

Intermediate Chef

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v1.2.1

Introductions

Introduce Yourself

- Name
- Current job role
- Previous job roles/background
- Experience with Chef and/or config management
- Location
- What are you hoping to get out of the class?

Course Objectives and Style

Course Objectives

- Upon completion of this course you will be able to:
 - Extend Chef with custom resources and providers
 - Describe the internals of a Chef Client run
 - Create, debug, and distribute custom Ohai plugins
 - Configure report and exception handlers
 - Avoid common cookbook errors using Foodcritic and Rubocop
 - Write simple unit tests with ChefSpec

Course Pre-Requisites

- Completed Chef Fundamentals or equivalent experience
- You should install the most recent version of Chef Development Kit from here
 - <http://downloads.chef.io/chef-dk/>
- You can check your version with the command `chef -v`

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

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 at the **end of class**

Agenda

Topics

- Chef Fundamentals Refresher
- Building Custom Resources
- Writing Ohai Plugins
- Chef Client Run Internals
- Implementing Chef Handlers
- Cookbook Style and Correctness
- Foodcritic and Rubocop
- An Introduction to ChefSpec
- Further Resources

Breaks!

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

Legend

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 0xffffffff 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!

Lab Environment

Lab VM

- URL_TO_LIST_OF_IP_ADDRESSES
- User: chef
- Password: chef

Lab - Login

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

```
ssh chef@54.174.197.139
The authenticity of host '54.174.197.139 (54.174.197.139)' can't be
established.
RSA key fingerprint is c1:34:39:16:cf:91:c0:d8:ea:53:e9:59:72:1f:a8:5e.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '54.174.197.139' (RSA) to the list of known hosts.
chef@54.174.197.139's password:
```

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

Chef Fundamentals Refresher

v1.2.1

Lesson Objectives

- After completing this lesson, you should be able to:
 - Create a new Organization
 - Manually configure your certificate (.pem file) & knife.rb on your workstation so it can communicate with Chef Server
 - Bulk upload all cookbook, role, environment and data bag files to the Chef Server

Problem Statement

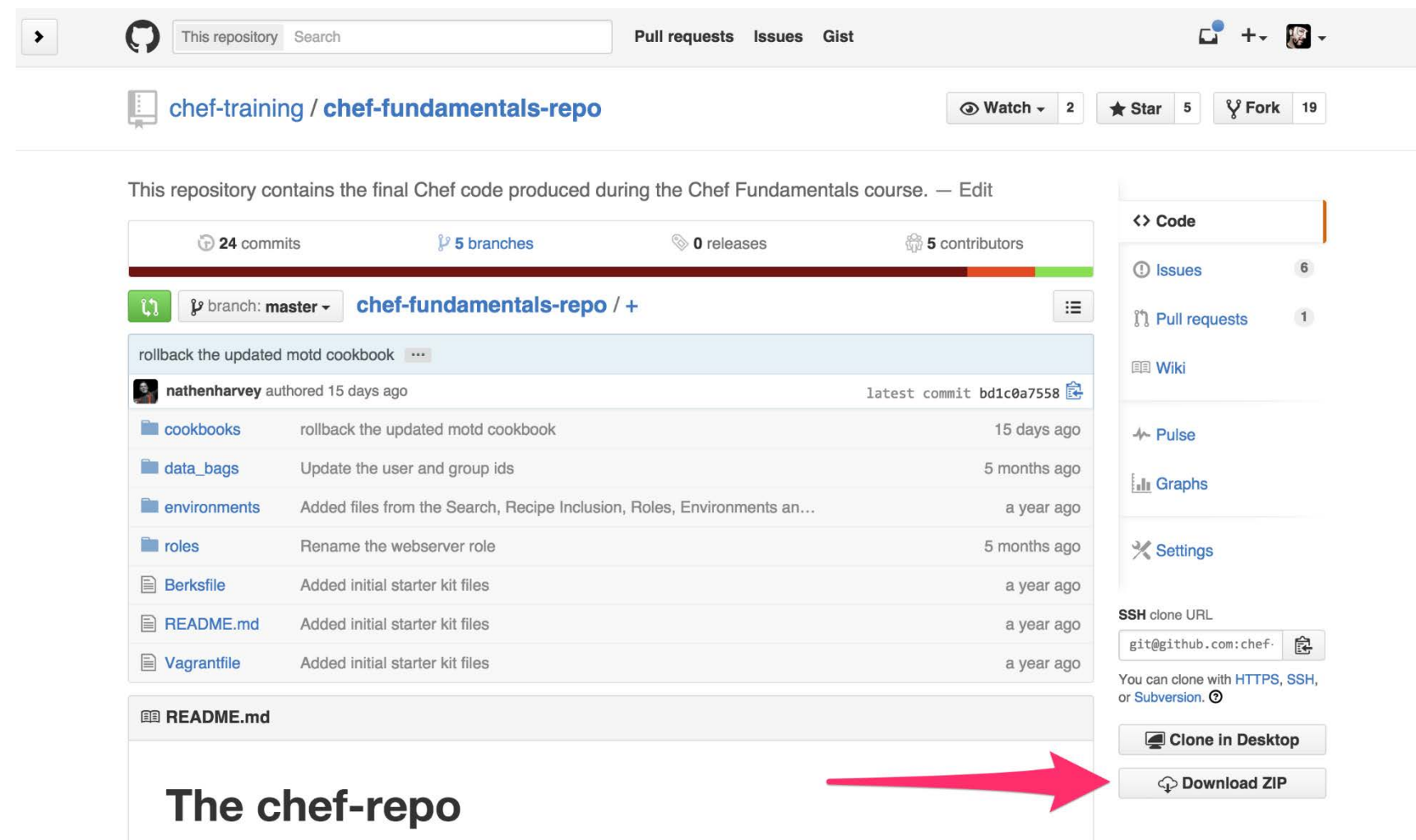
- **Problem:** We want to pick up where we left off after Chef Fundamentals class
- **Proposed Solution:** We need to
 - Set up a new Organization in Enterprise Chef
 - Configure your workstation to communicate with new Org
 - Download the Chef Fundamentals content from a GitHub repo
 - cookbooks, data bags, environments and roles
 - Upload all artifacts to your new Org
 - Configure server run list
 - Bootstrap server

Exercise: Set Up a Working Directory

- For the purposes of this class, make a working directory under your home directory called '`~/intermediate`', i.e.
 - Windows:-
 - `C:\Users\you\intermediate`
 - Mac/*nix:-
 - `/Users/you/intermediate`
- Navigate to this working Directory

Exercise: Download the Chef Fundamentals Repo

- Download the Chef Fundamentals working repo:
github.com/chef-training/chef-fundamentals-repo



Exercise: Extract the repo to Your Working Directory

```
$ cp ~/Downloads/chef-fundamentals-repo-master.zip .  
$ unzip chef-fundamentals-repo-master.zip
```

```
Archive:  chef-fundamentals-repo-master.zip  
bb06ea2c0cabaa855e4cb1d1c43bbe4d75caf70d  
  creating: chef-fundamentals-repo-master/  
  inflating: chef-fundamentals-repo-master/Berksfile  
  inflating: chef-fundamentals-repo-master/README.md  
  inflating: chef-fundamentals-repo-master/Vagrantfile  
    creating: chef-fundamentals-repo-master/cookbooks/  
    creating: chef-fundamentals-repo-master/cookbooks/apache/  
  inflating: chef-fundamentals-repo-master/cookbooks/apache/CHANGELOG.md  
  inflating: chef-fundamentals-repo-master/cookbooks/apache/README.md  
  inflating: chef-fundamentals-repo-master/cookbooks/apache/attributes/  
  inflating: chef-fundamentals-repo-master  
...
```

Exercise: View Your Working Directory

```
$ cd chef-fundamentals-repo-master  
$ ls -a
```

```
.      Berkshelf  Vagrantfile  data_bags    roles  
..     README.md   cookbooks    environments
```

- Notice there is no `chef` directory here
- You need to create one and place your `knife.rb` file and your `client.pem` in it

So What's in Our Working Directory Now?

```
cookbooks
```

```
|— apache
|— chef-client
|— chef_handler
|— cron
|— logrotate
|— motd
|— ntp
|— pci
|— users
|— windows
```

```
10 directories, 1 file
```

```
environments
```

```
|— dev.rb
|— production.rb
```

```
0 directories, 2 files
```

```
roles
```

```
|— base.rb
|— starter.rb
|— web.rb
```

```
0 directories, 3 files
```

```
data_bags
```

```
|— groups
|   |— clowns.json
|— users
|   |— bobo.json
|   |— frank.json
```

```
2 directories, 3 files
```

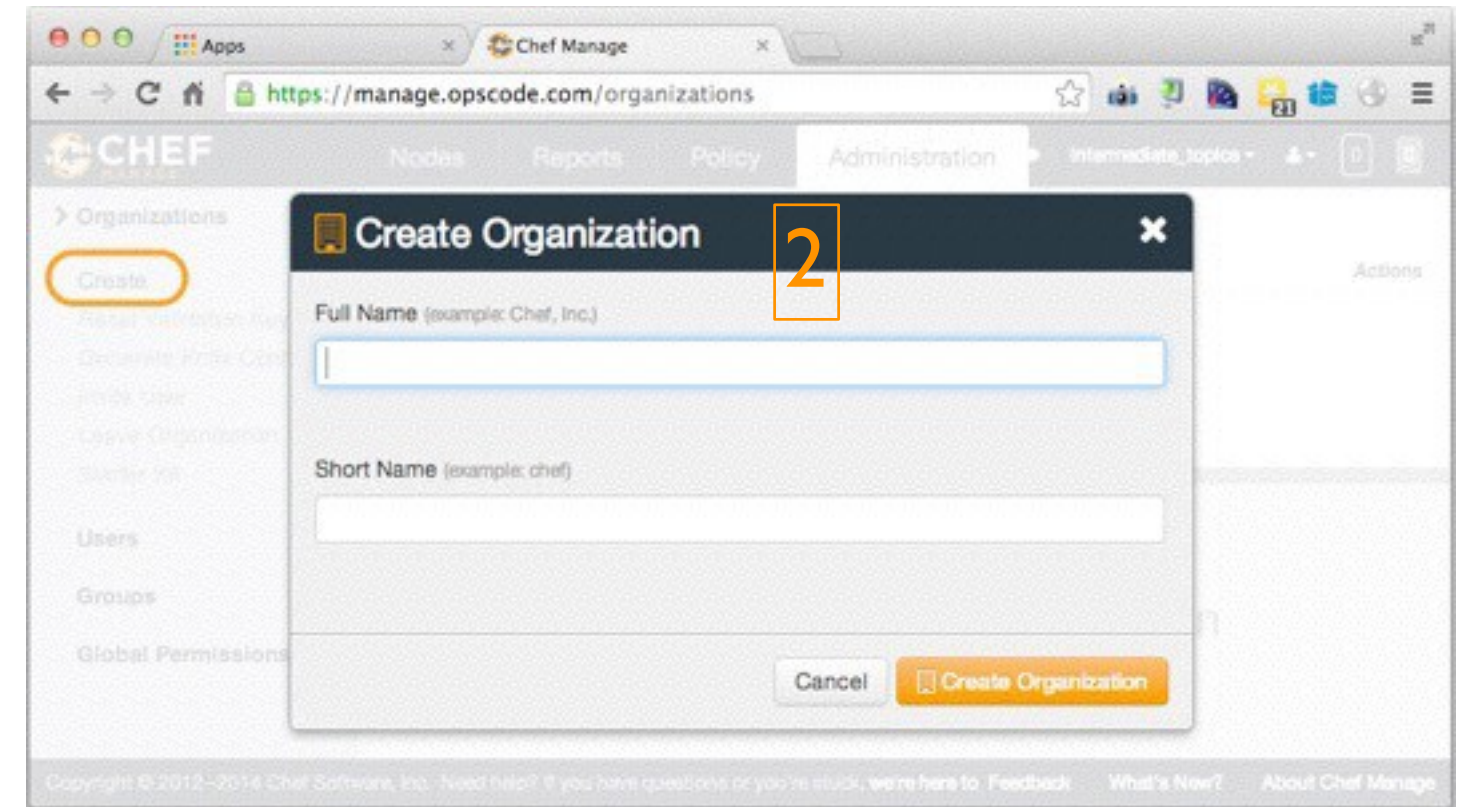
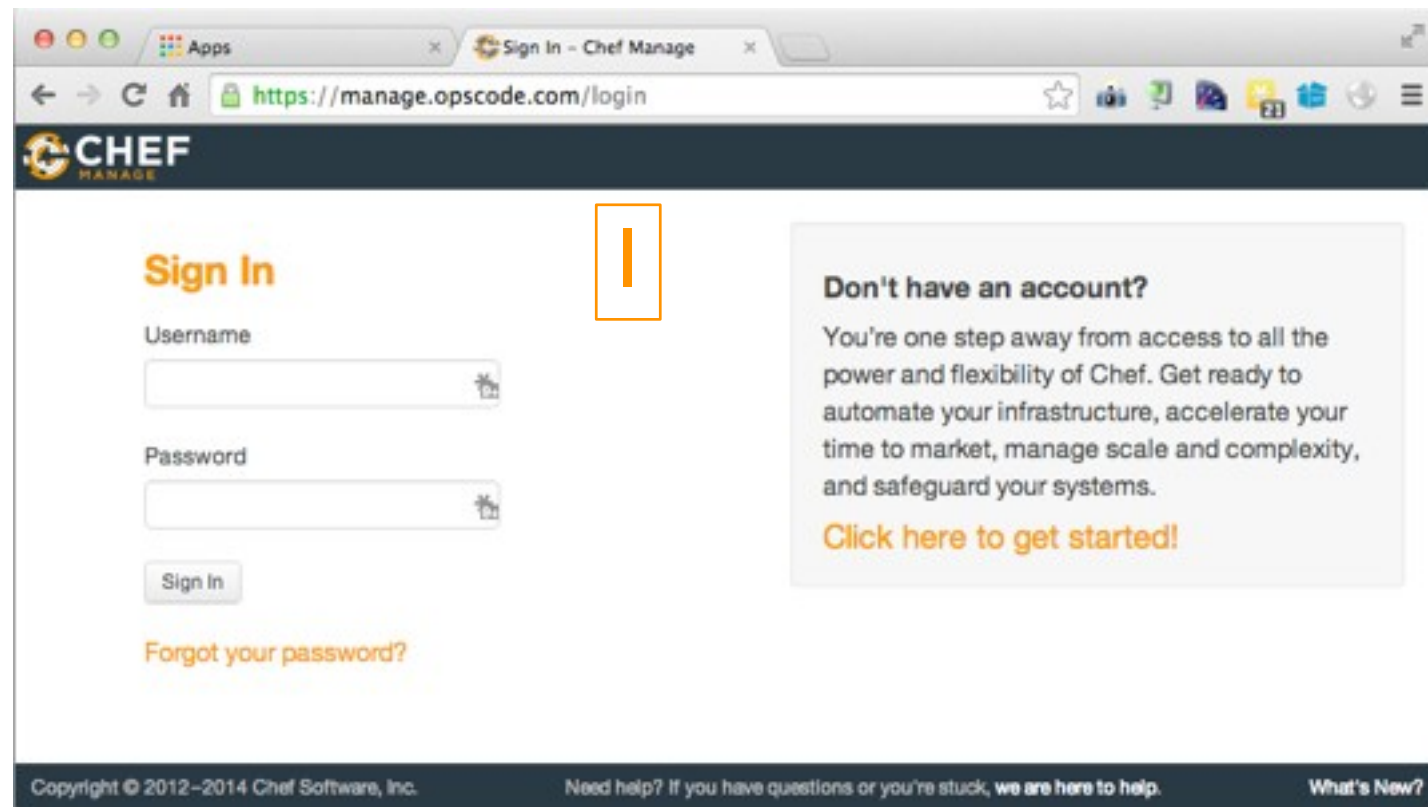
- These are the artifacts created in Chef Fundamentals
- Everything should be uploaded to the Chef Server

Exercise: Setup Steps

- Create a new account on Hosted Chef
- Configure your workstation to connect to Hosted Chef
 - What is required for this?
- Do NOT download a starter kit
- `knife client list` should show your validator client

Exercise: Create a New Org

- Visit Hosted Enterprise Chef (manage.chef.io)
- Sign in or create a new account
- Create a new Organization

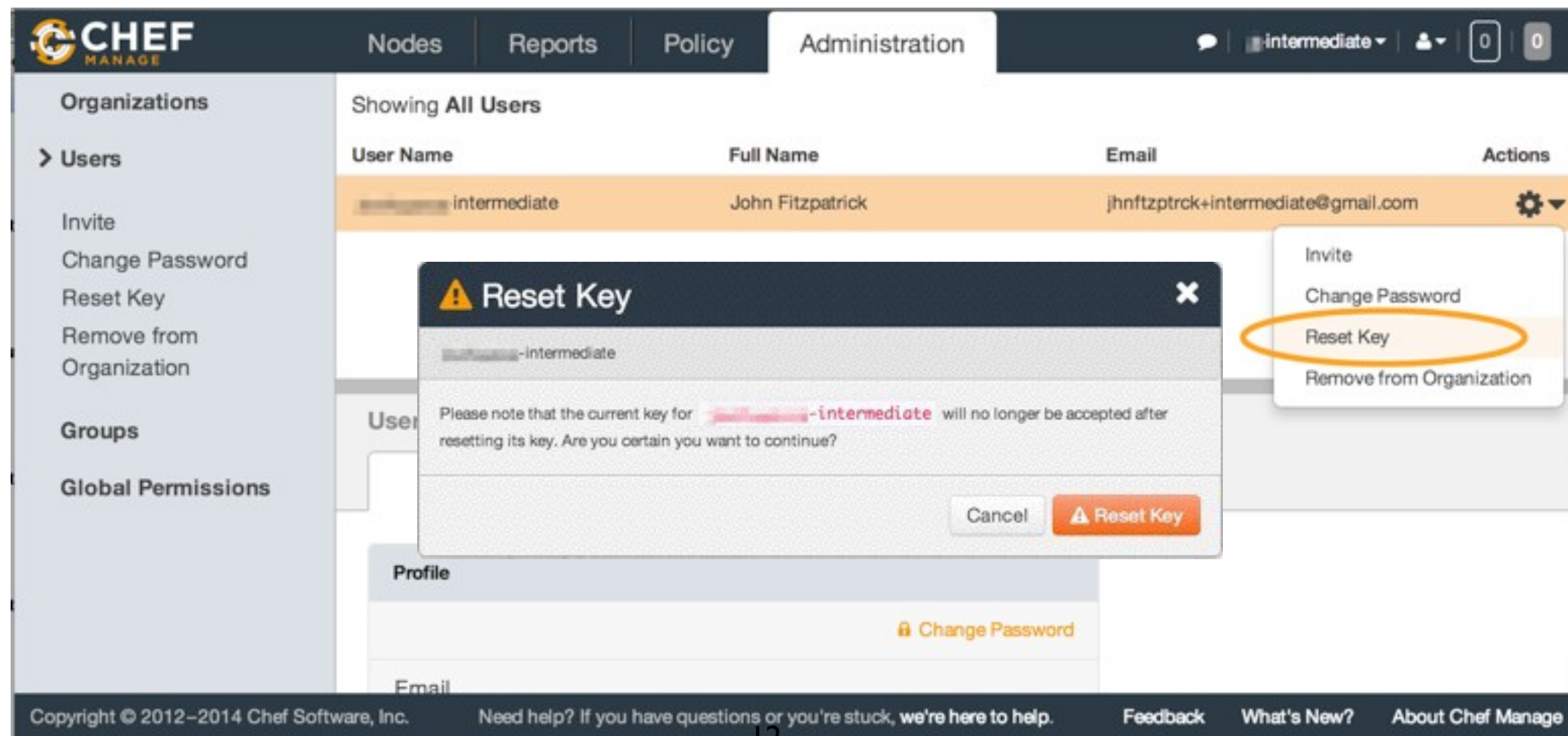


Configuring Your Workstation

- In Chef Fundamentals you set your workstation up the easy way using 'Starter Kit'
- In this class you will download your user *.pem* file and *knife.rb* and configure it manually

