote...

- Is a package resource
- Whose **name** is *httpd*

```
package "httpd" do
  action :install
end
```

So the resource we just wrote...

- Is a package resource
- Whose name is *httpd*
- With an install **action**

```
package "httpd" do
  action :install
end
```

Notice we didn't say how to install the package

- Resources are **declarative** - that means we say *what* we want to have happen, rather than *how*
- Resources take action through **Providers** - providers perform the how
- Chef uses the **platform** the node is running to determine the correct **provider** for a resource

Package Resource

```
package "git"
```

```
yum install git

apt-get install git

pacman sync git

pkg_add -r git
```

Providers are determined by node's platform

Exercise: Add a service resource to ensure the service is started and enabled at boot

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
...
# All rights reserved - Do Not Redistribute
#

package "httpd" do
  action :install
end

service "httpd" do
  action [ :enable, :start ]
end
```

SAVE FILE!

So the resource we just wrote...

```
service "httpd" do
  action [ :enable, :start ]
end
```

So the resource we just wrote...

- Is a **service** resource

```
service "httpd" do
  action [ :enable, :start ]
end
```

So the resource we just wrote...

- Is a service resource
- Whose **name** is *httpd*

```
service "httpd" do
  action [ :enable, :start ]
end
```

So the resource we just wrote...

- Is a service resource
- Whose **name** is *httpd*
- With two **actions**:
  - enable
  - start

```
service "httpd" do
  action [ :enable, :start ]
end
```

Order Matters

- Resources are executed in order

1st

```
package "haproxy" do
  action :install
end
```

2nd

```
template "/etc/haproxy/haproxy.cfg" do
  source "haproxy.cfg.erb"
  owner "root"
  group "root"
  mode "0644"
  notifies :restart, "service[haproxy]"
end
```

3rd

```
service "haproxy" do
  supports :restart => true
  action [:enable, :start]
end
```

Exercise: Add a cookbook_file resource to copy the home page in place

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
...

service "httpd" do
  action [ :enable, :start ]
end

cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end
```

SAVE FILE!

So the resource we just wrote...

```
cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end
```

So the resource we just wrote...

- Is a **cookbook_file** resource


```
cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end
```

So the resource we just wrote...

- Is a cookbook_file resource
- Whose **name** is: */var/www/html/index.html*

```
cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end
```

So the resource we just wrote...

- Is a cookbook_file resource
- Whose **name** is: */var/www/html/index.html*
- With two **parameters**:
  - **source** of *index.html*
  - **mode** of *"0644"*

```
cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end
```

Full contents of the apache recipe

```
#
# Cookbook Name:: apache
# Recipe:: default
#
# Copyright 2013, YOUR_COMPANY_NAME
#
# All rights reserved - Do Not Redistribute
#

package "httpd" do
  action :install
end

service "httpd" do
  action [ :enable, :start ]
end

cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end
```

Exercise: Add index.html to your cookbook's files/default directory

OPEN IN EDITOR: cookbooks/apache/files/default/index.html

```
<html>
<body>
  <h1>Hello, world!</h1>
</body>
</html>
```

SAVE FILE!

Exercise: Upload the cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache          [0.1.0]
Uploaded 1 cookbook.
```

The Run List

- The Run List is the ordered set of recipes and roles that the Chef Client will execute on a node
  - Recipes are specified by "**recipe[*name*]**"
  - Roles are specified by "**role[*name*]**"

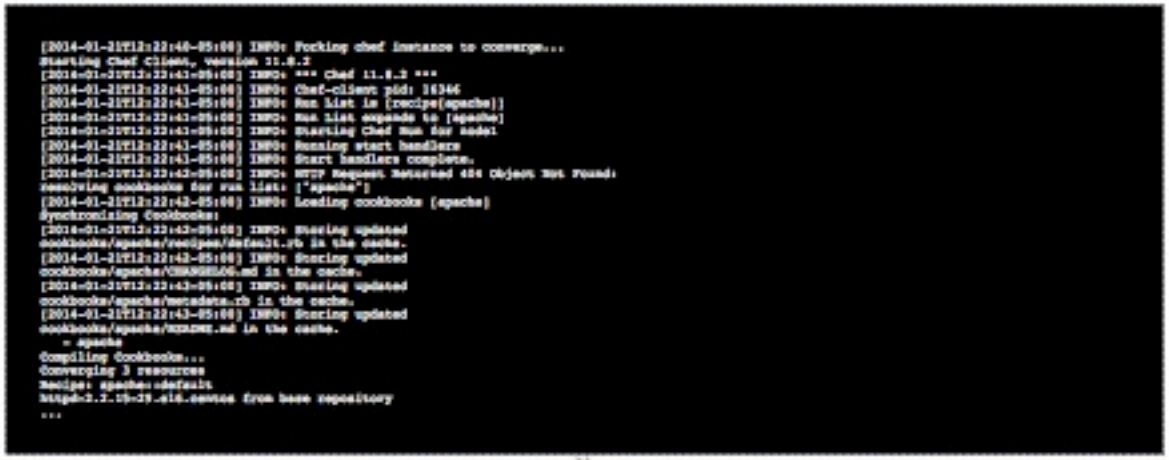
Exercise: Add apache recipe to test node's run list

```
$ knife node run_list add node1 "recipe[apache]"
```

```
node1:
  run_list: recipe[apache]
```

Exercise: Run Chef Client

```
chef@node1:~$ sudo chef-client
```



Exercise: Verify that the home page works

- Open a web browser
- Type in the the URL for your test node

Congratulate yourself!

- You have just written your first Chef cookbook!
- (clap!)

Reading the output of a chef-client run

```
Starting Chef Client, version 11.8.2
[2014-01-06T07:06:00-05:00] INFO: *** Chef 11.8.2 ***
[2014-01-06T07:06:00-05:00] INFO: Chef-client pid: 10781
[2014-01-06T07:06:01-05:00] INFO: Run List is [recipe[apache]]
[2014-01-06T07:06:01-05:00] INFO: Run List expands to [apache]
[2014-01-06T07:06:01-05:00] INFO: Starting Chef Run for node1
[2014-01-06T07:06:01-05:00] INFO: Running start handlers
[2014-01-06T07:06:01-05:00] INFO: Start handlers complete.
```

- The run list is shown
- The expanded Run List is the complete list, after nested roles are expanded

Reading the output of a chef-client run

```
resolving cookbooks for run list: ["apache"]
[2014-01-06T07:06:02-05:00] INFO: Loading cookbooks [apache]
Synchronizing Cookbooks:
[2014-01-06T07:06:02-05:00] INFO: Storing updated cookbooks/apache/recipes/default.rb in the
cache.
[2014-01-06T07:06:02-05:00] INFO: Storing updated cookbooks/apache/metadata.rb in the cache.
  - apache
Compiling Cookbooks...
```

- Loads the cookbooks in the order specified by the run list
- Downloads any files that are missing from the server

Reading the output of a chef-client run

```
Converging 3 resources
Recipe: apache::default
  * package[httpd] action install[2014-01-06T07:51:48-05:00] INFO: Processing
package[httpd] action install (apache::default line 9)
[2014-01-06T07:51:55-05:00] INFO: package[httpd] installing
httpd-2.2.15-29.el6.centos from base repository

    - install version 2.2.15-29.el6.centos of package httpd
```

- Checks to see if the package httpd is installed

Reading the output of a chef-client run

```
  * service[httpd] action enable[2014-01-06T07:52:06-05:00] INFO: Processing
service[httpd] action enable (apache::default line 13)
[2014-01-06T07:52:06-05:00] INFO: service[httpd] enabled

    - enable service service[httpd]

  * service[httpd] action start[2014-01-06T07:52:06-05:00] INFO: Processing
service[httpd] action start (apache::default line 13)
[2014-01-06T07:52:07-05:00] INFO: service[httpd] started

    - start service service[httpd]
```

- Checks to see if httpd is already enabled to run at boot - it is, take no further action
- Checks to see if httpd is already started - it is, take no further action

Idempotence

- Actions on resources in Chef are designed to be ***idempotent***
  - I.e. they can be applied multiple times but the end result is still the same - like multiplying by 1 in math!
  - Or in mathematical terms, $F(F(x))=F(x) \ \forall x$
- Chef is a "desired state configuration" system - if a resource is already configured, no action is taken. This is called ***convergence***

Reading the output of a chef-client run

```
  * cookbook_file[/var/www/html/index.html] action create[2014-01-06T07:52:07-05:00] INFO: Processing
cookbook_file[/var/www/html/index.html] action create (apache::default line 17)
[2014-01-06T07:52:07-05:00] INFO: cookbook_file[/var/www/html/index.html] created file /var/www/html/index.html

    - create new file /var/www/html/index.html[2014-01-06T07:52:07-05:00] INFO: cookbook_file[/var/www/html/
index.html] updated file contents /var/www/html/index.html

    - update content in file /var/www/html/index.html from none to 03fb1d
        --- /var/www/html/index.html    2014-01-06 07:52:07.285214202 -0500
        +++ /tmp/.index.html20140106-10796-1kxknbg    2014-01-06 07:52:07.868365963 -0500
        @@ -1 +1,6 @@
        +<html>
        +<body>
        +  <h1>Hello, world!</h1>
        +</body>
        +</html>[2014-01-06T07:52:07-05:00] INFO: cookbook_file[/var/www/html/index.html] mode changed to 644

    - change mode from '' to '0644'
    - restore selinux security context
```

- Checks for an index.html file
- There is already one in place, backup the file
- Set permissions on the file
- A diff of the written file is shown with the modified lines called out

Reading the output of a chef-client run

```
[2014-01-06T07:52:08-05:00] INFO: Chef Run complete in 23.477837576 seconds
[2014-01-06T07:52:08-05:00] INFO: Running report handlers
[2014-01-06T07:52:08-05:00] INFO: Report handlers complete
Chef Client finished, 4 resources updated
[2014-01-06T07:52:08-05:00] INFO: Sending resource update report (run-id:
952a8431-0994-468e-836c-0f7de7aa656e)
```

- Notice that a complete Chef-Run displays:
  - The time the client took to complete convergence
  - Status of report and exception handlers

Exercise: Re-run the Chef Client

```
chef@node1:~$ sudo chef-client
```

```
...
resolving cookbooks for run list: ["apache"]
[2014-01-06T07:57:13-05:00] INFO: Loading cookbooks [apache]
Synchronizing Cookbooks:
  - apache
Compiling Cookbooks...
Converging 3 resources
Recipe: apache::default
  * package[httpd] action install[2014-01-06T07:57:13-05:00] INFO: Processing package[httpd] action install (apache::default line 9)
 (up to date)
  * service[httpd] action enable[2014-01-06T07:57:17-05:00] INFO: Processing service[httpd] action enable (apache::default line 13)
 (up to date)
  * service[httpd] action start[2014-01-06T07:57:17-05:00] INFO: Processing service[httpd] action start (apache::default line 13)
 (up to date)
  * cookbook_file[/var/www/html/index.html] action create[2014-01-06T07:57:17-05:00] INFO: Processing cookbook_file[/var/www/html/
index.html] action create (apache::default line 17)
 (up to date)
[2014-01-06T07:57:17-05:00] INFO: Chef Run complete in 4.707139533 seconds
[2014-01-06T07:57:17-05:00] INFO: Removing cookbooks/apache/files/default/index.html from the cache; it is no longer needed by chef-
client.
[2014-01-06T07:57:17-05:00] INFO: Running report handlers
[2014-01-06T07:57:17-05:00] INFO: Report handlers complete
Chef Client finished, 0 resources updated
[2014-01-06T07:57:17-05:00] INFO: Sending resource update report (run-id: 1c201d2c-797f-43ab-a904-1ba329b9aab6)
```

Recap - So resources are grouped into recipes

recipe[apache::default]

```
package "httpd" do
  action :install
end

service "httpd" do
  action [ :enable, :start ]
end

cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end
```

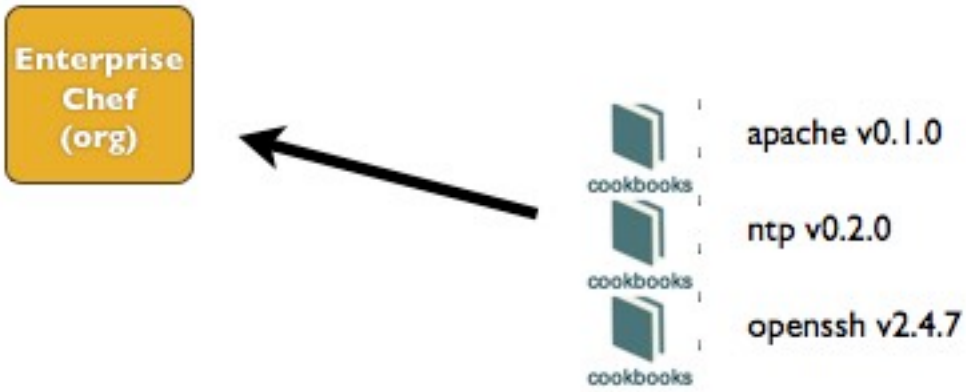
Cookbooks contain recipes and supporting files

