DevOps with Liberty and Chef

Jeremy Hughes

WebSphere DevOps Architect @ IBM

with thanks to Chef

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- What IS Chef?

- What IS Chef?
- What IS IBM WebSphere ® Liberty Profile?

- What IS Chef?
- What IS IBM WebSphere ® Liberty Profile?
- Why they're good together?

Overview of Chef

v2.0.0

Complexity

http://www.flickr.com/photos/michaelheiss/3090102907/

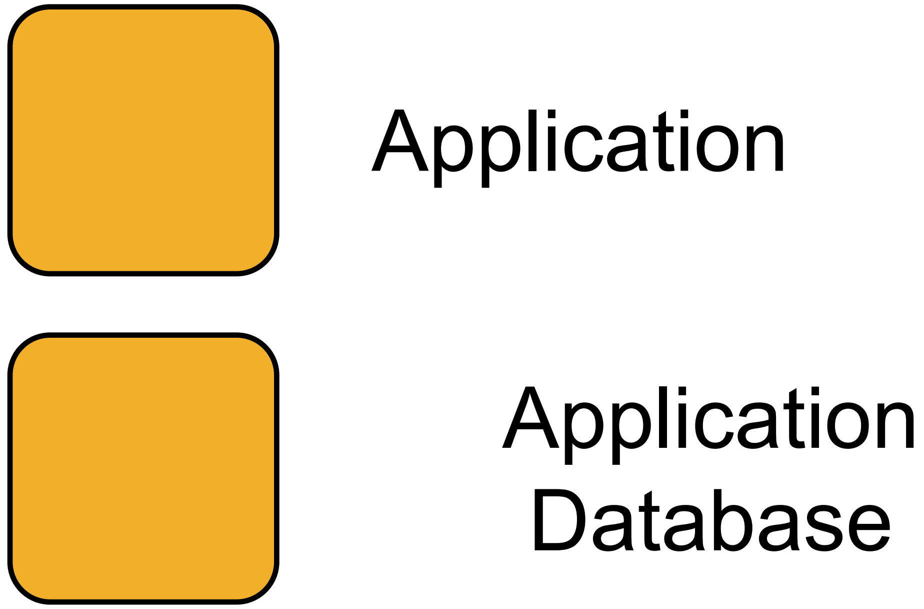
Items of Manipulation (Resources)

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

A tale of growth...