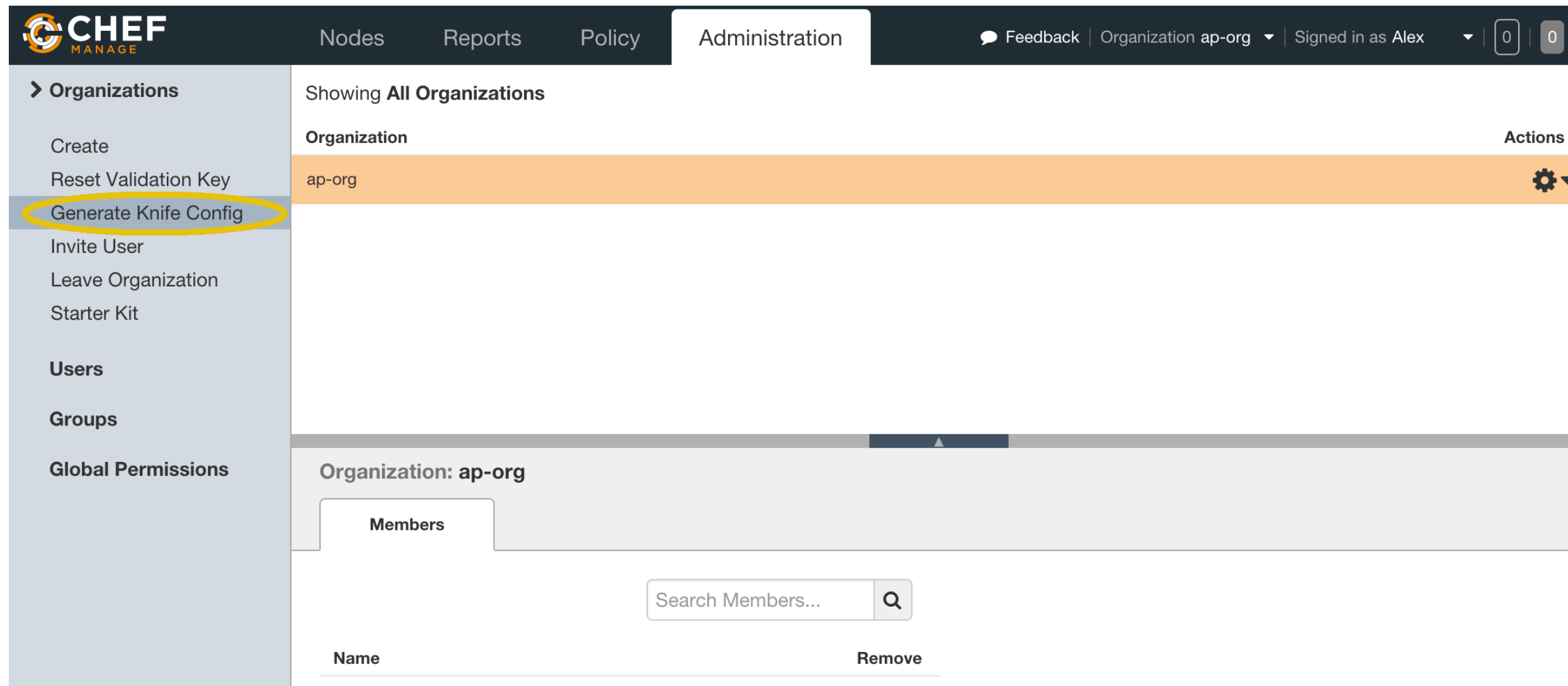
Exercise: Download Your Client pem

- Reset and download your private client pem file
- **Only do this** if you don't already have the .pem file available on your laptop



Exercise: Download knife.rb

- Download a knife.rb file specific for your user and organization



The screenshot shows the Chef Manage web interface. The top navigation bar includes 'Nodes', 'Reports', 'Policy', and 'Administration' (which is selected). On the right of the top bar, there is a 'Feedback' link, 'Organization ap-org', 'Signed in as Alex', and two circular icons with the number '0'. The left sidebar contains a list of navigation items: 'Organizations' (expanded), 'Create', 'Reset Validation Key', 'Generate Knife Config' (highlighted with a yellow circle), 'Invite User', 'Leave Organization', 'Starter Kit', 'Users', 'Groups', and 'Global Permissions'. The main content area shows 'Showing All Organizations' and a table with one row for 'ap-org'. Below this, there is a section for 'Organization: ap-org' with a 'Members' tab and a search bar labeled 'Search Members...'. At the bottom, there are columns for 'Name' and 'Remove'.

Exercise: Create and Populate a .chef Directory

```
$ cd ~/intermediate/chef-fundamentals-repo-master  
$ mkdir .chef  
$ cp ~/Downloads/<yourname>.pem .chef  
$ cp ~/Downloads/knife.rb .chef
```

- knife.rb & .pem file reside in the .chef directory which can be in
 1. <current-directory>/ .chef
 2. /etc/ .chef
 3. ~/ .chef

Exercise: Test Your Workstation

```
$ knife client list
```

```
<your-org>-validator.pem
```

Exercise: Upload to Hosted Chef

- Upload the following to the Chef server
 - cookbooks
 - data bags
 - roles
 - environments

Exercise: Upload Cookbooks

```
$ knife cookbook upload -a
```

```
Uploading apache           [0.2.0]
Uploading chef-client      [4.3.0]
Uploading chef_handler    [1.1.9]
Uploading cron             [1.6.1]
Uploading logrotate        [1.9.2]
Uploading motd             [0.1.0]
Uploading ntp              [1.8.6]
Uploading pci              [0.1.0]
Uploading users            [0.1.0]
Uploading windows          [1.37.0]
Uploaded all cookbooks.
```

Exercise: Upload data_bags

```
$ knife upload data_bags
```

```
Created data_bags/groups  
Created data_bags/users  
Created data_bags/groups/clowns.json  
Created data_bags/users/bobo.json  
Created data_bags/users/frank.json
```

Exercise: Upload Roles

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

```
Updated Role base!  
Updated Role starter!  
Updated Role web!
```

Exercise: Upload Environments

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

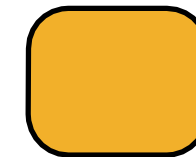
```
Updated Environment dev  
Updated Environment production
```


"Bootstrap" the Target Instance

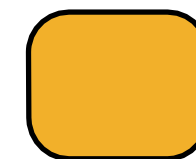
```
$ knife bootstrap <EXTERNAL_ADDRESS> \
  --sudo -x chef -P chef -N node1 -r 'role[web]' --bootstrap-version 12.5.1
```

```
uvo164727i3mvlh1jup2.vm.cld.sr --2015-05-13 04:31:10-- https://www.opscode.com/chef/install.sh
uvo164727i3mvlh1jup2.vm.cld.sr Resolving www.opscode.com... 184.106.28.90
uvo164727i3mvlh1jup2.vm.cld.sr Connecting to www.opscode.com|184.106.28.90|:443... connected.
uvo164727i3mvlh1jup2.vm.cld.sr HTTP request sent, awaiting response... 200 OK
uvo164727i3mvlh1jup2.vm.cld.sr Length: 15934 (16K) [application/x-sh]
uvo164727i3mvlh1jup2.vm.cld.sr Saving to: `STDOUT'
uvo164727i3mvlh1jup2.vm.cld.sr
100%[=====>] 15,934      --.-K/s      in 0s
uvo164727i3mvlh1jup2.vm.cld.sr
uvo164727i3mvlh1jup2.vm.cld.sr 2015-05-13 04:31:10 (538 MB/s) - written to stdout [15934/15934]
uvo164727i3mvlh1jup2.vm.cld.sr
uvo164727i3mvlh1jup2.vm.cld.sr Downloading Chef 12.5.1 for el...
uvo164727i3mvlh1jup2.vm.cld.sr downloading https://www.opscode.com/chef/metadata?
v=12.5.1&prerelease=false&nightlies=false&p=el&pv=6&m=x86_64
uvo164727i3mvlh1jup2.vm.cld.sr to file /tmp/install.sh.41533/metadata.txt
uvo164727i3mvlh1jup2.vm.cld.sr trying wget...
uvo164727i3mvlh1jup2.vm.cld.sr url https://opscode-omnibus-packages.s3.amazonaws.com/el/6/x86_64/
chef-12.5.1-1.el6.x86_64.rpm
...
```

knife bootstrap (no validator key)



Workstation



Node

knife bootstrap (no validator key)

```
knife bootstrap HOSTNAME -x root -P PASSWORD -N node1  
...
```

A large yellow rounded square icon representing the Chef Server.

Chef Server

A small yellow rounded square icon representing a Workstation.

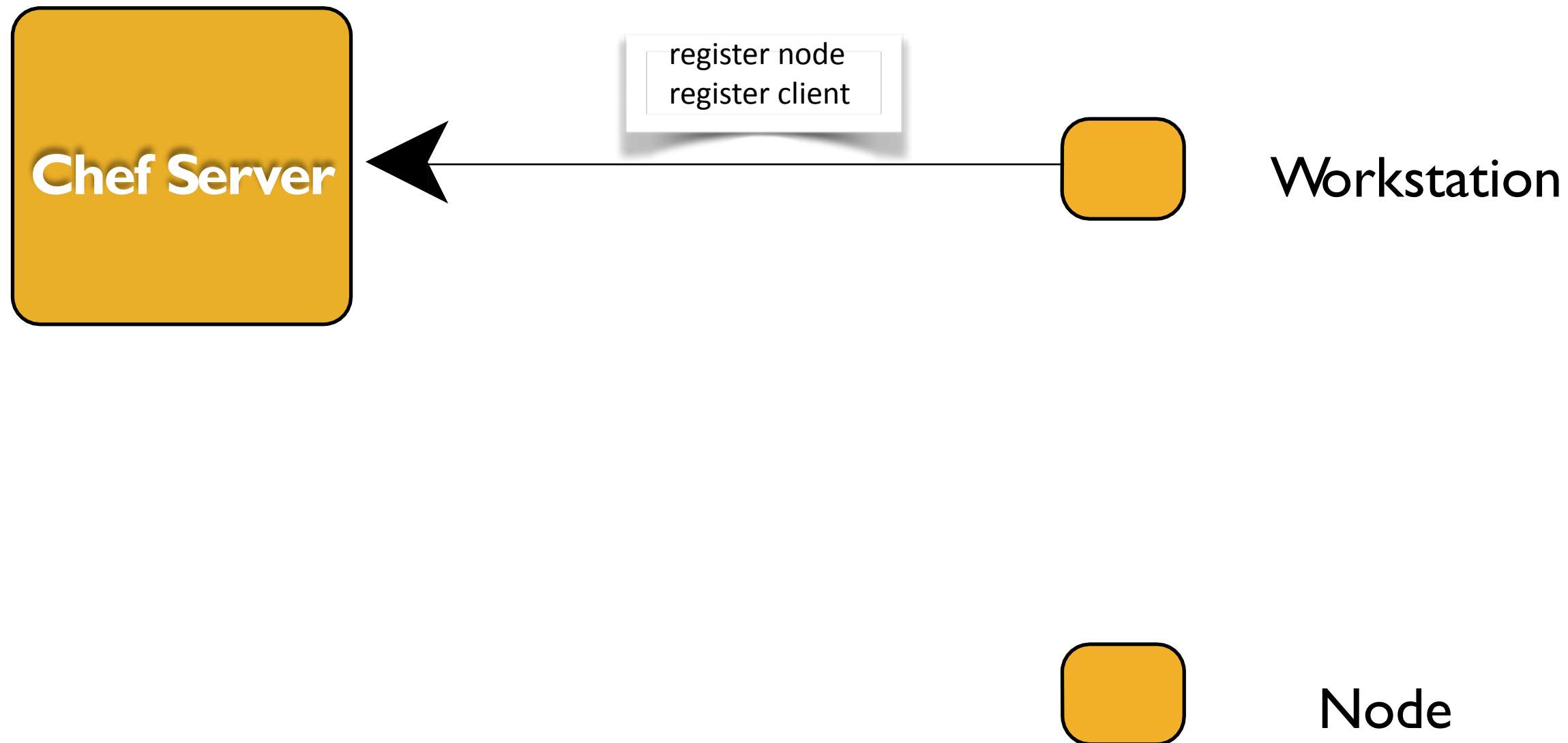
Workstation

A small yellow rounded square icon representing a Node.

Node

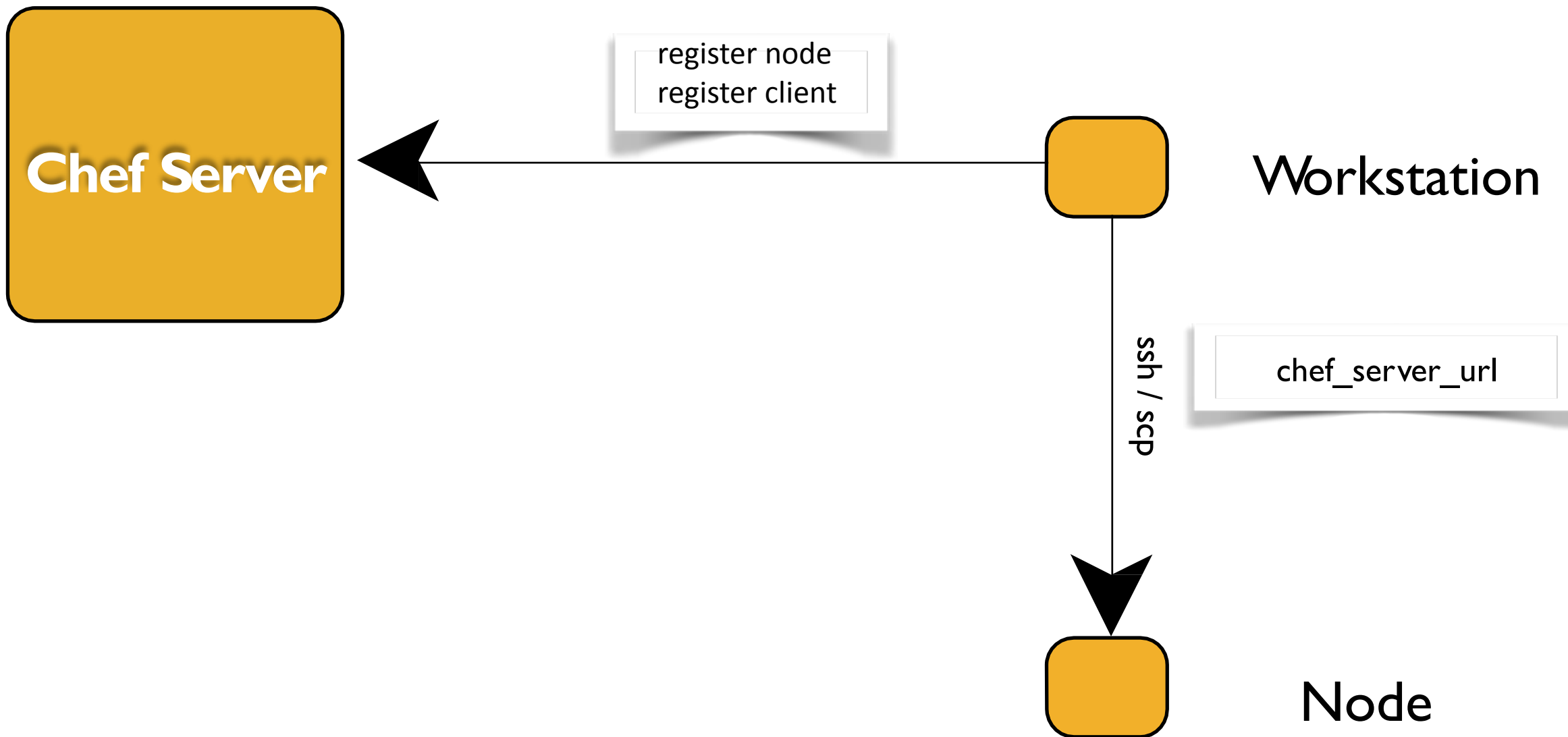
knife bootstrap (no validator key)

```
knife bootstrap HOSTNAME -x root -P PASSWORD -N node1  
...
```



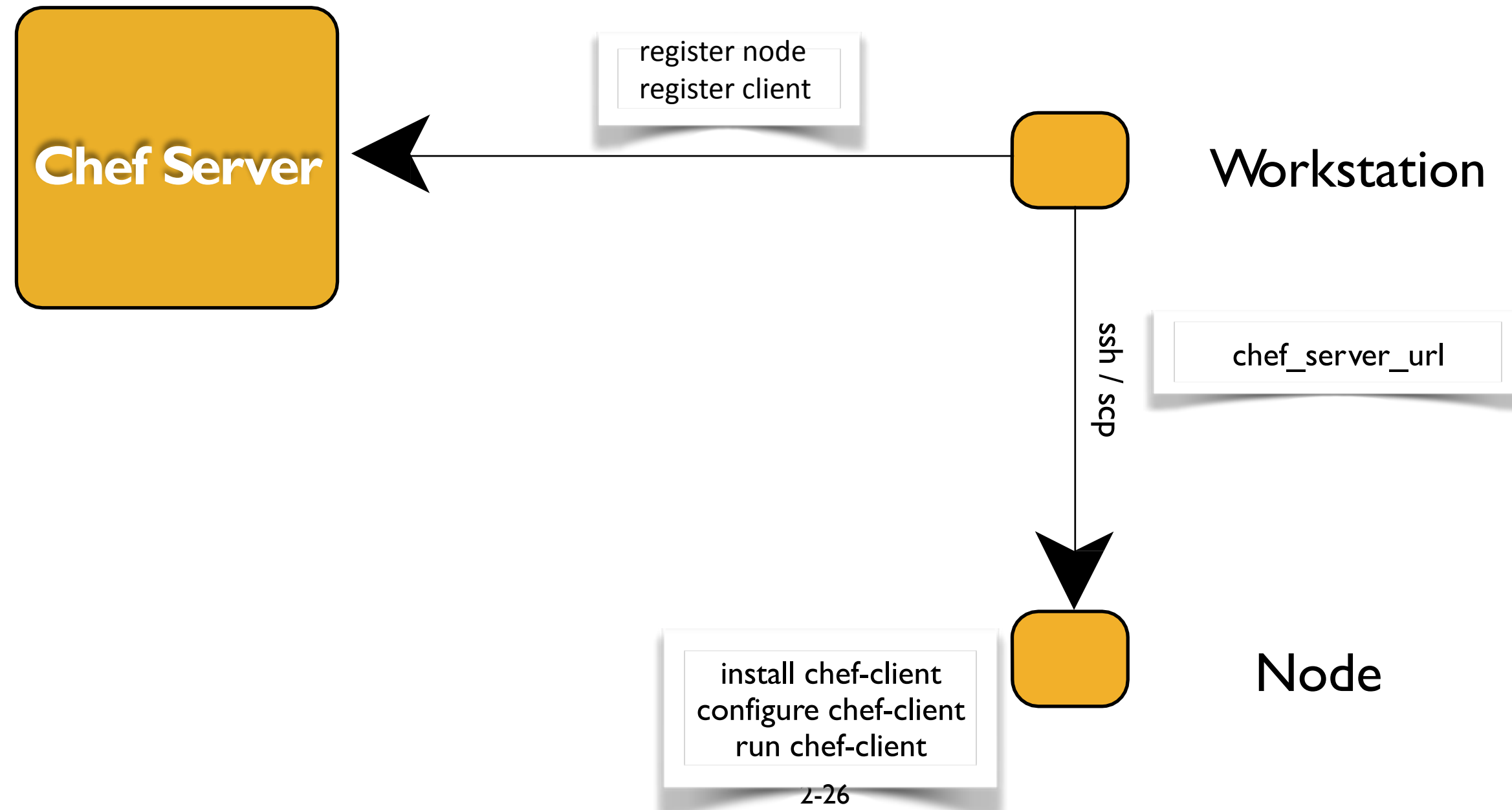
knife bootstrap

```
knife bootstrap HOSTNAME -x root -P PASSWORD -N node1  
...
```