```
& pwd
/Users/you/chef-repo
$ tree
...
├── cookbooks
|   ├── apache
|   |   ├── recipes
|   |   |   ├── default.rb
|   |   |   └── server.rb
|   |   ├── files
|   |   |   └── default
|   |   |       └── index.html
|   |   ├── metadata.rb
|   |   ├── attributes
|   |   |   └── default
...
```

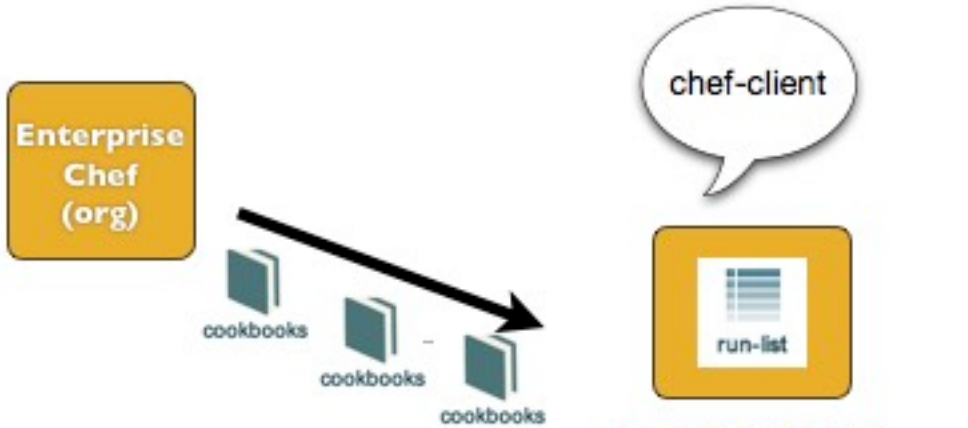
Recipes

Supporting File

Cookbooks are installed as artifacts on Chef Server



Nodes have run_lists made of recipes



Questions

- What makes up a cookbook?
- How do you create a new cookbook?
- What is a recipe?
- What is a resource?
- How do you upload a cookbook to the Chef Server?
- What is a run list?

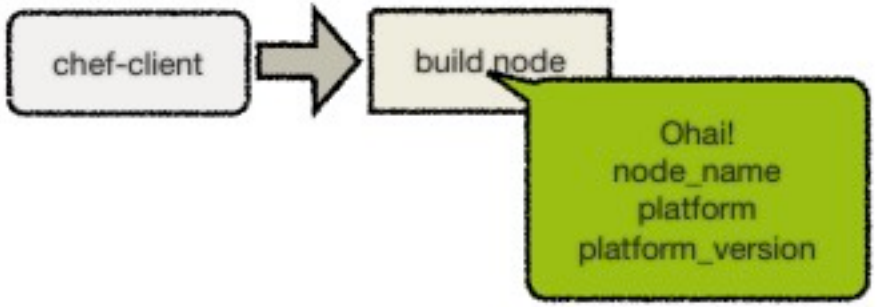
Dissecting Your First chef-client Run

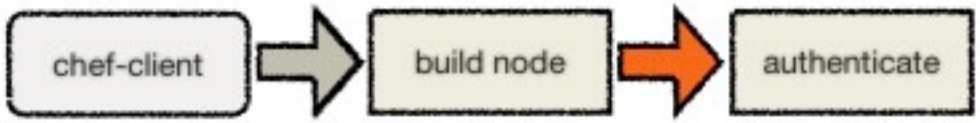
The Anatomy of a Chef run

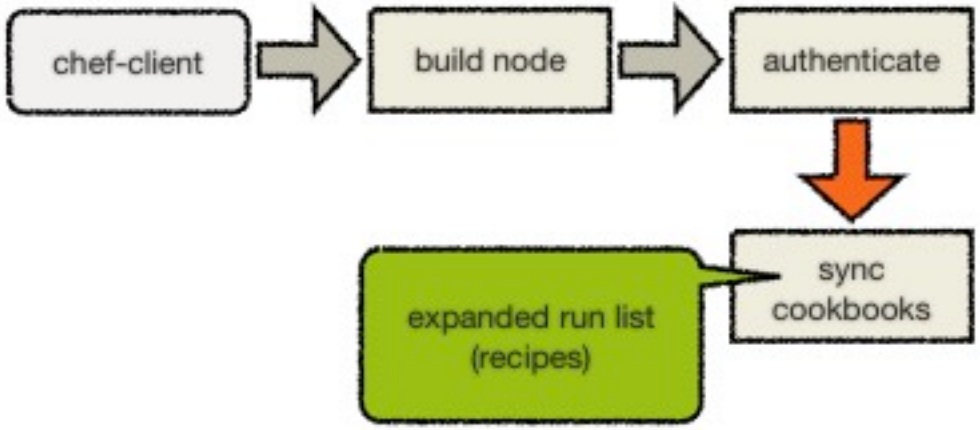
Lesson Objectives

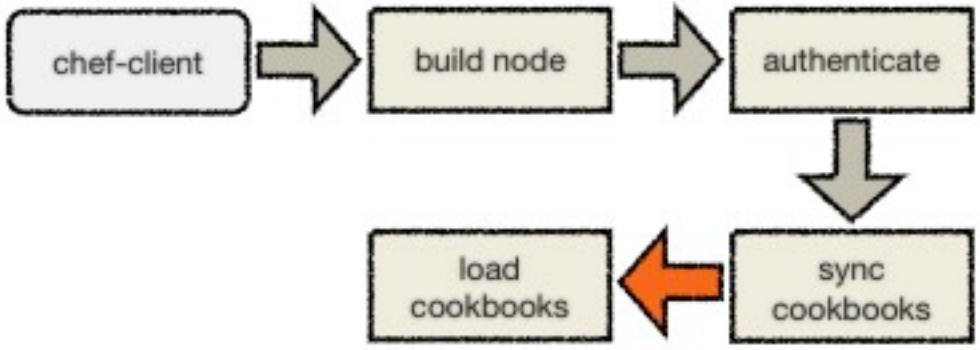
- After completing the lesson, you will be able to
  - List all the steps taken by a chef-client during a run
  - Explain the basic security model of Chef
  - Explain the concepts of the Resource Collection

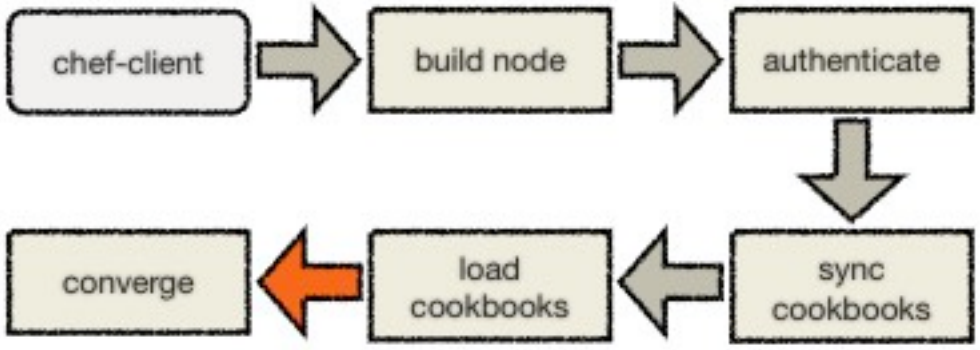

chef-client
build node

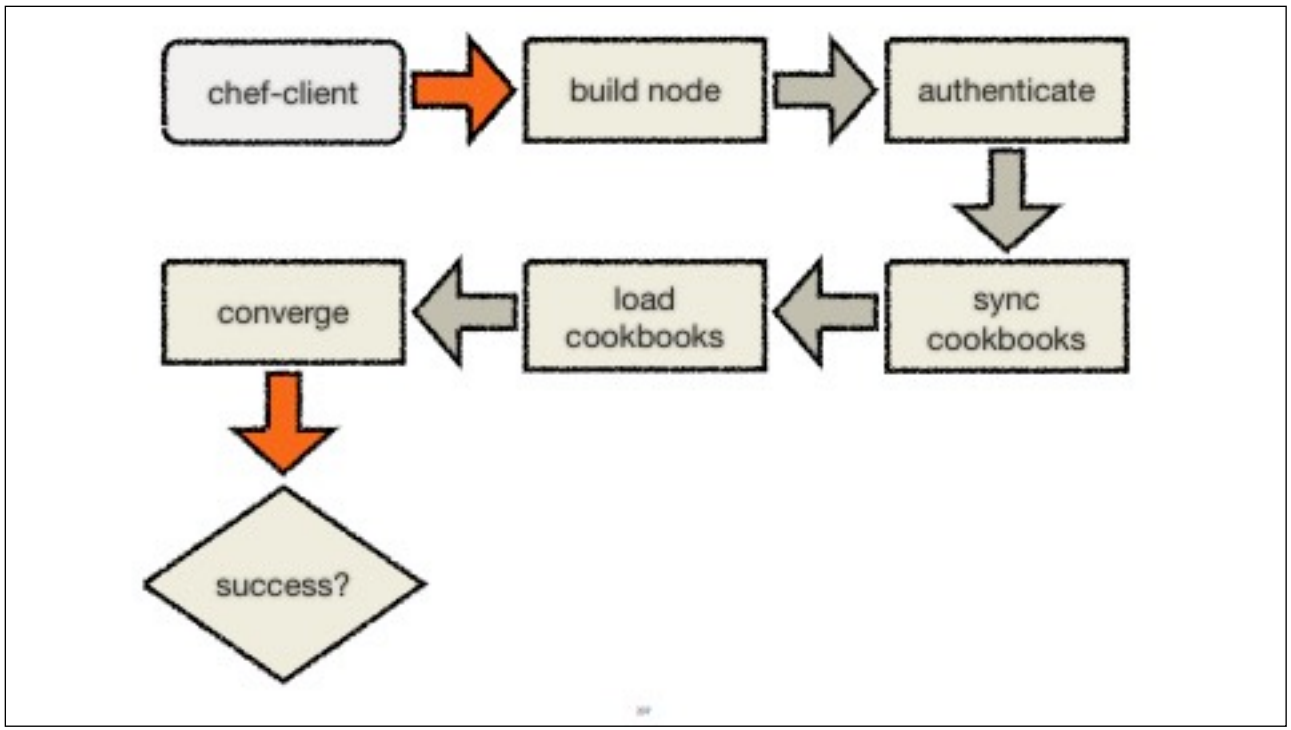

chef-client
build node
Ohai!
node_name
platform
platform_version

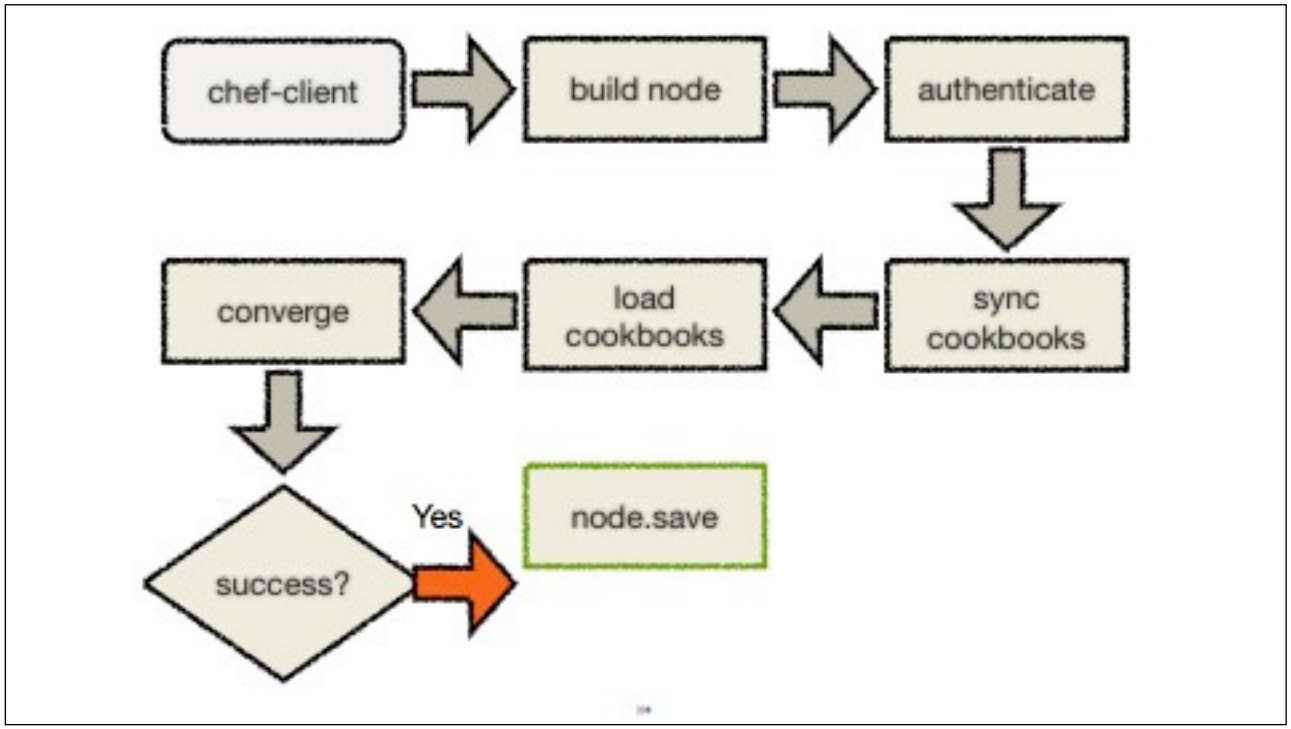

chef-client
build node
authenticate

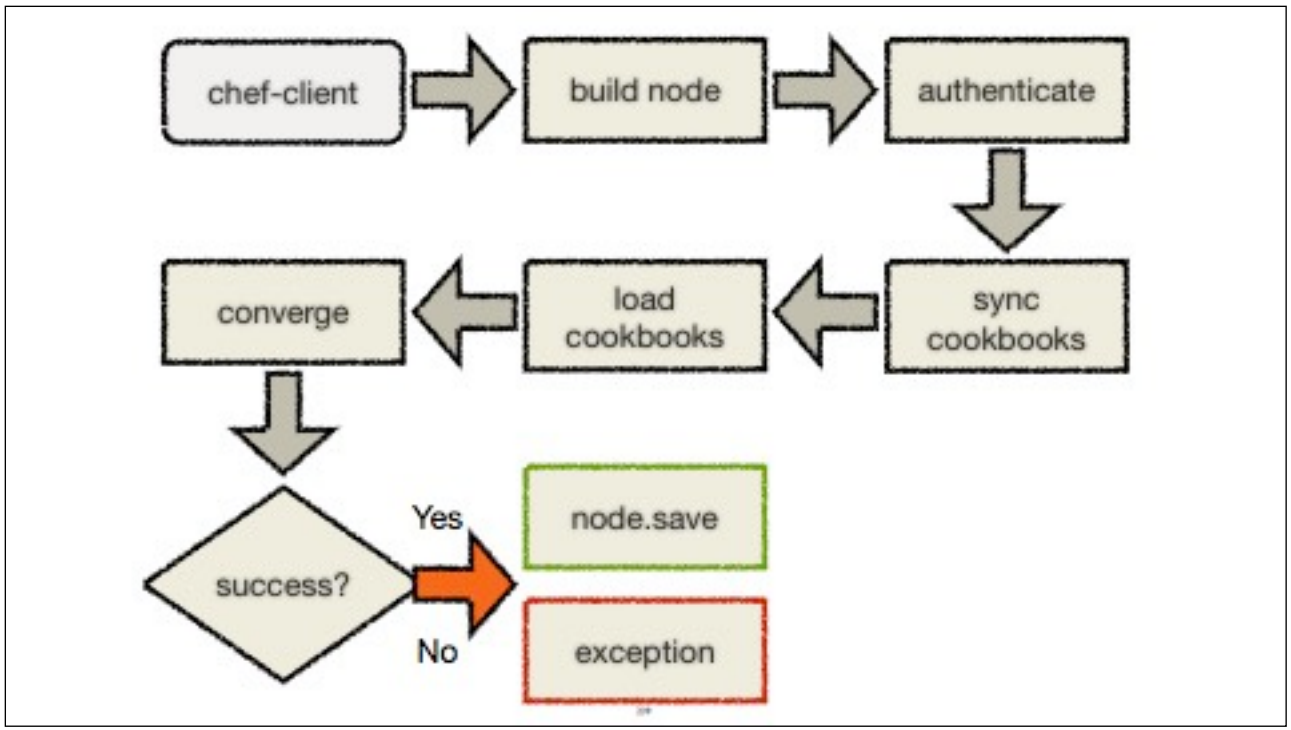

chef-client
build node
authenticate
sync
cookbooks
expanded run list
(recipes)

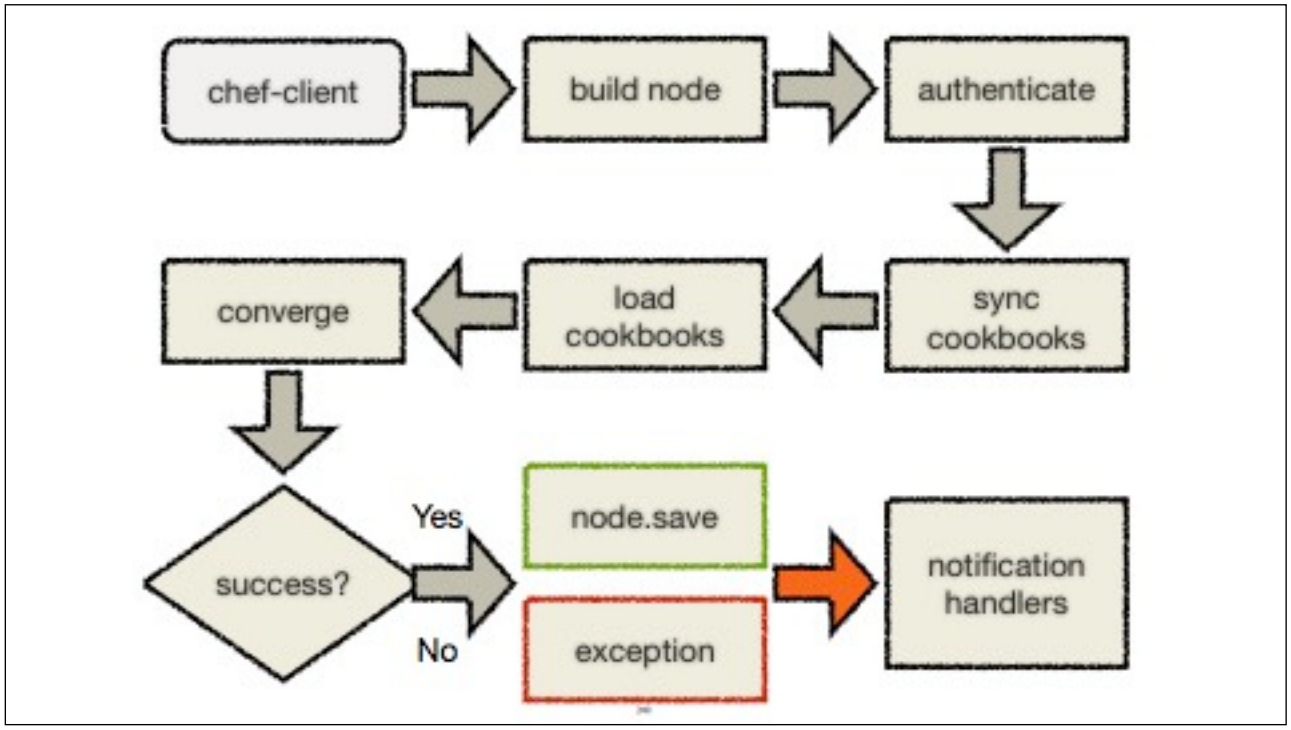

chef-client
build node
authenticate
sync cookbooks
load cookbooks


chef-client
build node
authenticate
sync cookbooks
load cookbooks
converge


chef-client
build node
authenticate
sync cookbooks
load cookbooks
converge
success?

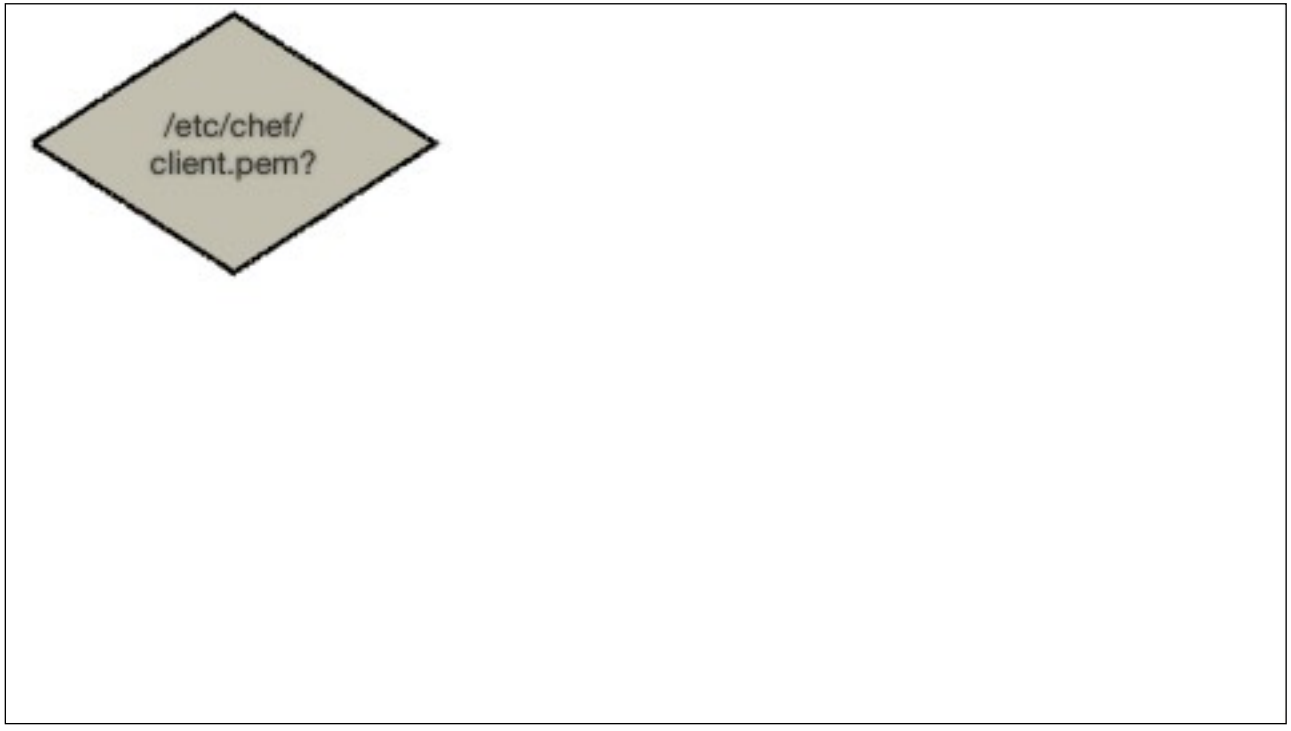

chef-client
build node
authenticate
sync cookbooks
load cookbooks
converge
Yes
node.save
success?

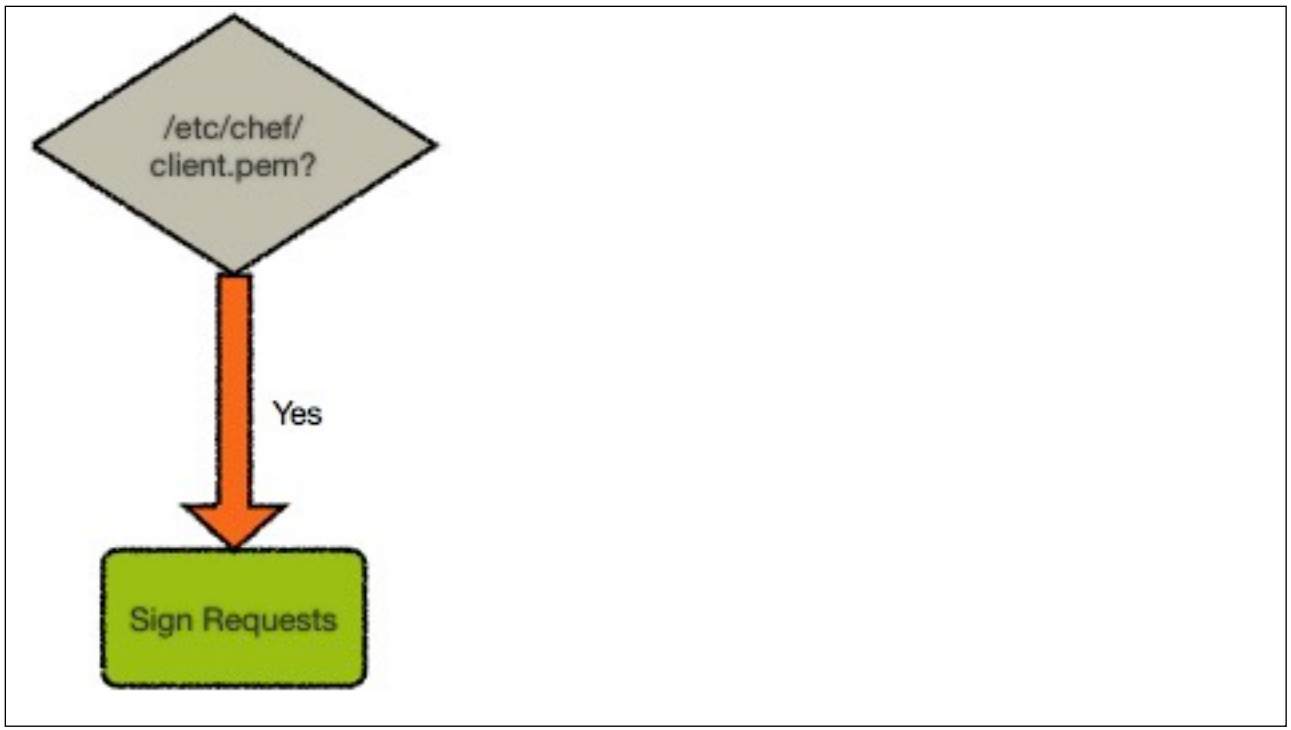

chef-client
build node
authenticate
sync cookbooks
load cookbooks
converge
success?
Yes
No
node.save
exception

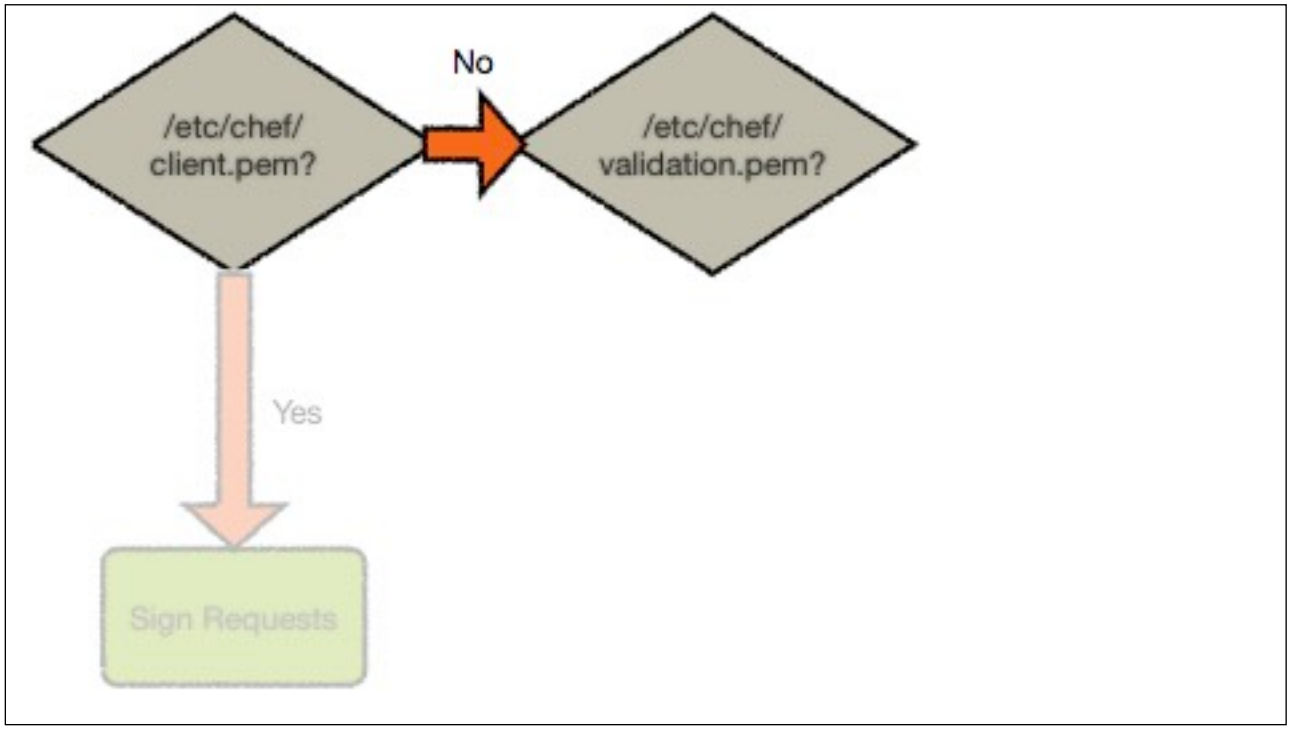

chef-client
build node
authenticate
sync cookbooks
load cookbooks
converge
success?
Yes
No
node.save
exception
notification handlers

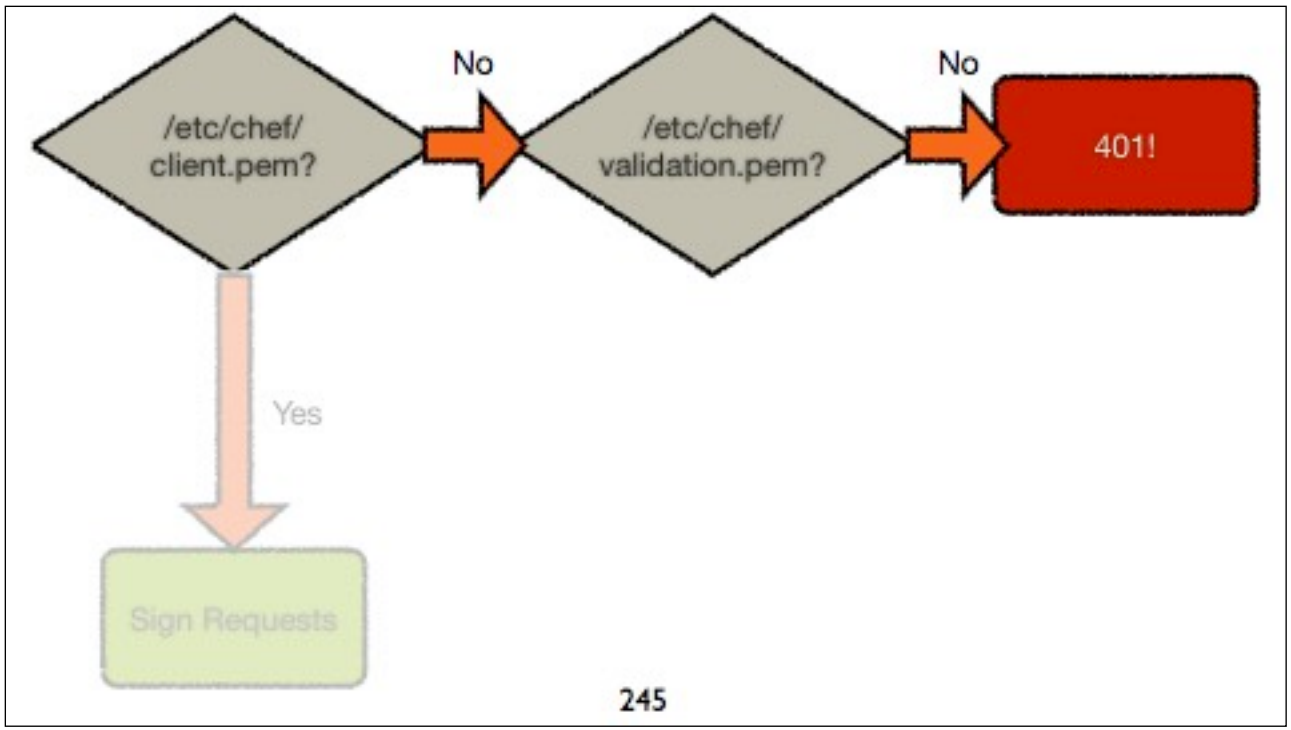
Private Keys

- Chef Server requires keys to authenticate.
  - `client.pem` - private key for API client
  - `validation.pem` - private key for ORGNAME-validator
- Next, let's see how those are used...

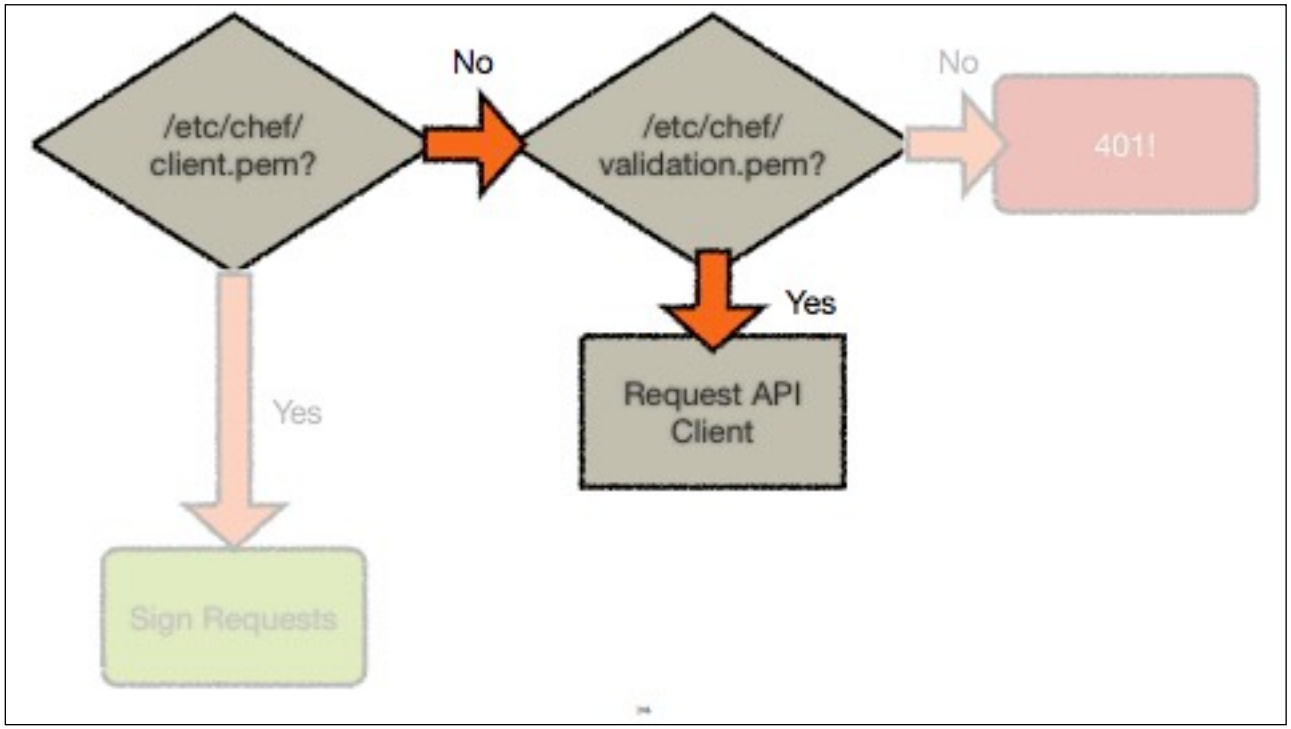


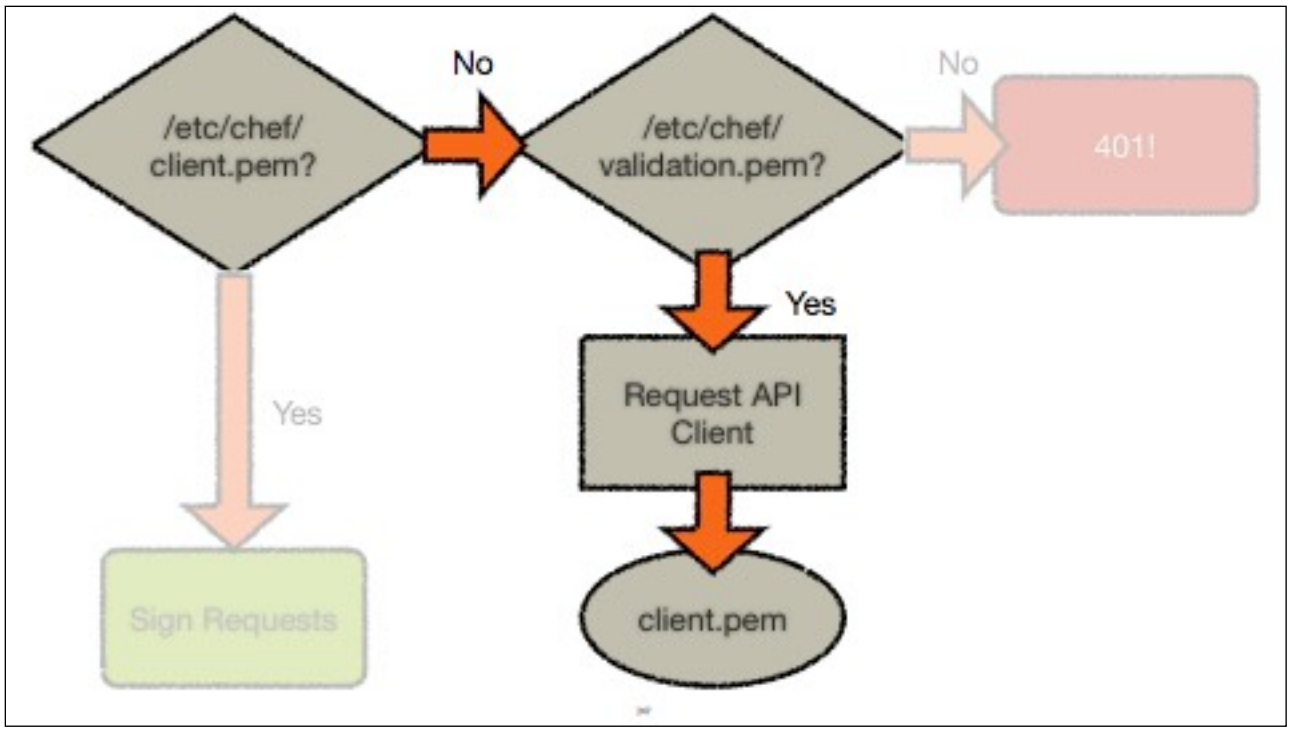

/etc/chef/
client.pem?
Yes
Sign Requests

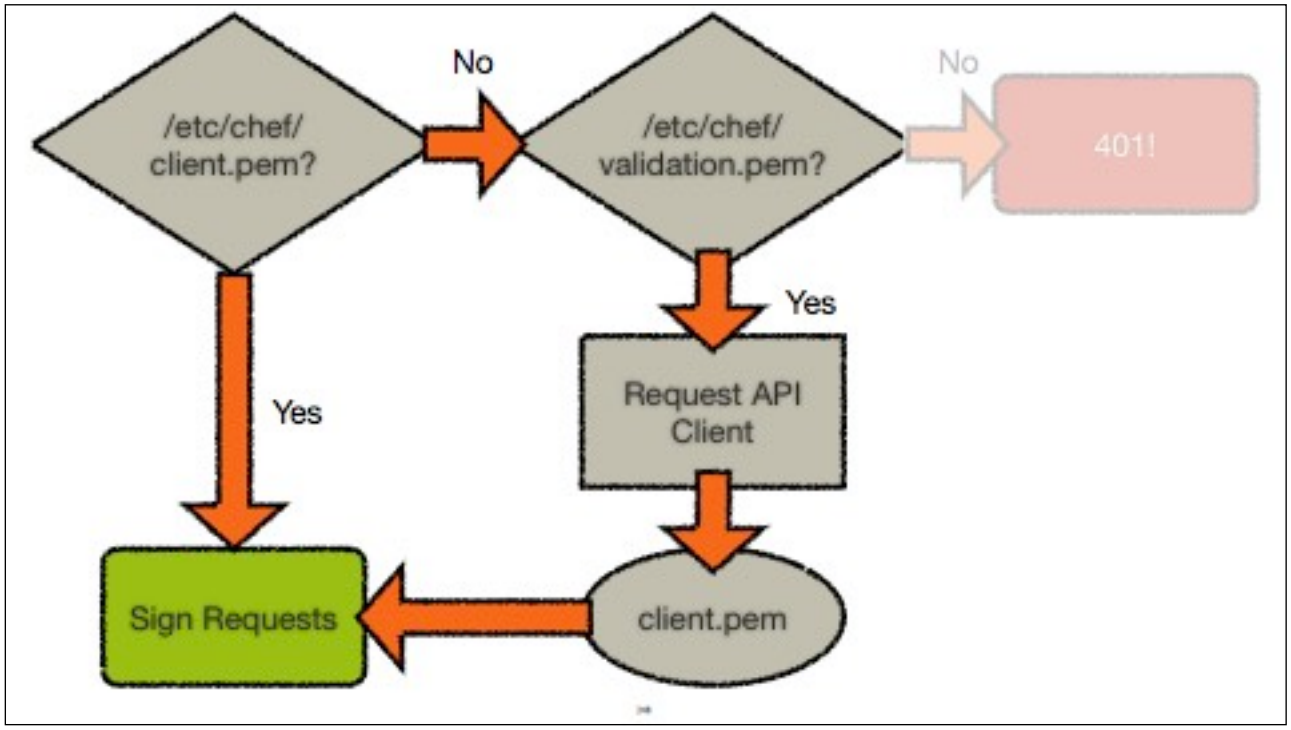

No
/etc/chef/
client.pem?
/etc/chef/
validation.pem?
Yes
Sign Requests


/etc/chef/
client.pem?
No
/etc/chef/
validation.pem?
No
401!
Yes
Sign Requests

245


/etc/chef/
client.pem?
No
/etc/chef/
validation.pem?
No
401!
Yes
Request API
Client
Yes
Sign Requests


/etc/chef/
client.pem?
No
/etc/chef/
validation.pem?
No
401!
Yes
Request API
Client
Yes
Sign Requests
client.pem


/etc/chef/
client.pem?
No
/etc/chef/
validation.pem?
No
401!
Yes
Request API
Client
Yes
Sign Requests
client.pem

About the resource collection

v2.1.6

Multiphase Execution - Compile Phase

- During the compile phase, Chef

1. Loads all cookbooks from the run list
2. Reads each recipe to build the resource collection

Multiphase Execution - Execute Phase

- During the execute phase chef takes the resource collection and for each resource it will

1. Check if the resource is in the required state
   - If 'yes' - do nothing
   - If 'no' - bring resource in line with required state
2. Move on to next resource

Resource Collection Phase 1 - Compile Phase

Recipe