Application

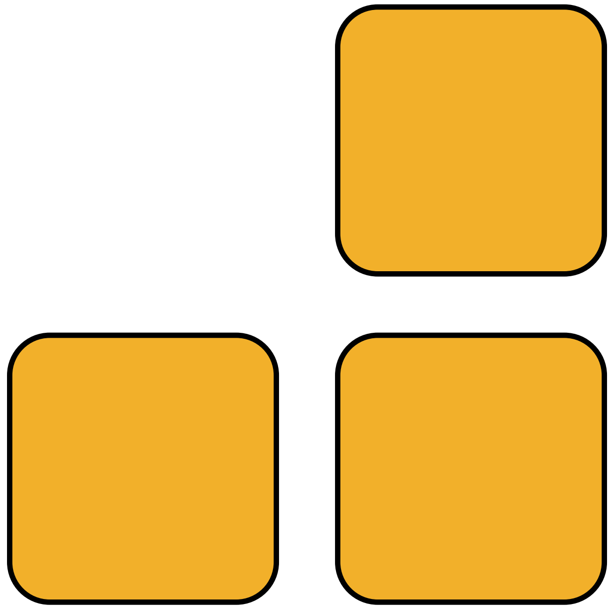
Add a database



Application

Application Database

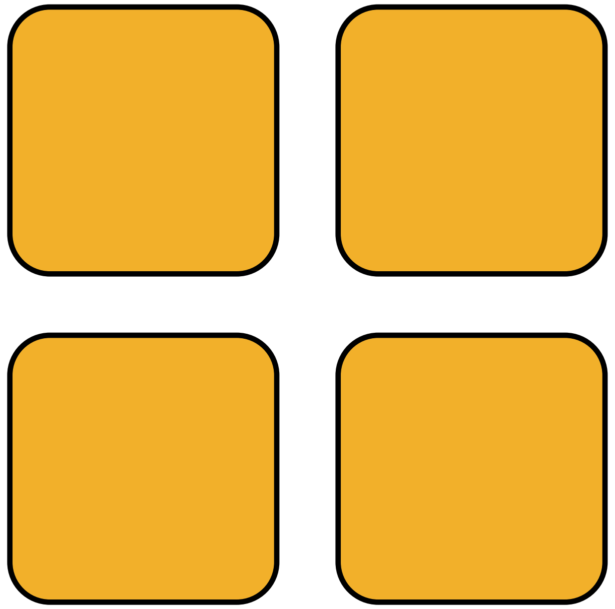