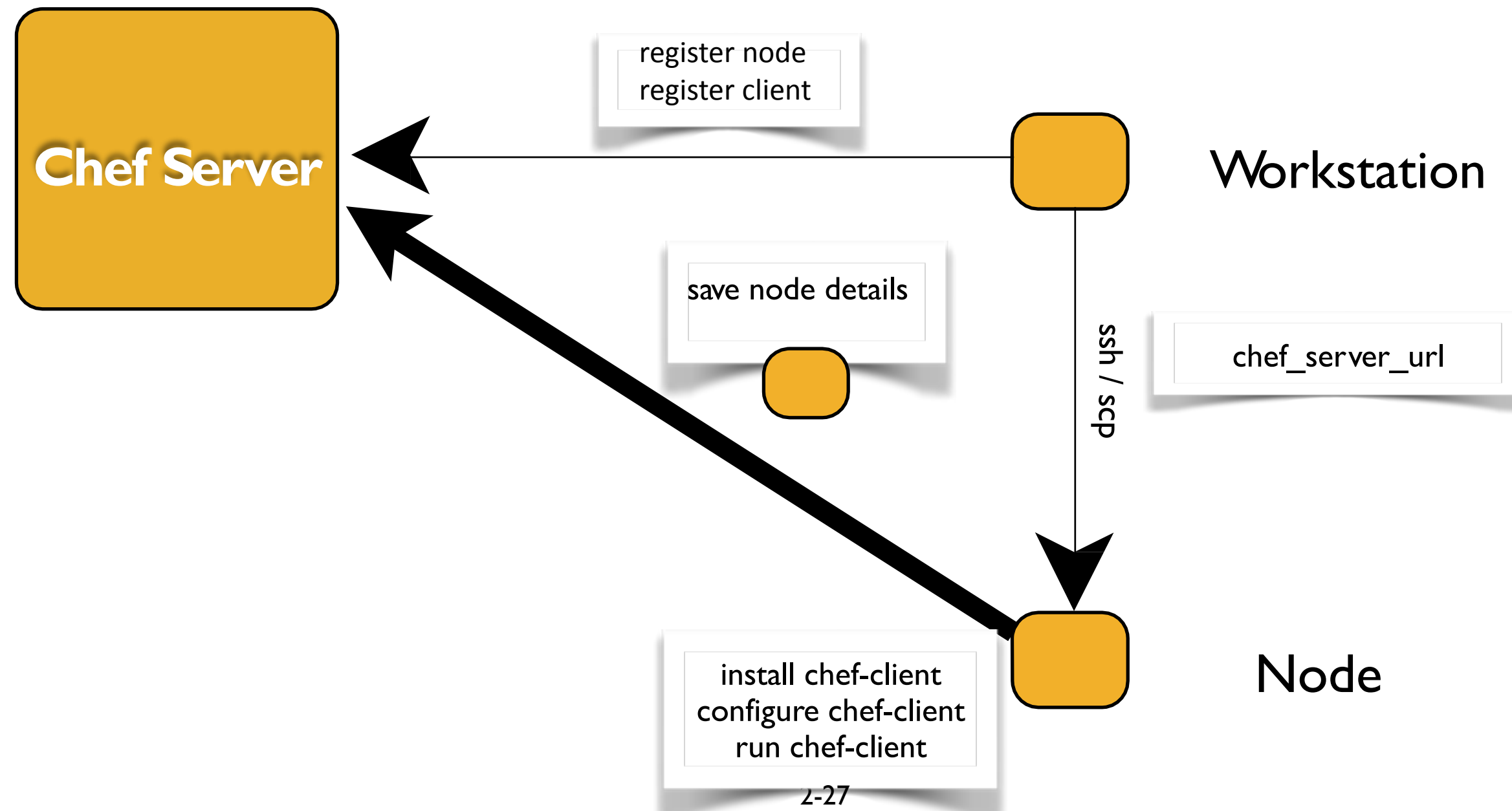
knife bootstrap

```
knife bootstrap HOSTNAME -x root -P PASSWORD -N node1  
...
```



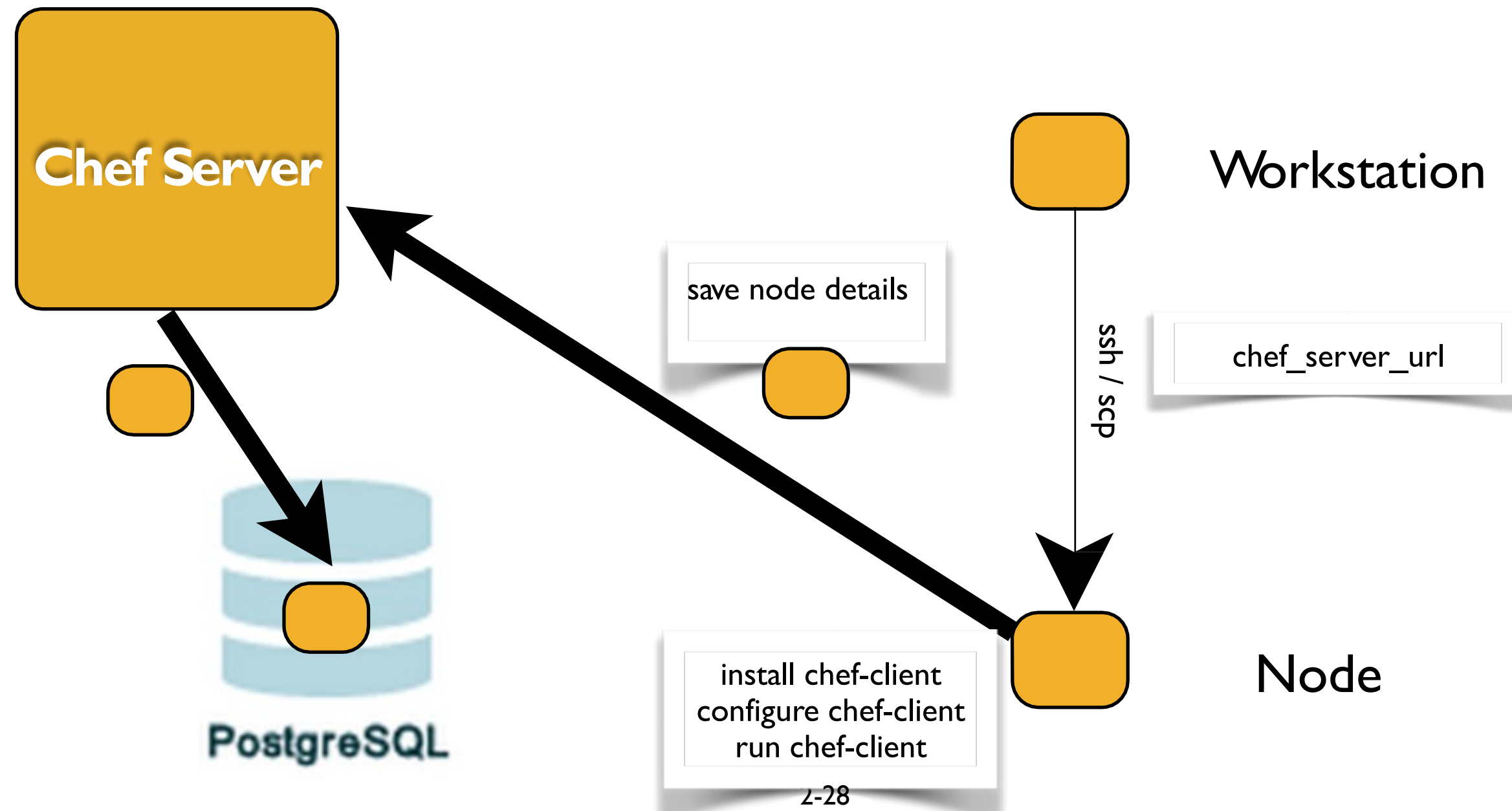
knife bootstrap (no validator key)

```
knife bootstrap HOSTNAME -x root -P PASSWORD -N node1  
...
```



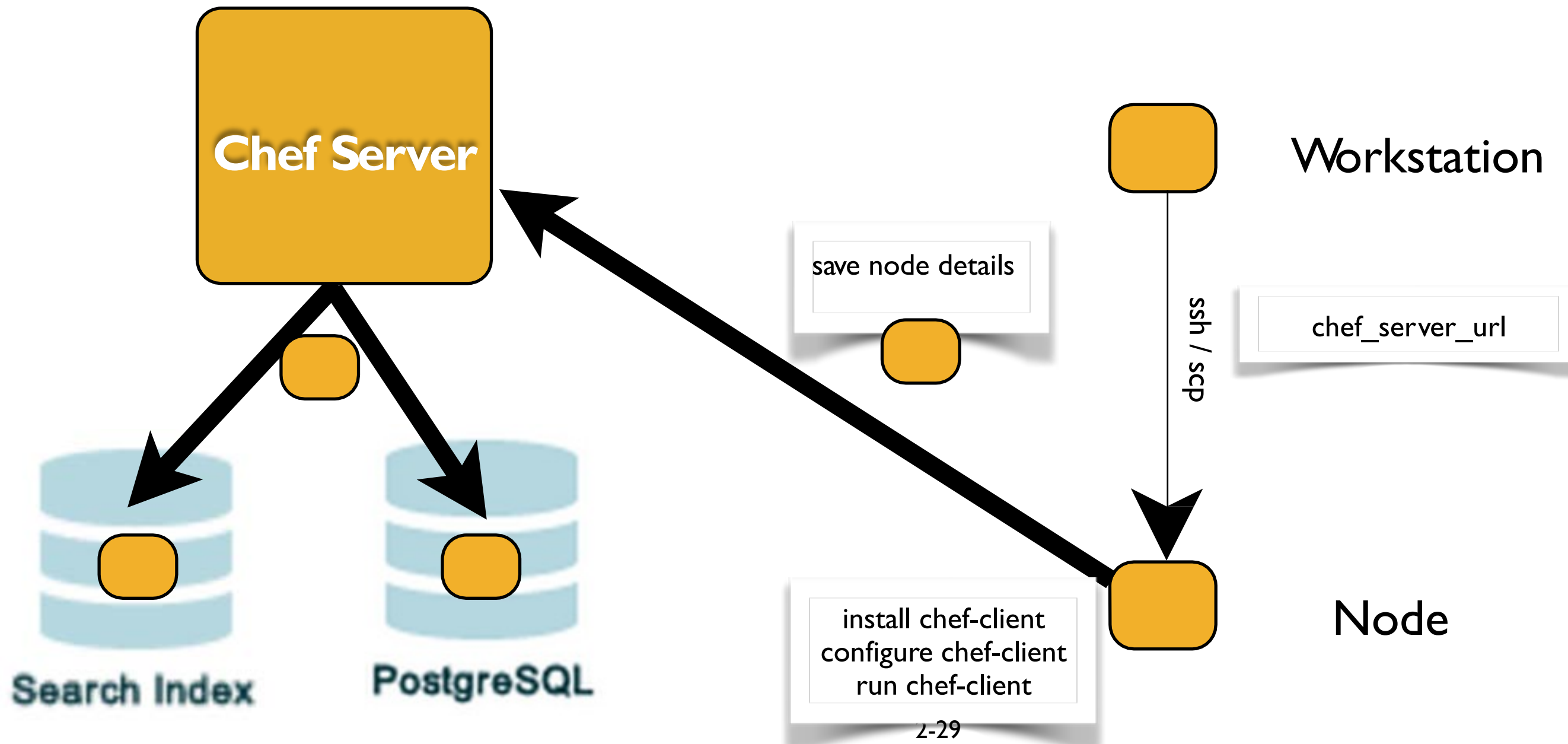
knife bootstrap

```
knife bootstrap HOSTNAME -x root -P PASSWORD -N node1  
...
```



knife bootstrap

```
knife bootstrap HOSTNAME -x root -P PASSWORD -N node1  
...
```



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

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  ohai
```

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

```
chef@node1:~$ chef-client -v  
Chef: 12.5.1
```

Exercise: Re-run the Chef Client

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

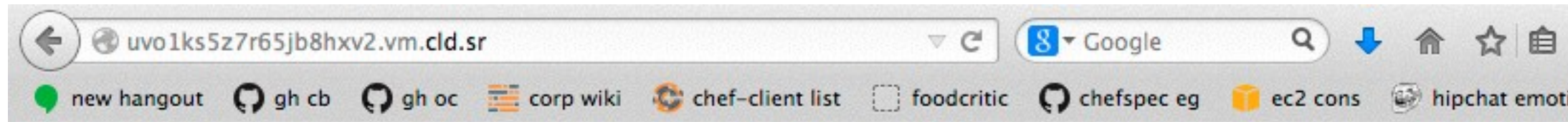
```
[2015-06-23T05:06:02+00:00] INFO: Forking chef instance to converge...
Starting Chef Client, version 12.5.1
[2015-06-23T05:06:02+00:00] INFO: *** Chef 12.5.1 ***
[2015-06-23T05:06:02+00:00] INFO: Chef-client pid: 5704
[2015-06-23T05:06:03+00:00] INFO: Run List is [role[web]]
[2015-06-23T05:06:03+00:00] INFO: Run List expands to [chef-client::delete_validation, chef-client,
ntp, motd, users, apache]
[2015-06-23T05:06:03+00:00] INFO: Starting Chef Run for node1
[2015-06-23T05:06:03+00:00] INFO: Running start handlers
[2015-06-23T05:06:03+00:00] INFO: Start handlers complete.
resolving cookbooks for run list: ["chef-client::delete_validation", "chef-client", "ntp", "motd",
"users", "apache"]
[2015-06-23T05:06:04+00:00] INFO: Loading cookbooks [apache@0.2.0, chef-client@4.3.0, cron@1.6.1,
logrotate@1.9.2, motd@0.1.0, ntp@1.8.6, pci@0.1.0, users@0.1.0, chef_handler@1.1.9, windows@1.37.0]
Synchronizing Cookbooks:
- apache
```

Exercise: Verify chef-client is Running

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

```
root          8933   0.3   2.2 130400 37816 ?        S1  
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
```

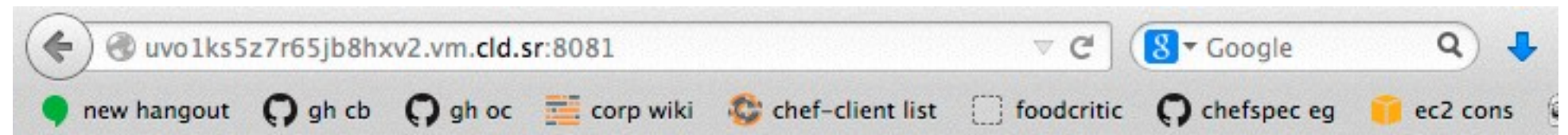
Exercise: Verify That the Two Sites Are Working



Welcome to Chef

We love clowns

10.160.201.90:80



Welcome to Chef

We love bears

10.160.201.90:8081

Review Questions

- What files did we download from Chef Server to configure our workstation?
- Where did we place these files?
- What other way could we have copied the repo files from GitHub?
 - Bonus point - why did we not do this?
- How did we upload all cookbooks to the Chef Server?

Building Custom Resources

Expanding Functionality in the Chef Framework

v1.2.1

Lesson Objectives

- After completing the lesson, you will be able to
 - Describe the components of a custom resource(previously called LWRP or HWRP)
 - Explain the Resource Domain Specific Language (DSL)
 - Build a resource from scratch
 - Will use a custom resource pattern introduced in Chef Client 12.5.0. A *compat_resource* cookbook exists to make this work on Chef Client 12.1 through 12.4


A Brief Review...

- **Resources** describe *what* we want to happen and *how*
- Resources
 - have a **name**
 - can have one or more **properties**(parameters)
 - take **action** to put the resource into a desired state
 - can send **notifications** to other resources

The Problem and the Success Criteria

- **The Problem:** We want to abstract the Apache virtual host configuration pattern.
- **Success Criteria:** We will create an `apache_vhost` resource that will let us manage Apache virtual hosts.

Exercise: Review the apache::default recipe

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

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

- Note the file cookbooks/apache/attributes/default.rb contains the following

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

Exercise: Review the apache::default recipe

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

```
# 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
```

Exercise: Review the apache::default recipe

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

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

Exercise: Review the apache::default recipe

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

```
# Add 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
```

Exercise: Change the Cookbook's Version Number in the Metadata



OPEN IN EDITOR: `cookbooks/apache/metadata.rb`

```
maintainer      "apache"
maintainer_email "YOUR_EMAIL"
license         "All rights reserved"
description     "Installs/Configures apache"
long_description IO.read(File.join(File.dirname(__FILE__), 'README.md'))
version         "0.3.0"
```

SAVE FILE!

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

Resource Naming

```
+ cookbooks
  |
  + apache
    |
    + resources
      |
      + vhost.rb
```

- Name of new resource is implied by its name in the cookbook
- In the above scenario, the new resource will be called `apache_vhost`

The Resource DSL

- **Methods:** `action`, `default_action`, `property`, `load_current_value`, `resource_name`
- `action` – defines an action with built-in Chef resources and Ruby code
- `property` – defines a parameter for the resource
- `load_current_value` – optional method to load the current values for all specified properties
- `resource_name` – specify a different name for the resource

Exercise: Create an apache_vhost Resource with One Allowed Actions

 **OPEN IN EDITOR:** cookbooks/apache/resources/vhost.rb

```
default_action :create
action :create do
  puts "My name is #{new_resource.name}"
end
```

SAVE FILE!

- When our apache_vhost resource calls `action :create`, execute this block. Also `:create` is the default action for the resource
- `puts` is Ruby code to print to STDOUT

Exercise: Set an Action in Our apache::default Recipe

 **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
```

```
# Enable an Apache Virtualhost
apache_vhost "lions" do
  action :create
end
```

- We call resource **apache_vhost**
- With name **"lions"**
- With action **:create** in the parameter block

SAVE FILE

Exercise: Upload the Apache Cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache      [0.3.0]  
Uploaded 1 cookbook.
```

Exercise: Run chef-client

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

```
Starting Chef Client, version 11.10.4
resolving cookbooks for run list: ["chef-client::delete_validation", "chef-client", "ntp", "motd", "users", "apache"]
Synchronizing Cookbooks:
  - chef-client
  - cron
  - logrotate
  - ntp
  - motd
  - pci
  - users
  - apache
...
* apache_vhost[lions] action createMy name is lions
(up to date)
...
Running handlers:
Running handlers complete

Chef Client finished, 12/35 resources updated in 12.045321863 seconds
```

Exercise: Use a Chef Resource Within Your Resource

 **OPEN IN EDITOR:** `cookbooks/apache/resources/vhost.rb`

```
default_action :create
action :create do
  log "My name is #{new_resource.name}"
end
```

SAVE FILE!

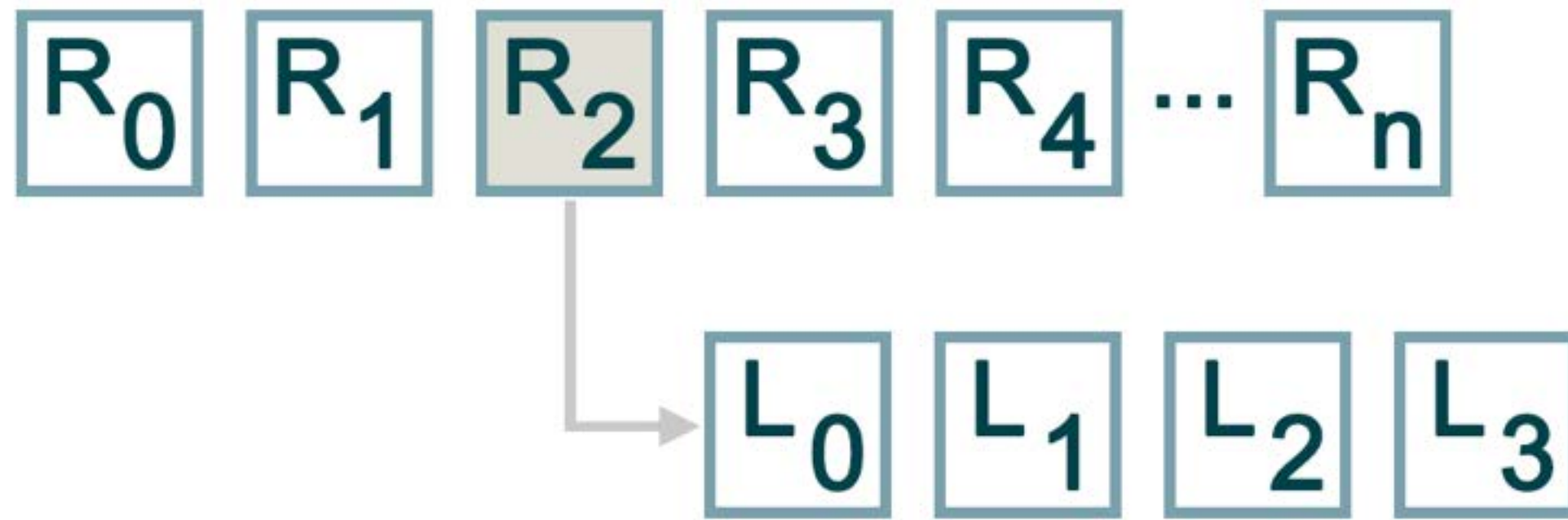
- Actions can use other resources
- The `log` resource uses Chef's logger object to print messages at `Chef::Config[:log_level]`

Custom resources and the Resource Collection



- A regular resource collection is just a big array of resources.

Custom resources and the Resource Collection



- Custom resources create a mini resource collection (execution context)
- Notifications are rolled up to the master resource collection.

Exercise: Upload the Apache Cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache      [0.3.0]  
Uploaded 1 cookbook.
```

Exercise: Run chef-client

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

```
* execute[mv /etc/httpd/conf.d/welcome.conf /etc/httpd/conf.d/welcome.conf.disabled] action
run (skipped due to only if)
```

```
* apache_vhost[lions] action create
* log[My name is lions] action write
```

```
* template[/etc/httpd/conf.d/clowns.conf] action create (up to date)
* directory[/srv/apache/clowns] action create (up to date)
* template[/srv/apache/clowns/index.html] action create (up to date)
* template[/etc/httpd/conf.d/bears.conf] action create (up to date)
* directory[/srv/apache/bears] action create (up to date)
* template[/srv/apache/bears/index.html] action create (up to date)
* template[/etc/httpd/conf.d/admin.conf] action create (up to date)
* directory[/srv/apache/admin] action create (up to date)
* template[/srv/apache/admin/index.html] action create (up to date)
* service[httpd] action enable (up to date)
* service[httpd] action start (up to date)
```

Running handlers:

Running handlers complete

Chef Client finished, 2/42 resources updated in 4.386652029 seconds

Exercise: Create Properties(parameters) for the apache_vhost Resource

 **OPEN IN EDITOR:** cookbooks/apache/resources/vhost.rb

```
property :site_name, :name_attribute => true, :kind_of => String
property :site_port, :default => 80, :kind_of => Fixnum

default_action :create
action :create do
```

SAVE FILE!