```
package "httpd" do
  action :install
end

cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end

service "httpd" do
  action [ :enable, :start ]
end
```

Resource Collection

```
resource_collection = [
 package["httpd"],
 cookbook_file["/var/www/html/index.html"],
 service ["httpd"]
]
```

Resource Collection Phase 2 - Execute Phase

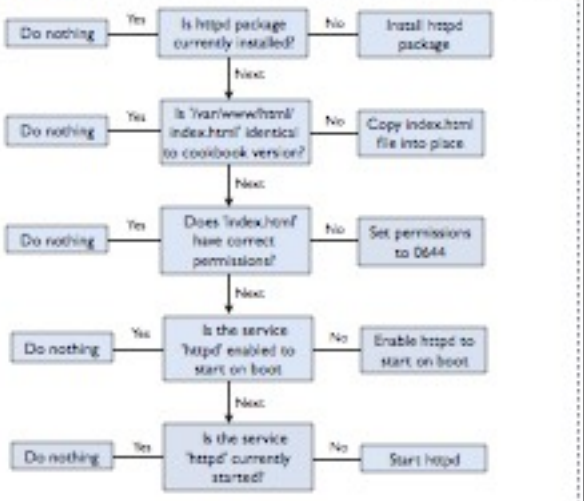
Recipe

```
package "httpd" do
  action :install
end

cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end

service "httpd" do
  action [ :enable, :start ]
end
```

Resource Collection

```
resource_collection = [
 package["httpd"],
 cookbook_file["/var/www/html/index.html"],
 service ["httpd"]
]
```

Execution



Recipe order is important!

- Recipes are executed in the order they appear in the run list

```
Run List:  recipe[ntp::client], recipe[openssh::server], recipe[apache::server]
```

- These recipes are invoked in the following order

1. recipe[ntp::client]
2. recipe[openssh::server]
3. recipe[apache::server]

Resource Collection - Multiple Recipes

1. recipe[ntp::client]

```
package "ntp" do
  action :install
end

template "/etc/ntp.conf" do
  source "ntp.conf.erb"
  owner "root"
  mode "0644"
end

service "ntp" do
  action :start
end
```

Resource Collection

```
resource_collection [
  package[ntp],
  template[/etc/ntp.conf],
  service[ntp]
```

Resource Collection - Multiple Recipes

2. recipe[openssh::client]

```
package "openssh" do
  action :install
end

template "/etc/sshd/sshd_config" do
  source "sshd_config.erb"
  owner "root"
  mode "0644"
end

service "openssh" do
  action :start
end
```

Resource Collection

```
resource_collection [
  package[ntp],
  template[/etc/ntp.conf],
  service[ntp],
  package[openssh],
  template[/etc/sshd/sshd_config],
  service[openssh]
```

Resource Collection - Multiple Recipes

3. recipe[httpd::server]

```
package "httpd" do
  action :install
end

service "httpd" do
  action [ :enable, :start ]
end

cookbook_file "/var/www/html/index.html" do
  source "index.html"
  mode "0644"
end
```

Resource Collection

```
resource_collection [
  package[ntp],
  template[/etc/ntp.conf],
  service[ntp],
  package[openssh],
  template[/etc/sshd/sshd_config],
  service[openssh],
  package[httpd],
  service[httpd],
  cookbook_file[/var/www/html/index.html]
]
```

The final resource collection

- So the resources are invoked in the following order during the execute phase

```
package[ntp]
template[/etc/ntp.conf]
service[ntp]
package[openssh]
template[/etc/sshd/sshd_config]
service[openssh]
package[httpd]
service[httpd]
cookbook_file[/var/www/html/index.html]
```

Multiphase Execution

- Plain ruby is executed in the compile phase
- Chef DSL is executed in the execute phase

Recipe

```
%w[sites-available sites-enabled mods-available].each do |dir|
  directory "/var/www/#{dir}" do
    action :create
    mode  '0755'
    owner 'root'
    group node["apache"]["root_group"]
  end
end
```

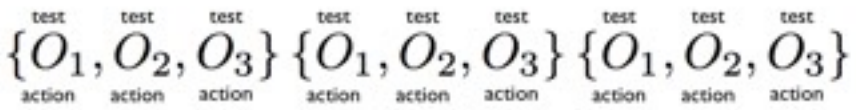
Resource Collection

```
resource_collection [
  directory["/var/www/sites-available"],
  directory["/var/www/sites-enabled"],
  directory["/var/www/mods-available"],
]
```

Remember - Resource order is important!

- Resources are invoked in the order they appear in the recipe

recipe-1 recipe-2 recipe-3



[---------- resource collection ---------]

Review Questions

- What are the steps in a Chef Client run?
- How does a new machine get a private key with which to authenticate requests?
- If you have the right credentials in place, why else might you not be able to authenticate?
- In which phase of a chef-client run do plain Ruby statements get evaluated?

Introducing the Node object

Attributes & Search

Lesson Objectives

- After completing the lesson, you will be able to
  - Explain what the Node object represents in Chef
  - List the Nodes in an organization
  - Show details about a Node
  - Describe what Node Attributes are
  - Retrieve a node attribute directly, and via search

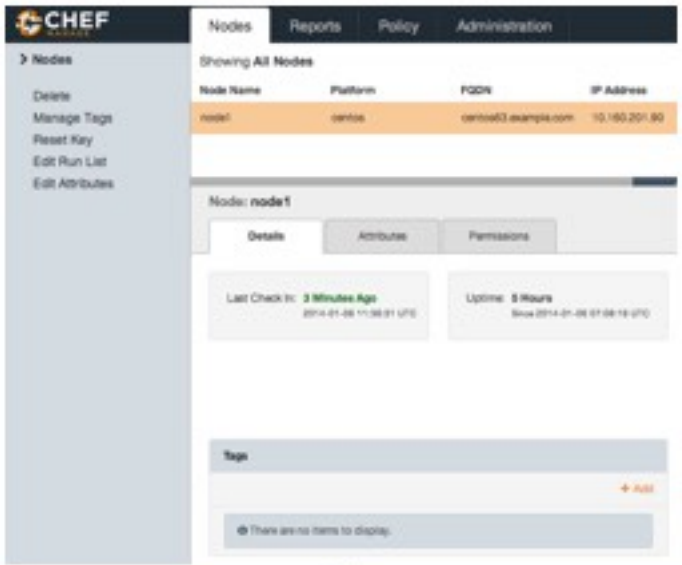
What is the Node object

- A node is any physical, virtual, or cloud machines that is configured to be maintained by a Chef
- The 'node object' is the representation of that physical node within Chef (e.g. in JSON)
- When you are writing Recipes, the Node object is always available to you.

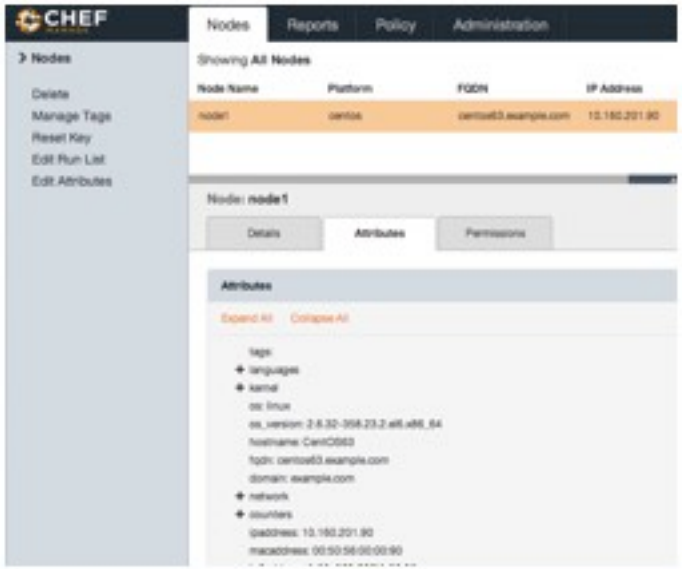
Node

- The node is registered with Chef Server
- The Chef Server displays information about the node
- This information comes from Ohai

View Node on Chef Server



View Node on Chef Server



Exercise: List nodes

```
$ knife node list
```

```
node1
```

Exercise: List clients

```
$ knife client list
```

```
ORGNAME-validator
node1
```

Each node must have a unique name

- Every node must have a unique name within an organization
- Chef defaults to the *Fully Qualified Domain Name* of the server, i.e. in the format `server.domain.com`
- We overrode it to "node1" to make typing easier

Exercise: Show node details

```
$ knife node show node1
```

```
Node Name:   node1
Environment: _default
FQDN:        centos63.example.com
IP:          10.160.201.90
Run List:    recipe[apache]
Roles:
Recipes:     apache
Platform:    centos 6.4
Tags:
```

What is the Node object

- Nodes are made up of Attributes
  - Many are discovered **automatically** (platform, ip address, number of CPUs)
  - Many other objects in Chef can also add Node attributes (Cookbooks, Roles and Environments, Recipes, Attribute Files)
  - Nodes are stored and indexed on the Chef Server

Ohai


```
"languages": {
  "ruby": {

  },
  "perl": {
    "version": "5.14.2",
    "archname": "x86_64-
linux-gnu-thread-multi"
  },
  "python": {
    "version": "2.6.6",
    "builddate": "Jul 10
2013, 22:48:45"
  },
  "perl": {
    "version": "version",
    "archname": "x86_64-
linux-thread-multi"
  },
    "lua": {
      "version": "5.1.4"
},
```

```
"kernel": {
  "name": "Linux",
  "release": "3.2.0-32-virtual",
  "version": "#1 SMP Wed Oct 16
18:37:12 UTC 2013",
  "machine": "x86_64",
  "modules": {
    "isofs": {
      "size": "70066",
      "refcount": "2"
    },
    "des_generic": {
      "size": "16604",
      "refcount": "0"
    }
  },
  "os": "GNU/Linux"
},
"os": "linux",
"os_version":
"2.6.32-358.23.2.el6.x86_64",
"ohai_time": 1389105685.7735305,
```

```
"network": {
  "interfaces": {
    "lo": {
      "mtu": "16436",
      "flags": [
        "LOOPBACK", "UP","LOWER_UP"
      ],
      "encapsulation": "Loopback",
      "addresses": {
        "127.0.0.1": {
          "family": "inet",
          "netmask": "255.0.0.0",
          "scope": "Node"
        },
        "::1": {
          "family": "inet6",
          "scope": "Node"
        }
      },
    },
    "eth0": {
      "type": "eth",
      "number": "0",
```


Exercise: Run Ohai on node

```
chef@node1:~$ ohai | less
```


```
{
  "languages": {
    "ruby": {

    },
    "java": {
      "version": "1.6.0_24",
      "runtime": {
        "name": "OpenJDK Runtime Environment (IcedTea6 1.11.13)",
        "build": "rhel-1.65.1.11.13.el6_4-x86_64"
      },
      "hotspot": {
        "name": "OpenJDK 64-Bit Server VM",
        "build": "20.0-b12, mixed mode"
      }
```

Exercise: Show all the node attributes

```
$ knife node show node1 -l
```

```
Node Name:   node1
Environment: _default
FQDN:        centos63.example.com
IP:          10.160.201.90
Run List:    recipe[apache]
Roles:
Recipes:     apache
Platform:    centos 6.4
Tags:
Attributes:
tags:

Default Attributes:

Override Attributes:

Automatic Attributes (Ohai Data):
block_device:
  dm-0:
    removable: 0
    size:      28393472
```

Exercise: Show the raw node object

```
$ knife node show node1 -Fj
```

```
{
  "name": "node1",
  "chef_environment": "_default",
  "run_list": ["recipe[apache]"],
  "normal": {"tags":[]}
}
```

Exercise: Show only the fqdn attribute

```
$ knife node show node1 -a fqdn
```

```
node1:
  fqdn: centos63.example.com
```

Exercise: Use search to find the same data

```
$ knife search node "*:*" -a fqdn
```

```
1 items found

node1:
  fqdn: centos63.example.com
```

Review Questions

- What is the Node object?
- What is a Node Attribute?
- How do you display all the attributes of a Node?
- Can you search for the **cpu** attribute of your node?

Setting Node Attributes

Setting attributes in recipes and attribute files

Lesson Objectives

- After completing the lesson, you will be able to
  - Describe where and how attributes are set
  - Explain the attribute merge order and precedence rules
  - Declare an attribute with a recipe and set its value

What are Attributes?

- Attributes represent information about your node
- The information can be auto-detected from the node (e.g. # of CPUs, amount of RAM) & populated by Ohai
- You can also set attributes on your node using cookbook recipes & attribute files, roles, environments, etc
- Attributes keep the program code separate from data
- All attributes are set on the "node object", and are indexed for search on the server

Attribute Sources

- Attributes can be set at various levels (in increasing order of precedence)
  - Automagically on the node itself (by Ohai)
  - In roles
  - In environments
  - In cookbook recipes
  - In cookbook attribute files

Ohai - set automatically