Make database redundant



Application

App Databases

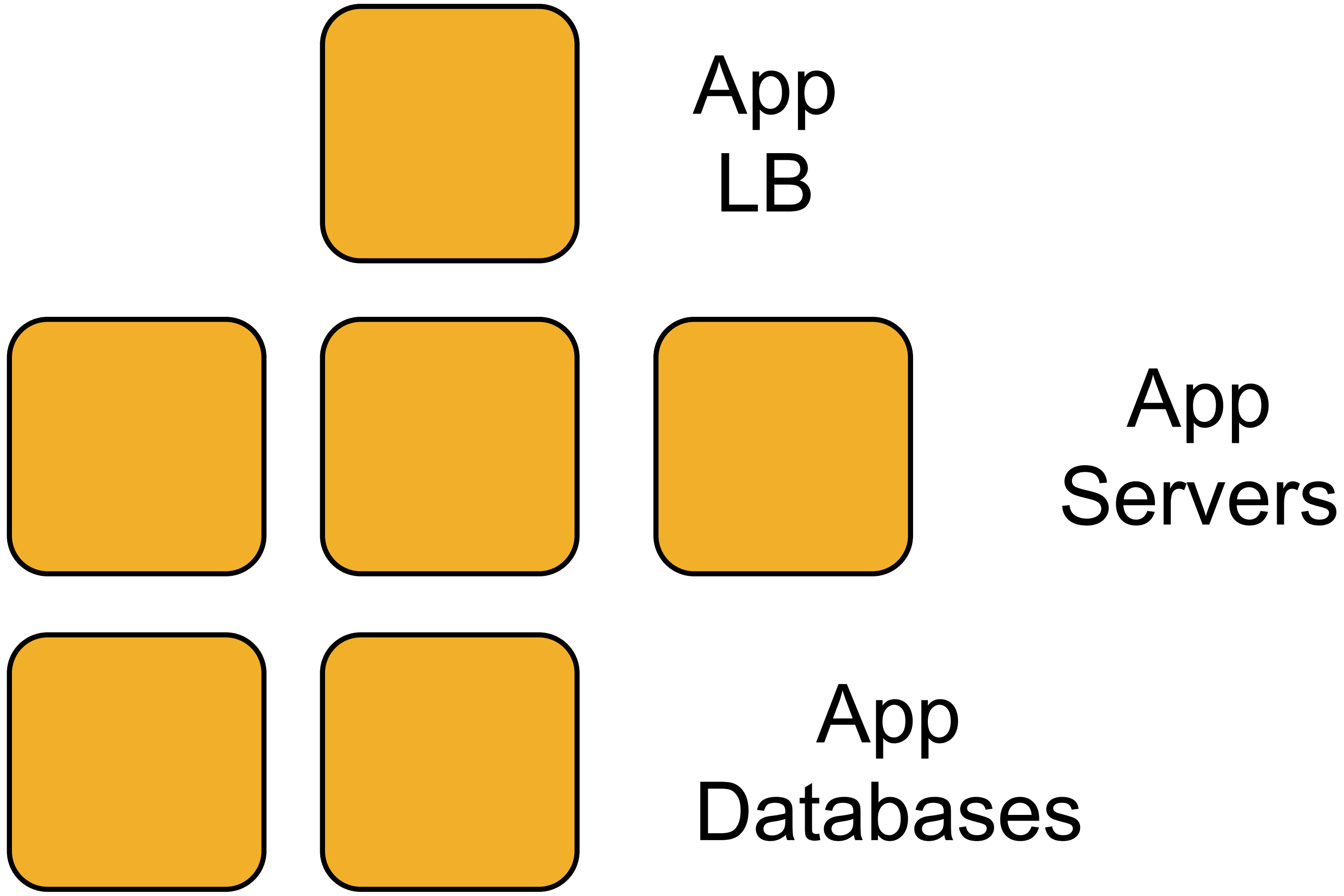
Application server redundancy