- `property` takes the name of the attribute and an (optional) hash of validation parameters
- These validation parameters are specific to the Resource DSL

Exercise: Create Properties(parameters) for the apache_vhost Resource

 **OPEN IN EDITOR:** cookbooks/apache/resources/vhost.rb

```
property :site_name, :name_attribute => true, :kind_of => String
property :site_port, :default => 80, :kind_of => Fixnum

default_action :create
action :create do
```

SAVE FILE!

- **:name_attribute** set the site_name to the resource name
- **:default** sets the default value for this parameter
- **:kind_of** ensures the value is a particular class


Resource Validation Parameters

Validation	Meaning
<code>:callbacks</code>	Hash of Procs, should return true
<code>:default</code>	Default value for the parameter
<code>:equal_to</code>	Match the value with <code>==</code>
<code>:kind_of</code>	Ensure the value is of a particular class
<code>:name_attribute</code>	Set to the resource name
<code>:regex</code>	Match the value against the regex
<code>:required</code>	The parameter must be specified
<code>:respond_to</code>	Ensure the value has a given method

:kind_of examples

- :kind_of accepts many types, either built-in Ruby classes, or your own
 - :kind_of => String # String
 - :kind_of => Array # Array
 - :kind_of => Fixnum # Fixnum
 - :kind_of => [:some, :list, :of, :symbols]
 - :kind_of => [TrueClass, FalseClass]
 - :kind_of => [String, Array] # composite

Exercise: Extend :create action


 **OPEN IN EDITOR:** cookbooks/apache/resources/vhost.rb

```
property :site_name, :name_attribute => true, :kind_of => String
property :site_port, :default => 80, :kind_of => Fixnum

default_action :create
action :create do
  # Set the document root
  document_root = "/srv/apache/#{new_resource.site_name}"

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


Exercise: Extend :create action

 **OPEN IN EDITOR:** cookbooks/apache/resources/vhost.rb

```
# 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 => new_resource.site_name,
    :port => new_resource.site_port
  )
end
end
```

Exercise: Use apache_vhost in a Recipe

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

```
# Enable an Apache Virtualhost
apache_vhost "lions" do
  site_port 8080
  action :create
  notifies :restart, "service[httpd]"
end

# Iterate over the apache sites
node["apache"]["sites"].each do |site_name, site_data|
```

Exercise: Upload the Apache Cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache      [0.3.0]  
Uploaded 1 cookbook.
```

Exercise: Run chef-client

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

```
* apache_vhost[lions] action create
  * template[/etc/httpd/conf.d/lions.conf] action create
    create new file /etc/httpd/conf.d/lions.conf
      - update content in file /etc/httpd/conf.d/lions.conf from none to 75b467
      --- /etc/httpd/conf.d/lions.conf 2015-06-23 06:09:51.291365440 +0000
      +++ /tmp/chef-rendered-template20150623-29275-lugg8tg 2015-06-23
06:09:51.291365440 +0000
@@ -1,18 @@
+ Listen 8080
+
+<VirtualHost *:8080>
+  ServerAdmin webmaster@localhost
+
+  DocumentRoot /srv/apache/lions
+  <Directory />
+    Options FollowSymLinks
+    AllowOverride None
```

Exercise: Verify New 'lions' Site



Welcome to Chef

We love lions


10.160.157.59:8080

The Resource Collection - Inline Resources

Resource Collection

```
resource_collection = [
    ...,
    package[httpd],
    service[httpd],
    apache_vhost[lions],
    resource_collection = [
        template["/etc/httpd/conf.d/lions.conf"],
        directory ["/srv/apache/lions"],
        template["/srv/apache/lions/index.html"],
    ],
    template["/etc/httpd/conf.d/clowns.conf"],
    directory["/srv/apache/clowns"],
    template["/srv/apache/clowns/index.html"],
    template["/etc/httpd/conf.d/bears.conf"],
    directory["/srv/apache/bears"],
    template["/srv/apache/clowns/bears.html"]
]
```

All notifications in inline resources are rolled up to 'master' resource collection



Exercise: Add the lions to the attributes

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

```
default[ "apache" ][ "sites" ][ "clowns" ] = { "port" => 80 }  
default[ "apache" ][ "sites" ][ "bears" ] = { "port" => 81 }  
default[ "apache" ][ "sites" ][ "lions" ] = { "port" => 8080 }
```

Exercise: Refactor apache::default Recipe



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

```
# Iterate over the apache sites
node["apache"]["sites"].each do |site_name, site_data|
  # Enable an Apache Virtualhost
  apache_vhost site_name do
    site_port site_data['port']
    action :create
    notifies :restart, "service[httpd]"
  end
end
```


Exercise: Remove the lions apache_vhost

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

```
# Enable an Apache Virtualhost
apache_vhost "lions" do
  site_port 8080
  action :create
  notifies :restart, "service[httpd]"
end

# Iterate over the apache sites
node["apache"]["sites"].each do |site_name, site_data|
  # Enable an Apache Virtualhost
  apache_vhost site_name do
    site_port site_data['port']
```

SAVE FILE!

Exercise: Upload the Apache Cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache      [0.3.0]  
Uploaded 1 cookbook.
```

Exercise: Run chef-client

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

```
* apache_vhost[lions] action create
  * template[/etc/httpd/conf.d/lions.conf] action create (up to date)
  * directory[/srv/apache/lions] action create (up to date)
  * template[/srv/apache/lions/index.html] action create (up to date)
  (up to date)
* apache_vhost[lions] action create
  * template[/etc/httpd/conf.d/lions.conf] action create (up to date)
  * directory[/srv/apache/lions] action create (up to date)
  * template[/srv/apache/lions/index.html] action create (up to date)
  (up to date)
* apache_vhost[clowns] action create
  * template[/etc/httpd/conf.d/clowns.conf] action create (up to date)
  * directory[/srv/apache/clowns] action create (up to date)
  * template[/srv/apache/clowns/index.html] action create (up to date)
  (up to date)
```

Exercise: Add the :remove Action



OPEN IN EDITOR: `cookbooks/apache/resources/vhost.rb`

```
end
end

action :remove do
  file "/etc/httpd/conf.d/#{new_resource.site_name}.conf" do
    action :delete
  end
end
```

SAVE FILE

Exercise: Refactor apache::default recipe



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..
  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|
```

- Delete existing **execute** resource that disables the welcome site

Exercise: Refactor apache::default recipe



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

```
# Disable the default virtual host
apache_vhost "welcome" do
  action :remove
  notifies :restart, "service[httpd]"
end
```

```
# Iterate over the apache sites
node["apache"]["sites"].each do |site_name, site_data|
```

- Add a new `apache_vhost` resource with `action :remove`

Exercise: Upload the Apache Cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache      [0.3.0]  
Uploaded 1 cookbook.
```

Exercise: Run chef-client

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

```
Recipe: apache::default
* yum_package[httpd] action install (up to date)
* apache_vhost[welcome] action remove
  * file[/etc/httpd/conf.d/welcome] action delete (up to date)
    (up to date)
* apache_vhost[lions] action create
  * template[/etc/httpd/conf.d/lions.conf] action create (up to date)
  * directory[/srv/apache/lions] action create (up to date)
  * template[/srv/apache/lions/index.html] action create (up to date)
    (up to date)
```


Other Ways to Write Resources

- We wrote a Custom Resource using out-of-the-box Chef resources
- You can write pure Ruby in LWRPs as well
 - http://docs.chef.io/lwrp_custom_provider_ruby.html
- You can also write pure Chef resources/providers by inheriting from `Chef::Resource::Base` and `Chef::Provider::Base` and putting them in `libraries/`

Use Cases for Custom Resources

- Hide unnecessary implementation details
- Example: app admin team decides how to create Apache virtual hosts, JBoss JVMs, etc.
- Write resources to allow people to safely instantiate them
 - Parameter validation for correctness/conformance (e.g. "we don't name JVMs with punctuation characters")
 - Reject invalid values (e.g. "port -1")
 - Restrict what tunables are available to consumers

Review Questions

- Where are the custom resources stored?
- Why is it important to write idempotent resources?
- What would you write custom resources for?

Writing Ohai Plugins

Getting More Data From Your Systems

v1.2.1

Lesson Objectives

After completing the lesson, you will be able to:

- Explain the function Ohai and Ohai Plugins
- Write your own Ohai Plugins
- Force Ohai Plugins to run
- Disable Ohai Plugins

Running Ohai

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

```
{  
  "languages": {  
    "ruby": {  
      "platform": "x86_64-darwin13.0.0", "version":  
        "1.9.3",  
      "release_date": "2013-11-22",  
      ...  
    }  
  }  
}
```

Ohai Data Collection

- Platform details: `redhat`, `windows`, etc.
- Processor information
- Kernel data
- FQDNs
- Cloud provider data (EC2, Azure, Rackspace, etc)
- Windows device drivers
- and more...

Why Write Ohai Plugins?

- Collect specialized data not "in the box"
- Examples:
 - Information about some daemon you want to expose
 - Hardware inventory information from external sources (BMC, IPMI, Remedy ARS?)
 - Statistics collection on-the-cheap (e.g. shove netstat attributes into automatic data)

Ohai!

- Ohai writes automatic attributes - they can't be changed by other components of Chef
- Automatic attributes form the base for every node object at the beginning of every Chef run
- Many plugins are enabled by default
- Plugins can be disabled

Loading and Disabling Plugins

- The `/etc/chef/client.rb` file manages which additional plugins are loaded and the plugins to disable.
- This file is maintained by the chef-client cookbook's config recipe.

Examining the chef-client Cookbook

- We're already using two recipes on the node from the chef-client cookbook
 - `chef-client::service`
(via `chef-client::default`)
 - `chef-client::delete_validation`
- Let us look at the `chef-client::config` recipe.

Exercise: View the chef-client::config Recipe



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

```
template "#{node["chef_client"]["conf_dir"]}/client.rb" do
  source 'client.rb.erb' owner d_owner
  group d_group
  mode 00644
  variables(
    :chef_config => node['chef_client']['config'],
    :chef_requires => chef_requires,
    :ohai_disabled_plugins => node['ohai']['disabled_plugins'],
    :start_handlers => node['chef_client']['config']['start_handlers'],
    :report_handlers => node['chef_client']['config']['report_handlers'],
    :exception_handlers => node['chef_client']['config'] ['exception_handlers']
  )
  notifies :create, 'ruby_block[reload_client_config]', :immediately
end
```

Exercise: View the chef-client::config Template

 **OPEN IN EDITOR:** cookbooks/chef-client/templates/default/client.rb.erb

```
<% if node.attribute?("ohai") && node["ohai"].attribute?("plugin_path") -%>

Ohai::Config[:plugin_path] << "<%= node["ohai"]["plugin_path"] %>"
<% end -%>

<% unless @ohai_disabled_plugins.empty? -%>
Ohai::Config[:disabled_plugins] = [<%= @ohai_disabled_plugins.map { |k|
k.match(/...

<% end -%>
```

Exercise: Update the base role



OPEN IN EDITOR: roles/base.rb

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

Exercise: Upload the base role

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

```
Updated Role base!
```

Writing Ohai Plugins: Apache Modules

- **Problem:** We want to capture all installed Apache modules as part of our node data
- **Success:** Apache module data is visible in our node attributes

Writing Ohai Plugins: apache.modules

```
chef@node1:~$ apachectl -t -D DUMP_MODULES
```

```
Loaded Modules:
```

```
core_module (static)
mpm_prefork_module (static)
http_module (static)
so_module (static)
auth_basic_module (shared)
auth_digest_module (shared)
authn_file_module (shared)
authn_alias_module (shared)
...
```

Installing Ohai Plugins

- Custom Ohai plugins are installed with the Ohai cookbook
 - Configures plugin path for Ohai
 - Delivers plugin to Ohai plugins directory with Chef
 - <http://supermarket.chef.io/cookbooks/ohai>
- <http://docs.chef.io/ohai.html>

Exercise: Download the Ohai Cookbook

```
$ knife cookbook site download ohai 2.0.0
```

```
Downloading ohai from the cookbooks site at version 2.0.0 to  
/Users/YOU/chef-repo/ohai-2.0.0.tar.gz
```

```
Cookbook saved: /Users/YOU/chef-repo/cookbooks/ohai-2.0.0.tar.gz
```

Exercise: Download the Ohai Cookbook

```
$ tar -zxvf ohai-2.0.0.tar.gz -C cookbooks/
```

```
x ohai/  
x ohai/CHANGELOG.md  
x ohai/README.md  
x ohai/attributes  
x ohai/attributes/default.rb  
x ohai/files  
x ohai/files/default  
x ohai/files/default/plugins  
x ohai/files/default/plugins/README  
x ohai/metadata.json
```

Exercise: Upload the Ohai Cookbook

```
$ knife cookbook upload ohai
```

```
Uploading ohai [2.0.0]
```

```
Uploaded 1 cookbook.
```

Exercise: Inspect the Ohai Cookbook

 **OPEN IN EDITOR:** `cookbooks/ohai/attributes/default.rb`

```
# FHS location would be /var/lib/chef/ohai_plugins or similar.
case node["platform_family"]
when "windows"
  default["ohai"]["plugin_path"] = "C:/chef/ohai_plugins"
else
  default["ohai"]["plugin_path"] = "/etc/chef/ohai_plugins"
end

# The list of plugins and their respective file locations
default["ohai"]["plugins"]["ohai"] = "plugins"
```

Exercise: Update apache cookbook

- We could create our modules.rb file and add it to the ohai cookbook, but...
- We now have to maintain a forked version of the community cookbook
- Let's use our apache cookbook instead!

Exercise: Update the metadata.rb



OPEN IN EDITOR: cookbooks/apache/metadata.rb

```
name                'apache'
maintainer           'Your Name'
maintainer_email     'your_email@example.com'
license              'All rights reserved'
description          'Installs/Configures apache'
long_description     IO.read(File.join(File.dirname(__FILE__), 'README.md'))
version              '0.4.0'

depends               'ohai'
```

SAVE FILE!

Basic Ohai DSL

- `Ohai.plugin(:Name)` - used to identify the plugin

```
Ohai.plugin(:Name) do
  provides "attribute_a", "attribute_b"
  depends "attribute_x", "attribute_y"

  collect_data(:default) do
    attribute_a Mash.new
    # some Ruby code
  end

  collect_data(:platform) do
    attribute_a Mash.new
    # platform-specific Ruby code
  end
end
```

Basic Ohai DSL

- `Ohai.plugin(:Name)` - used to identify the plugin
- `provides` - comma-separated list of attributes defined by the plugin

```
Ohai.plugin(:Name) do
  provides "attribute_a", "attribute_b"
  depends "attribute_x", "attribute_y"

  collect_data(:default) do
    attribute_a Mash.new
    # some Ruby code
  end

  collect_data(:platform) do
    attribute_a Mash.new
    # platform-specific Ruby code
  end
end
```

Basic Ohai DSL

- **Ohai.plugin(:Name)** - used to identify the plugin
- **provides** - comma-separated list of attributes defined by the plugin
- **depends** - comma-separated list of attributes collected by another plugin

```
Ohai.plugin(:Name) do
  provides "attribute_a", "attribute_b"
  depends "attribute_x", "attribute_y"

  collect_data(:default) do
    attribute_a Mash.new
    # some Ruby code
  end

  collect_data(:platform) do
    attribute_a Mash.new
    # platform-specific Ruby code
  end
end
```

Basic Ohai DSL

- `Ohai.plugin(:Name)` - used to identify the plugin
- `provides` - comma-separated list of attributes defined by the plugin
- `depends` - comma-separated list of attributes collected by another plugin
- `collect_data(:default)` - the default code run if the platform is not defined

```
Ohai.plugin(:Name) do
  provides "attribute_a", "attribute_b"
  depends "attribute_x", "attribute_y"

  collect_data(:default) do
    attribute_a Mash.new
    # some Ruby code
  end

  collect_data(:platform) do
    attribute_a Mash.new
    # platform-specific Ruby code
  end
end
```

Basic Ohai DSL

- `Ohai.plugin(:Name)` - used to identify the plugin
- `provides` - comma-separated list of attributes defined by the plugin
- `depends` - comma-separated list of attributes collected by another plugin
- `collect_data(:default)` - the default code run if the platform is not defined
- `collect_data(:platform)` - the code run for a specific platform

```
Ohai.plugin(:Name) do
  provides "attribute_a", "attribute_b"
  depends "attribute_x", "attribute_y"

  collect_data(:default) do
    attribute_a Mash.new
    # some Ruby code
  end

  collect_data(:platform) do
    attribute_a Mash.new
    # platform-specific Ruby code
  end
end
```

Exercise: Create modules.rb



OPEN IN EDITOR: `apache/files/default/plugins/modules.rb`

```
Ohai.plugin(:Apache) do
  provides
  "apache/modules"

  collect_data(:default) do
    apache Mash.new
    modules = shell_out("apachectl -t -D DUMP_MODULES")
    apache[:modules] = modules.stdout
  end
end
```

SAVE FILE!

Mash.new

- It's essentially a Hash that allows you to use string keys and symbol keys interchangeably to return the same value.
- <https://github.com/chef/chef/blob/master/lib/chef/mash.rb>

shell_out (Mixlib::ShellOut)

- Cross-platform library for safely executing shell commands from within Chef, Ohai, etc.
- Deals with passing arguments, capturing STDERR and STDOUT, timing-out hung processes
- Deals with cross-platform (Linux, UNIX, Windows) subprocess quirks
- **Never use backticks/Process.spawn/system!**
- **Use shell_out (Mixlib::Shellout)!**

Exercise: Write the ohai_plugin recipe



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

```
ohai 'reload_apache' do
  plugin 'apache'
  action :nothing
end

cookbook_file "#{node['ohai']['plugin_path']}/modules.rb" do
  source 'plugins/modules.rb'
  owner 'root'
  group 'root'
  mode '0644'
  notifies :reload, 'ohai[reload_apache]', :immediately
end

include_recipe 'ohai::default'
```

Exercise: Upload the apache cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache [0.4.0]
```

```
Uploaded 1 cookbook.
```

Exercise: Add apache::ohai_plugin to the web role



OPEN IN EDITOR: roles/web.rb

```
name "web"
description "Web Server"
run_list "role[base]", "recipe[apache]", "recipe[apache::ohai_plugin]"
default_attributes({
  "apache" => {
    "sites" => {
      "admin" => {
        "port" => 8000
      },
      "bears" => {
        "port" => 8081
      }
    }
  }
})
```

Exercise: Upload the web role

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

```
Updated Role web!
```

Exercise: Run chef-client

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

```
Starting Chef Client, version 12.3.0
```

```
resolving cookbooks for run list: ["chef-client::config", "chef-  
client::delete_validation", "chef-client", "ntp", "motd", "users",  
"apache", "apache::ohai_plugin"]
```

```
Synchronizing Cookbooks:
```

- ohai
- cron
- apache
- chef-client
- chef_handler

Exercise: Show apache attribute

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

```
node1:
  apache:
    indexfile: index1.html
    modules: Loaded Modules:
      core_module (static)
      mpm_prefork_module (static)
      http_module(static)
      so_module (static)
      auth_basic_module (shared)
```

Exercise: View plugin

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

```
Ohai.plugin(:Apache) do
  provides "apache/modules"

  collect_data(:default) do
    apache Mash.new
    modules = shell_out("apachectl -t -D DUMP_MODULES")
    apache[:modules] = modules.stdout
  end
end
```

Can We Make It Better?