```
"languages": {
  "ruby": {

  },
  "perl": {
    "version": "5.14.2",
    "archname": "x86_64-
linux-gnu-thread-multi"
  },
  "python": {
    "version": "2.6.6",
    "builddate": "Jul 10
2013, 22:48:45"
  },
  "perl": {
    "version": "5.10.1",
    "archname": "x86_64-
linux-thread-multi"
  }
},
```

```
"kernel": {
  "name": "Linux",
  "release": "3.2.0-32-virtual",
  "version": "#1 SMP Wed Oct 16
18:37:12 UTC 2013",
  "machine": "x86_64",
  "modules": {
    "isofs": {
      "size": "70066",
      "refcount": "2"
    },
    "des_generic": {
      "size": "16604",
      "refcount": "0"
    }
  },
  "os": "GNU/Linux"
},
"os": "linux",
"os_version":
"2.6.32-358.23.2.el6.x86_64",
"ohai_time": 1389105685.7735305,
```

```
"network": {
  "interfaces": {
    "lo": {
      "mtu": "16436",
      "flags": [
        "LOOPBACK", "UP","LOWER_UP"
      ],
      "encapsulation": "Loopback",
      "addresses": {
        "127.0.0.1": {
          "family": "inet",
          "netmask": "255.0.0.0",
          "scope": "Node"
        },
        "::1": {
          "family": "inet6",
          "scope": "Node"
        }
      },
    },
    "eth0": {
      "type": "eth",
      "number": "0",
```

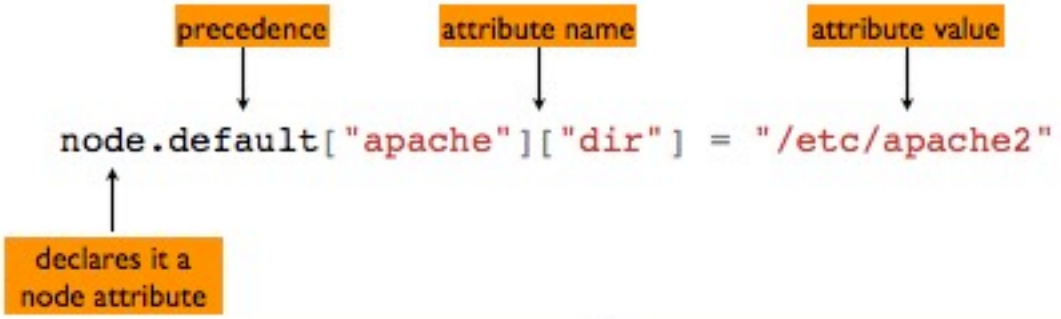
Setting attributes in attribute files

- Attributes can be set in the cookbook's attributes file
  - `./cookbooks/<cookbook>/attributes/default.rb`
- Format is

- We'll look at precedence later....

Setting Attributes in Recipes

- They can also be set directly in Recipes
- Precede attribute name with 'node.' as follows



The Problem and the Success Criteria

- **The Problem:** We have defined our 'index.html' homepage in the recipe, but we may want to change that without altering the recipe
- **Success Criteria:** We can change the homepage by changing an attribute value

Exercise: Set attribute in attributes file

OPEN IN EDITOR: cookbooks/apache/attributes/default.rb

```
default["apache"]["indexfile"] = "index1.html"
```

SAVE FILE!

- Set an attribute to a specific value in the attributes file

Exercise: Add index1.html to cookbook's files/default directory

OPEN IN EDITOR: cookbooks/apache/files/default/index1.html

```
<html>
 <body>
  <h1>Hello, world!</h1>
   <h2>This is index1.html</h2>
    <p>We configured this in the attributes file</p>
 </body>
</html>
```

SAVE FILE!

Exercise: Set attribute in a recipe

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
service "httpd" do
  action [:enable, :start]
end

cookbook_file "/var/www/html/index.html" do
  source node["apache"]["indexfile"]
  mode "0644"
end
```

SAVE FILE!

Exercise: Upload the cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache          [0.1.0]
Uploaded 1 cookbook.
```

Exercise: Re-run Chef Client

```
chef@node1:~$ sudo chef-client
```

```
Starting Chef Client, version 11.8.2
resolving cookbooks for run list: ["apache"]
...
Recipe: apache::default
  * package[httpd] action install (up to date)
  * service[httpd] action enable (up to date)
  * service[httpd] action start (up to date)
  * cookbook_file[/var/www/html/index.html] action create
    - update content in file /var/www/html/index.html from 03fb1d to 478a29
        --- /var/www/html/index.html    2014-01-07 04:28:34.994965341 -0500
        +++ /tmp/.index.html20140107-12128-a6cmxl 2014-01-07 04:31:24.049155232 -0500
        @@ -1,6 +1,8 @@
         <html>
        -<body>
        + <body>
            <h1>Hello, world!</h1>
        -</body>
        +    <h2>This is index1.html</h2>
        +    <p>We configured this in the attributes file</p>
        + </body>
         </html>
    - restore selinux security context

Chef Client finished, 1 resources updated
```

Exercise: Verify new homepage works

- Open a web browser
- The homepage takes the attribute file value

Exercise: Set attribute in the recipe

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
service "apache2" do
  action [:enable, :start]
end

node.default["apache"]["indexfile"] = "index2.html"
cookbook_file "/var/www/html/index.html" do
  source node["apache"]["indexfile"]
  mode "0644"
end
```

SAVE FILE!

Exercise: Add index2.html to cookbook's files/default directory

OPEN IN EDITOR: cookbooks/apache/files/default/index2.html

```
<html>
 <body>
  <h1>Hello, world!</h1>
   <h2>This is index2.html</h2>
    <p>We configured this in the recipe</p>
 </body>
</html>
```

SAVE FILE!

Exercise: Upload the cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache          [0.1.0]
Uploaded 1 cookbook.
```

Exercise: Re-run Chef Client

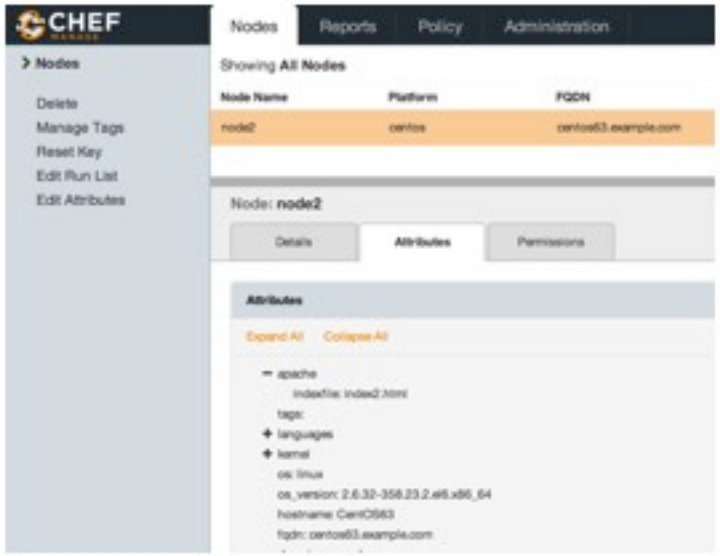
```
chef@node1:~$ sudo chef-client
```

```
Starting Chef Client, version 11.8.2
resolving cookbooks for run list: ["apache"]
...
Recipe: apache::default
  * package[httpd] action install (up to date)
  * service[httpd] action enable (up to date)
  * service[httpd] action start (up to date)
  * cookbook_file[/var/www/html/index.html] action create
    - update content in file /var/www/html/index.html from 478a29 to 153183
        --- /var/www/html/index.html    2014-01-07 04:31:24.049155232 -0500
        +++ /tmp/.index.html20140107-12296-11u8kv7      2014-01-07 04:32:45.605669431 -0500
        @@ -1,8 +1,8 @@
         <html>
          <body>
           <h1>Hello, world!</h1>
        -   <h2>This is index1.html</h2>
        -    <p>We configured this in the attributes file</p>
        +   <h2>This is index2.html</h2>
        +    <p>We configured this in the recipe</p>
          </body>
         </html>
    - restore selinux security context

Chef Client finished, 1 resources updated
```

Exercise: Verify new homepage works

- Open a web browser
- Recipe value has taken precedence

Exercise: Viewing Attributes via WebUI



Exercise: Viewing attributes using knife

```
$ knife node show node1 -l | more
```

```
...
Attributes:
tags:

Default Attributes:
apache:
  indexfile: index2.html

Override Attributes:

Automatic Attributes (Ohai Data):
block_device:
  dm-0:
    removable: 0
    size:      31563776
...
```

Setting Attributes in Roles and Environments

- Attributes can also be set in Roles and Environments
- These use raw JSON or Ruby format

```
default_attributes({"apache" => {"port" => 80}})
```

- More later in Roles and Environments sections...

Default Attribute Precedence

- Please note this is a simplified diagram, and the precedences shown can be overridden

Questions

- What is an attribute?
- Where can attributes be set?
- What knife command can you use to view attributes?
- How many levels of attribute precedence are there?
- Which takes precedence, a default attribute set in the attribute file or in a recipe?

Attributes, Templates, and Cookbook Dependencies

Writing an MOTD Cookbook

Lesson Objectives

- After completing the lesson, you will be able to
  - Describe Cookbook Attribute files
  - Use ERB Templates in Chef
  - Explain Attribute Precedence
  - Describe Cookbook Metadata
  - Specify cookbook dependencies
  - Perform the cookbook creation, upload, and test loop

The Problem and the Success Criteria

- **The Problem:** We need to add a message that appears at login that states:
  - "This server is property of COMPANY"
  - "This server is in-scope for PCI compliance" if the server is, in fact, in scope.
- **Success Criteria:** We see the message when we log in to the test node

Possible Solutions

- We could use an MOTD cookbook to supply the 'Company' name as a node attribute and write out the message
- The line on PCI compliance only gets written if a 'PCI Compliance' attribute is set to 'true' for that Company

We have a small problem...

- We don't have a node attribute for 'Company', nor if the server is in scope for 'PCI Compliance'
- Also, well factored cookbooks only contain the information relevant to their domain
  - We know we will likely have other things related to PCI (security settings, for example)
- So the best thing to do is create a separate PCI cookbook, and add our attribute there

Solution

- We'll create an MOTD cookbook to write out the MOTD - this cookbook configures 'Company' name as a node attribute
- We'll also create a PCI cookbook which configures a 'PCI compliance' attribute - this attribute is then read by MOTD cookbook
- We'll create the MOTD cookbook first, then we'll create the PCI cookbook

Exercise: Create a cookbook named ‘motd’

```
$ knife cookbook create motd
```

```
** Creating cookbook motd
** Creating README for cookbook: motd
** Creating CHANGELOG for cookbook: motd
** Creating metadata for cookbook: motd
```

Exercise: Create a default.rb attribute file

OPEN IN EDITOR: `cookbooks/motd/attributes/default.rb`

```
default["motd"]["company"] = "Chef"
```

SAVE FILE!

- Creates a new Node attribute: `node["motd"]["company"]`
- Sets the values to the string "Chef"
- Note: there is no space between 'default' and '['
- The 'motd' in the attribute is just convention so you know the cookbook the attribute was set in. This is not an enforced syntax

Exercise: Open the default recipe in your editor

OPEN IN EDITOR: `cookbooks/motd/recipes/default.rb`

```
#
# Cookbook Name:: motd
# Recipe:: default
#
# Copyright 2013, YOUR_COMPANY_NAME
#
# All rights reserved - Do Not Redistribute
#
```

What resource should we use?

- We could try and use a `cookbook_file` here, and rely on the file copy rules
  - Create a file per server, basically
- Obviously, that's dramatically inefficient
- Instead, we will render a **template** - a file that is a mixture of the contents we want, and embedded Ruby code

Exercise: Add template resource for /etc/motd

- Use a **template** resource
- The **name** is `"/etc/motd"`
- The resource has two parameters
  - **source** is `"motd.erb"`
  - **mode** is `"0644"`

The template[/etc/motd] resource

OPEN IN EDITOR: cookbooks/motd/recipes/default.rb

```
#
# Cookbook Name:: motd
# Recipe:: default
#
# Copyright 2013, YOUR_COMPANY_NAME
#
# All rights reserved - Do Not Redistribute
#

template "/etc/motd" do
  source "motd.erb"
  mode "0644"
end
```

SAVE FILE!

Exercise: Open motd.erb in your Editor

OPEN IN EDITOR: cookbooks/motd/templates/default/motd.erb

```
This server is property of <%= node["motd"]["company"] %>
 <% if node["pci"]["in_scope"] -%>
 This server is in-scope for PCI compliance
 <% end -%>
```

SAVE FILE!

- **"erb"** stands for "Embedded Ruby"

Exercise: Open motd.erb in your Editor

OPEN IN EDITOR: cookbooks/motd/templates/default/motd.erb

```
This server is property of <%= node["motd"]["company"] %>
 <% if node["pci"]["in_scope"] -%>
 This server is in-scope for PCI compliance
 <% end -%>
```

- To embed a value within an ERB template:
  - Start with <%=
  - Write your Ruby expression - most commonly a node attribute
  - End with %>

Exercise: Open motd.erb in your Editor

OPEN IN EDITOR: cookbooks/motd/templates/default/motd.erb

```
This server is property of <%= node["motd"]["company"] %>
 <% if node["pci"]["in_scope"] -%>
 This server is in-scope for PCI compliance
 <% end -%>
```

- You can use any Ruby construct in a template
  - Starting with <% will evaluate the expression, but not insert the result
  - Ending with -%> will not insert a line in the resulting file
  - Note there are no spaces in 'node["pci"]["in_scope"]'

Templates Are Used For Almost All Configuration Files

- Templates are very flexible ways to create your configuration files
- Coupled with Chef's attribute precedence rules, you can create very effective, data-driven cookbooks

Best Practice: Recipes contain the pattern, attributes supply the details

- Recipes contain the pattern for how to do something. ("How we deploy Tomcat")
- Attributes contain the details. ("What port do we run tomcat on?")

Exercise: Upload the motd cookbook

```
$ knife cookbook upload motd
```

```
Uploading motd                  [0.1.0]
Uploaded 1 cookbook.
```

Exercise: Create a cookbook named ‘pci’

```
$ knife cookbook create pci
```

```
** Creating cookbook pci
** Creating README for cookbook: pci
** Creating CHANGELOG for cookbook: pci
** Creating metadata for cookbook: pci
```

Exercise: Create a default.rb attribute file

OPEN IN EDITOR: `cookbooks/pci/attributes/default.rb`

```
default["pci"]["in_scope"] = true
```

SAVE FILE!

- Creates a new Node attribute: `node["pci"]["in_scope"]`
- Sets the value to the Ruby '`true`' literal

Best Practice: Always use 'default' attributes in your cookbooks

- When setting an attribute in a cookbook, it should (almost) always be a **default** attribute

Exercise: Upload the PCI cookbook

```
$ knife cookbook upload pci
```

```
Uploading pci                    [0.1.0]
Uploaded 1 cookbook.
```

Exercise: Add the motd recipe to your test node's run list

```
$ knife node run_list add node1 "recipe[motd]"
```

```
node1:
  run_list:
    recipe[apache]
    recipe[motd]
```

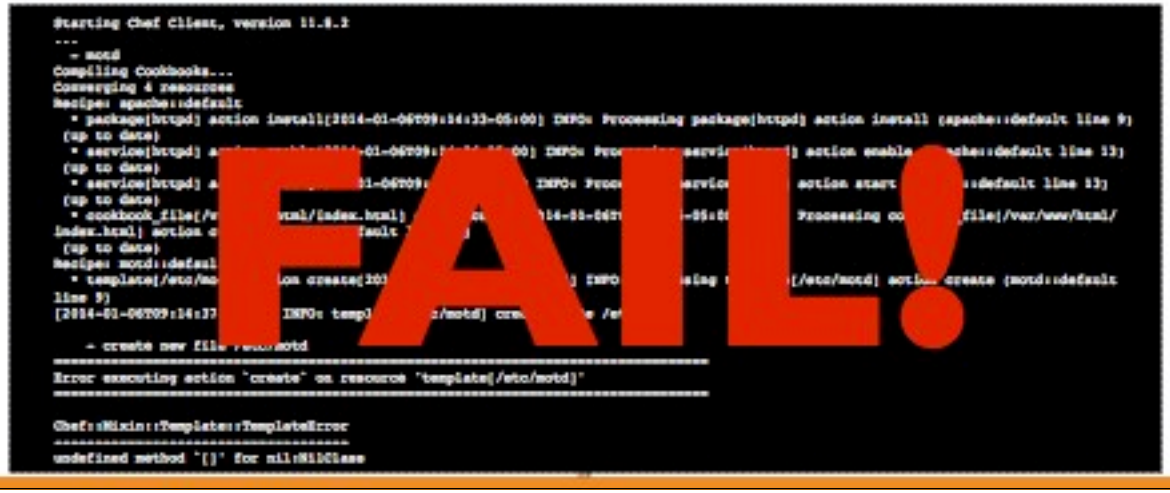
Exercise: Add the motd recipe to your test node's run list

```
$ knife node show node1
```

```
Node Name:   node1
Environment: _default
FQDN:        centos63.example.com
IP:          10.160.201.90
Run List:    recipe[apache], recipe[motd]
Roles:
Recipes:     apache
Platform:    centos 6.4
Tags:
```

Exercise: Re-run the Chef Client

```
chef@node1:~$ sudo chef-client
```



You probably see this at the bottom of your screen...

```
Template Context:
----------------
on line #2
  1:  This server is property of <%= node["motd"]["company"] %>
  2:  <% if node["pci"]["in_scope"] -%>
  3:  This server is in-scope for PCI compliance
  4:  <% end -%>


[2014-01-06T09:14:37-05:00] INFO: Running queued delayed notifications before re-raising
exception
[2014-01-06T09:14:37-05:00] ERROR: Running exception handlers
[2014-01-06T09:14:37-05:00] ERROR: Exception handlers complete
[2014-01-06T09:14:37-05:00] FATAL: Stacktrace dumped to /var/chef/cache/chef-stacktrace.out
Chef Client failed. 0 resources updated
[2014-01-06T09:14:37-05:00] INFO: Sending resource update report (run-id: c001b9d5-
c2f6-4026-9cc6-ff0901aa563c)
[2014-01-06T09:14:37-05:00] ERROR: "\xE2" from ASCII-8BIT to UTF-8
[2014-01-06T09:14:37-05:00] FATAL: Chef::Exceptions::ChildConvergeError: Chef run process
exited unsuccessfully (exit code 1)
```

Stack Traces

- A stack trace tells you where in a program an error occurred
- They can (obviously) be very detailed
- They can also be intensely useful, as they supply the data you need to find a problem

Scroll up

- In this case, Chef actually knows exactly what went wrong.
- Scroll up to find out.

```
================================================================================
Error executing action `create` on resource 'template[/etc/motd]'
================================================================================

Chef::Mixin::Template::TemplateError
------------------------------------
undefined method `[]' for nil:NilClass

Resource Declaration:
---------------------
# In /var/chef/cache/cookbooks/motd/recipes/default.rb

 10: template "/etc/motd" do
 11:   source "motd.erb"
 12:   mode "0644"
 13: end
```

We do not have the attribute we are using in the conditional

```
INFO: Run List is [recipe[apache], recipe[motd]]
INFO: Run List expands to [apache, motd]
INFO: Starting Chef Run for node1.local
INFO: Running start handlers
INFO: Start handlers complete.
resolving cookbooks for run list: ["apache", "motd"]
INFO: Loading cookbooks [apache, motd]
```

- Can anyone guess why?
- We did not load the PCI cookbook!

nil:NilClass error

- The bottom line is when you see this error

```
undefined method `[]' for nil:NilClass
```

- It most often means you tried to look up a node attribute that does not exist!

Best Practice: Make sure cookbooks have default values

- If a cookbook needs an attribute to exist, it should
  1. Define a default value for it in an attribute file, or
  2. Depend on another cookbook that does
- **Never rely on an attribute being created manually**

Exercise: Add a dependency on the PCI cookbook to the MOTD cookbook

OPEN IN EDITOR: cookbooks/motd/metadata.rb

```
maintainer        "YOUR_COMPANY_NAME"
maintainer_email  "YOUR_EMAIL"
license           "All rights reserved"
description       "Installs/Configures motd"
long_description  IO.read(File.join(File.dirname(__FILE__), 'README.md'))
version           "0.1.0"
```

Exercise: Add a dependency on the PCI cookbook to the MOTD cookbook

OPEN IN EDITOR: cookbooks/motd/metadata.rb

```
maintainer        "YOUR_COMPANY_NAME"
maintainer_email  "YOUR_EMAIL"
license           "All rights reserved"
description       "Installs/Configures motd"
long_description  IO.read(File.join(File.dirname(__FILE__), 'README.md'))
version           "0.1.0"
depends "pci"
```

- Cookbooks that depend on other cookbooks will cause the dependent cookbook to be downloaded to the client, and evaluated

Cookbook Metadata

OPEN IN EDITOR: cookbooks/motd/metadata.rb

```
maintainer        "YOUR_COMPANY_NAME"
maintainer_email "YOUR_EMAIL"
license           "All rights reserved"
description       "Installs/Configures motd"
long_description IO.read(File.join(File.dirname(__FILE__), 'README.md'))
version           "0.1.0"
depends "pci"
```

Cookbook Attributes are applied for all downloaded cookbooks!

- Cookbooks downloaded as dependencies will have their attribute files evaluated
- Even if there is no recipe from the cookbook in the run-list

Exercise: Upload the motd cookbook

```
$ knife cookbook upload motd
```

```
Uploading motd                    [0.1.0]
Uploaded 1 cookbook.
```

Exercise: Re-run the Chef Client

```
chef@node1:~$ sudo chef-client
```

```
Forking chef instance to converge...
Starting Chef Client, version 11.8.2
*** Chef 11.8.2 ***
Chef-client pid: 15152
Run List is [recipe[apache], recipe[motd]]
Run List exp    [apac    otd]
Starting Chef    or no
-
    - update co    i    /m    rom e3    o 62
        (new con    A    put su    ed)
    - restore sel    it
Chef Run complete    035877    ds
Removing cookbooks/    e/files/    ult/index2    fro    ache; it    lo    needed by chef-
client.
Running report handlers
Report handlers complete
Chef Client finished, 1 resources updated
Sending resource update report (run-id: f923449e-cc7b-45f7-a9fb-ac1da3653557)
```

WIN!

Exercise: Check your work