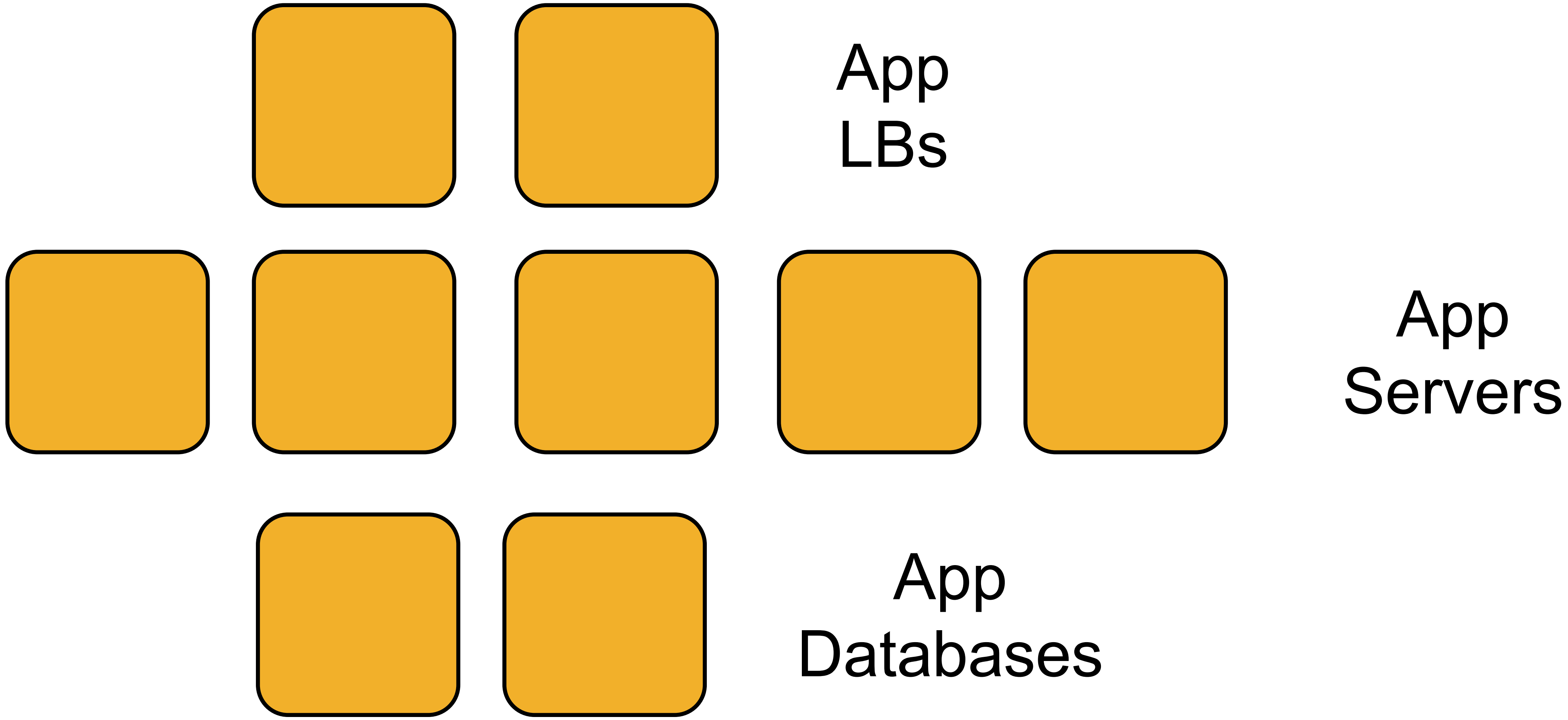
App Servers

App Databases

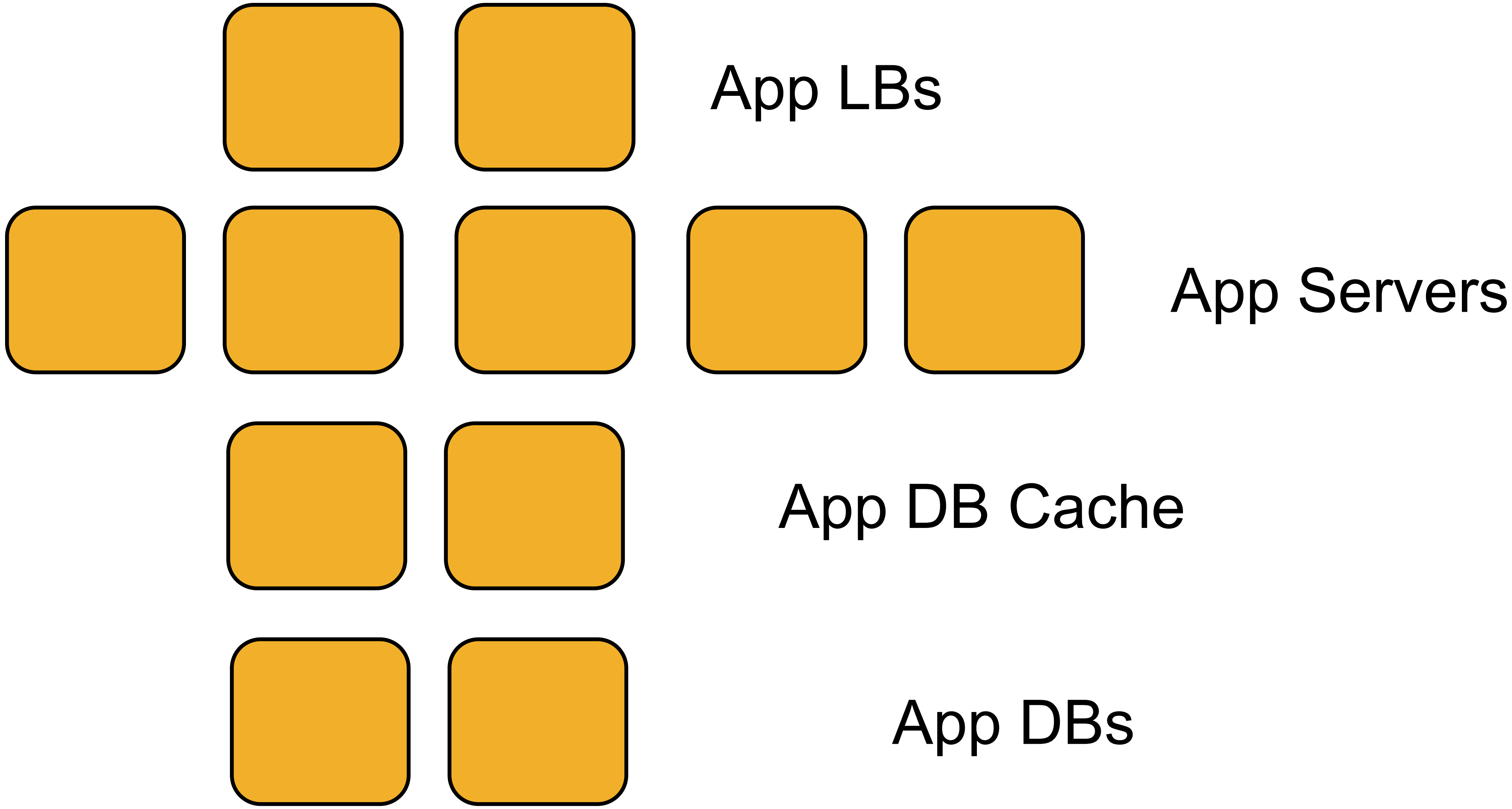
Add a load balancer



Webscale!