- We have Apache module data!
- It's saved as one big string... that's a bummer
- Let's sort this into a group of static and shared modules

Exercise: Refactor modules.rb



OPEN IN EDITOR: `apache/files/default/plugins/modules.rb`

```
Ohai.plugin(:Apache) do
  provides "apache/modules"

  collect_data(:default) do
    apache Mash.new
    apache[:modules] = { :static => [], :shared => [] }
    modules = shell_out("apachectl -t -D DUMP_MODULES")
    # ... CONTINUED ON THE NEXT SLIDE ...
  end
end
```

Exercise: Refactor modules.rb



OPEN IN EDITOR: `apache/files/default/plugins/modules.rb`

```
# ... CONTINUED FROM PREVIOUS SLIDE ...
modules.stdout.each_line do |line|
  fullkey, value = line.split("(", 2).map { |token| token.strip }
  apache_module = fullkey.gsub("_module", "")
  dso_type = value.to_s.chomp("\)")
  if dso_type.match(/shared/)
    apache[:modules][:shared] << apache_module
  elsif dso_type.match(/static/)
    apache[:modules][:static] << apache_module
  end
end

end

end
```

Exercise: Upload the apache cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache [0.4.0]
```

```
Uploaded 1 cookbook.
```

Exercise: Run chef-client

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

```
Starting Chef Client, version 11.12.8
```

```
resolving cookbooks for run list: ["apache::ohai_plugin"]
```

```
Synchronizing Cookbooks:
```

- apache
- ohai

```
Compiling Cookbooks...
```

```
Recipe: apache::ohai_plugin
```

```
  * ohai[reload_apache] action nothing (skipped due to action  
:nothing)
```

```
  * cookbook_file[/etc/chef/ohai_plugins/modules.rb] action create
```

Exercise: Show apache.modules Attributes

```
$ knife node show node1 -a apache.modules
```

```
node1:
  apache.modules:
    shared:
      auth_basic
      auth_digest
      authn_file
      ...
    static:
      core
      mpm_prefork
```

Plugin Debugging Notes

- Ohai will **ignore plugin failures/exceptions**
- This is to avoid breaking Chef Client during such an early phase
- If you get no data from your plugins, this is probably why
- **Write plugins defensively. Check for all error conditions!**

Ohai Hints

- Ohai plugins can be forced to run, even if detected system state says that they shouldn't!
- For example, its impossible to reliably detect whether a server is in EC2, so EC2 plugin may not run
- Solution: Force the EC2 plugin to run by placing an empty JSON document (`" {} "`) in `/etc/chef/ohai/hints/ec2.json`

Disabling Ohai Plugins

- Some plugins can execute slowly on different platforms
- You can disable plugins whose data you don't use to save speed things up!
- Only disables plugins for Ohai when run with chef-client

The Problem & Success Criteria

- **The Problem:** Our systems are LDAP/Active Directory joined and thus the Ohai data contains thousands of user accounts, slowing down the Chef run.
- **Success Criteria:** We will disable the :Passwd plugin to avoid collecting this information

Exercise: Disable :Passwd Plugin

```
$ knife node show node1 -a etc.passwd
```

```
node1:
  etc.passwd:
    abrt:
      dir:    /etc/abrt
      gecos:
      gid:    173
      shell:  /sbin/nologin
      uid:    173
    adm:
      dir:    /var/adm
```

Exercise: Update the Base Role



OPEN IN EDITOR: roles/base.rb

```
name "base"
description "Base Server Role"
run_list "recipe[chef-client::config]", "recipe[chef-client::delete_v..."
default_attributes({
  "ohai" => {
    "disabled_plugins" => [ ":Passwd" ]
  }
})
```

Exercise: Upload the Base Role

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

```
Updated Role base!
```

Exercise: Disable :Passwd Plugin

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

```
Starting Chef Client, version 11.12.4
```

```
resolving cookbooks for run list: ["apache::ohai_plugin", "chef-  
client::delete_validation", "chef-client", "ntp", "motd", "users",  
"apache"]
```

```
...
```

```
Running handlers:
```

```
Running handlers complete
```

```
Chef Client finished, 1/4 resources updated in 9.690084663 seconds
```

Exercise: Disable :Passwd Plugin

```
$ knife node show node1 -a etc.passwd
```

```
node1:  
  etc.passwd:
```

Exercise: Disable :Passwd Plugin

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

```
chef_server_url  
"https://api.opscode.com/organizations/intermediate050614"  
validations_client_name "intermediate050614-validator"  
verify_api_cert true  
node_name "node1"
```

```
Ohai::Config[:plugin_path] << "/etc/chef/ohai_plugins"
```

```
Ohai::Config[:disabled_plugins] = [:Passwd]
```

```
Dir.glob[File.join("/etc/chef", "client.d", "*.rb")].each do |conf|
```

Other Tips

- Extreme situations: whitelist only the attributes you want to send: <http://ckbk.it/whitelist-node-attrs>
- Minimize the amount of JSON you are sending across the wire on every run
- Useful if you have many (>10,000) nodes
- Docs: <http://docs.chef.io/ohai.html>

Review Questions

- What command can you run at the command line to invoke Ohai?
- How are Ohai plugins installed?
- What is wrong with this first line of an Ohai definition:
`"Ohai.plugin(:name) do"`?

Chef Client Run Internals

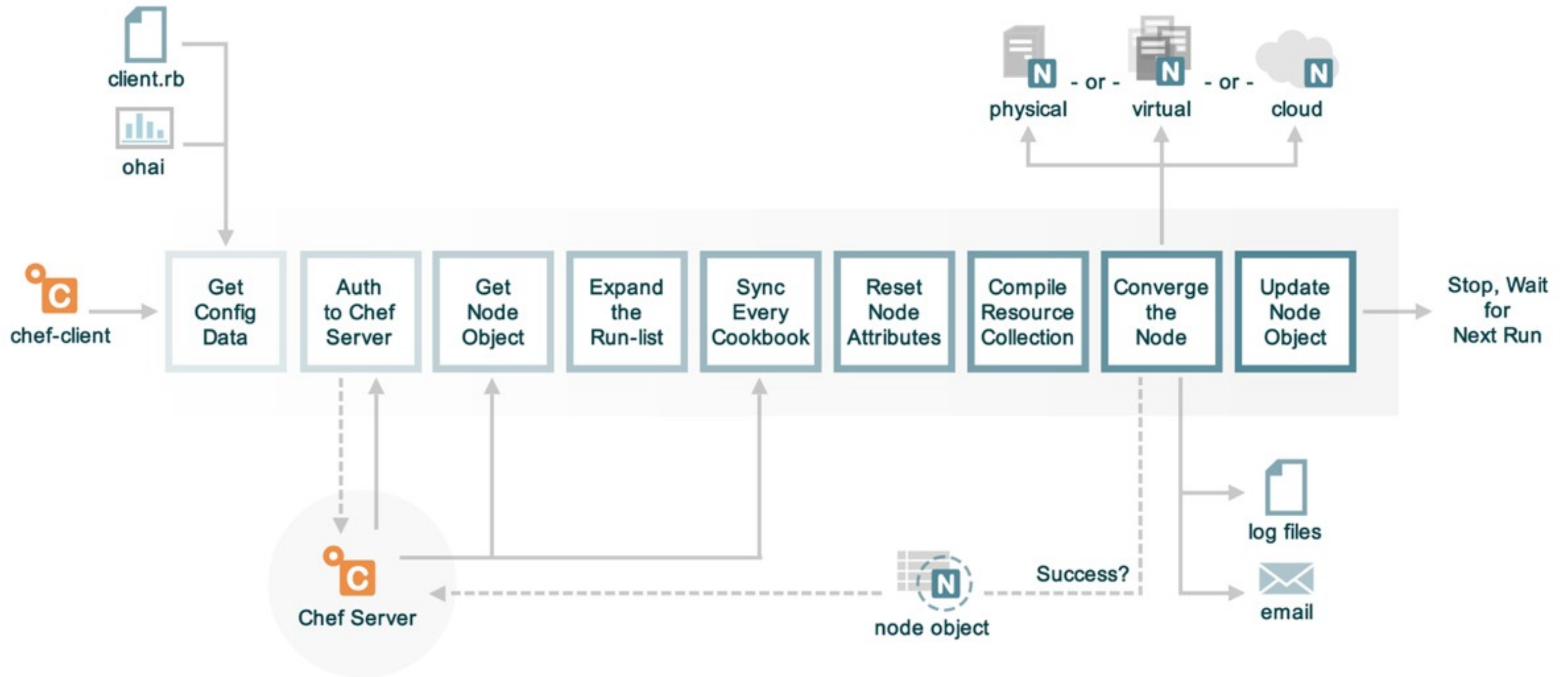
What Really Happens When Chef Runs?

v1.2.1

Lesson Objectives

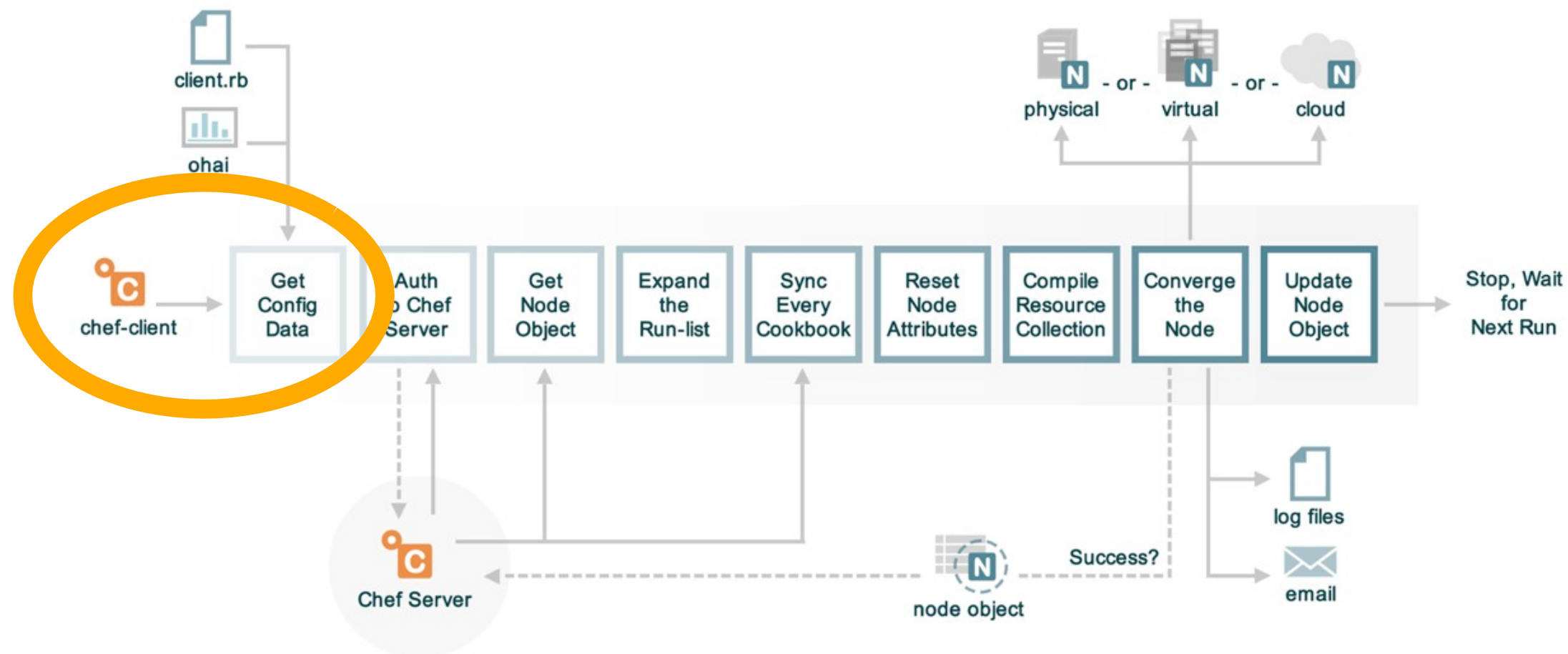
- After completing the lesson, you will be able to:
 - Explain what happens under the hood when Chef Client runs
 - Describe the purpose of the `run_context` and `run_status` objects
 - Use `node.run_state` to pass information around the recipe at execution time

Remember This From Fundamentals?



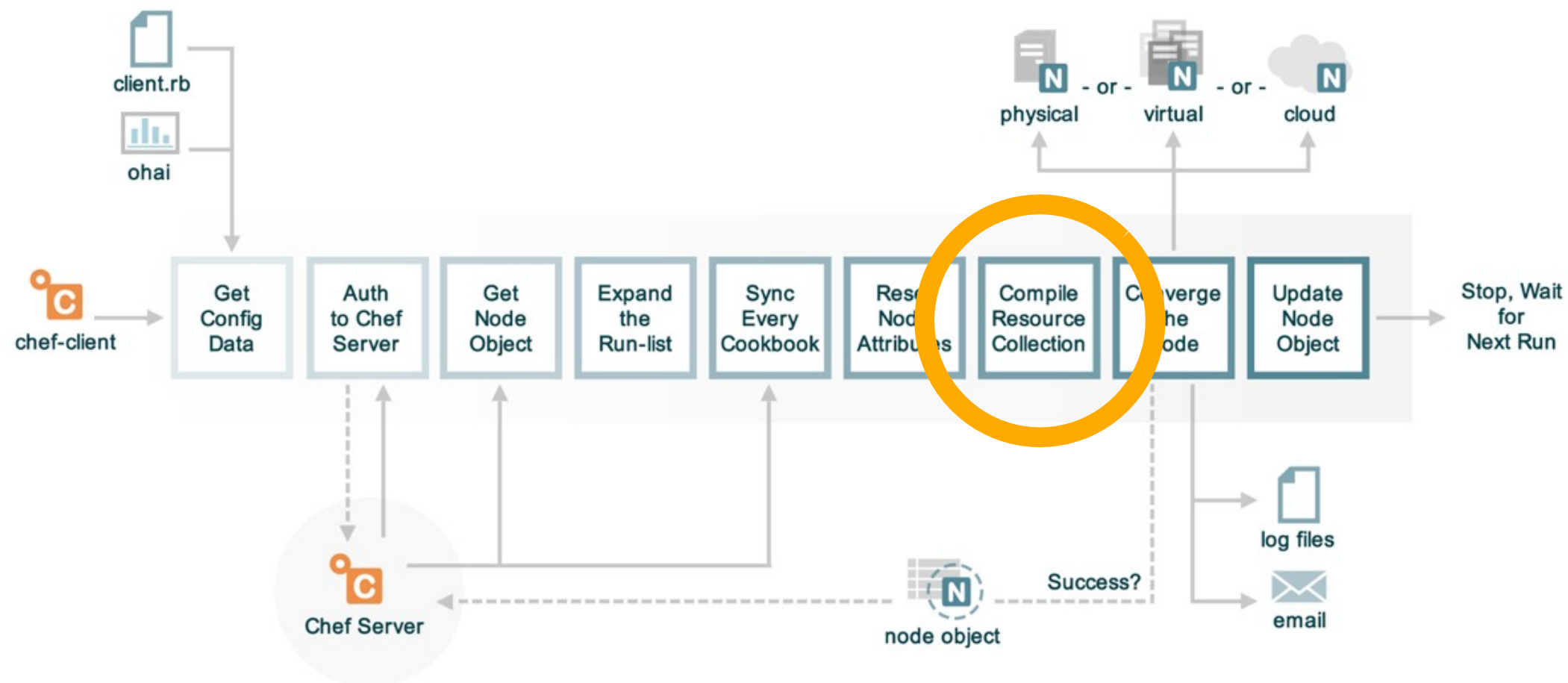
Customizations

- Ohai Plugins

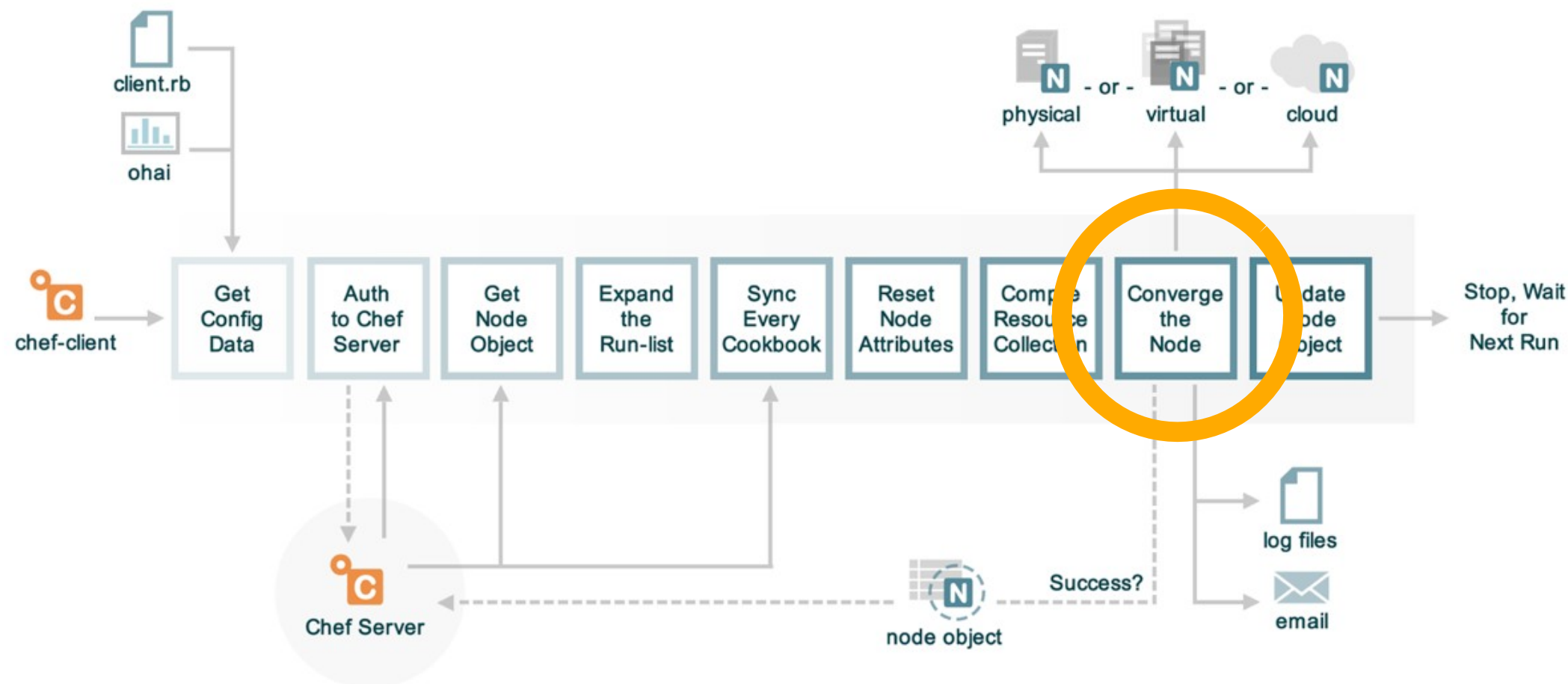


Customizations

- LWRPs
- HWRPs
- Libraries



Customizations



- Exception Handlers
- Report Handlers

What is the run_context?

- Master object for the Chef run for this node
- Important parts of the hierarchy:
 - `run_context`
 - `node`
 - `chef_environment`
 - `run_status`
 - `run_state`
 - `cookbook_collection`
 - `resource_collection`
 - `events`

What is the `run_status`?

- Hangs off `node`
- Stores current status of run
- Resources that are converged, resources that changed during this run
- Run status methods (`success?` / `failed?`)
- We'll use this object later when we write event handlers

What is the run_state?

- A Hash that hangs off node
- A place for you to stash transient data during the run
- Transmits data between resources



The Problem and Success Criteria

- **Problem:** We can't decide what scripting language we want to use to write our web application.
- **Success Criteria:** Chef has randomly chosen one for us each time it runs.



or



Practical Extraction and Report Language

Exercise: Update the metadata.rb



OPEN IN EDITOR: cookbooks/apache/metadata.rb

```
name                'apache'
maintainer           'Your Name'
maintainer_email     'your_email@example.com'
license              'All rights reserved'
description          'Installs/Configures apache'
long_description     IO.read(File.join(File.dirname(__FILE__), 'README.md'))
version              '0.5.0'

depends               'ohai'
```

SAVE FILE!

Exercise: Edit Apache recipe



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

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

ruby_block "randomly_choose_language" do
  block do
    if Random.rand > 0.5
      node.run_state['scripting_language'] = 'php'
    else
      node.run_state['scripting_language'] = 'perl'
    end
  end
end

package "scripting_language" do
  package_name lazy { node.run_state['scripting_language'] }
  action :install
end
```

SAVE FILE!

ruby_block resource

```
ruby_block "randomly_choose_language" do
  block do
    if Random.rand > 0.5
      node.run_state['scripting_language'] = 'php'
    else
      node.run_state['scripting_language'] = 'perl'
    end
  end
end
```

- `ruby_block` declares a block of Ruby to run at **execute** time
- It has direct access to the `node` structure and other aspects of the run
- Store something on `node.run_state` for later use

node.run_state

```
node.run_state['scripting_language'] = 'php'
```

- `node.run_state` is an empty Hash
- Discarded at the end of the run

Lazy parameter evaluation

```
package "scripting_language" do
  package_name lazy { node.run_state['scripting_language'] }
  action :install
end
```

- Normally resource parameters must be specified completely at **compile** time
- Sometimes their value is not known until **execute** time
- Use the `lazy{ }` block to have parameters evaluated then

Upload the new apache cookbook

```
$ knife cookbook upload apache
```

```
Uploading apache [0.5.0]  
Uploaded 1 cookbook.
```

Run Chef Client

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

- * ruby_block[randomly_choose_language] action run
 - execute the ruby block randomly_choose_language
- * package[scripting_language] action install
 - install version 5.3.3-27.el6_5 of package php

Review Questions

- Where would you stash transient data during the run?
- What object stores the current status of the run?
- What resource allows you to execute ruby code at execute time?
- What can be used to populate resource attributes at execute time?