```
chef@node1:~$ cat /etc/motd
```

```
This server is property of Chef
This server is in-scope for PCI compliance
```

Exercise: Show your test node's pci attribute

```
$ knife search node "pci:*" -a pci
```

```
1 items found

node1:
  pci:
    in_scope: true
```

Exercise: Set attribute to false

OPEN IN EDITOR: cookbooks/pci/attributes/default.rb

```
default["pci"]["in_scope"] = false
```

SAVE FILE!

- Set the attribute to false

Exercise: Upload the PCI cookbook

```
$ knife cookbook upload pci
```

```
Uploading pci                    [0.1.0]
Uploaded 1 cookbook.
```

Exercise: Re-run the Chef Client

```
chef@node1:~$ sudo chef-client
```

```
Forking chef instance to converge...
Starting Chef Client, version 11.8.2
*** Chef 11.8.2 ***
Chef-client pid: 15350
Run List is [recipe[apache], recipe[motd]]
Run List expands to [apache, motd]
Starting Chef Run for node1
-
template[/etc/motd] updated file contents /etc/motd

    - update content in file /etc/motd from 62ebb9 to d36e1f
        (current file is binary, diff output suppressed)
    - restore selinux security context

Chef Run complete in 5.634796214 seconds
Running report handlers
Report handlers complete
Chef Client finished, 1 resources updated
Sending resource update report (run-id: 06efc909-6740-49bb-971d-82657e066236)
```

Exercise: Check your work

```
chef@node1:~$ cat /etc/motd
```

```
This server is property of Chef
```

Exercise: Show your test node's pci attribute

```
$ knife node show node1 -a pci
```

```
1 items found

node1:
  pci:
    in_scope: false
```

Congratulations!

- You now know the 3 most important resources in the history of configuration management
  - Package
  - Template
  - Service

Review Questions

- What goes in a cookbook's attribute files?
- What are the 3 different levels of precedence?
- When do you need to specify a cookbook dependency?
- What does <%= mean, and where will you encounter it?
- What are the 3 most important resources in configuration management?

Template Variables, Notifications, and Controlling Idempotency

Refactoring the Apache Cookbook

Lesson Objectives

- After completing the lesson, you will be able to
  - Use the **execute** resource
  - Control idempotence manually with **`not_if`** and **`only_if`**
  - Navigate the Resources page on docs.chef.io
  - Describe the Directory resource
  - Implement resource notifications
  - Explain what Template Variables are, and how to use them
  - Use Ruby variables, loops, and string expansion

The Problem and the Success Criteria

- **The Problem:** We need to deploy multiple custom home pages running on different ports
- **Success Criteria:** Be able to view our custom home page

Exercise: Change the cookbook's version number in the metadata

OPEN IN EDITOR: cookbooks/apache/metadata.rb

```
maintainer        "YOUR_COMPANY_NAME"
maintainer_email  "YOUR_EMAIL"
license           "All rights reserved"
description       "Installs/Configures apache"
long_description  IO.read(File.join(File.dirname(__FILE__), 'README.md'))
version           "0.2.0"
```

SAVE FILE!

- Major, Minor, Patch
- Semantic Versioning Policy: http://semver.org/

Exercise: Edit the attribute file default.rb

OPEN IN EDITOR: cookbooks/apache/attributes/default.rb

```
default["apache"]["sites"]["clowns"] = { "port" => 80 }
default["apache"]["sites"]["bears"] = { "port" => 81 }
```

SAVE FILE!

- We add information about the sites we need to deploy
  - One about Clowns, running on port 80
  - One about Bears, running on port 81

Exercise: Open the default apache recipe in your editor

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
package "httpd" do
  action :install
end

service "httpd" do
  action [:enable, :start]
end

node.default["apache"]["indexfile"] = "index2.html"
cookbook_file "/var/www/html/index.html" do
  source node["apache"]["indexfile"]
  mode "0644"
end

# Tasks:-
# Disable the default virtual host
# Iterate over the apache sites
 # Set the document root
 # Add a template for Apache virtual host configuration
 # Add a directory resource to create the document_root
 # Add a template resource for the virtual host's index.html
```

Exercise: Use the 'execute' resource to disable the default Apache virtual host

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
service "httpd" do
  action [ :enable, :start ]
end

# Disable the default virtual host
execute "mv /etc/httpd/conf.d/welcome.conf /etc/httpd/conf.d/welcome.conf.disabled" do
  only_if do
    File.exist?("/etc/httpd/conf.d/welcome.conf")
  end
  notifies :restart, "service[httpd]"
end

cookbook_file "/var/www/html/index.html" do
```

SAVE FILE!

- Renames the default site config file, but only if the file exists
- If the action succeeds, restart Apache

Execute resources are generally not idempotent

- Chef will stop your run if a resource fails
- Most command line utilities are not idempotent and can only be run once - they assume a human being is interacting with, and understands, the state of the system
  - e.g. '`mv /foo/file1 /bar`' will work the first time its run, but will fail the second time
- The result is - it's up to you to make execute resources idempotent

Enter the not_if and only_if metaparameters

```
only_if do
  File.exist?("/etc/httpd/conf.d/welcome.conf")
end
```

- The **`only_if`** parameter causes the resources actions to be taken only if its argument returns true
- The **`not_if`** parameter is the opposite of only_if - the actions are taken only if its argument returns false

Building the resource collection - revisited

- It is important to understand the difference between these two pieces of code

```
execute "start-apache" do
  not_if <code to check if apache is running>
  notifies :start, "service[httpd]"
end
```

This code is placed in the resource collection during the 'compile' phase and executed during the 'execute' phase

```
if !<code to check if apache is running>
  execute "start-apache" do
    notifies :start, "service[httpd]"
  end
end
```

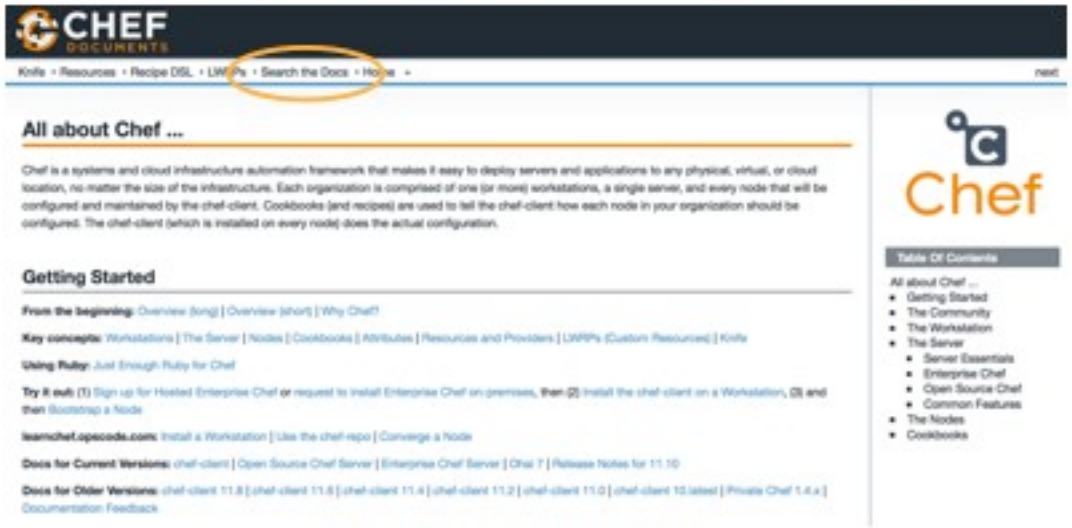
This code is executed during the 'compile' phase before any Chef DSL

Executing code during the compile phase could potentially prevent the resource from getting added to the resource collection

Best Practice: The Chef Docs Site

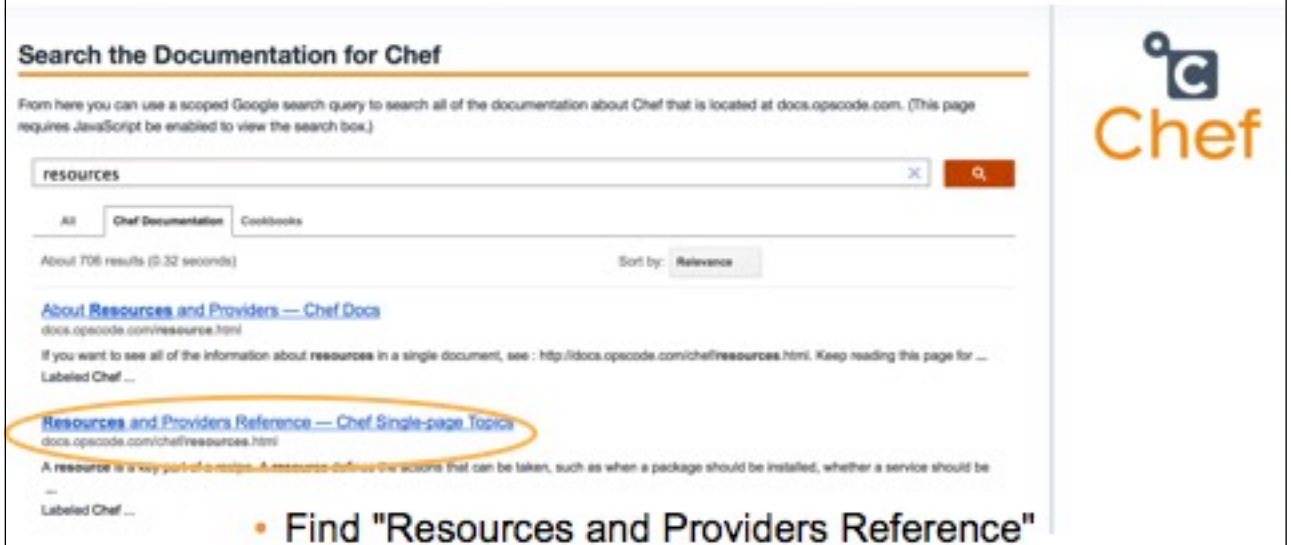
- The Chef Docs Site is the home for all of the documentation about Chef.
  - It is very comprehensive
  - It has a page on every topic
- http://docs.chef.io
- Let's use the docs to learn more about **`not_if`** and **`only_if`**

Exercise: Search for more information about Resources



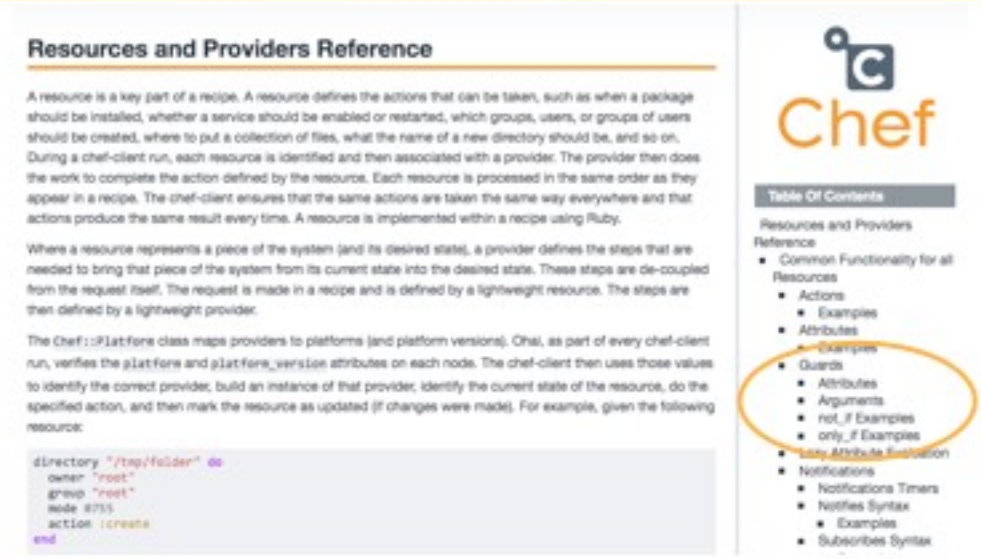
- Search for "Resources"

Exercise: Search for more information about Resources



- Find "Resources and Providers Reference"

The Resources Page



Resources and Providers Reference

A resource is a key part of a recipe. A resource defines the actions that can be taken, such as when a package should be installed, whether a service should be enabled or restarted, which groups, users, or groups of users should be created, where to put a collection of files, what the name of a new directory should be, and so on. During a chef-client run, each resource is identified and then associated with a provider. The provider then does the work to complete the action defined by the resource. Each resource is processed in the same order as they appear in a recipe. The chef-client ensures that the same actions are taken the same way everywhere and that actions produce the same result every time. A resource is implemented within a recipe using Ruby.

Where a resource represents a piece of the system (and its desired state), a provider defines the steps that are needed to bring that piece of the system from its current state into the desired state. These steps are de-coupled from the request itself. The request is made in a recipe and is defined by a lightweight resource. The steps are then defined by a lightweight provider.

The `Chef::Platform` class maps providers to platforms (and platform versions). Ohai, as part of every chef-client run, verifies the `platform` and `platform_version` attributes on each node. The chef-client then uses those values to identify the correct provider, build an instance of that provider, identify the current state of the resource, do the specified action, and then mark the resource as updated (if changes were made). For example, given the following resource:

```
directory "/tmp/folder" do
  owner "root"
  group "root"
  mode 0755
  action :create
end
```

Chef

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Resources and Providers Reference
- Common Functionality for all Resources
  - Actions
    - Examples
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  - Guards
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    - Arguments
    - not_if Examples
    - only_if Examples
  - Lazy Attribute Evaluation
  - Notifications
    - Notifications Timers
    - Notifies Syntax
      - Examples
    - Subscribes Syntax

Notifications

```
notifies :restart, "service[httpd]"
```

- Resource Notifications in Chef are used to trigger an action on a resource when the current resources actions are successful.
- "If we delete the site, restart apache"
- The first argument is an action, and the second argument is the string representation of a given resource
- Like not_if and only_if, **notifies** is a resource metaparameter - any resource can notify any other

Exercise: Iterate over each apache site

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
execute "mv /etc/httpd/conf.d/welcome.conf /etc/httpd/conf.d/welcome.conf.disabled" do
  only_if do
    File.exist?("/etc/httpd/conf.d/welcome.conf")
  end
  notifies :restart, "service[httpd]"
end

node.default["apache"]["indexfile"] = "index2.html"
cookbook_file "/var/www/index.html" do
  source node["apache"]["indexfile"]
  mode "0644"
end
```

- Delete the cookbook_file resource

Exercise: Iterate over each apache site and set document_root

OPEN IN EDITOR: cookbooks/apache/recipes/default.rb

```
# Disable the default virtual host
execute "mv /etc/httpd/conf.d/welcome.conf /etc/httpd/conf.d/welcome.conf.disabled" do
  only_if do
    File.exist?("/etc/httpd/conf.d/welcome.conf")
  end
  notifies :restart, "service[httpd]"
end

# Iterate over the apache sites
node["apache"]["sites"].each do |site_name, site_data|
# Set the document root
  document_root = "/srv/apache/#{site_name}"
```

SAVE FILE!

- `node["apache"]["sites"]` is a ruby hash, with keys and values

Exercise: Iterate over each apache site

```
node["apache"]["sites"].each do |site_name, site_data|
  document_root = "/srv/apache/#{site_name}"
```

- Calling `.each` loops over each site

```
default["apache"]["sites"]["clowns"] = { "port" => 80 }
default["apache"]["sites"]["bears"] = { "port" => 81 }
```

- First pass
  - `site_name = 'clowns'`
  - `site_data = { "port" => 80 }`
- Second pass
  - `site_name = 'bears'`
  - `site_data = { "port" => 81 }`

Exercise: Iterate over each apache site

```
node["apache"]["sites"].each do |site_name, site_data|
  document_root = "/srv/apache/#{site_name}"
```

- Create a variable called `document_root`
- `#{site_name}` means "insert the value of site_name here"
- First pass
  - The value is the string `"/srv/apache/clowns"`
- Second pass
  - The value is the string `"/srv/apache/bears"`

Exercise: Add a template for Apache virtual host configuration

```
# Iterate over the apache sites
node["apache"]["sites"].each do |site_name, site_data|
# Set the document root
  document_root = "/srv/apache/#{site_name}"

# Add a template for Apache virtual host configuration
  template "/etc/httpd/conf.d/#{site_name}.conf" do
    source "custom.erb"
    mode "0644"
    variables(
      :document_root => document_root,
      :port => site_data["port"]
    )
    notifies :restart, "service[httpd]"
  end
```

Template Variables

- Not all data you might need in a template is necessarily node attributes
- The **variables** parameter lets you pass in custom data for use in a template

Exercise: Add a directory resource to create the document_root

- Use a **directory** resource
- The **name** is `document_root`
- The resource has two parameters
  - **mode** is `"0755"`
  - **recursive** is `true`
- Use the Resources page on the Docs Site to read more about what **recursive** does.

Exercise: Add the directory resource

```
# Add a template for Apache virtual host configuration
  template "/etc/httpd/conf.d/#{site_name}.conf" do
    source "custom.erb"
    mode "0644"
    variables(
      :document_root => document_root,
      :port => site_data["port"]
    )
    notifies :restart, "service[httpd]"
  end

# Add a directory resource to create the document_root
  directory document_root do
    mode "0755"
    recursive true
  end
```

Exercise: Add a template resource to supply the index.html for the virtual host

```
# Add a directory resource to create the document_root
  directory document_root do
    mode "0755"
    recursive true
  end

# Add a template resource for the virtual host's index.html
  template "#{document_root}/index.html" do
    source "index.html.erb"
    mode "0644"
    variables(
      :site_name => site_name,
      :port => site_data["port"]
    )
  end
end
```

Don't forget the last "end"

```
# Add a template resource for the virtual host's index.html
  template "#{document_root}/index.html" do
    source "index.html.erb"
    mode "0644"
    variables(
      :site_name => site_name,
      :port => site_data["port"]
    )
  end
end
```

See the correct, whole file at https://gist.github.com/8954699

Exercise: Add custom.erb to your templates directory

OPEN IN EDITOR: cookbooks/apache/templates/default/custom.erb

- Note the two **template variables** are prefixed with an @ symbol
- If you are feeling hardcore, type it
- https://gist.github.com/8955103

```
<% if @port != 80 -%>
  Listen <%= @port %>
<% end -%>

<VirtualHost *:<%= @port %>>
  ServerAdmin webmaster@localhost

  DocumentRoot <%= @document_root %>
  <Directory />
    Options FollowSymLinks
    AllowOverride None
  </Directory>
  <Directory <%= @document_root %>
    Options Indexes FollowSymLinks MultiViews
    AllowOverride None
    Order allow,deny
    allow from all
  </Directory>
</VirtualHost>
```

SAVE FILE!

Exercise: Add index.html.erb to your templates directory

OPEN IN EDITOR: cookbooks/apache/templates/default/index.html.erb

```
<html>
  <body>
    <h1>Welcome to <%= node["motd"]["company"] %></h1>
    <h2>We love <%= @site_name %></h2>
    <%= node["ipaddress"] %>:<%= @port %>
  </body>
</html>
```

SAVE FILE!

- Note the two **template variables** are prefixed with an @ symbol
- https://gist.github.com/8955080

Exercise: Upload the Apache cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache                    [0.2.0]
Uploaded 1 cookbook.
```

Exercise: Re-run the Chef Client

```
chef@node1:~$ sudo chef-client
```

Exercise: Fix typo in custom.erb

OPEN IN EDITOR: cookbooks/apache/templates/default/custom.erb

```
<% if @port != 80 -%>
  Listen <%= @port %>
<% end -%>

<VirtualHost *:<%= @port %>>
  ServerAdmin webmaster@localhost

  DocumentRoot <%= @document_root %>
  <Directory />
    Options FollowSymLinks
    AllowOverride None
  </Directory>
  <Directory <%= @document_root %>>
    Options Indexes FollowSymLinks MultiViews
    AllowOverride None
    Order allow,deny
    allow from all
  </Directory>
</VirtualHost>
```

SAVE FILE!

Exercise: Re-run the Chef Client

```
chef@node1:~$ sudo chef-client
```

```
...
================================================================================
Error executing action `restart` on resource 'service[httpd]'
================================================================================

Mixlib::ShellOut::ShellCommandFailed
------------------------------------
Expected process to
---- Begin output of
STDOUT: Starting
STDERR: Syntax
<Directory> directiv
---- End output of
Ran /sbin/service
Resource Declaration
---------------------
# In /var/chef/cache/cookbooks/apache/recipes/default.rb

 43: service "httpd" do
 44:   action [ :enable, :restart ]
 45: end
...
```

FAIL!

Exercise: Move the service resource to end of recipe

```
# Add a template resource for the virtual host's index.html
  template "#{document_root}/index.html" do
    source "index.html.erb"
    mode "0644"
    variables(
      :site_name => site_name,
      :port => site_data["port"]
    )
  end
end

service "httpd" do
  action [ :enable, :start ]
end
```

Exercise: Re-run the Chef Client

```
chef@node1:~$ sudo chef-client
```

```
      - start service service[httpd]

Recipe: motd::default
  * template[/etc/motd] action create[2014-02-11T04:34:23-05:00] INFO: Processing template[/etc/motd]
action create (motd::default line 9)
 (up to date)
[2014-02-11T0   3-05:00   O: temp   etc   l/con   owns.com   ding   art action to
service[httpd]   yed)
Recipe: apache   ult
  * service[htt   ti   20   -11T04   -05:   roo   ser   httpd] action
restart (apache   l   e
[2014-02-11T04:34   I   e[httpd   arte

      - restart serv   ice[h

[2014-02-11T04:34:26   00] INFO:   f Run comp   in 9.   1215 secon
[2014-02-11T04:34:26-05:00] INFO: Running report handlers
[2014-02-11T04:34:26-05:00] INFO: Report handlers complete
Chef Client finished, 5 resources updated
[2014-02-11T04:34:26-05:00] INFO: Sending resource update report (run-id: d1e6c73e-9406-46b8-b022-
d7bdf0868432)
```

WIN!

Exercise: Re-run the Chef Client

```
chef@node1:~$ sudo chef-client
```

```
[2014-01-07T05:13:43-05:00] INFO: execute[mv /etc/httpd/conf.d/welcome.conf /etc/httpd/conf.d/
welcome.conf.disabled] sending restart action to service[httpd] (delayed)
Recipe: apache::default
  * service[httpd] action restart[2014-01-07T05:13:43-05:00] INFO: Processing service[httpd] action
restart (apache::default line 13)
[2014-01-07T05:13:45-05:00] INFO: service[httpd] restarted

    - restart service service[httpd]