Now we need a caching layer



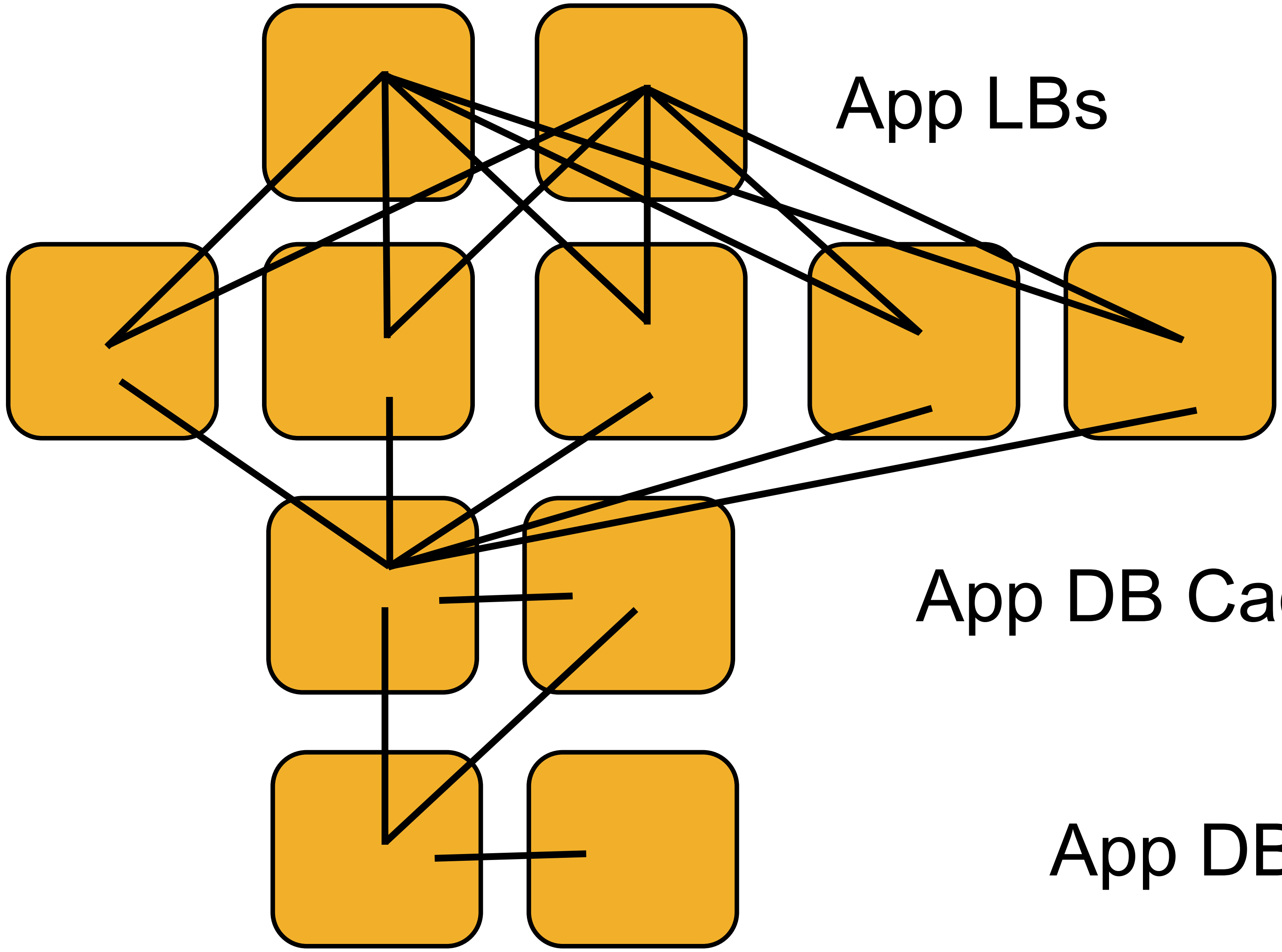
App LBs

App Servers

App DB Cache

App DBs

Infrastructure has a Topology



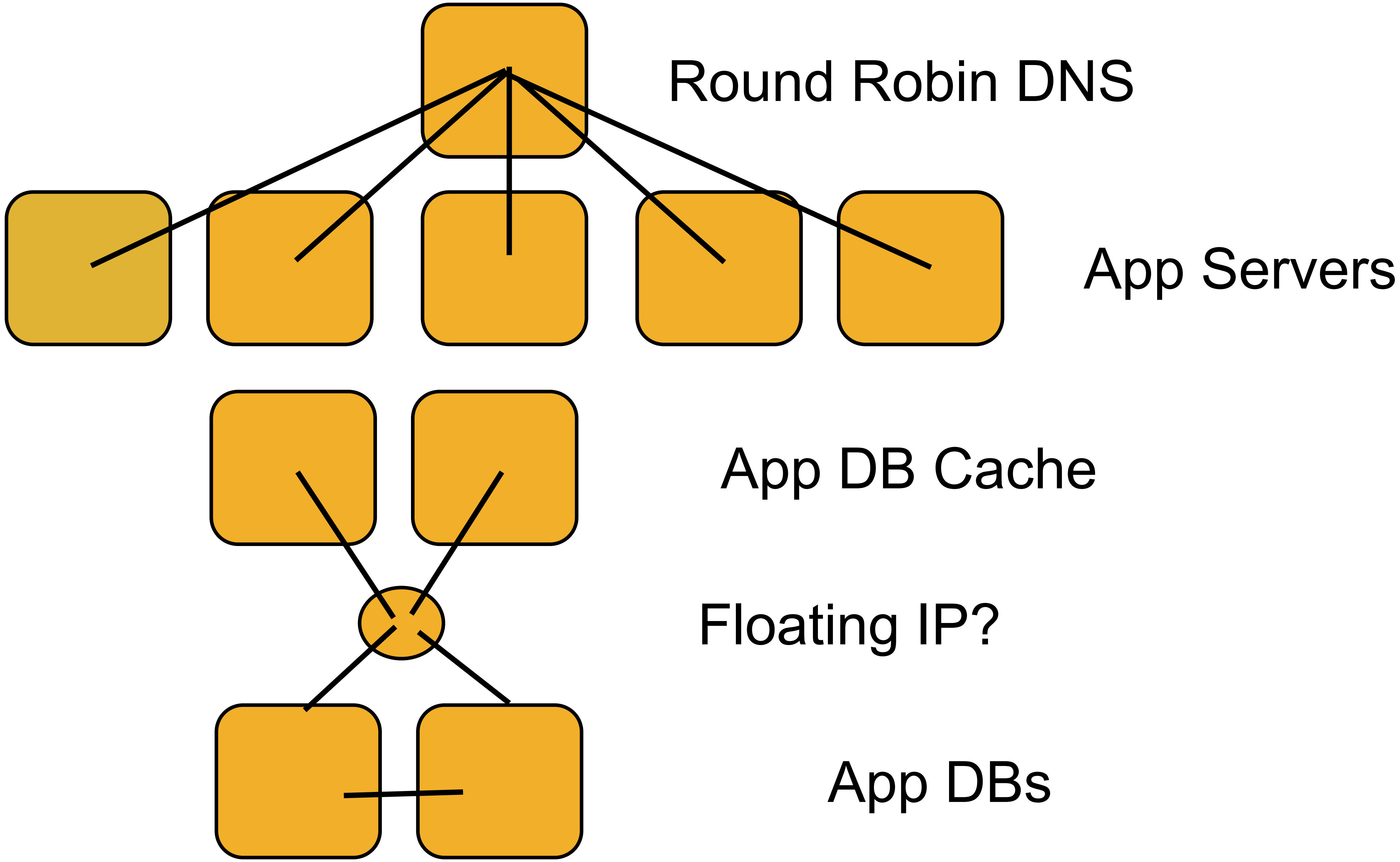