Implementing Chef Handlers

Communicating the Status of a Chef Client Run

v1.2.1

Lesson Objectives

- After completing this lesson, you will be able to
 - Describe Chef handlers
 - Write custom report handlers
 - Distribute handlers to nodes
 - Configure Chef to use custom handlers

Handlers

- Handlers run at the start or end of a chef-client run
- They are *Ruby programs* that can read the status information of your chef-client run
- Three types:
 - Report
 - Exception
 - Start

Report Handlers

- Used when a chef-client run succeeds
- Runs when the `run_status.success?` is `true`
- Community Examples:
 - http://amplifiedata.org/splunk_storm_chef_handler.html
 - <http://onddo.github.io/chef-handler-zookeeper/>
 - https://github.com/realityforge/chef-graphite_handler

Exception Handlers

- Used when a chef-client run fails
- Runs when the `run_status.failed?` is `true`
- Community Examples:
 - https://github.com/morgoth/airbrake_handler
 - https://github.com/jblaine/syslog_handler
 - <http://onddo.github.io/chef-handler-sns/>

Start Handlers

- Used to run events at the beginning of the chef-client run
- May **NOT** be loaded using the `chef_handler` resource
- Install with `chef_gem` or add to the `start_handlers` setting in the `client.rb`
- <https://github.com/chef/chef-reporting>

Writing Custom Handlers

- Use any ruby gem or library
- Distribute to nodes with the `chef_handler` or `chef-client` cookbooks
- Optionally configure through `client.rb` settings

Exercise: Download the chef_handler Cookbook

```
$ knife cookbook site download chef_handler 1.1.9
```

```
Downloading chef_handler from the cookbooks site  
at version 1.1.9 to /Users/YOU/chef-repo/  
chef_handler-1.1.9.tar.gz
```

```
Cookbook saved: /Users/YOU/chef-repo/  
chef_handler-1.1.9.tar.gz
```

Exercise: Download the chef-client Cookbook

```
$ tar -zxvf chef_handler-1.1.9.tar.gz -C cookbooks/
```

```
x chef_handler/  
x chef_handler/CHANGELOG.md  
x chef_handler/README.md  
x chef_handler/attributes  
x chef_handler/attributes/default.rb  
x chef_handler/files  
x chef_handler/files/default  
x chef_handler/files/default/handlers  
x chef_handler/files/default/handlers/README  
x chef_handler/libraries  
x chef_handler/libraries/matchers.rb
```

Exercise: Upload the chef_handler Cookbook

```
$ knife cookbook upload chef_handler
```

```
Uploading chef_handler           [1.1.9]  
Uploaded 1 cookbook.
```

The Problem and Success Criteria

- **Problem:** When a chef-client run ends we want to be notified via email of only the resources that have changed on the node.
- **Success Criteria:** We receive an email containing the resource changed on the node.

Let's Write a Handler

- We're going to write a new handler that will **email** us when chef-client runs
- It will send us all of the resources that changed during the chef-client run
- <http://docs.chef.io/handlers.html>

Dear Ruby, How Do You Email?

- Handlers are *Ruby programs* that can read the status information of your chef-client run
- We could write a library to send an email or we could look for one

Dear Ruby, How Do You Email?

- We could look at Ruby's Standard Library - <http://www.rubydoc.info/stdlib/core/1.9.3> - but that won't get it
- Or we could look at Ruby's Extended Library - <http://www.rubydoc.info/stdlib> - but we won't find it there
- We could look at Ruby gems - <https://www.rubygems.org/> - to no avail
- This will do it - https://www.ruby-toolbox.com/categories/e_mail

Library Cookbook Pattern

- We could modify the `chef_handler` cookbook to add a recipe for the email handler
- However, we'd basically be “**forking**” an upstream cookbook
- Instead, let's create our own cookbook and use `chef_handler` as a “**library**”
- Code reusability!

Exercise: Create a Cookbook Named 'email_handler'

```
$ knife cookbook create email_handler
```

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

Exercise: Edit the default Recipe



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

```
chef_gem "pony" do
  action :install
end

include_recipe "chef_handler"

# ... CONTINUES ON NEXT SLIDE ...
```

SAVE FILE

Exercise: Setup the Handler



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

```
chef_gem "pony" do
  action :install
end
```

```
include_recipe "chef_handler"
```

```
cookbook_file "#{node['chef_handler']['handler_path']}/email_handler.rb" do
  source "handlers/email_handler.rb"
  owner "root"
  group "root"
  mode "0644"
end
```

```
# ... CONTINUES ON NEXT SLIDE ...
```

SAVE FILE!

The chef_handler Resource

- **chef_handler** is a resource packaged with the chef_handler cookbook
- It has two actions, **:enable** and **:disable**
- It has three arguments
 - **source** - the file containing the handler code
 - **arguments** - any pieces of information needed to initialize the handler
 - **supports** - **:report**, **:exception**
- Defaults:
 - **:enable**
 - **:report => true, :exception => true**

Exercise: Setup the Handler



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

```
# ... CONTINUES FROM PREVIOUS SLIDE ...

chef_handler "MyCompany::EmailMe" do
  source "#{node['chef_handler']['handler_path']}/email_handler.rb"
  arguments [node['email_handler']['from_address'],
             node['email_handler']['to_address']]
  action :enable
end
```

SAVE FILE!

Exercise: Set the Attributes



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

```
default['email_handler']['from_address'] = "chef@localhost"  
default['email_handler']['to_address'] = "chef@localhost"
```

SAVE FILE!

Exercise: Write the Handler



OPEN IN EDITOR: ../email_handler/files/default/handlers/email_handler.rb

```
require 'rubygems'
require 'pony'

module MyCompany
  class EmailMe < Chef::Handler
    # ... CONTINUES ON NEXT SLIDE ...
  end
end
```

- All custom exception and report handlers are defined using Ruby and must be a subclass of the `Chef::Handler` class.
- The module and class match what we defined as the name of the chef_handler in the recipe

The initialize Method



OPEN IN EDITOR: ../email_handler/files/default/handlers/email_handler.rb

```
module MyCompany
  class EmailMe < Chef::Handler

    def initialize(from_address, to_address)
      @from_address = from_address
      @to_address = to_address
    end

    # ... CONTINUES ON NEXT SLIDE ...
  end
end
```

- Initialize the handler with the arguments we passed in the definition
- You can create the method with any args you need to meet your requirements

The Report Method



OPEN IN EDITOR: ../email_handler/files/default/handlers/email_handler.rb

```
# ... CONTINUES FROM PREVIOUS SLIDE ...

def report
  status = "Failed"
  if success?
    status = "Successful"
  end
  subject = "#{status} Chef run report from #{node.name}"
  # ... CONTINUES ON NEXT SLIDE ...
```

- The **report** interface is used to define how a handler will behave and is a required part of any custom handler

The updated_resources Hash



OPEN IN EDITOR: ../email_handler/files/default/handlers/email_handler.rb

```
# ... CONTINUES FROM PREVIOUS SLIDE ...
body = ""
if ! run_status.updated_resources.empty?
  # get some info about all the changed resources!
  run_status.updated_resources.each do |r|
    body += "The resource #{r.name} was changed in cookbook
#{r.cookbook_name} at #{r.source_line}\n"
  end
else
  body += "No resources changed by chef-client\n"
end
# ... CONTINUES ON NEXT SLIDE ...
```

- **updated_resources** records information about all the resources changed during a chef-client run
- read through this hash with **.each**, pull interesting information out about each resource

Exercise: Finish email_handler.rb



OPEN IN EDITOR: ../email_handler/files/default/handlers/email_handler.rb

```
# ... CONTINUES FROM PREVIOUS SLIDE ...  
  
Pony.mail(:to => @to_address,  
          :from => @from_address,  
          :subject => subject,  
          :body => body)  
  
end  
end  
end
```

SAVE FILE!

- Use `Pony.mail` to send a message containing info on changed resources

Other Dependencies

- Make sure all necessary functions are available!
 - Some sort of mail transfer agent (MTA)
 - Some sort of email reader (MUA)
- These are distinct functional pieces
 - May have uses other than the handler
 - Get to be their own cookbooks!

Exercise: Download the postfix Cookbook

```
$ knife cookbook site download postfix 3.6.2
```

```
Downloading postfix from the cookbooks site  
at version 3.6.2 to /Users/YOU/chef-repo/  
postfix- 3.6.2.tar.gz
```

```
Cookbook saved: /Users/YOU/chef-  
repo/ postfix- 3.6.2.tar.gz
```

Exercise: Download the postfix Cookbook

```
$ tar -zxvf postfix-3.6.2.tar.gz -C cookbooks/
```

```
x postfix/  
x postfix/CHANGELOG.md  
x postfix/README.md  
x postfix/attributes  
x postfix/attributes/default.rb  
x postfix/files  
x postfix/files/default  
x postfix/files/default/tests  
x postfix/files/default/tests/minitest  
x postfix/files/default/tests/minitest/support
```


Exercise: Upload the postfix Cookbook

```
$ knife cookbook upload postfix
```

```
Uploading postfix  
upload complete
```

```
[3.6.2]
```

Exercise: Create the mailx Cookbook

```
$ knife cookbook create mailx
```

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

Exercise: Install the Package

 **OPEN IN EDITOR:** `cookbooks/mailx/recipes/default.rb`

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

SAVE FILE!

Exercise: Upload the email_handler Cookbook

```
$ knife cookbook upload mailx
```

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

Exercise: Add the Mail Dependencies



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

```
chef_gem "pony" do
  action :install
end

include_recipe "chef_handler"
include_recipe "postfix"
include_recipe "mailx"
```

Include the postfix cookbook default recipe and mailx cookbook default recipe to the email_handler's default recipe.

SAVE FILE!

Exercise: Update the metadata.rb

 **OPEN IN EDITOR:** cookbooks/email_handler/metadata.rb

```
name          "email_handler"
maintainer     "You"
maintainer_email "you@somewhere.com"
license        "Apache 2.0"
description    "Email me on every Chef run"
long_description IO.read(File.join(File.dirname(__FILE__),
  'README.md' ))
version        "0.1.0"
```

```
depends "chef_handler"
depends "postfix"
depends "mailx"
```

SAVE FILE!

Exercise: Upload the email_handler Cookbook

```
$ knife cookbook upload email_handler
```

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

Exercise: Add email_handler to Base Role



OPEN IN EDITOR: roles/base.rb

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

SAVE FILE

Best Practice: Add Handlers at Beginning of Run

- Set up handlers (especially exception handlers) at the beginning of the run_list
- That way, if the run fails, the handler will still execute

Exercise: Upload the base Role

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

```
Updated Role base!
```

Exercise: Run chef-client

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

```
...  
* chef_handler[MyCompany::EmailMe] action enable  
  - load /var/chef/handlers/email_handler.rb  
  - enable chef_handler[MyCompany::EmailMe] as a  
report handler  
  - enable chef_handler[MyCompany::EmailMe] as a  
exception handler  
...
```

Read the Message Using "mail"

```
chef@node1$ mail
```

```
Heirloom Mail version 12.4 7/29/08. Type ? for help.
```

```
"/var/spool/mail/chef": 1 message 1 new
```

```
>N 1 pony@unknown Wed May 14 09:14 30/2412 "Successful Chef run report from node1"
```

```
& r
```

```
To: chef@localhost pony@unknown
```

```
Subject: Re: Successful Chef run report from node1
```

```
pony@unknown wrote:
```

```
> The resource pony was changed in cookbook email_handler at /var/chef/cache/cookbooks/  
email_handler/recipes/default.rb:9:in `from_file'
```

```
> The resource /var/chef/handlers was changed in cookbook chef_handler at /var/chef/cache/  
cookbooks/chef_handler/recipes/default.rb:23:in `from_file'
```

```
> The resource /etc/postfix/main.cf was changed in cookbook postfix at /var/chef/cache/  
cookbooks/postfix/recipes/default.rb:95:in `block in from_file'
```

```
> The resource /etc/postfix/master.cf was changed in cookbook postfix at /var/chef/cache/  
cookbooks/postfix/recipes/default.rb:95:in `block in from_file'
```

Review Questions

- What cookbook is used to configure Chef Handlers?
- What are the three types of Chef Handler?
- When are Start Handlers run?
- When are Report Handlers run?
- When are Exception Handlers run?

Implementing Chef Handlers

Communicating the Status of a Chef Client Run

v1.2.1

Lesson Objectives

- After completing this lesson, you will be able to
 - Describe Chef handlers
 - Write custom report handlers
 - Distribute handlers to nodes
 - Configure Chef to use custom handlers

Handlers

- Handlers run at the start or end of a chef-client run
- They are *Ruby programs* that can read the status information of your chef-client run
- Three types:
 - Report
 - Exception
 - Start

Report Handlers

- Used when a chef-client run succeeds
- Runs when the `run_status.success?` is `true`
- Community Examples:
 - http://amplifiedata.org/splunk_storm_chef_handler.html
 - <http://onddo.github.io/chef-handler-zookeeper/>
 - https://github.com/realityforge/chef-graphite_handler

Exception Handlers

- Used when a chef-client run fails
- Runs when the `run_status.failed?` is `true`
- Community Examples:
 - https://github.com/morgoth/airbrake_handler
 - https://github.com/jblaine/syslog_handler
 - <http://onddo.github.io/chef-handler-sns/>

Start Handlers

- Used to run events at the beginning of the chef-client run
- May **NOT** be loaded using the `chef_handler` resource
- Install with `chef_gem` or add to the `start_handlers` setting in the `client.rb`
- <https://github.com/chef/chef-reporting>

Writing Custom Handlers

- Distribute to nodes with the `chef_handler` or `chef-client` cookbooks
- Optionally configure through `client.rb` settings

Exercise: Download the chef_handler Cookbook

```
$ knife cookbook site download chef_handler 1.1.9
```

```
Downloading chef_handler from the cookbooks site  
at version 1.1.9 to /Users/YOU/chef-repo/  
chef_handler-1.1.9.tar.gz
```

```
Cookbook saved: /Users/YOU/chef-repo/  
chef_handler-1.1.9.tar.gz
```

Exercise: Download the chef-client Cookbook

```
$ tar -zxvf chef_handler-1.1.9.tar.gz -C cookbooks/
```

```
x chef_handler/  
x chef_handler/CHANGELOG.md  
x chef_handler/README.md  
x chef_handler/attributes  
x chef_handler/attributes/default.rb  
x chef_handler/files  
x chef_handler/files/default  
x chef_handler/files/default/handlers  
x chef_handler/files/default/handlers/README  
x chef_handler/libraries  
x chef_handler/libraries/matchers.rb
```

Exercise: Upload the chef_handler Cookbook

```
$ knife cookbook upload chef_handler
```

```
Uploading chef_handler          [1.1.9]  
Uploaded 1 cookbook.
```

The Problem and Success Criteria

- **Problem:** When a chef-client run ends we want to write to a file all the resources that have changed on the node.
- **Success Criteria:** We see a file that containing the resource changed on the node.

Let's Write a Handler

- We're going to write a new handler that will **create a file** when chef-client runs
- It will store all of the resources that changed during the chef-client run
- <http://docs.chef.io/handlers.html>

Library Cookbook Pattern

- We could modify the `chef_handler` cookbook to add a recipe for the file handler
- However, we'd basically be “**forking**” an upstream cookbook
- Instead, let's create our own cookbook and use `chef_handler` as a “**library**”
- Code reusability!

Exercise: Create a Cookbook Named 'file_handler'

```
$ chef generate cookbook cookbooks/file_handler
```

```
Compiling Cookbooks...
```

```
Recipe: code_generator::cookbook
```

```
  * directory[/Users/username/chef-repo/cookbooks/file_handler] action create
```

```
    - create new directory /Users/username/chef-repo/cookbooks/file_handler
```

```
  * template[/Users/username/chef-repo/cookbooks/file_handler/metadata.rb]
```

```
  action create_if_missing
```

```
    - create new file /Users/username/chef-
```

```
repo/cookbooks/file_handler/metadata.rb
```

```
    - update content in file /Users/username/chef-
```

```
repo/cookbooks/file_handler/metadata.rb from none to 9f7125
```

```
    (diff output suppressed by config)
```

Exercise: Edit the default recipe



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

```
include_recipe "chef_handler"

cookbook_file "<#{node['chef_handler']['handler_path']}/file_handler.rb" do
  source "file_handler.rb"
  owner "root"
  group "root"
  mode "0644"
end

# ... CONTINUED ON THE NEXT SLIDE ...
```

SAVE FILE

The chef_handler Resource

- **chef_handler** is a resource packaged with the chef_handler cookbook
- It has two actions, **:enable** and **:disable**
- It has three arguments
 - **source** - the file containing the handler code
 - **arguments** - any pieces of information needed to initialize the handler
 - **supports** - **:report**, **:exception**
- Defaults:
 - **:enable**
 - **:report => true, :exception => true**

Exercise: Edit the default recipe



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

```
# ... CONTINUED FROM THE PREVIOUS SLIDE ...

cookbook_file "#{node['chef_handler']['handler_path']}/file_handler.rb" do
  source "file_handler.rb"
  owner "root"
  group "root"
  mode "0644"
end

chef_handler "CompanyName::FileHandler" do
  source "#{node['chef_handler']['handler_path']}/file_handler.rb"
end
```

SAVE FILE

Exercise: Create a file in the cookbook

```
$ chef generate file cookbooks/file_handler file_handler.rb
```

Compiling Cookbooks...

Recipe: code_generator::cookbook_file

- * directory[/Users/username/chef-repo/cookbooks/file_handler/files/default] action create

- create new directory /Users/username/chef-repo/cookbooks/file_handler/files/default

- * template[/Users/username/chef-repo/cookbooks/file_handler/files/default/file_handler.rb] action

create

- create new file /Users/username/chef-repo/cookbooks/file_handler/files/default/file_handler.rb

- update content in file /Users/username/chef-

repo/cookbooks/file_handler/files/default/file_handler.rb from none to e3b0c4

Exercise: Write the Handler

 **OPEN IN EDITOR:** ../file_handler/files/default/file_handler.rb

```
module CompanyName
  class FileHandler < Chef::Handler
    def report
      # TODO: write the report handling
    end
  end
end
```

- The module and class match what we defined as the name of the chef_handler in the recipe
- All custom exception and report handlers must be a subclass of the **Chef::Handler** class.

Exercise: Write the Handler

 **OPEN IN EDITOR:** ../file_handler/files/default/file_handler.rb

```
module CompanyName
  class FileHandler < Chef::Handler
    def report
      # TODO: write the report handling
    end
  end
end
```

- The **report** method is used to define how a handler will behave and is a required part of any custom handler

Exercise: Write the Handler

 **OPEN IN EDITOR:** ../file_handler/files/default/file_handler.rb

```
def report
  message = ""

  if run_status.updated_resources.empty?
    message += "No resources changed by chef-client - #{Time.now}"
  else
    run_status.updated_resources.each do |r|
      message += "The resource #{r.name} from"
      message += " #{r.cookbook_name}::#{r.recipe_name}"
      message += " :#{r.source_line} was changed.\n"
    end
  end
  File.write("/var/log/chef-client_updated.log", message)
end
```

Exercise: Update the metadata.rb

 **OPEN IN EDITOR:** cookbooks/file_handler/metadata.rb

```
name          "file_handler"
maintainer     "You"
maintainer_email "you@somewhere.com"
license        "Apache 2.0"
description    ""
long_description IO.read(File.join(File.dirname(__FILE__),
  'README.md' ))
version        "0.1.0"
```

```
depends "chef_handler"
```

SAVE FILE!

Exercise: Upload the Cookbook

```
$ knife cookbook upload file_handler
```

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

Exercise: Add file_handler to Base Role



OPEN IN EDITOR: roles/base.rb

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

SAVE FILE

Best Practice: Add Handlers at Beginning of Run

- Set up handlers (especially exception handlers) at the beginning of the run_list
- That way, if the run fails, the handler will still execute

Exercise: Upload the base Role

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

```
Updated Role base!
```

Exercise: Run chef-client

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

```
Recipe: chef_handler::default
  * remote_directory[/var/chef/handlers] action nothing (skipped due to
act...
Recipe: file_handler::default
  * cookbook_file[/var/chef/handlers/file_handler.rb] action create (up to
...
  * chef_handler[CompanyName::FileHandler] action enable
    - disable CompanyName::FileHandler as a report handler
    - disable CompanyName::FileHandler as a exception handler
    - load CompanyName::FileHandler from /var/chef/handlers/file_handler.rb
    - enable chef_handler[CompanyName::FileHandler] as a report handler
    - enable chef_handler[CompanyName::FileHandler] as a exception handler
```


Read the log file

```
chef@node1$ cat /var/log/chef-client_updated.log
```

```
Chef Client Finished Running at 2015-09-25 02:47:13 +0000  
The resource CompanyName::FileHandler from  
file_handler::default:/var/chef/cache/cookbooks/file_handler/recipes/default  
.rb:16:in `from_file' was changed.
```

Review Questions

- When are Report Handlers run?
- When are Exception Handlers run?
- What cookbook is used to configure Chef Handlers?
- What class do custom handlers subclass?
- What method must a custom handler implement?
- Where should recipes that load handlers be placed in the run_list?

Cookbook Style & Correctness

The Real Benefits of Infrastructure as Code

v1.2.1

Lesson Objectives

- After completing this lesson, you will be able to:
 - Explain the benefits of correctness checking your cookbooks
 - Explain how and why you should test your cookbooks

Devops is a Two-Way Street

- It's great when developers care about
 - **uptime!**
 - **scaling!**
 - **deployment!**
- Put them on call!
etc. etc. etc.