[2014-01-07T05:13:46-05:00] INFO: Chef Run complete in 10.389166164 seconds
[2014-01-07T05:13:46-05:00] INFO: Removing cookbooks/apache/files/default/index2.html from the
cache; it is no longer needed by chef-client.
[2014-01-07T05:13:46-05:00] INFO: Running report handlers
[2014-01-07T05:13:46-05:00] INFO: Report handlers complete
Chef Client finished, 8 resources updated
[2014-01-07T05:13:46-05:00] INFO: Sending resource update report (run-id: b929bc5f-4465-4669-8027-
b7d7b44741d9)
```

Exercise: Verify the two sites are working!

Best Practice: Recipes contain the pattern, attributes supply the details

- Recipes contain the pattern for how to do something. ("How we deploy apache virtual hosts")
- Attributes contain the details. ("What virtual hosts should we deploy?")

Review Questions

- How do you control the idempotence of an Execute resource?
- Where can you learn the details about all the core resources in Chef?
- What is a notification?
- What is a template variable?
- What does `#{foo}` do in a Ruby string?

Search

A deeper dive....

v2.1.6

CHEF

Lesson Objectives

- After completing the lesson, you will be able to
  - Describe the query syntax used in search
  - Invoke a search from command line
  - Build a search into your recipe code

What is search?

- Use search to query data indexed on the chef server
- Syntax is

```
$ knife search INDEX SEARCH_QUERY
```

- Where index can be client, environment, node, role, (or the name of a data bag)
- Search query **runs on** the server and is **invoked from** within a recipe, using knife or via WebUI

Exercise: Use knife search

```
$ knife search node "*:*"
```

```
Node Name:   node1
Environment: _default
FQDN:        centos63.example.com
IP:          10.160.201.90
Run List:    recipe[apache], recipe[motd]
Roles:
Recipes:     apache, motd
Platform:    centos 6.4
Tags:
```

Query Syntax

- Chef search uses the Solr 'key:search_pattern' syntax

```
$ knife search node "ipaddress:10.20.30.40"
```

- Use an asterisk ("*") for >=0 chars in a wildcard search

```
$ knife search node "ipaddress:10.*"
$ knife search node "platfo*:ubuntu"
```

- Use a question mark ("?") to replace a single character

```
$ knife search node "platform_version:12.0?"
```

Indexing and search delay

- Search is based on an index, so if you write to a node it may not be immediately available

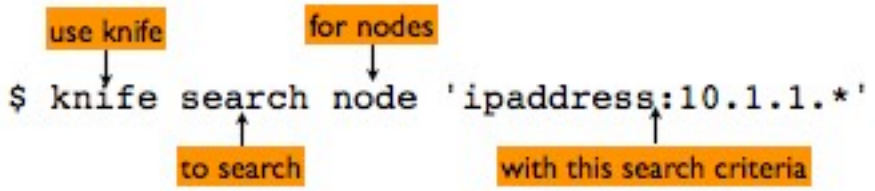
```
node.default["serveradmin"] = "Jane"

search("node","*:*").each do |servers|
 user servers["serveradmin"]
end
```

BAD PRACTICE!

- Here, since the attribute value has just been written the search will not pick it up until the index is rebuilt
- Also, node attributes changed during a Chef run aren't posted to the server until the entire Chef run is successful
- But the value is stored in memory - so no need to search!

Remember what you're searching for!



- A successful search returns **all objects**, not just the attributes, that satisfy the search criteria
- In other words 'search for nodes containing this attribute', **NOT** 'search for this attribute across nodes'!

Exercise: Find a node with the specific attribute value

```
$ knife search node "ipaddress:10.*"
```

```
1 items found

Node Name:   node1
Environment: _default
FQDN:        centos63.example.com
IP:          10.160.201.90
Run List:    recipe[apache], recipe[motd]
Roles:
Recipes:     apache, motd
Platform:    centos 6.4
Tags:
```

Exercise: Using Knife to find an attribute value

```
$ knife search node "*:*" -a ipaddress
```

```
1 items found

node1:
  ipaddress: 10.160.201.90
```

Exercise: Return just the attribute value

```
$ knife search node "ipaddress:10.*" -a ipaddress
```

```
1 items found

node1:
  ipaddress: 10.160.201.90
```

Exercise: Boolean matching

```
$ knife search node "ipaddress:10* AND
platform_family:rhel"
```

```
1 items found

Node Name:   node1
Environment: _default
FQDN:        centos63.example.com
IP:          10.160.201.90
Run List:    recipe[apache], recipe[motd]
Roles:
Recipes:     apache, motd
Platform:    centos 6.4
Tags:
```

Search from within a recipe

- You can invoke a search within a recipe, and use the results to apply further Chef primitives

```
search(INDEX, SEARCH_QUERY).each do |result|
 foo
end
```

- For example

```
search("node", "role:webserver").each do |webserver|
 [register webserver with load balancer]
 or
 [configure firewall so webserver can access database]
end
```

Exercise: Search for an attribute in a recipe

OPEN IN EDITOR: cookbooks/apache/recipes/ip-logger.rb

```
search("node","platform:centos").each do |server|
  log "The CentOS servers in your organization have the following
FQDN/IP Addresses:- #{server["fqdn"]}/#{server["ipaddress"]}"
end
```

SAVE FILE!

Exercise: Upload the Apache cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache                    [0.2.0]
Uploaded 1 cookbook.
```

Exercise: Add the recipe to your test node's run list

```
$ knife node run_list add node1 'recipe[apache::ip-logger]'
```

```
node1:
  run_list:
    recipe[apache]
    recipe[motd]
    recipe[apache::ip-logger]
```

Recipe Naming

- Recipes are referenced using the notation '**cookbook::recipe**', where 'recipe' is the name of the '**.rb**' file in the "cookbook/recipe" directory
- The "default.rb" recipe for a given cookbook may be referred to just the cookbook name (e.g. '*mysql*')
- If we added another recipe to this cookbook named 'backup', we would refer to it as '*mysql::backup*'

Exercise: Re-run the Chef Client

```
chef@node1:~$ sudo chef-client
```

```
Recipe: apache::ip-logger
  * log[The CentOS servers in your organization have the following FQDN/IP
Addresses:- centos63.example.com/10.160.201.90] action
write[2014-01-07T05:42:21-05:00] INFO: Processing log[The CentOS servers in your
organization have the following FQDN/IP Addresses: Server centos63.example.com/
10.160.201.90] action write (apache::ip-logger line 4)
[2014-01-07T05:42:21-05:00] INFO: The CentOS servers in your organization have the
following FQDN/IP Addresses: Server centos63.example.com/10.160.201.90


[2014-01-07T05:42:22-05:00] INFO: Chef Run complete in 6.376181602 seconds
[2014-01-07T05:42:22-05:00] INFO: Running report handlers
[2014-01-07T05:42:22-05:00] INFO: Report handlers complete
Chef Client finished, 1 resources updated
[2014-01-07T05:42:22-05:00] INFO: Sending resource update report (run-id:
cecf34e9-eab6-4379-a5a6-d6d135ae8cc7)
```

Exercise: Remove the recipe to your test node's run list

```
$ knife node run_list remove node1 'recipe[apache::ip-logger]'
```

```
node1:
  run_list:
    recipe[apache]
    recipe[motd]
```

Questions

- What search engine is Chef search built upon?
- What is searchable in Chef?
- What character can you use for a wildcard search in Solr?
- Why should you not set an attribute and then immediately search for it?

Recipe Inclusion, Data Bags, and Search

Writing a Users cookbook

Lesson Objectives

- After completing the lesson, you will be able to
  - Explain what Data Bags are, and how they are used
  - Describe the User and Group resources
  - Use the `include_recipe` directive
  - Describe the role Search plays in recipes

The Problem and the Success Criteria

- **The Problem**: Employees should have local user accounts created on servers, along with custom groups
- **Success Criteria:** We can add new employees and groups to servers dynamically

Where should we store the user data?

- As we've seen, we could start by storing information about users as Node Attributes
- This is sort of a bummer, because we would be duplicating a lot of information - every user in the company would be stored in every Node object!
- Additionally, it would be very hard to integrate such a solution with another source of truth about users

Introducing Data Bags

- A data bag is a **container** for **items** that represent information about your infrastructure that is not tied to a single node
- Examples
  - Users
  - Groups
  - Application Release Information

Make a data_bags directory

```
$ mkdir -p data_bags/users
```

```
(No output)
```

Exercise: Create a data bag named users

```
$ knife data_bag create users
```

```
Created data_bag[users]
```

Exercise: Create a user item in the users data bag

OPEN IN EDITOR: data_bags/users/bobo.json

```
{
  "id": "bobo",
  "comment": "Bobo T. Clown",
  "uid": 2000,
  "gid": 0,
  "home": "/home/bobo",
  "shell": "/bin/bash"
}
```

SAVE FILE!

Exercise: Create the data bag item

```
$ knife data_bag from file users bobo.json
```

```
Updated data_bag_item[users::bobo]
```

Exercise: Create another user in the users data bag

OPEN IN EDITOR: data_bags/users/frank.json

```
{
  "id": "frank",
  "comment": "Frank Belson",
  "uid": 2001,
  "gid": 0,
  "home": "/home/frank",
  "shell": "/bin/bash"
}
```

SAVE FILE!

Exercise: Create the data bag item

```
$ knife data_bag from file users frank.json
```

```
Updated data_bag_item[users::frank]
```

Exercise: Show all the items in users data bag

```
$ knife search users "*:*"
```

```
2 items found

chef_type:  data_bag_item
comment:    Frank Nelson
data_bag:   users
gid:        0
home:       /home/frank
id:         frank
shell:      /bin/bash
uid:        2001

chef_type:  data_bag_item
comment:    Bobo T. Clown
data_bag:   users
gid:        0
home:       /home/bobo
id:         bobo
shell:      /bin/bash
uid:        2000
```

Exercise: Find Bobo's shell in Chef

```
$ knife search users "id:bobo" -a shell
```

```
1 items found

data_bag_item_users_bobo:
  shell: /bin/bash
```

Exercise: Create a data bag named groups

```
$ mkdir data_bags/groups
$ knife data_bag create groups
```

```
Created data_bag[groups]
```

Exercise: Create a group item in the group data bag

OPEN IN EDITOR: data_bags/groups/clowns.json

```
{
  "id": "clowns",
  "gid": 3000,
  "members": ["bobo", "frank"]
}
```

SAVE FILE!

Exercise: Create the data bag item

```
$ knife data_bag from file groups clowns.json
```

```
Updated data_bag_item[groups::clowns]
```

Exercise: Show all the groups in Chef

```
$ knife search groups "*:*"
```

```
1 items found

chef_type:  data_bag_item
data_bag:   groups
gid:        3000
id:         clowns
members:
    bobo
    frank
```

Exercise: Create a cookbook named 'users'

```
$ knife cookbook create users
```

```
** Creating cookbook users
** Creating README for cookbook: users
** Creating CHANGELOG for cookbook: users
** Creating metadata for cookbook: users
```

Exercise: Open the default recipe in your editor

OPEN IN EDITOR: cookbooks/users/recipes/default.rb

```
#
# Cookbook Name:: users
# Recipe:: default
#
# Copyright 2013, YOUR_COMPANY_NAME
#
# All rights reserved - Do Not Redistribute
#
```

SAVE FILE!

Exercise: Open the default recipe in your editor

```
search("users", "*:*").each do |user_data|
  user user_data["id"] do
    comment user_data["comment"]
    uid user_data["uid"]
    gid user_data["gid"]
    home user_data["home"]
    shell user_data["shell"]
  end
end

include_recipe "users::groups"
```

- We use the same search we just tried with Knife in the recipe
- Each item is bound to `user_data`
- Use the Chef Docs for information about the **user** resource

Exercise: Open the default recipe in your editor

```
search("users", "*:*").each do |user_data|
  user user_data["id"] do
    comment user_data["comment"]
    uid user_data["uid"]
    gid user_data["gid"]
    home user_data["home"]
    shell user_data["shell"]
  end
end

include_recipe "users::groups"
```

- **include_recipe** ensures another recipes resources are complete before we continue
- Chef will only include each recipe once

Best Practice: Use include_recipe liberally

- If there is a pre-requisite for your recipe that resides in another recipe (the JVM existing for your Java application, for example)
  - Always use `include_recipe` to include it specifically, even if you put it in a run list

Exercise: Open the users::groups recipe in your editor

OPEN IN EDITOR: cookbooks/users/recipes/groups.rb

```
search("groups", "*:*").each do |group_data|
  group group_data["id"] do
    gid group_data["gid"]
    members group_data["members"]
  end
end
```

SAVE FILE!

- This file follows the same pattern as the default users recipe
- Use the Chef Docs for information about the **group** resource

Exercise: Upload the users cookbook

```
$ knife cookbook upload users
```

```
Uploading users              [0.1.0]
Uploaded 1 cookbook.
```

Exercise: Add the users recipe to your test node's run list

```
$ knife node run_list add node1 'recipe[users]'
```

```
node1:
  run_list:
    recipe[apache]
    recipe[motd]
    recipe[users]
```

Exercise: Re-run the Chef Client

```
chef@node1$ sudo chef-client
```

```
...
Recipe: users::default
  * user[bobo] action create[2014-01-07T06:16:26-05:00] INFO: Processing user[bobo] action create
(users::default line 10)
[2014-01-07T06:16:26-05:00] INFO: user[bobo] created

    - create user user[bobo]

  * user[frank] action create[2014-01-07T06:16:26-05:00] INFO: Processing user[frank] action create
(users::default line 10)
[2014-01-07T06:16:27-05:00] INFO: user[frank] created

    - create user user[frank]

Recipe: users::groups
  * group[clowns] action create[2014-01-07T06:16:27-05:00] INFO: Processing group[clowns] action
create (users::groups line 2)
[2014-01-07T06:16:27-05:00] INFO: group[clowns] created

    - create group[clowns]
...
```

Exercise: Verify the users and groups exist

```
chef@node1:~$ cat /etc/passwd
```

```
frank:x:2001:0:Frank Belson:/home/frank:/bin/bash
bobo:x:2000:0:Bobo T. Clown:/home/bobo:/bin/bash
```

```
chef@node1:~$ cat /etc/group
```

```
clowns:x:3000:bobo,frank
```

Let's review real quick..

- We just created a centralized user and group repository, from scratch
  - (That's kind of like what LDAP and Active Directory do, only they are, well, fancier.)
- Between Data Bags and Node Attribute precedence, Chef provides a plethora of ways to inform the patterns you use to configure your infrastructure

Review Questions

- What are Data Bags?
- How are they used?
- What does the User resource do?
- What is `include_recipe`, and why is it useful?
- How does search work inside a recipe?
- What other applications do you see for search?
- How could we have used Data Bags in the refactored Apache recipe?
- Where would you go to find out more?

Roles

Role-based Attributes and Merge Order Precedence

v2.1.6

CHEF

Lesson Objectives

- After completing the lesson, you will be able to
  - Explain what Roles are, and how they are used to provide clarity
  - Discuss the Role Ruby DSL
  - Show a Role with Knife
  - Explain how merge order affects the precedence hierarchy
  - Describe nested Roles

What is a Role?

- So far, we've been just adding recipes directly to a single node
- But that's not how your infrastructure works - think about how you refer to servers
  - *"It's a **web server**"*
  - *"It's a **database** server"*
  - *"It's a **monitoring** server"*

What is a Role?

- Roles allow you to conveniently encapsulate the run lists and attributes required for a server to "be" what you already think it is
- In practice, Roles make it **easy to configure many nodes identically** without repeating yourself each time

Best Practice: Roles live in your chef-repo

- Like Data Bags, you have options with how to create a Role
- The best practice is that all of your Roles live in the `roles` directory of your chef-repo
- They can be created via the API and Knife, but it's nice to be able to see them evolve in your source control history

Exercise: Create the webserver role

OPEN IN EDITOR: `roles/webserver.rb`

- A Role has a:
  - name
  - description
  - run_list

```
name "webserver"
description "Web Server"
run_list "recipe[apache]"
default_attributes({
  "apache" => {
    "sites" => {
      "admin" => {
        "port" => 8000
      }
    }
  }
})
```

SAVE FILE!

Exercise: Create the webserver role

OPEN IN EDITOR: roles/webserver.rb

- You can set default node attributes within a role.

```
name "webserver"
description "Web Server"
run_list "recipe[apache]"
default_attributes({
  "apache" => {
    "sites" => {
      "admin" => {
        "port" => 8000
      }
    }
  }
})
```

SAVE FILE!

Exercise: Create the role

```
$ knife role from file webserver.rb
```

```
Updated Role webserver!
```

Exercise: Show the role with knife

```
$ knife role show webserver
```

```
chef_type:            role
default_attributes:
  apache:
    sites:
      admin:
        port:  8000
description:          Web Server
env_run_lists:
json_class:           Chef::Role
name:                 webserver
override_attributes:
run_list:             recipe[apache]
```

Exercise: Search for roles with recipe[apache] in their run list

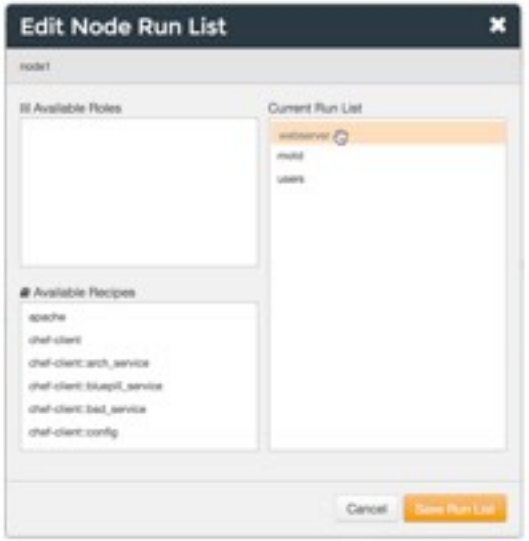
```
$ knife search role "run_list:recipe\[apache\]"
```

```
1 items found

chef_type:            role
default_attributes:
  apache:
    sites:
      admin:
        port:  8000
description:          Web Server
env_run_lists:
json_class:           Chef::Role
name:                 webserver
override_attributes:
run_list:             recipe[apache]
```

Exercise: Replace recipe[apache] with role[webserver] in run list

- Click the 'Nodes' tab then select node 'node1'
- Click 'Edit Run List' from left navigation bar
- Drag 'Apache' over from 'Current Run List' to 'Available Recipes'
- Drag 'webserver' over from 'Available Roles' to the top of 'Current Run List'
- Click 'Save Run List'



Exercise: Re-run the Chef Client

```
chef@node1$ sudo chef-client
```

```
INFO: *** Chef 11.8.2 ***
INFO: Chef-client pid: 5634
INFO: Run List is [role[webserver], recipe[motd], recipe[users]]
INFO: Run List expands to [apache, motd, users]
```

Exercise: Re-run the Chef Client

```
  * directory[/srv/apache/admin] action create[2014-01-07T06:39:51-05:00] INFO: Processing directory[/srv/apache/admin] action
create (apache::default line 53)
[2014-01-07T06:39:51-05:00] INFO: directory[/srv/apache/admin] created directory /srv/apache/admin

    - create new directory /srv/apache/admin[2014-01-07T06:39:51-05:00] INFO: directory[/srv/apache/admin] mode changed to 755

    - change mode from '' to '0755'
    - restore selinux security context

  * template[/srv/apache/admin/index.html] action create[2014-01-07T06:39:51-05:00] INFO: Processing template[/srv/apache/
admin/index.html] action create (apache::default line 58)
[2014-01-07T06:39:51-05:00] INFO: template[/srv/apache/admin/index.html] created file /srv/apache/admin/index.html

    - create new file /srv/apache/admin/index.html[2014-01-07T06:39:51-05:00] INFO: template[/srv/apache/admin/index.html]
updated file contents /srv/apache/admin/index.html

    - update content in file /srv/apache/admin/index.html from none to 8abbb3
        --- /srv/apache/admin/index.html    2014-01-07 06:39:51.762119942 -0500
        +++ /tmp/chef-rendered-template20140107-17953-1awqbi    2014-01-07 06:39:51.764120088 -0500
        @@ -1 +1,8 @@
        +<html>
        +  <body>
        +    <h1>Welcome to Chef</h1>
        +    <h2>We love admin</h2>
        +    10.168.201.90:8000
        +  </body>
        +</html>[2014-01-07T06:39:51-05:00] INFO: template[/srv/apache/admin/index.html] mode changed to 644

    - change mode from '' to '0644'
```

Node Attributes that are hashes are merged

- The apache cookbooks attribute file contains:

```
default["apache"]["sites"]["clowns"] = { "port" => 80 }
default["apache"]["sites"]["bears"] = { "port" => 81 }
```

- While our role has...

```
default_attributes({
  "apache" => {
    "sites" => {
      "admin" => {
        "port" => 8000
      }
    }
  }
})
```

Exercise: Display the apache.sites attribute on all nodes with webserver role

```
$ knife search node "role:webserver" -a apache.sites
```

```
1 items found

node1:
 apache.sites:
   admin:
     port:  8000
   bears:
     port:  81
   clowns:
     port:  80
```

Exercise: Edit the webserver role

OPEN IN EDITOR: roles/webserver.rb

- Do not forget the **comma** after the admin site
- Change the value of the bears site to be 8081

```
default_attributes({
  "apache" => {
    "sites" => {
      "admin" => {
        "port" => 8000
      },
      "bears" => {
        "port" => 8081
      }
    }
  }
})
```

SAVE FILE!

Exercise: Create the role

```
$ knife role from file webserver.rb
```

```
Updated Role webserver!
```

Exercise: Re-run the Chef Client

```
chef@node1$ sudo chef-client
```

```
...
[2014-01-07T06:57:48-05:00] INFO: template[/etc/httpd/conf.d/bears.conf] updated file contents /etc/
httpd/conf.d/bears.conf

    - update content in file /etc/httpd/conf.d/bears.conf from 30610b to 92e1e4
        --- /etc/httpd/conf.d/bears.conf    2014-01-07 05:13:42.450113970 -0500
        +++ /tmp/chef-rendered-template20140107-18263-5563t5    2014-01-07 06:57:48.091397610 -0500
        @@ -1,6 +1,6 @@
        -  Listen 81
        +  Listen 8081

        -<VirtualHost *:81>
        +<VirtualHost *:8081>
           ServerAdmin webmaster@localhost

           DocumentRoot /srv/apache/bears
...
```

Exercise: Display the apache sites attribute on all nodes with the webserver role

```
$ knife search node 'role:webserver' -a apache.sites
```

```
1 items found

node1:
  apache.sites:
    admin:
      port:  8000
    bears:
      port:  8081
    clowns:
      port:  80
```

When you combine merge order and precedence rules, you get this:

Merge Order and Precedence

	Attribute Files	Node / Recipe	Environment	Role
default	1	2	3	4
force_default	5	6		
normal	7	8		
override	9	10	12	11
force_override	13	14		
automatic			15	

Best Practice: Roles get default attributes

- While it is awesome that you can use overrides, in practice there is little need
- If you always set **default** node attributes in your cookbook attribute files
- You can almost **always** set default node attributes in your role, and let merge order do the rest

Best Practice: Have "base" roles

- In addition to obvious roles, such as "webserver", it is a common practice to group any functionality that "goes together" in a role
- The most common example here is a **base** role, where you include all the recipes that should be run on every node

Exercise: Create the base role

OPEN IN EDITOR: `roles/base.rb`

```
name "base"
description "Base Server Role"
run_list "recipe[motd]", "recipe[users]"
```

SAVE FILE!