App LBs

App Servers

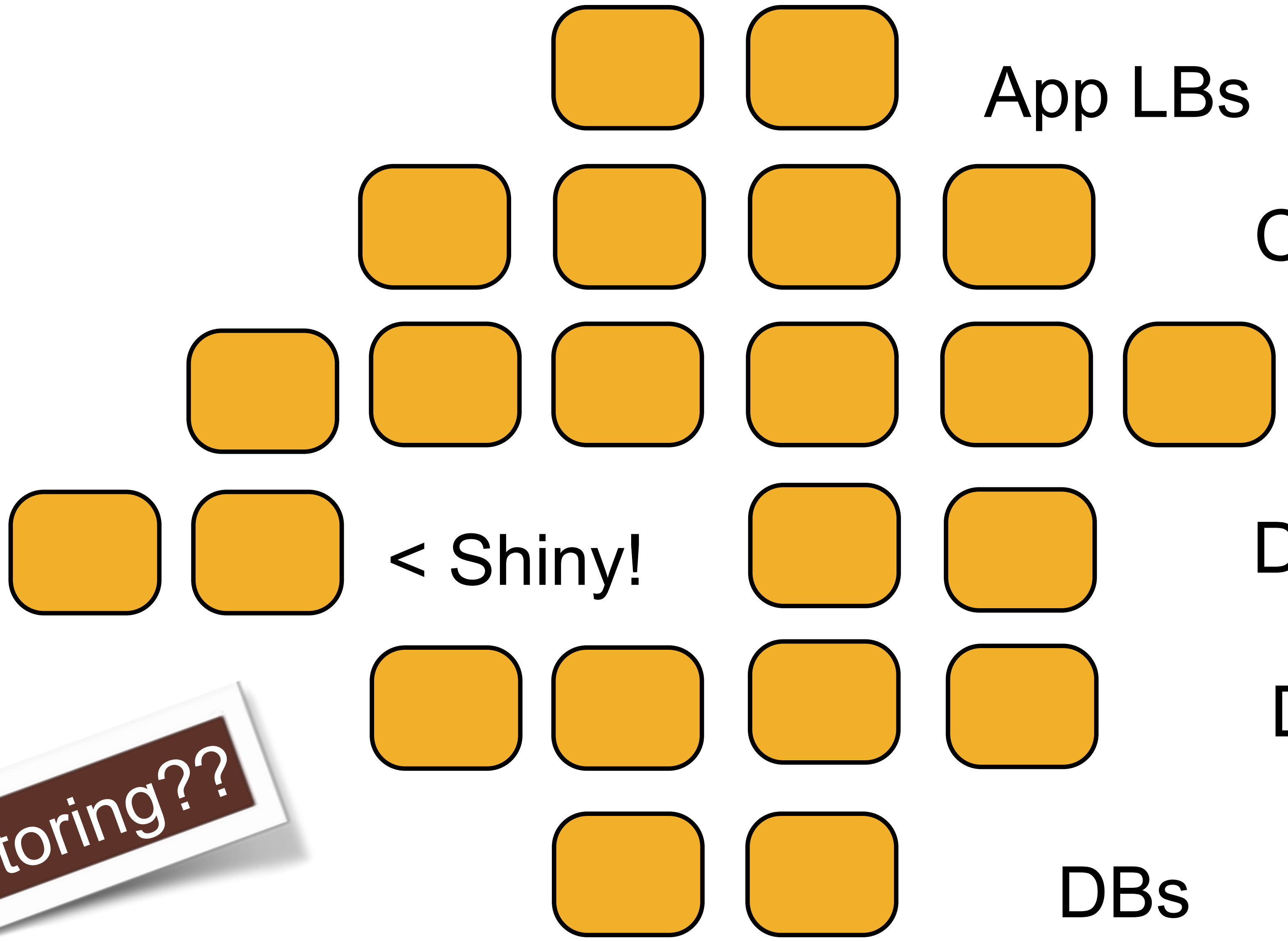
App DB Cache

App DBs

Your Infrastructure is a Snowflake



Complexity Increases Quickly



App LBs

Cache

App Servers

< Shiny!