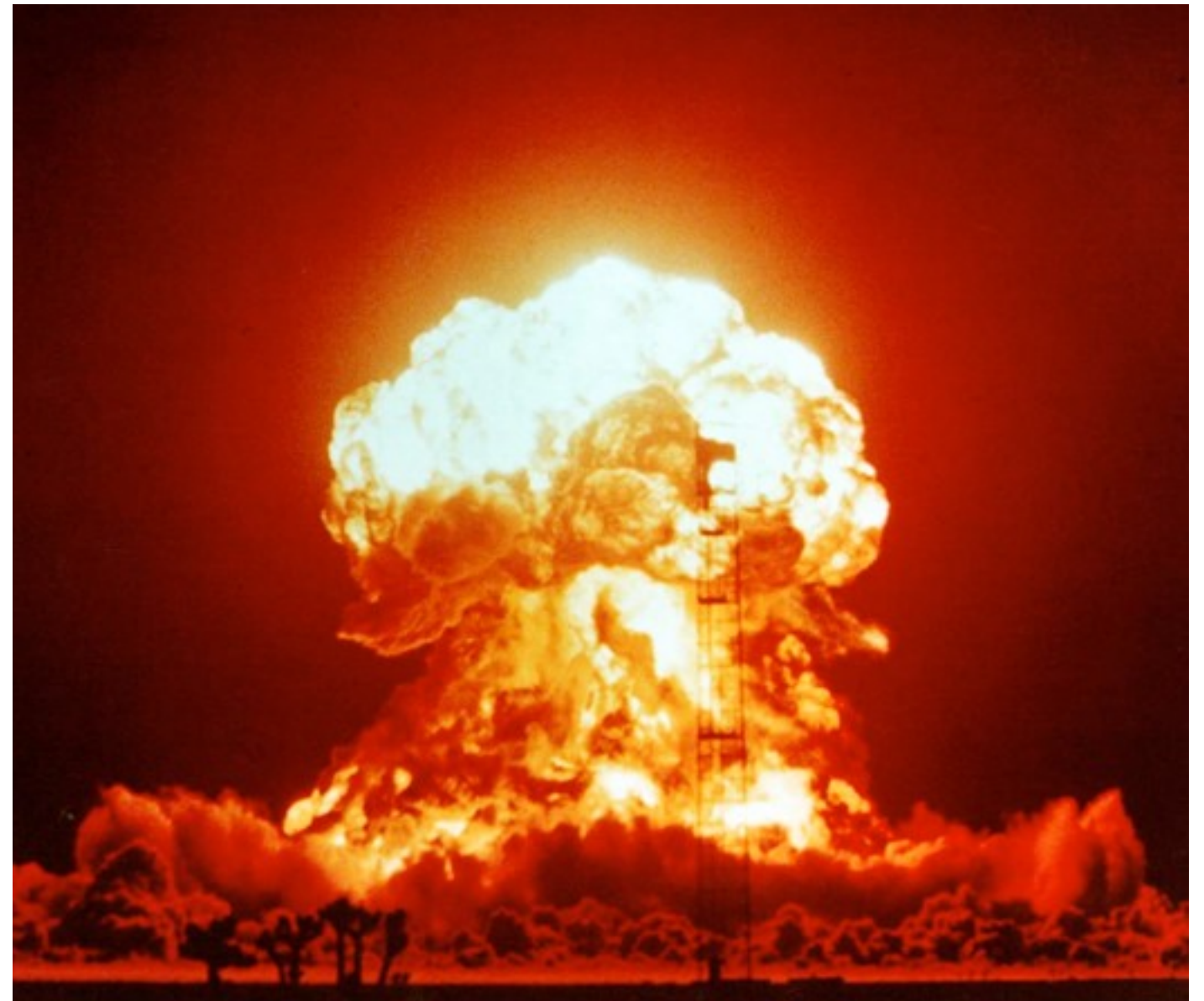
Devops is a Two-Way Street



- **Operations** also has as much or more to learn from developers as well!

Old Software Development Workflow

- Write some code
- <ad-hoc verification here>
- Go to pre-production
- <ad-hoc verification here>
- Go to production
- **Production failure**



New Software Development Workflow

- Write some code
- Write and run some **unit tests**
- Go to pre-production
- Run some **integration/acceptance tests**
- Go to production
- **Lowered chance of production failure**



Old Chef Cookbook Workflow

- Write some cookbook code
- <ad-hoc verification here>
- Go to pre-production
- <ad-hoc verification here>
- Go to production
- **Whoops, broke production**



New Chef Cookbook Workflow

- Write some cookbook code
- Check for **code correctness**
- Write and run some **unit tests**
- Go to pre-production
- Run some **integration tests**
- Go to production



Tools of the Trade

- **Code correctness:** Foodcritic, Rubocop
- **Unit tests:** ChefSpec
- **Integration tests** (not covered in this class): Test Kitchen, ServerSpec, BATS

Foodcritic

v1.2.1

Module Objectives

- After completing this module, you should be able to:
 - Use Foodcritic to avoid common cookbook errors

What is Foodcritic?

- A lint testing tool, or correctness checker
- Ensure you adhere to best practices for cookbook style
- Ability to write and use custom rules
- <http://foodcritic.io/>



Foodcritic

- A **code linting** tool for Chef
 - Checks **code correctness**
 - **Catches common mistakes** before they cause problems
 - Extensible & Configurable
 - Create new **rulesets**
 - Ignore existing rulesets
- Integrates nicely into **CI pipelines**

Rules and Tags

- All rules are numbered, e.g.
 - *FC002* - *"Avoid string interpolation where not required"*
 - *FC034* - *"Unused template variables"*
- Rules can be categorized and tagged, e.g.
 - 'style'
 - 'portability'
 - ...

FC002: Avoid string interpolation where not required

style strings

When you declare a resource in your recipes you frequently want to reference dynamic values such as node attributes. This warning will be shown if you are unnecessarily wrapping an attribute reference in a string.

Unnecessary string interpolation

This example would match the FC002 rule because the `version` attribute has been unnecessarily quoted.

```
# Don't do this
package "mysql-server" do
  version "#{node['mysql']['version']}"
  action :install
end
```

Modified version

This modified example would not match the FC002 rule:

```
package "mysql-server" do
  version node['mysql']['version']
  action :install
end
```


Abide by Best Practices

- There are 50+ rules in Foodcritic; your cookbooks should pass them (or have a good reason if they do not)
- You can write your own rules.
- Extra community-contributed rules:
<http://www.foodcritic.io/#extra-rules>

The Problem and the Success Criteria

- **The Problem:** We want to make sure our Apache cookbook follows best practice for Chef code
- **Success Criteria:** We use Foodcritic to check our cookbook before committing it

Foodcritic

- If you are using the ChefDK, you already have foodcritic installed
- Located at: `.\chefdk\embedded\bin\foodcritic`

Exercise: Check Cookbook Correctness with Foodcritic

```
$ foodcritic cookbooks/apache
```

```
FC003: Check whether you are running with chef server before using server-  
specific features: ./recipes/default.rb:43  
FC003: Check whether you are running with chef server before using server-  
specific features: ./recipes/iplogger.rb:1  
FC008: Generated cookbook metadata needs updating: ./metadata.rb:2  
FC008: Generated cookbook metadata needs updating: ./metadata.rb:3  
FC009: Resource attribute not recognised: ./recipes/default.rb:27  
FC016: LWRP does not declare a default action: ./resources/vhost.rb:1
```

Exercise: Narrow the Tests

```
$ foodcritic cookbooks/apache -t ~FC003 -t ~FC009
```

```
FC008: Generated cookbook metadata needs updating: ./metadata.rb:2  
FC008: Generated cookbook metadata needs updating: ./metadata.rb:3  
FC016: LWRP does not declare a default action: ./resources/vhost.rb:1
```

Exercise: Fix the Cookbook to Clear the Errors

```
$ foodcritic cookbooks/apache -t ~FC003 -t ~FC009
```

```
(no output)
```

- Edit your cookbook to fix the **FC008** & **FC016** errors, then rerun your Foodcritic
- Refer to <http://www.foodcritic.io/> to find the errors
- No output means no errors!

Running Certain Tests

- Run only certain categories of test

```
$ foodcritic <path> -t style
```

- Run specific tests

```
$ foodcritic <path> -t FC034
```

- Exclude specific tests

```
$ foodcritic <path> -t ~FC034
```

Saving Foodcritic Rules

- When you have defined your set of tag options, you can save them to a file called **.foodcritic**
- Foodcritic will read that file upon execution, and use those as the default options

Best Practice: Run Foodcritic Before Each Commit

- Always **check** in correct code!
- Make **Foodcritic** a part of your **build pipeline** with commit hooks or other methods
- The Foodcritic web page has extensive documentation & examples showing how to build Foodcritic rules into Jenkins or Travis-CI

Rubocop

v1.2.1

Lesson Objectives

- After completing this lesson, you should be able to
 - Evaluate your Ruby coding style against community standards
 - Improve your code by iterating through style warnings
 - Prevent specific rules from generating warnings

The Problem and the Success Criteria

- **The Problem:** We want to make sure our Apache cookbook follows best practice for Ruby code
- **Success Criteria:** We use Rubocop to check our cookbook before committing it

Rubocop

- New Ruby developers often ask for guidance on writing idiomatic Ruby
- Rubocop gives the same kind of feedback for your Ruby style that Foodcritic gives for your Chef Code
- Evaluates your Chef code for Ruby best practices, not for Chef style
- Documentation located here

<https://github.com/bbatsov/rubocop>

Navigate to Apache Cookbook

```
$ cd cookbooks/apache
```

Exercise: Use Additional Rules

```
$ rubocop
```

```
recipes/default.rb:53:7: C: Use the new Ruby 1.9 hash syntax.
```

```
  :site_name => site_name,
```

```
^^^^^^^^^^^^^^
```

```
recipes/default.rb:54:7: C: Use the new Ruby 1.9 hash syntax.
```

```
  :port => site_data["port"]
```

```
^^^^^^
```

```
recipes/default.rb:54:26: C: Prefer single-quoted strings when you don't need  
string interpolation or special symbols.
```

```
  :port => site_data["port"]
```

```
^^^^^
```

```
4 files inspected, 50 offences detected
```

Fixing Rubocop Offenses

- We can mask offenses using the rubocop configuration file `.rubocop.yml`
- Rubocop can automatically generate a configuration called file named `.rubocop_todo.yml` that contains entries to mask all of your offenses
- We can use `.rubocop_todo.yml` to iterate through the offenses
- `.rubocop_todo.yml` settings are documented at <https://github.com/bbatsov/rubocop/blob/master/README.md>

Exercise: Generate .rubocop_todo.yml

```
$ rubocop --auto-gen-config
```

```
recipes/default.rb:54:7: C: Use the new Ruby 1.9 hash syntax.
```

```
  :port => site_data["port"]  
  ^^^^^^^
```

```
recipes/default.rb:54:26: C: Prefer single-quoted strings when you don't need  
string interpolation or special symbols.
```

```
  :port => site_data["port"]  
                ^^^^^^^
```

```
7 files inspected, 38 offences detected
```

```
Created .rubocop_todo.yml.
```

```
Run rubocop with --config .rubocop_todo.yml, or  
add inherit from: .rubocop_todo.yml in a .rubocop.yml file.
```

Exercise: Review .rubocop_todo.yml



OPEN IN EDITOR: .rubocop_todo.yml

```
This configuration was generated by `rubocop --auto-gen-config`  
# on 2014-10-09 10:42:37 -0400 using RuboCop version 0.18.1.  
# The point is for the user to remove these configuration records  
# one by one as the offences are removed from the code base.  
# Note that changes in the inspected code, or installation of new  
# versions of RuboCop, may require this file to be generated again.  
  
# Offence count: 4  
# Cop supports --auto-correct.  
# Configuration parameters: SupportedStyles.  
HashSyntax:  
  EnforcedStyle: hash_rockets  
  
# Offence count: 2  
LineLength:  
  Max: 127
```

Exercise: Review .rubocop_todo.yml



OPEN IN EDITOR: `.rubocop_todo.yml`

```
# Offence count: 2
# Cop supports --auto-correct.
SpaceInsideBrackets:
  Enabled: false

# Offence count: 28
# Cop supports --auto-correct.
# Configuration parameters: EnforcedStyle, SupportedStyles.
StringLiterals:
  Enabled: false

# Offence count: 1
# Cop supports --auto-correct.
TrailingWhitespace:
  Enabled: false
```

Exercise: Update .rubocop.yml



OPEN IN EDITOR: .rubocop.yml

```
inherit from: .rubocop_todo.yml
```

SAVE FILE!

Exercise: Re-run rubocop

```
$ rubocop
```

```
Inspecting 7 files
```

```
.....
```

```
4 files inspected, no offences detected
```

Work Through the Issues

- We now have a configuration file that masks all of our offenses
- We want to fix some of the offenses and mask the others
- Move the configuration rules for the offenses we want to continue masking from `.rubocop_todo.yml` to `.rubocop.yml`

Exercise: Update Rubocop Configuration



OPEN IN EDITOR: `cookbooks/apache/.rubocop.yml`

```
#inherit from: .rubocop_todo.yml <<- Comment out this line
```

```
Encoding:
```

```
  Enabled: false
```

```
LineLength:
```

```
  Max: 200
```

```
HashSyntax:
```

```
  EnforcedStyle: hash_rockets
```

```
StringLiterals:
```

```
  Enabled: false
```

SAVE FILE!

Exercise: Re-generate .rubocop_todo.yml

```
$ rubocop --auto-gen-config
```

```
recipes/default.rb:15:11: C: Space inside square brackets detected.  
  action [ :enable, :start ]  
          ^  
recipes/default.rb:15:27: C: Space inside square brackets detected.  
  action [ :enable, :start ]  
              ^  
recipes/default.rb:19:87: C: Trailing whitespace detected.  
execute "mv /etc/httpd/conf.d/welcome.conf /etc/httpd/conf.d/welcome.conf.disabled" do  
                                                                 ^  
  
7 files inspected, 4 offences detected  
Created .rubocop_todo.yml.  
Run rubocop with --config .rubocop_todo.yml, or  
add inherit from: .rubocop_todo.yml in a .rubocop.yml file.
```


Fixing Rubocop Offenses

We decide we want to fix these offenses

1. Add `inherit from: to .rubocop.yml`
2. Remove an entry from `.rubocop_todo.yml`
3. Fix offenses
4. Verify fix by running Rubocop
5. Lather-Rinse-Repeat (steps 2-4)
6. Remove `.rubocop_todo.yml`

Exercise: Update .rubocop.yml



OPEN IN EDITOR: `.rubocop.yml`

```
inherit from: .rubocop_todo.yml    <<- Un-comment this line
```

```
Encoding:
```

```
  Enabled: false
```

```
LineLength:
```

```
  Max: 200
```

```
HashSyntax:
```

```
  EnforcedStyle: hash_rockets
```

```
StringLiterals:
```

```
  Enabled: false
```

SAVE FILE!

Exercise: Delete Entry From .rubocop_todo.yml



OPEN IN EDITOR: `.rubocop_todo.yml`

```
# Offence count: 1
# Cop supports --auto-correct.
Style/SpaceAfterComma:
  Enabled: false
```

```
# Offence count: 2
# Cop supports --auto-correct.
Style/SpaceInsideBrackets:
  Enabled: false
```

```
# Offence count: 1
# Cop supports --auto-correct.
Style/TrailingWhitespace:
  Enabled: false
```

SAVE FILE!

Exercise: Re-run rubocop

```
$ rubocop
```

```
Offences:
```

```
recipes/default.rb:19:87: C: Trailing whitespace detected.  
execute "mv /etc/httpd/conf.d/welcome.conf /etc/httpd/conf.d/welcome.conf.disabled" do  
                                                                    ^
```

```
4 files inspected, 1 offence detected
```

Exercise: Fix Default Recipe



OPEN IN EDITOR: `recipes/default.rb`

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

```
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
```

Remove trailing whitespace
from line 19

SAVE FILE!

Exercise: Re-run rubocop

```
$ rubocop
```

```
Inspecting 7 files  
.....  
7 files inspected no offenses detected
```



Review Questions

- What guidelines does Rubocop help you enforce?
- Why might you want to exclude certain cops?
- What is the name of Rubocop configuration file?

An Introduction to ChefSpec

Unit Testing Your Cookbooks to Prevent Regressions

v1.2.1

Lesson Objectives

- After completing the lesson, you will be able to:
 - Explain what unit testing means for Chef cookbooks and recipes
 - Explain why to write unit tests for Chef recipes
 - Use ChefSpec to create and manage a test suite for your cookbooks

Problem Statement

- **Problem:** We broke our motd cookbook one too many times
- **Proposed Solution:** Use ChefSpec to write tests to ensure the code is valid

Installing ChefSpec

- ChefSpec is already included in the Chef Development Kit (ChefDK)

ChefSpec is RSpec

- ChefSpec is built on-top of RSpec
 - The standard Ruby testing tool
- RSpec has a familiar, English-like syntax
- ChefSpec adds the knowledge of Chef to RSpec

Exercise: Move into cookbook

```
$ cd cookbooks/motd
```

```
(No output)
```

Exercise: Create a Spec Helper

 **OPEN IN EDITOR:** `cookbooks/motd/spec/spec_helper.rb`

```
require 'chefspec'

ChefSpec::Coverage.start!
```

SAVE FILE!

- By convention, test suites have a “helper”
- Avoid restating `require 'chefspec'` over and over
- Can configure RSpec in here (formatting, enforced style, etc.)

Exercise: Make a directories for the tests

```
$ mkdir spec  
$ mkdir spec/unit  
$ mkdir spec/unit/recipes
```

(No output)

General Test Approach

- Set up the test
 - Make a Chef run in memory
 - Set up test harness if necessary
- Make some assertions (expectations)

ChefSpec Example

```
require 'spec_helper'

describe 'cookbook_name::recipe_name' do
  let(:chef_run) do
    runner = ChefSpec::ServerRunner.new
    runner.converge(described_recipe)
  end

  it 'does something' do
    expect(chef_run).to action_resourcetype('NAME OF THE RESOURCE')
  end
end
```

<https://github.com/sethvargo/chefspec>

ChefSpec Example

```
require 'spec_helper'

describe 'cookbook_name::recipe_name' do
  let(:chef_run) do
    runner = ChefSpec::ServerRunner.new
    runner.converge(described_recipe)
  end

  it 'does something' do
    expect(chef_run).to action_resourcetype('NAME OF THE RESOURCE')
  end
end
```

Loads a file that contains common libraries and helper methods that are shared across all tests.

ChefSpec Example

```
require 'spec_helper'

describe 'cookbook_name::recipe_name' do
  let(:chef_run) do
    runner = ChefSpec::ServerRunner.new
    runner.converge(described_recipe)
  end

  it 'does something' do
    expect(chef_run).to action_resourcetype('NAME OF THE RESOURCE')
  end
end
```

This is describing the cookbook's recipe under test. The text here is the name of the fully-qualified name of the recipe to test.

ChefSpec Example

```
require 'spec_helper'

describe 'cookbook_name::recipe_name' do
  let(:chef_run) do
    runner = ChefSpec::ServerRunner.new
    runner.converge(described_recipe)
  end

  it 'does something' do
    expect(chef_run).to action_resourcetype('NAME OF THE RESOURCE')
  end
end
```

let sets up a helper 'method' named chef_run that creates our in-memory chef-client run for the cookbook recipe currently under test.

ChefSpec Example

```
require 'spec_helper'

describe 'cookbook_name::recipe_name' do
  let(:chef_run) do
    runner = ChefSpec::ServerRunner.new
    runner.converge(described_recipe)
  end

  it 'does something' do
    expect(chef_run).to action_resourcetype('NAME OF THE RESOURCE')
  end
end
```

it defines a single test. The text is used to describe the test. Within the block the expectations are defined.

ChefSpec Example

```
require 'spec_helper'

describe 'cookbook_name::recipe_name' do
  let(:chef_run) do
    runner = ChefSpec::ServerRunner.new
    runner.converge(described_recipe)
  end

  it 'does something' do
    expect(chef_run).to action_resourcetype('NAME OF THE RESOURCE')
  end
end
```

This is an expectation. Stating an expectation that the chef_run to have a resource take a particular action.