Exercise: Create the role

```
$ knife role from file base.rb
```

```
Updated Role base!
```

Exercise: Add the base role to the webserver role's run list

OPEN IN EDITOR: roles/webserver.rb

```
name "webserver"
description "Web Server"
run_list "role[base]", "recipe[apache]"
default_attributes({
  "apache" => {
```

- Put `role[base]` at the front of the `run_list`

SAVE FILE!

Exercise: Update the role

```
$ knife role from file webserver.rb
```

```
Updated Role webserver!
```

Exercise: Re-run the Chef Client

```
chef@node1$ sudo chef-client
```

```
INFO: *** Chef 11.8.2 ***
Chef-client pid: 5634
INFO: Run List is [role[webserver], recipe[motd],
recipe[users]]
INFO: Run List expands to [motd, users, apache]
```

Best Practice: Be explicit about what you need or expect

- Chef will only execute a recipe the first time it appears in the run list
- So be explicit about your needs and expectations - either by nesting roles or using `include_recipe`

Exercise: Set the run list to just role[webserver]

- Remove all the entries in the run list other than `role[webserver]`

Review Questions

- What is a Role?
- What makes for a "good" role?
- How do you search for roles with a given recipe in their run list?
- How many times will Chef execute a recipe in the same run?

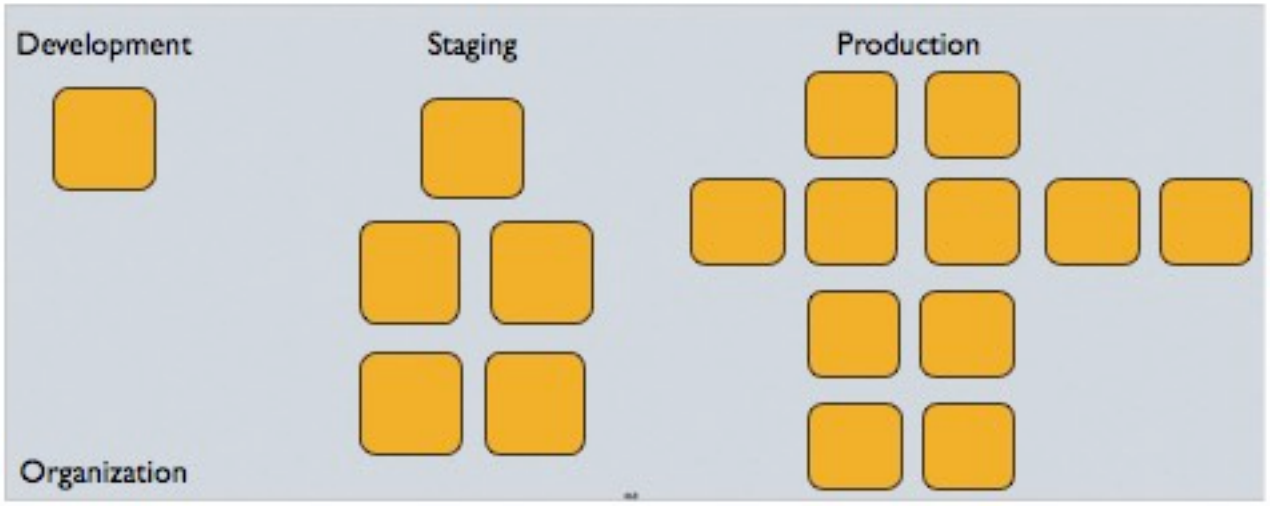
Environments

Cookbook Version Constraints and Override Attributes

Lesson Objectives

- After completing the lesson, you will be able to
  - Describe what an Environment is, and how it is different from an Organization
  - Set cookbook version constraints
  - Explain when to set attributes in an environment

Environments



Environments

- Every Organization starts with a single environment
- Environments reflect your patterns and workflow
  - Development
  - Test
  - Staging
  - Production
  - etc.

Environments Define Policy

- Each environment may include attributes necessary for configuring the infrastructure in that environment
  - Production needs certain Yum repos
  - QA needs different Yum repos
  - The version of the Chef cookbooks to be used

Environment Best Practice

- We cannot share cookbooks between organizations
- Best Practice: If you need to share cookbooks or roles, you likely want an Environment rather than an organization

- Environments allow for isolating resources within a single organization

Exercise: Use knife to show the available cookbook versions

```
$ knife cookbook show apache
```

```
apache    0.2.0  0.1.0
```

Exercise: List current environments

```
$ knife environment list
```

```
_default
```

- The `_default` environment is read-only, and sets no policy at all

Make an environments directory

```
$ mkdir environments
```

```
(No output)
```

Exercise: Create a dev environment

OPEN IN EDITOR: environments/dev.rb

```
name "dev"
description "For developers!"
cookbook "apache", "= 0.2.0"
```

SAVE FILE!

- Environments have **names**
- Environments have a **description**
- Environments *can* have one or more **cookbook** constraints

Cookbook Version Constraints

- = Equal to
- There are other options but equality is the recommended practice.
- Learn more at http://docs.chef.io/chef/essentials_cookbook_versions.html

Exercise: Create the dev environment

```
$ knife environment from file dev.rb
```

```
Updated Environment dev
```

Exercise: Show your dev environment

```
$ knife environment show dev
```

```
chef_type:            environment
cookbook_versions:
  apache:   = 0.2.0
default_attributes:
description:          For developers!
json_class:           Chef::Environment
name:                 dev
override_attributes:
```

Exercise: Change your node's environment to "dev"

- Click the 'Nodes' tab then select node 'node1'
- Select `dev` from the 'Environments' drop-down list
- Click 'Save'

Exercise: Re-run the Chef Client

```
chef@node1$ sudo chef-client
```

```
INFO: Chef Run complete in 1.587776095 seconds
INFO: Running report handlers
INFO: Report handlers complete
```

Exercise: Create a production environment

OPEN IN EDITOR: environments/production.rb

- Make sure the apache cookbook is set to version 0.1.0
- Set an override attribute for being in scope - no matter what, you are in scope

```
name "production"
description "For Prods!"
cookbook "apache", "= 0.1.0"
override_attributes({
  "pci" => {
    "in_scope" => true
  }
})
```

SAVE FILE!

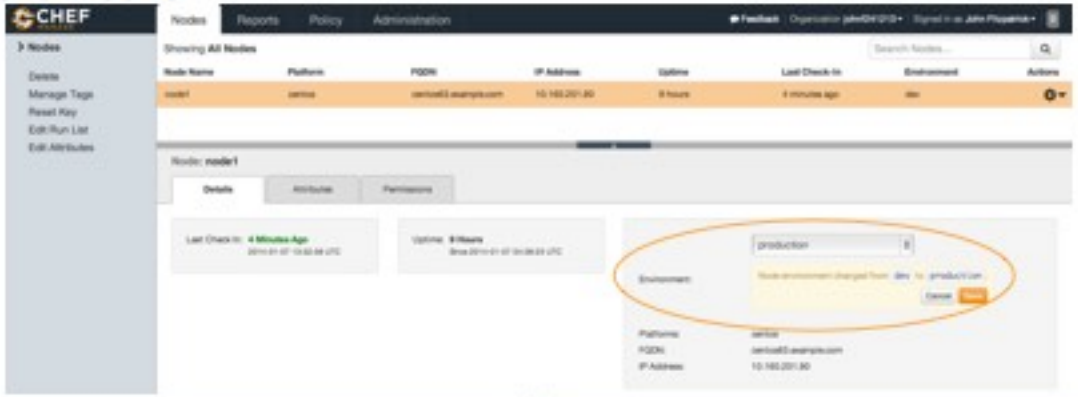
Exercise: Create the production environment

```
$ knife environment from file production.rb
```

```
Updated Environment production
```

Exercise: Change your node's environment to "production"

- Click the 'Nodes' tab then select node 'node1'
- Select `production` from the 'Environments' drop-down list
- Click 'Save'



Exercise: Re-run the Chef Client

```
chef@node1$ sudo chef-client
```

```
INFO: Loading cookbooks [apache, motd, pei, users]
Synchronizing Cookbooks:
...
Recipe: motd::default
  * template[/etc/motd] action create[2014-01-07T08:40:00-05:00] INFO: Processing template[/etc/motd] action create
(motd::default line 9)
[2014-01-07T08:40:00-05:00] INFO: template[/etc/motd] backed up to /var/chef/backup/etc/motd.chef-20140107084000.070961
[2014-01-07T08:40:00-05:00] INFO: template[/etc/motd] updated file contents /etc/motd

    - update content in file /etc/motd from d36e1f to 62ebb9
      (current file is binary, diff output suppressed)
...
  * cookbook_file[/var/www/index.html] action create[2014-01-07T08:40:05-05:00] INFO: Processing cookbook_file[/var/www/
index.html] action create (apache::default line 18)
 (up to date)
[2014-01-07T08:40:06-05:00] INFO: Chef Run complete in 8.048307322 seconds
[2014-01-07T08:40:06-05:00] INFO: Removing cookbooks/apache/templates/default/index.html.erb from the cache; it is no
longer needed by chef-client.
[2014-01-07T08:40:06-05:00] INFO: Removing cookbooks/apache/templates/default/custom.erb from the cache; it is no longer
needed by chef-client.
```

Rollbacks and Desired State Best Practice

- Chef is not magic - it manages state for **declared** resources
- We just rolled back to an earlier version of the apache cookbook
- While the recipe applied fine, investigating the system will reveal Apache is still configured as it was in the 0.2.0 cookbook
- A better way to ensure a smooth rollback: write contra-resources to clean up, and have a new version of the cookbook.

Review Questions

- What is an Environment?
- How is it different from an Organization?
- What kind of node attributes do you typically set from an Environment?

Chef Supermarket

Open Source: Saving you time!

v2.1.6

CHEF

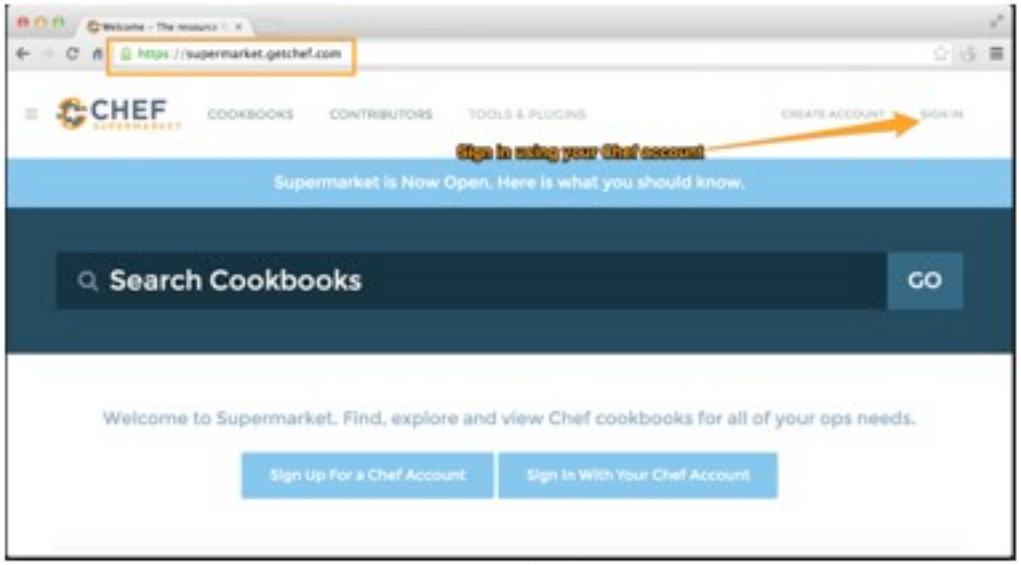
Lesson Objectives

- After completing the lesson, you will be able to
  - Find, preview and download cookbooks from the Chef Supermarket community site
  - Use knife to work with the Chef Supermarket site API
  - Download, extract, examine and implement cookbooks from the Chef Supermarket

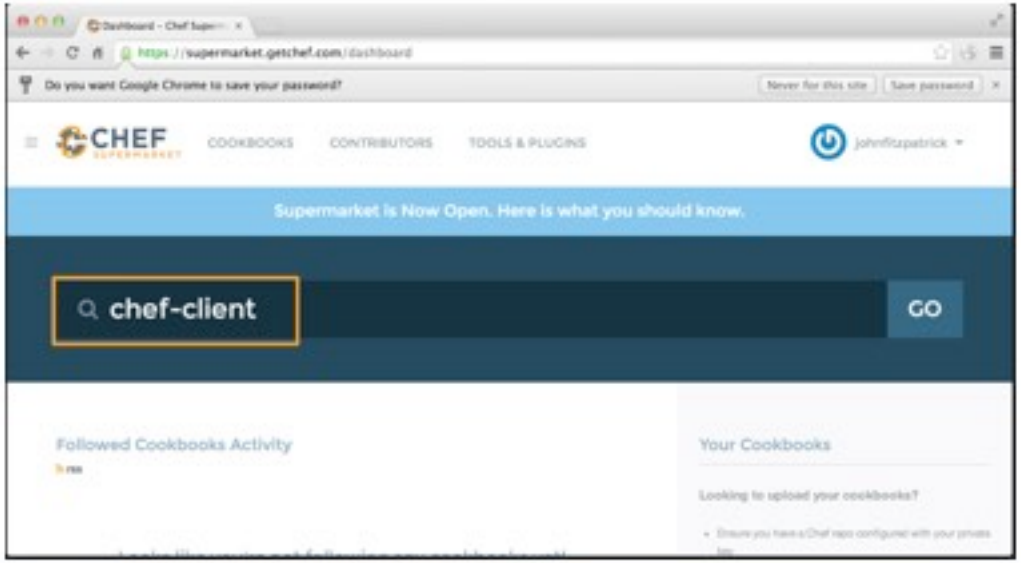
The easy way...

- We've been writing some cookbooks so far...
- Hundreds already exist for a large number of use cases and purposes. Many (but only a fraction) are maintained by Chef.
- Think of it like RubyGems.org, CPAN.org, or other focused plugin-style distribution sites.

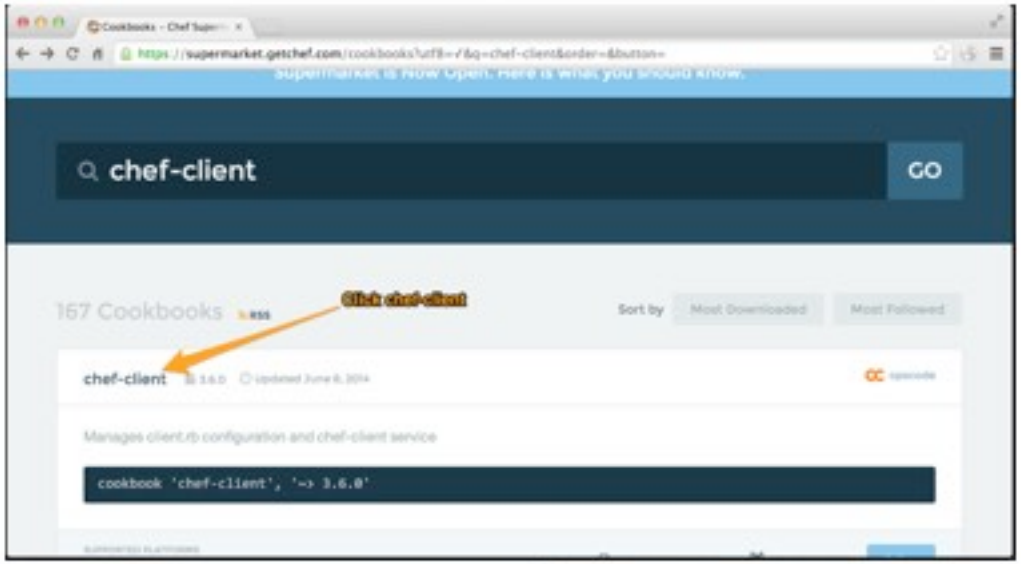
Exercise: Log into Supermarket



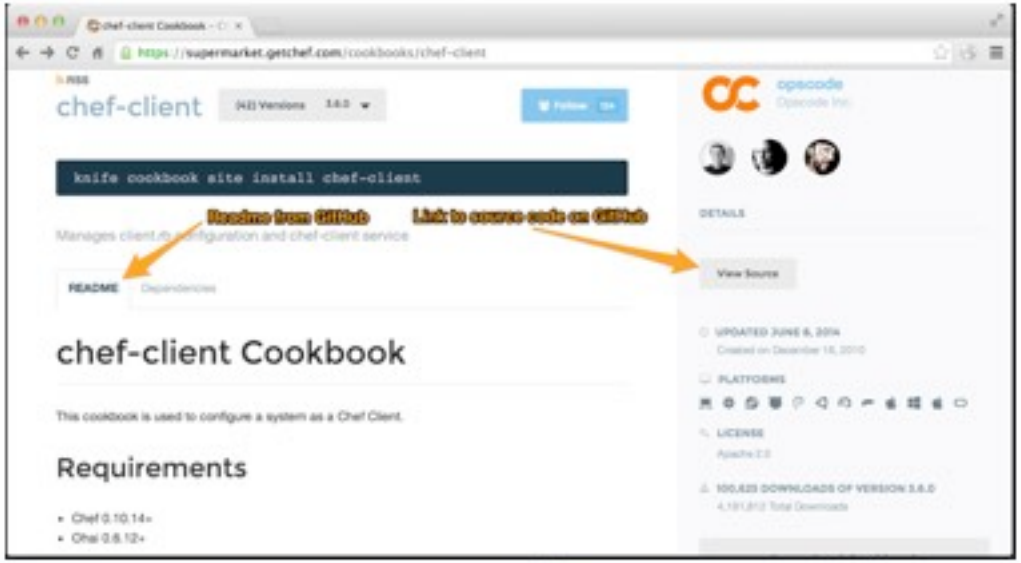
Exercise: Search for chef-client



Search results



Viewing a cookbook



You can download cookbooks directly from the site...

- You can download cookbooks directly from the Supermarket site, but:
  - It doesn't put them in your Chef Repository
  - It isn't fast if you know what you're looking for (click, click...)
  - It isn't necessarily fast if you **don't** know what you're looking for.
  - You're already using knife for managing cookbooks and other things in your Chef Repository.

Introducing Knife Cookbook Site plugin

- Knife includes a "cookbook site" plugin with some sub-commands:
  - search
  - show
  - download
  - ... and more!

Download and use chef-client cookbook

Exercise: Use knife to search the Chef Supermarket

```
$ knife cookbook site search chef-client
```

```
chef:
  cookbook:             http://cookbooks.opscode.com/api/v1/cookbooks/chef
  cookbook_description: Installs and configures Chef for chef-client and chef-server
  cookbook_maintainer:  opscode
  cookbook_name:        chef
chef-client:
  cookbook:             http://cookbooks.opscode.com/api/v1/cookbooks/chef-client
  cookbook_description: Manages client.rb configuration and chef-client service
  cookbook_maintainer:  opscode
  cookbook_name:        chef-client
chef-client-cron:
  cookbook:             http://cookbooks.opscode.com/api/v1/cookbooks/chef-client-cron
  cookbook_description: Manages aspects of only chef-client
  cookbook_maintainer:  bryanwb
  cookbook_name:        chef-client-cron
```

Exercise: Use knife to show the chef-client cookbook on the Chef Supermarket

```
$ knife cookbook site show chef-client
```

```
average_rating: 4.85714
category:       Utilities
created_at:     2010-12-16T23:00:45Z
description:    Manages client.rb configuration and chef-client service
external_url:   github.com/opscode-cookbooks/chef-client
latest_version: http://cookbooks.opscode.com/api/v1/cookbooks/chef-client/
versions/3_2_0
maintainer:     opscode
name:           chef-client
updated_at:     2013-12-19T19:02:44Z
versions:
  http://cookbooks.opscode.com/api/v1/cookbooks/chef-client/versions/3_2_0
  http://cookbooks.opscode.com/api/v1/cookbooks/chef-client/versions/3_1_2
  http://cookbooks.opscode.com/api/v1/cookbooks/chef-client/versions/3_1_0
```

Exercise: Download the chef-client cookbook

```
$ knife cookbook site download chef-client
```

```
Downloading chef-client from the cookbooks
site at version 3.2.0 to /Users/
johnfitzpatrick/cheftraining/fundamentals2.0/
chef-repo/chef-client-3.2.0.tar.gz

Cookbook saved: /Users/YOU/chef-repo/chef-
client-3.2.0.tar.gz
```

Exercise: Extract chef-client cookbook tarball

```
$ tar -zxvf chef-client*.tar.gz -C cookbooks/
```

```
x chef-client/
x chef-client/attributes/
x chef-client/CHANGELOG.md
x chef-client/CONTRIBUTING
x chef-client/LICENSE
x chef-client/metadata.json
x chef-client/metadata.rb
x chef-client/README.md
x chef-client/recipes/
x chef-client/templates/
x chef-client/templates/arch/
x chef-client/templates/default/
x chef-client/templates/windows/
x chef-client/templates/default/debian/
x chef-client/templates/default/redhat/
x chef-client/templates/default/solaris/
x chef-client/templates/arch/conf.d/
x chef-client/templates/arch/rc.d/
x chef-client/recipes/config.rb
x chef-client/recipes/cron.rb
x chef-client/recipes/default.rb
x chef-client/recipes/delete_validation.rb
```

What we just did...

- Cookbooks are distributed as a versioned .tar.gz archive.
- The latest version is downloaded by default (you can specify the version).
- Extract the cookbook into the "cookbooks" directory with tar.
- Next, let's examine the contents.

Best practice: well written cookbooks have a README!

- Documentation for cookbooks doesn't need to be extensive, but a README should describe some important aspects of a cookbook:
  - Expectations (cookbooks, platform, data)
  - Recipes and their purpose
  - LWRPs, Libraries, etc.
  - Usage notes
- Read the README first!

Best Practice: This runs as root!

- So, you just downloaded source code from the internet.
- As root.
- To load in the magic machine that:
  - **Makes your computers run code**
- Read the *entire* cookbook first!

Examining the chef-client cookbook

- We're going to use two recipes on the node from the chef-client cookbook.
  - delete_validation
  - service (via default)

Exercise: View the chef-client::delete_validation recipe

OPEN IN EDITOR: cookbooks/chef-client/recipes/delete_validation.rb

```
unless chef_server?
  file Chef::Config[:validation_key] do
    action :delete
    backup false
    only_if { ::File.exists?(Chef::Config[:client_key]) }
  end
end
```

SAVE FILE!