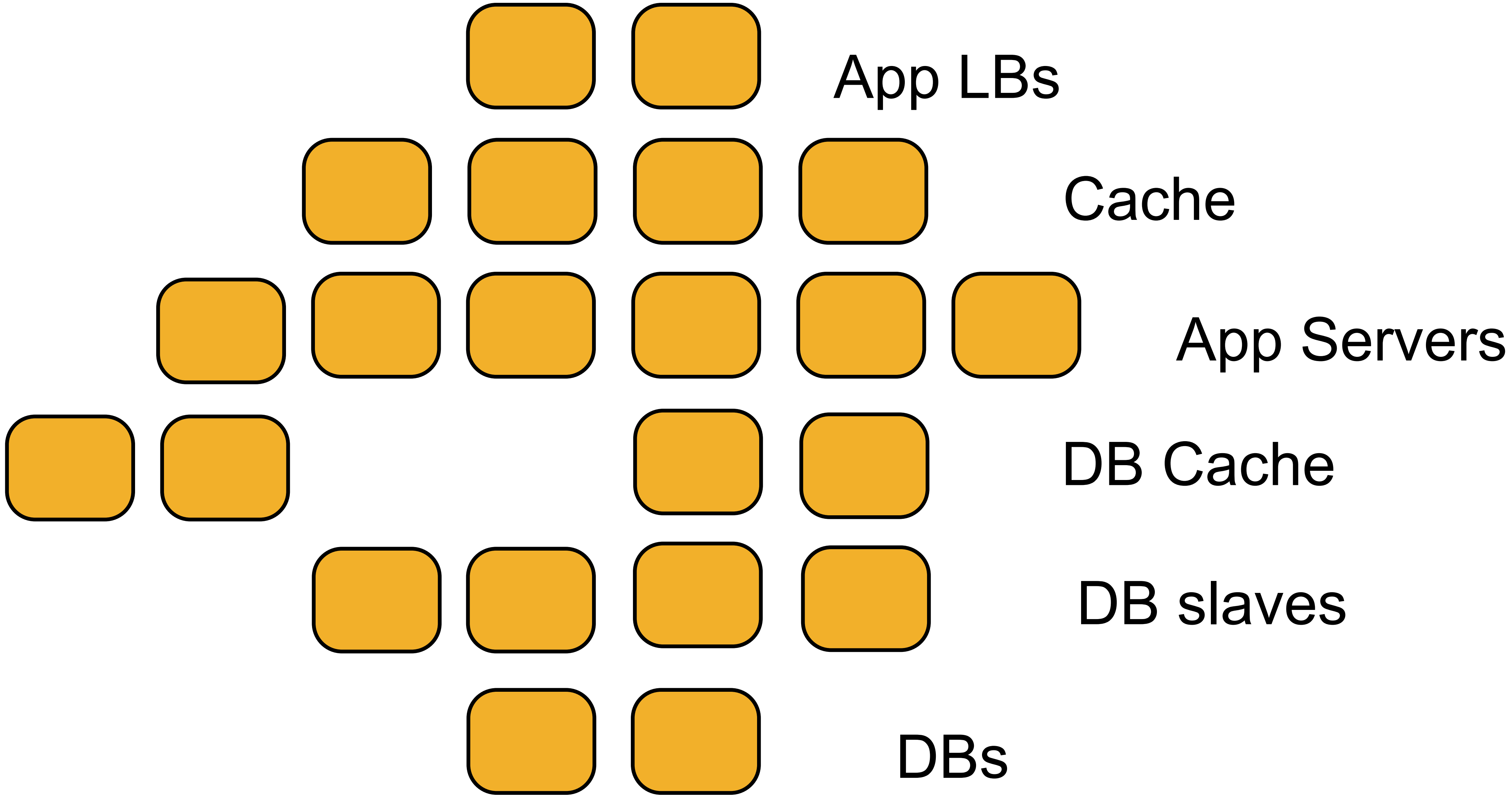
DB Cache

DB slaves

DBs

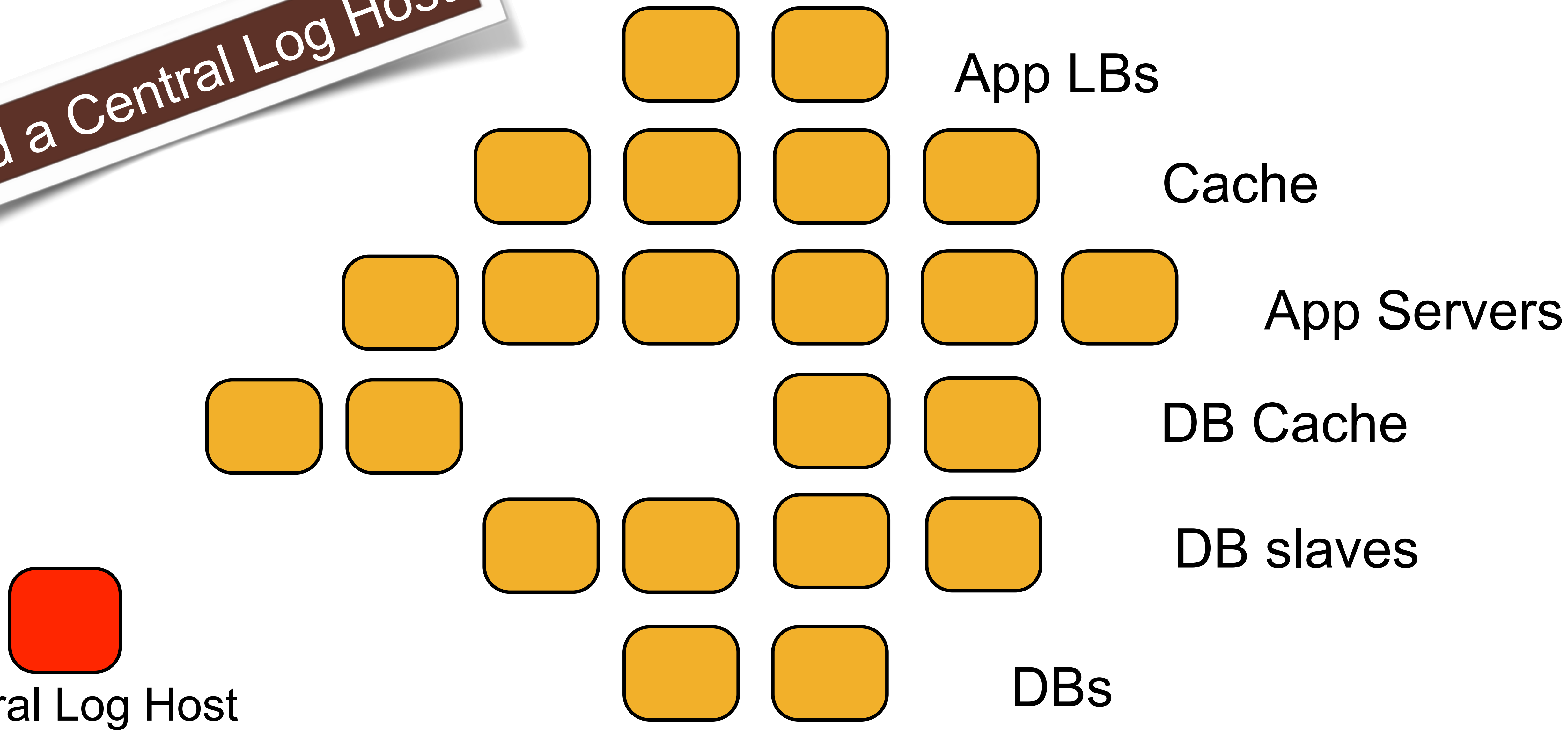
Are we monitoring??