Exercise: Create a Skeleton Test



OPEN IN EDITOR: .../motd/spec/unit/recipes/default_spec.rb

```
require 'spec_helper'

describe 'motd::default' do
  let(:chef_run) do
    runner = ChefSpec::ServerRunner.new
    runner.converge(described_recipe)
  end

  it 'creates an motd correctly'
end
```

- Test file name should match recipe name (default) and **must** end in `_spec.rb`
- An `it` without a `do..end` block means the test is **pending**

Exercise: Run rspec From the Cookbook

```
$ rspec
```

```
*  
Pending:  
  motd::default creates an motd correctly  
    # Not yet implemented  
    # ./spec/unit/recipes/default_spec.rb:7  
  
Finished in 0.00033 seconds  
1 example, 0 failures, 1 pending  
  
No Chef resources found, skipping coverage calculation...
```


Exercise: Write a Real Test



OPEN IN EDITOR:

```
require 'spec_helper' /unit/recipes/default_spec.rb

describe 'motd::default' do
  let(:chef_run) do
    runner = ChefSpec::ServerRunner.new
    runner.converge(described_recipe)
  end
  it 'creates an motd correctly' do
    expect(chef_run).to create_template('/etc/motd').with(
      :user => 'root',
      :group => 'root',
      :mode => '0644'
    )
  end
end
```

SAVE FILE

Exercise: Run rspec

```
$ rspec
```

```
Failures:
```

```
1) motd::default creates an motd correctly
```

```
Failure/Error: expect(chef_run).to create_template('/etc/motd').with(  
  expected "template[/etc/motd]" to have parameters:
```

```
  user "root", was nil
```

```
  group "root", was nil
```

```
# ./spec/unit/recipes/default_spec.rb:7:in `block (2 levels) in <...`
```

```
Finished in 0.03019 seconds
```

```
1 example, 1 failure
```

```
...
```

Exercise: Update Original Recipe

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

```
template "/etc/motd" do
  source "motd.erb"
  mode "0644"
  user "root"
  group "root"
  action :create
end
```

- Add user and group so the test passes
- Add explicit action

SAVE FILE!

Exercise: Run rspec Again

```
$ rspec
```

```
.
```

```
Finished in 0.02726 seconds  
1 example, 0 failures
```

```
ChefSpec Coverage report generated...
```

```
Total Resources: 1  
Touched Resources: 1  
Touch Coverage: 100.0%
```

```
You are awesome and so is your test coverage! Have a fantastic day!
```

Why Write Unit Tests?

- Unit tests quickly assert our intended behavior
- Act as documentation for the recipe
- Ensure that when we or others work with the recipe they do not break our intended behavior.

Using Fauxhai to Mock Platforms

- ChefSpec is great for unit testing cross-platform cookbooks
- Let us add tests to our `mailx` cookbook that supports both CentOS and Ubuntu variants.
- On CentOS mailx is installed through the mailx package.
- On Ubuntu mailx is installed through the mailutils package.

Exercise: Move into cookbook

```
$ cd chef-repo  
$ cd cookbooks/mailx
```

(No output)

Exercise: Make directories for the tests

```
$ mkdir spec  
$ mkdir spec/unit  
$ mkdir spec/unit/recipes
```


Exercise: Create a Spec Helper

 **OPEN IN EDITOR:** `cookbooks/mailx/spec/spec_helper.rb`

```
require 'chefspec'

ChefSpec::Coverage.start!
```

SAVE FILE!

- Same as before, only now we are in the `mailx` cookbook

Exercise: Write a Real Test



OPEN IN EDITOR: .../mailx/spec/unit/recipes/default_spec.rb

```
require 'spec_helper'

describe 'mailx::default' do
  context 'on Ubuntu' do
    let(:chef_run) do
      runner = ChefSpec::ServerRunner.new( { :platform => 'ubuntu',
                                              :version => '14.04' })

      runner.converge(described_recipe)
    end

    it 'should install the correct packages' do
      expect(chef_run).to install_package('mailutils')
    end
  end
end

# ... CONTINUED ON THE NEXT SLIDE ...
```

SAVE FILE!

Exercise: Write a Real Test

 **OPEN IN EDITOR:** `.../mailx/spec/unit/recipes/default_spec.rb`

```
# ... CONTINUED FROM PREVIOUS SLIDE ...
context 'on CentOS' do
  let(:chef_run) do
    runner = ChefSpec::ServerRunner.new( { :platform => 'centos',
                                             :version => '6.5' })

    runner.converge(described_recipe)
  end
  it 'should install the correct packages' do
    expect(chef_run).to install_package('mailx')
  end
end
end
end
```

- Set up test context for CentOS

SAVE FILE!

Exercise: Run rspec

```
$ rspec
```

```
..
```

```
Finished in 0.18828 seconds (files took 5.17 seconds to load)  
2 examples, 1 failures
```

```
ChefSpec Coverage report generated...
```

```
Total Resources:      1  
Touched Resources:    1  
Touch Coverage:       100.0%
```

```
You are awesome and so is your test coverage! Have a fantastic day!
```

Exercise: Add Cross-platform Attributes

 **OPEN IN EDITOR:** cookbooks/mailx/attributes/default.rb

```
case node[ 'platform' ]  
  when "ubuntu"  
    default[ 'mailx' ][ 'mailx-package' ] = "mailutils"  
  when "centos"  
    default[ 'mailx' ][ 'mailx-package' ] = "mailx"  
end
```

SAVE FILE!

Exercise: Install the Package

 **OPEN IN EDITOR:** cookbooks/mailx/recipes/default.rb

```
package node[ 'mailx' ][ 'mailx-package' ] do
  action :install
end
```

SAVE FILE!

Exercise: Run rspec

```
$ rspec
```

```
..
```

```
Finished in 0.18828 seconds (files took 5.17 seconds to load)  
2 examples, 0 failures
```

```
ChefSpec Coverage report generated...
```

```
Total Resources: 2  
Touched Resources: 2  
Touch Coverage: 100.0%
```

```
You are awesome and so is your test coverage! Have a fantastic day!
```

Review Questions

- What is ChefSpec used for?
- What tool is ChefSpec based on?
- What directory does do your tests go into?
- Given a recipe named 'backup', what will the ChefSpec test filename be?

Further Resources

v1.2.1

What Do I Do Now?

- To learn more you are going to need more practice and more resources. It takes a village and a couple of web servers.
- In this module, we will:
 - Provide you with resources that you can read
 - Provide you with resources that you can watch
 - Provide you with resources that you can listen
 - Provide you with resources that you can attend

The Slides From This Course

- <https://goo.gl/cExAi1>
- Provided in PDF format



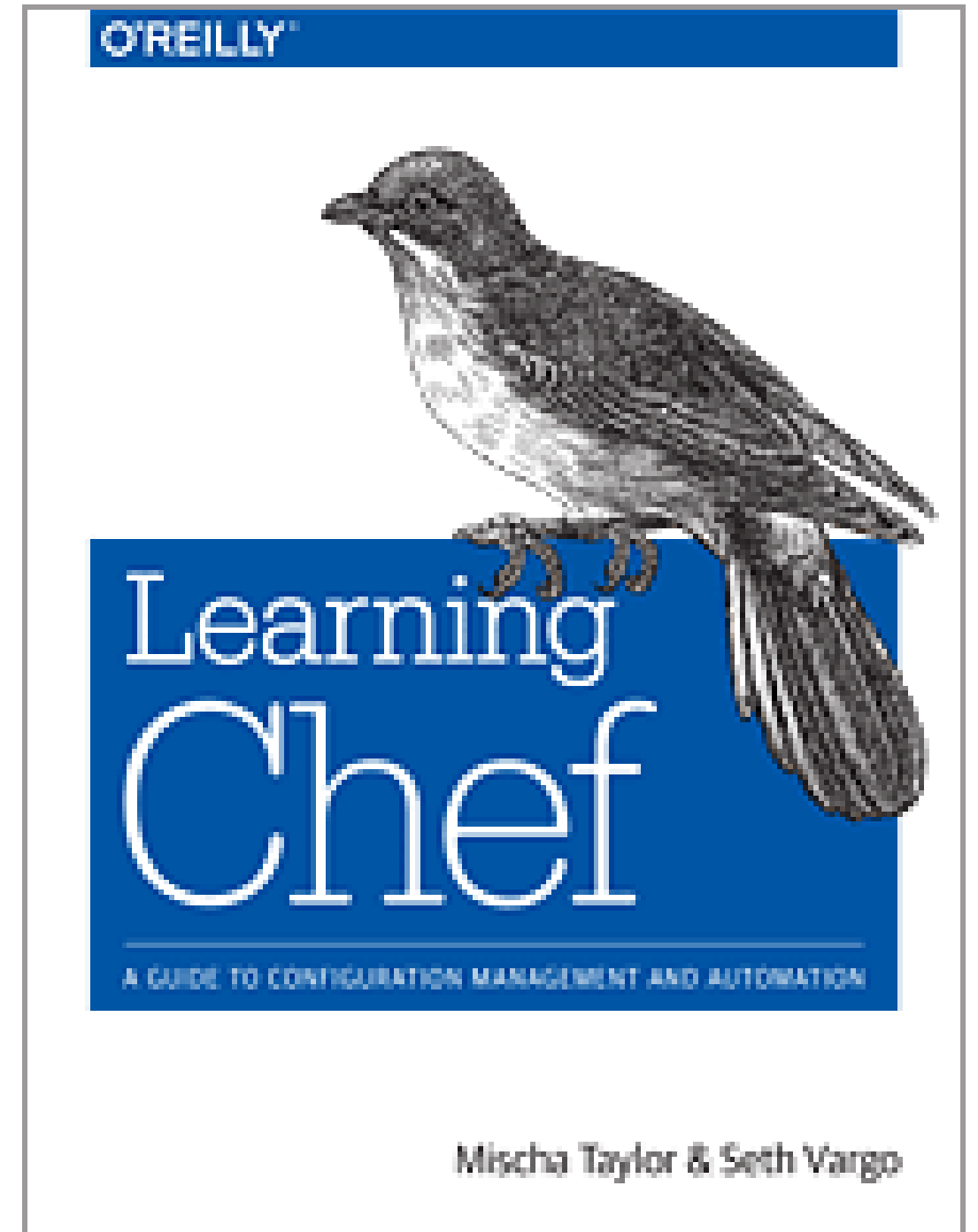
Documentation

- <http://docs.chef.io>



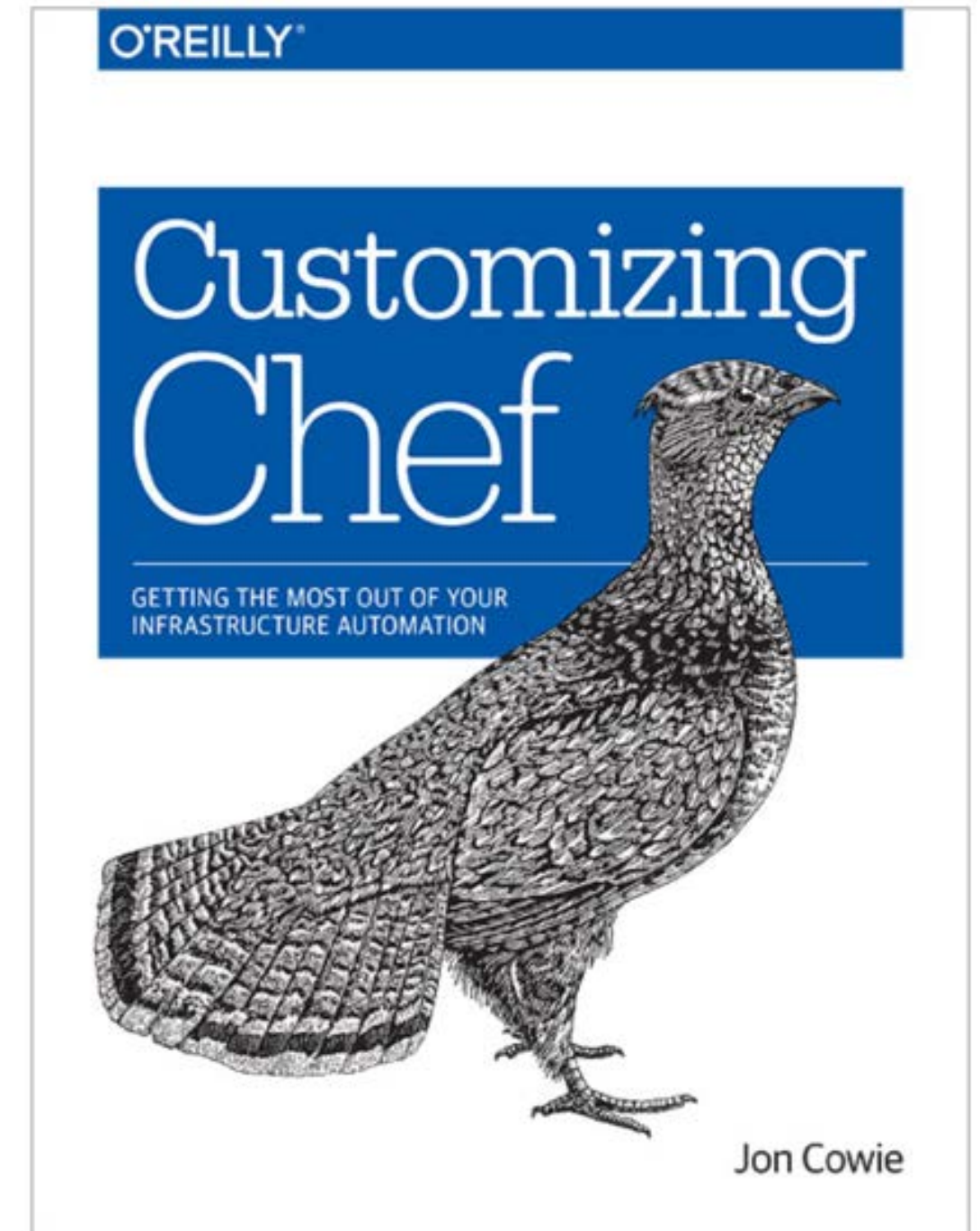
Learning Chef

A Guide to Configuration
Management and Automation



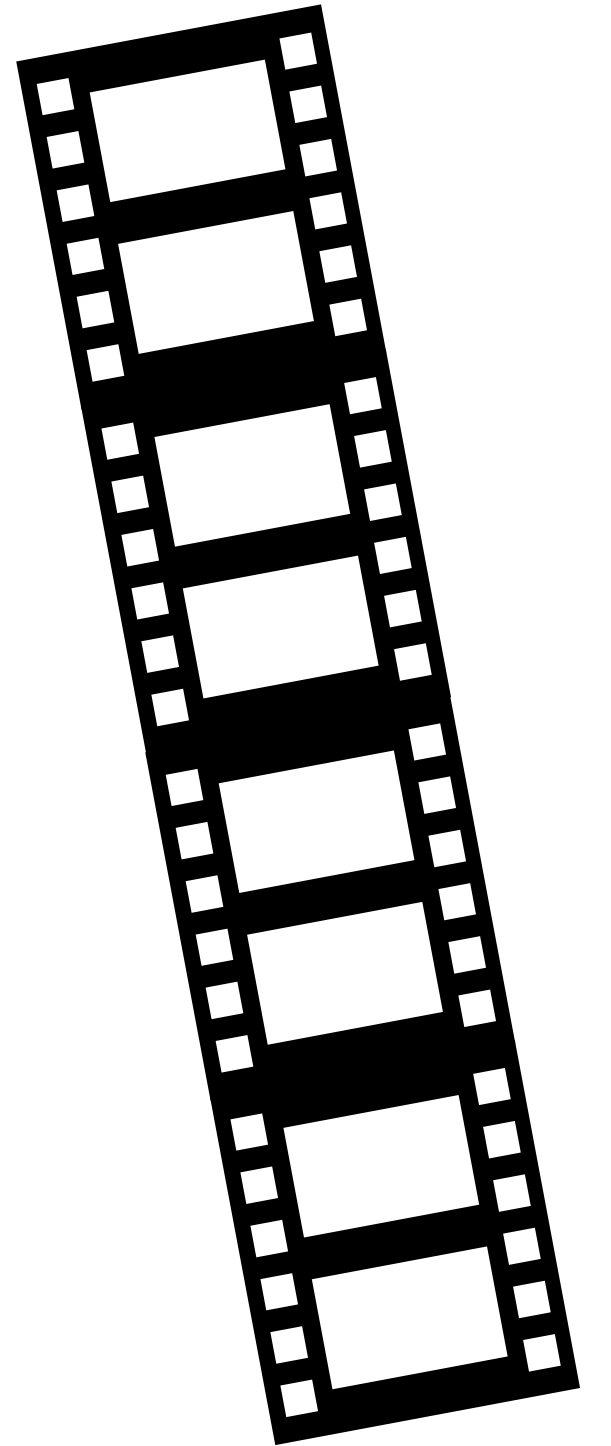
Customizing Chef

Getting the Most Out of Your
Infrastructure Automation



Youtube Channel

- ChefConf Talks
- Training Videos
- <https://www.youtube.com/user/getchef/playlists>



foodfightshow.org

- <http://foodfightshow.org>
- Food Fight is a bi-weekly podcast for the Chef community. We bring together the smartest people in the Chef community and the broader DevOps world to discuss the thorniest issues in system administration.



theshipshow.com

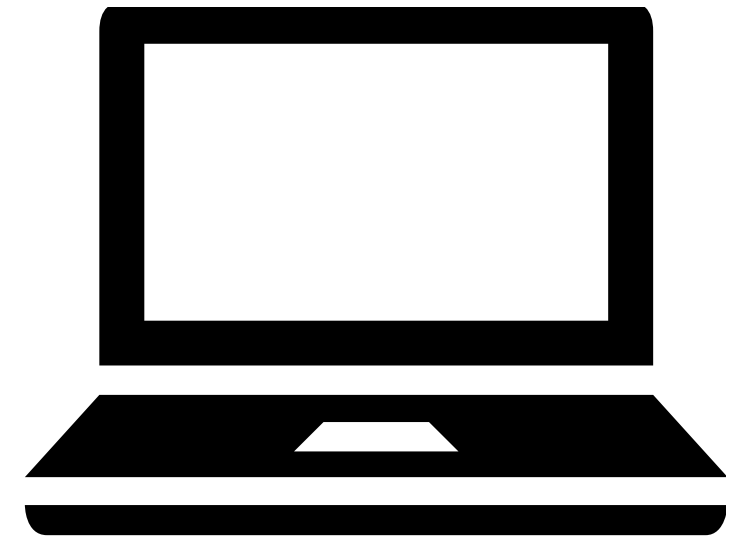
- <http://theshipshow.com>

The Ship Show is a twice-monthly podcast, featuring discussion on everything from build engineering to devops to release management, plus interviews, new tools and techniques, and reviews.



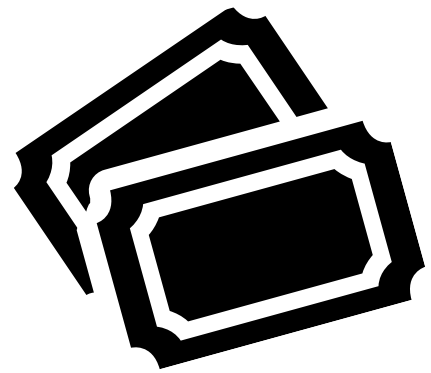
Chef Developers' IRC Meeting

- Join members of the Chef Community in a meeting for Chef Developers where we'll discuss the future of the Chef project and other things pertinent to the community.
- [irc.freenode.net#chef-hacking](https://irc.freenode.net/#chef-hacking)
- <https://github.com/chef/chef-community-irc-meetings>



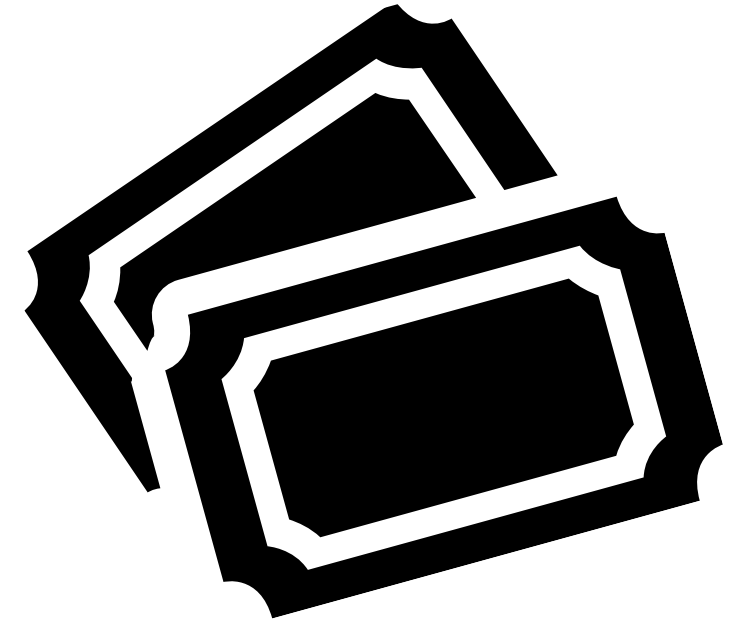
Chef Community Summit

- The Chef Community will gather for two days of open space sessions and brainstorm on Chef best practices.
- The Chef Community Summit is a facilitated Open Space event. The participants of the summit propose topics, organize an agenda, and discuss and work on the ideas that are most important to the community.
- <https://www.chef.io/summit>



ChefConf

- It's the gathering of hundreds of Chef community members
- We get together to learn about the latest and greatest in the industry (both the hows and the whys), as well as exchange ideas, brainstorm solutions, and give hugs, which has become the calling card of the DevOps community, and the Chef community in particular



Discussion

What questions can we answer for you?