Exercise: Add chef-client::delete_validation to your base role

OPEN IN EDITOR: roles/base.rb

```
name "base"
description "Base Server Role"
run_list "recipe[chef-client::delete_validation]", "recipe[motd]", "recipe[users]"
```

SAVE FILE!

- Add the **delete_validation** recipe

Best Practice: Delete the validation certificate when it isn't required

- Once Chef enters the actual run, synchronizing cookbooks, it has registered its own API client with the validation certificate
- That certificate is no longer required. We do this first because in case the run fails for another reason, we know at least the validation certificate is gone

Exercise: View the chef-client::default recipe

OPEN IN EDITOR: cookbooks/chef-client/recipes/default.rb

```
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS,
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
# See the License for the specific language governing permissions and
# limitations under the License.
#

include_recipe "chef-client::service"
```

SAVE FILE!

Best Practice: Sane defaults do "pretty much" what you expect

- The main point of the "chef-client" cookbook is managing the "chef-client" program. It is designed that it can run as a daemonized service.
- The least surprising thing for most users is that the default recipe starts the service.
- You can manage the service in a number of ways, see the cookbook's README.md.

Exercise: View the chef-client::service recipe

OPEN IN EDITOR: cookbooks/chef-client/recipes/service.rb

- The recipe supports a number of **service** providers and styles.
- It works on a lot of **platforms**.
- Everything is controllable through **attributes**.

```
supported_init_styles = [
  'arch',
  'bluepill',
  'bsd',
  'daemontools',
  'init',
  'launchd',
  'runit',
  'smf',
  'upstart',
  'winsw'
]
init_style = node['chef_client']['init_style']

# Services moved to recipes
if supported_init_styles.include? init_style
  include_recipe "chef-client::#{init_style}_service"
else
  log "Could not determine service init style, manual intervention required
to start up the chef-client service."
end
```

Best Practice: Well-written cookbooks change behavior based on attributes

- Ideally, you don't have to modify the contents of a cookbook to use it for your specific use case.
- Look at the attributes directory for things you can override through roles to affect behavior of the cookbook.
- Of course, well written cookbooks have sane defaults, and a README to describe all this.

Exercise: Upload the chef-client cookbook

```
$ knife cookbook upload chef-client
```

```
Uploading che
ERROR: Cookbo  hef-clie  co  ok  ' version '>= 1.2.0',
ERROR: which  ot curr  y bein  loa  and  f  on the
server.
```

FAIL!

Exercise: Download the cron cookbook

```
$ knife cookbook site download cron
```

```
Downloading cron from the cookbooks site at version
1.2.8 to /Users/YOU/chef-repo/cron-1.2.8.tar.gz
Cookbook saved: /Users/YOU/chef-repo/
cron-1.2.8.tar.gz
```

Exercise: Extract cron cookbook tarball

```
$ tar -zxvf cron*.tar.gz -C cookbooks/
```

```
x cron/
x cron/CHANGELOG.md
x cron/README.md
x cron/metadata.json
x cron/metadata.rb
x cron/providers
x cron/providers/d.rb
x cron/recipes
x cron/recipes/default.rb
x cron/recipes/test.rb
x cron/resources
x cron/resources/d.rb
x cron/templates
x cron/templates/default
x cron/templates/default/cron.d.erb
```

Exercise: Upload the cron cookbook

```
$ knife cookbook upload cron
```

```
Uploading cron                  [1.2.8]
Uploaded 1 cookbook.
```

Exercise: Upload the chef-client cookbook

```
$ knife cookbook upload chef-client
```

FAIL!

```
Uploadi   che      t      .1.0]
ERROR:  cookbook chef-client depends on
cookbook 'logrotate' version '>= 1.2.0',
ERROR: which is not currently being
uploaded and cannot be found on the
server.
```

Exercise: Download the logrotate cookbook

```
$ knife cookbook site download logrotate
```

```
Downloading logrotate from the cookbooks site at
version 1.4.0 to /Users/johnfitzpatrick/
cheftraining/chef-repo/logrotate-1.4.0.tar.gz
Cookbook saved: /Users/YOU/chef-repo/
logrotate-1.4.0.tar.gz
```

Exercise: Extract logrotate cookbook tarball

```
$ tar -zxvf logrotate*.tar.gz -C cookbooks/
```

```
    x logrotate/
x logrotate/CHANGELOG.md
x logrotate/README.md
x logrotate/attributes
x logrotate/attributes/default.rb
x logrotate/definitions
x logrotate/definitions/logrotate_app.rb
x logrotate/libraries
x logrotate/libraries/logrotate_config.rb
x logrotate/metadata.json
x logrotate/metadata.rb
x logrotate/recipes
x logrotate/recipes/default.rb
x logrotate/recipes/global.rb
x logrotate/templates
x logrotate/templates/default
x logrotate/templates/default/logrotate-global.erb
x logrotate/templates/default/logrotate.erb
```

Exercise: Upload the logrotate cookbook

```
$ knife cookbook upload logrotate
```

```
Uploading logrotate                [1.4.0]
Uploaded 1 cookbook.
```

Exercise: Upload the chef-client cookbook

```
$ knife cookbook upload chef-client
```

```
Uploadi                    .0
Uploaded                   boo
```

WIN!

Exercise: Add chef-client recipe to base role

OPEN IN EDITOR: roles/base.rb

```
name "base"
description "Base Server Role"
run_list "recipe[chef-client::delete_validation]", "recipe[chef-client]",
"recipe[motd]", "recipe[users]"
```

SAVE FILE!

Exercise: Upload the base role

```
$ knife role from file base.rb
```

```
Updated Role base!
```

Exercise: Re-run the Chef Client

```
...
Recipe: chef-client::delete_validation
  * file[/etc/chef/validation.pem] action delete[2014-01-07T09:05:43-05:00] INFO: Processing file[/etc/chef/validation.pem] action
delete (chef-client::delete_validation line 25)
[2014-01-07T09:05:43-05:00] INFO: file[/etc/chef/validation.pem] deleted file at /etc/chef/validation.pem

    - delete file /etc/chef/validation.pem
...
  * service[chef-client] action enable[2014-01-07T09:05:46-05:00] INFO: Processing service[chef-client] action enable (chef-
client::init_service line 32)
[2014-01-07T09:05:47-05:00] INFO: service[chef-client] enabled

    - enable service service[chef-client]

  * service[chef-client] action start[2014-01-07T09:05:47-05:00] INFO: Processing service[chef-client] action start (chef-
client::init_service line 32)
[2014-01-07T09:05:48-05:00] INFO: service[chef-client] started

    - start service service[chef-client]
...
[2014-01-07T09:05:55-05:00] INFO: template[/etc/init.d/chef-client] sending restart action to service[chef-client] (delayed)
Recipe: chef-client::init_service
  * service[chef-client] action restart[2014-01-07T09:05:55-05:00] INFO: Processing service[chef-client] action restart (chef-
client::init_service line 32)
[2014-01-07T09:06:01-05:00] INFO: service[chef-client] restarted

    - restart service service[chef-client]

[2014-01-07T09:06:01-05:00] INFO: Chef Run complete in 29.341853545 seconds
```

Exercise: Verify chef-client is running

```
chef@node1$ ps awux | grep chef-client
```

```
root      8933  0.3  2.2 130400 37816 ?        Sl   03:19
0:01 /opt/chef/embedded/bin/ruby /usr/bin/chef-client -d -c /
etc/chef/client.rb -L /var/log/chef/client.log -P /var/run/
chef/client.pid -i 1800 -s 300
```

Convergent infrastructure

- Our node is now running chef-client as a daemon, and it will converge itself over time on a (by default) 30 minute interval.
- The amount of resources converged may vary with longer intervals, depending on configuration drift on the system.
- Because Chef resources are idempotent, it will only configure what it needs to each run.

Download and use ntp cookbook

NTP Cookbook

- Network time protocol - keeps system clocks in sync
- Chef Server authentication is time sensitive!

Exercise: Download the ntp cookbook

```
$ knife cookbook site download ntp
```

```
Downloading ntp from the cookbooks
site at version 1.5.4 to /Users/YOU/
chef-repo/ntp-1.5.4.tar.gz

Cookbook saved: /Users/YOU/chef-repo/
ntp-1.5.4.tar.gz
```

Exercise: Extract the ntp cookbook

```
$ tar -zxvf ntp*.tar.gz -C cookbooks/
```

```
x ntp/
x ntp/CHANGELOG.md
x ntp/README.md
x ntp/attributes
x ntp/attributes/default.rb
x ntp/files
x ntp/files/default
x ntp/files/default/ntp.ini
x ntp/files/default/ntp.leapseconds
x ntp/files/default/tests
x ntp/files/default/tests/minitest
x ntp/files/default/tests/minitest/default_test.rb
x ntp/files/default/tests/minitest/support
x ntp/files/default/tests/minitest/support/helpers.rb
x ntp/files/default/tests/minitest/undo_test.rb
x ntp/files/default/usr.sbin.ntpd.apparmor
x ntp/metadata.json
x ntp/metadata.rb
x ntp/recipes
```

Examining the ntp cookbook

- The cookbook is quite flexible, but for this exercise we're just interested in the most basic use, an NTP client.
  - default recipe

Exercise: View the ntp::default recipe

```
node['ntp']['packages'].each do |ntppkg|
  package ntppkg
end
```

```
template node['ntp']['conffile'] do
  source    'ntp.conf.erb'
  owner     node['ntp']['conf_owner']
  group     node['ntp']['conf_group']
  mode      '0644'
  notifies :restart,
"service[#{node['ntp']['service']}]"
end
```

```
service node['ntp']['service'] do
  supports :status => true, :restart => true
  action [:enable, :start]
end
```

- All **packages** are installed
- The **service** is enabled and started
- The **template** notifies the service

Exercise: Upload the ntp cookbook

```
$ knife cookbook upload ntp
```

```
Uploading ntp                [1.5.4]
Uploaded 1 cookbook.
```

Exercise: Add the ntp recipe to the base role

OPEN IN EDITOR: roles/base.rb

```
name "base"
description "Base Server Role"
run_list "recipe[chef-client::delete_validation]", "recipe[chef-client]",
"recipe[ntp]", "recipe[motd]", "recipe[users]"
```

SAVE FILE!

Exercise: Upload the base role

```
$ knife role from file base.rb
```

```
Updated Role base!
```

Exercise: Re-run the Chef Client

```
Recipe: ntp::default
  * package[ntp] action install[2014-01-07T09:27:01-05:00] INFO: Processing package[ntp] action install
(ntp::default line 25)
 (up to date)
  * package[ntpdate] action install[2014-01-07T09:27:08-05:00] INFO: Processing package[ntpdate] action
install (ntp::default line 25)
 (up to date)
...
  * template[/etc/ntp.conf] action create[2014-01-07T09:27:09-05:00] INFO: Processing template[/etc/
ntp.conf] action create (ntp::default line 71)
[2014-01-07T09:27:09-05:00] INFO: template[/etc/ntp.conf] backed up to /var/chef/backup/etc/
ntp.conf.chef-20140107092709.254951
[2014-01-07T09:27:09-05:00] INFO: template[/etc/ntp.conf] updated file contents /etc/ntp.conf

    - update content in file /etc/ntp.conf from ba8f03 to c38ibb
        --- /etc/ntp.conf   2013-10-27 09:07:05.541644862 -0400
        +++ /tmp/chef-rendered-template20140107-20557-ttvqaw   2014-01-07 09:27:09.248975286 -0500
        @@ -1,58 +1,30 @@
...
[2014-01-07T09:27:10-05:00] INFO: template[/etc/ntp.conf] sending restart action to service[ntpd] (delayed)
Recipe: ntp::default
  * service[ntpd] action restart[2014-01-07T09:27:10-05:00] INFO: Processing service[ntpd] action restart
(ntp::default line 100)
[2014-01-07T09:27:11-05:00] INFO: service[ntpd] restarted

    - restart service service[ntpd]
```

Review Questions

- What is the Chef Supermarket site URL?
- What are two ways to download cookbooks from the Chef Supermarket?
- What is the first thing you should read when downloading a cookbook?
- Who vets the cookbooks on the Chef Supermarket?

Further Resources

v2.1.6

CHEF

Working with Chef Software, Inc.

Chef Status

- Status for Chef related systems can be found by browsing to
  - http://status.chef.io, or
  - https://twitter.com/opscode_status

How do I interact with Chef support?

- There are two ways to raise a ticket with Chef Support
  - Via the Web UI at http://www.chef.io/support/
  - By sending an email to support@chef.io
- The Web UI allows you to submit any severity level ticket, however emailed tickets default to 'severity 3'
- The Web UI allows you to view previously submitted tickets for an org

To re-open a closed ticket

- To re-open a closed ticket either
  - Click on the closed ticket in the web interface, and reply in the box provided, or
  - Reply to the email thread
- This will restart the ticket and move it back into the active queue

Dealing with Support

- When an org signs up for a support contract, the email domain of the primary user is used as a key, and anyone with an email in that domain can submit tickets
- E.g. user1@domain.com starts a support contract for an org, then user2@domain.com and user3@domain.com can also submit tickets on behalf of "domain.com" for that org
- Any user email address be added explicitly to the Support Tool for your org by emailing sales@chef.io or submitting a ticket

New releases

- Release Notes can be found here
  - http://docs.chef.io/

Further Resources

Chef Fundamentals - Q&A Forum

- Chef Fundamentals Google Group Q&A Forum
- http://bit.ly/ChefFundamentalsForum
- Join the group and post questions

Further Resources: Cookbooks and Plugins

- Useful cookbooks
  - DNS: djbdns, pdns, dnsimple, dynect, route53
  - Monitoring: nagios, munin, zenoss, zabbix
  - Package repos: yum, apt, freebsd
  - Security: ossec, snort, cis_benchmark
  - Logging: rsyslog, syslog-ng, logstash, logwatch
- Application cookbooks:
  - application, database
  - python, java, php, ruby
- Plugins
  - Cloud: knife-ec2, knife-rackspace, knife-openstack, knife-hp
  - Windows: knife-windows
- More listed on docs.chef.io

Further Resources

- http://chef.io/
- http://supermarket.chef.io/
- http://docs.chef.io/
- http://learn.chef.io
- http://lists.opscode.com
- http://youtube.com/user/getchef
- irc.freenode.net #chef, #chef-hacking, #learnchef
- Twitter @chef #getchef

Food Fight Show

- http://foodfightshow.org
- The Podcast Where DevOps Chef Do Battle
- Regular updates about new Cookbooks, Knife-plugins, and more
- Best Practices for working with Chef

CHEFCONF2015

- March 31 - April 2 in Santa Clara Convention Center
- Register now
- https://www.chef.io/chefconf/
- Now accepting presentation proposals

Appendix:
Just Enough Ruby for Chef

A quick & dirty crash course

Lesson Objectives

- After completing the lesson, you will be able to
  - Explain what irb is, and how to use it.
  - Describe the function of:
    - Variable Assignment
    - Basic Arithmetic
    - Strings
    - Truthiness
    - Operators
    - Hashes
    - Regular Expressions
    - Conditionals
    - Method Declaration
    - Classes
    - Objects

irb - the interactive ruby shell

- irb is the interactive ruby shell
- It is a REPL for Ruby
  - Read-Eval-Print-Loop
  - LISP, Python, Erlang, Clojure, etc.
- An interactive programming environment
- Super-handy for trying things out

Exercise: Start irb on your 'target' node

```
chef@node1$ /opt/chef/embedded/bin/irb
```

```
irb(main):001:0>
```

Variable assignment

```
chef@node1$ /opt/chef/embedded/bin/irb
```

```
irb(main):001:0> x = "hello"
=> "hello"

irb(main):002:0> puts x
hello
=> nil
```

Arithmetic

```
irb(main):003:0> 1 + 2
=> 3
```

Arithmetic

```
irb(main):004:0> 18 - 5
=> 13
```

Arithmetic

```
irb(main):005:0> 2 * 7
=> 14
```

Arithmetic

```
irb(main):006:0> 5 / 2
=> 2
```

Arithmetic

```
irb(main):007:0> 5 / 2.0
=> 2.5
```

Arithmetic

```
irb(main):008:0> 5.class
=> Fixnum

irb(main):009:0> 5.0.class
=> Float
```

Arithmetic

```
irb(main):010:0> 1 + (2 * 3)
=> 7
```

Strings

```
irb(main):011:0> 'jungle'
=> "jungle"
```

Strings

```
irb(main):012:0> 'it\'s alive'
=> "it's alive"
```

Strings

```
irb(main):013:0> "animal"
=> "animal"
```

Strings

```
irb(main):014:0> "\"so easy\""
=> "\"so easy\""

irb(main):015:0> puts "\"so easy\""
"so easy"
=> nil
```

Strings

```
irb(main):016:0> x = "pretty"
=> "pretty"

irb(main):017:0> "#{x} nice"
=> "pretty nice"

irb(main):018:0> '#{x} nice'
=> "\#{x} nice"
```

Truthiness

```
irb(main):019:0> true
=> true

irb(main):020:0> false
=> false

irb(main):021:0> nil
=> nil

irb(main):022:0> !!nil
=> false

irb(main):023:0> !!0
=> true

irb(main):024:0> !!x
=> true
```

Operators

```
irb(main):025:0> 1 == 1
=> true

irb(main):026:0> 1 == true
=> false

irb(main):027:0> 1 != true
=> true

irb(main):028:0> !!1 == true
=> true
```

Operators

```
irb(main):029:0> 2 < 1
=> false

irb(main):030:0> 2 > 1
=> true

irb(main):031:0> 4 >= 3
=> true

irb(main):032:0> 4 >= 4
=> true

irb(main):033:0> 4 <= 5
=> true

irb(main):034:0> 4 <= 3
=> false
```

Operators

```
irb(main):035:0> 5 <=> 5
=> 0

irb(main):036:0> 5 <=> 6
=> -1

irb(main):037:0> 5 <=> 4
=> 1
```

Arrays

```
irb(main):038:0> x = ["a", "b", "c"]
=> ["a", "b", "c"]

irb(main):039:0> x[0]
=> "a"

irb(main):040:0> x.first
=> "a"

irb(main):041:0> x.last
=> "c"
```

Arrays

```
irb(main):042:0> x + ["d"]
=> ["a", "b", "c", "d"]

irb(main):043:0> x
=> ["a", "b", "c"]

irb(main):044:0> x = x + ["d"]
=> ["a", "b", "c", "d"]

irb(main):045:0> x
=> ["a", "b", "c", "d"]
```

Arrays

```
irb(main):046:0> x << "e"
=> ["a", "b", "c", "d", "e"]

irb(main):047:0> x
=> ["a", "b", "c", "d", "e"]
```

Arrays

```
irb(main):048:0> x.map { |i| "the letter #{i}" }
=> ["the letter a", "the letter b", "the letter
c", "the letter d", "the letter e"]

irb(main):049:0> x
=> ["a", "b", "c", "d", "e"]
```

Arrays

```
irb(main):050:0> x.map! { |i| "the letter #{i}" }
=> ["the letter a", "the letter b", "the letter
c", "the letter d", "the letter e"]

irb(main):051:0> x
=> ["the letter a", "the letter b", "the letter
c", "the letter d", "the letter e"]
```

Hashes

```
irb(main):052:0> h = {
irb(main):053:1* "first_name" => "Gary",
irb(main):054:1* "last_name" => "Gygax"
irb(main):055:1> }
=> {"first_name"=>"Gary",
"last_name"=>"Gygax"}
```

Hashes

```
irb(main):056:0> h.keys
=> ["first_name", "last_name"]

irb(main):057:0> h["first_name"]
=> "Gary"

irb(main):058:0> h["age"] = 33
=> 33

irb(main):059:0> h.keys
=> ["first_name", "last_name", "age"]
```

Hashes

```
irb(main):060:0> h.values
=> ["Gary", "Gygax", 33]
```

Hashes

```
irb(main):061:0> h.each { |k, v| puts "#{k}: #{v}" }
first_name: Gary
last_name: Gygax
age: 33
=> {"first_name"=>"Gary", "last_name"=>"Gygax",
"age"=>33}
```

Regular Expressions

```
irb(main):062:0> x = "I want to believe"
=> "I want to believe"

irb(main):063:0> x =~ /I/
=> 0

irb(main):064:0> x =~ /lie/
=> 12

irb(main):065:0> x =~ /smile/
=> nil

irb(main):066:0> x !~ /smile/
=> true
```

Regular Expressions

```
irb(main):067:0> x.sub(/t/, "T")
=> "I wanT to believe"

irb(main):068:0> puts x
I want to believe
=> nil

irb(main):069:0> x.gsub!(/t/, "T")
=> "I wanT To believe"

irb(main):070:0> puts x
I wanT To believe
=> nil
```

Conditionals

```
irb(main):071:0> x = "happy"
=> "happy"

irb(main):072:0> if x == "happy"
irb(main):073:1>   puts "Sure am!"
irb(main):074:1> elsif x == "sad"
irb(main):075:1>   puts "Boo!"
irb(main):076:1> else
irb(main):077:1*   puts "Therapy?"
irb(main):078:1> end
Sure am!
=> nil
```

Conditionals

```
irb(main):079:0> case x
irb(main):080:1> when "happy"
irb(main):081:1>   puts "Sure Am!"
irb(main):082:1>   1
irb(main):083:1> when "sad"
irb(main):085:1>   puts "Boo!"
irb(main):086:1>   2
irb(main):087:1> else
irb(main):088:1>   puts "Therapy?"
irb(main):089:1>   3
irb(main):090:1> end
Sure Am!
=> 1
```

Method Definition

```
irb(main):091:0> def metal(str)
irb(main):092:1>   puts "!!#{str} is metal!!"
irb(main):093:1> end
=> nil

irb(main):094:0> metal("ozzy")
!!ozzy is metal!!
=> nil
```

Classes

```
irb(main):095:0> class Person
irb(main):096:1>   attr_accessor :name, :is_metal
irb(main):097:1>
irb(main):098:1>   def metal
irb(main):099:2>     if @is_metal
irb(main):100:3>       puts "!!#{@name} is metal!!"
irb(main):101:3>     end
irb(main):102:2>   end
irb(main):103:1> end
=> nil
```

Classes

```
irb(main):104:0> p = Person.new
=> #<Person:0x891ab4c>

irb(main):105:0> p.name = "Adam Jacob"
=> "Adam Jacob"

irb(main):106:0> p.is_metal = true
=> true

irb(main):107:0> p.metal
!!Adam Jacob is metal!!
=> nil

irb(main):108:0> p.is_metal = false
=> false

irb(main):109:0> p.metal
=> nil
```

Review Questions

- What is irb?
- What is true in ruby? What is false?
- How do you press for the truth?
- What does >= do?
- How do you define a method?
- What is a class?
- What is an object?
- The book you want: "Programming Ruby 1.9" http://pragprog.com/book/ruby3/programming-ruby-1-9