...and change happens!



...and change happens!

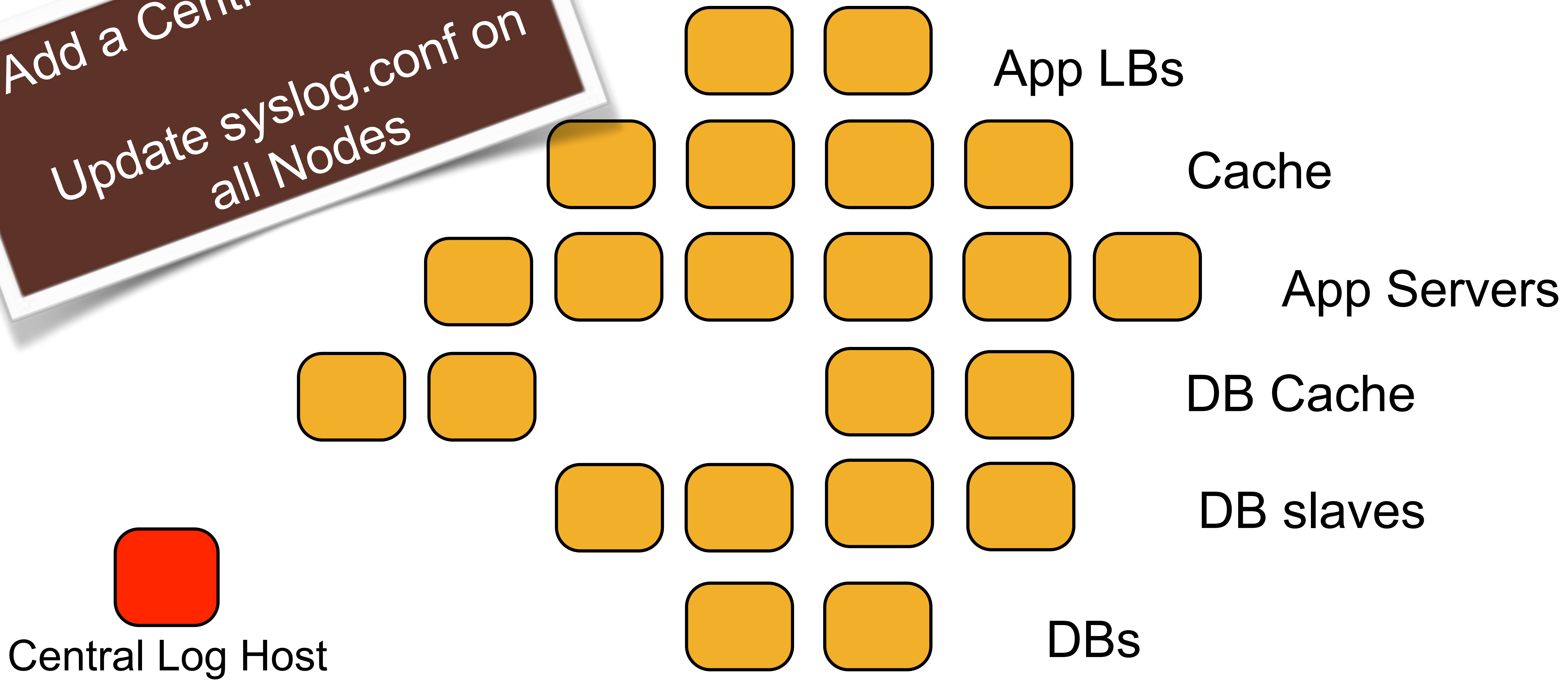
Add a Central Log Host



...and change happens!

Add a Central Log Host

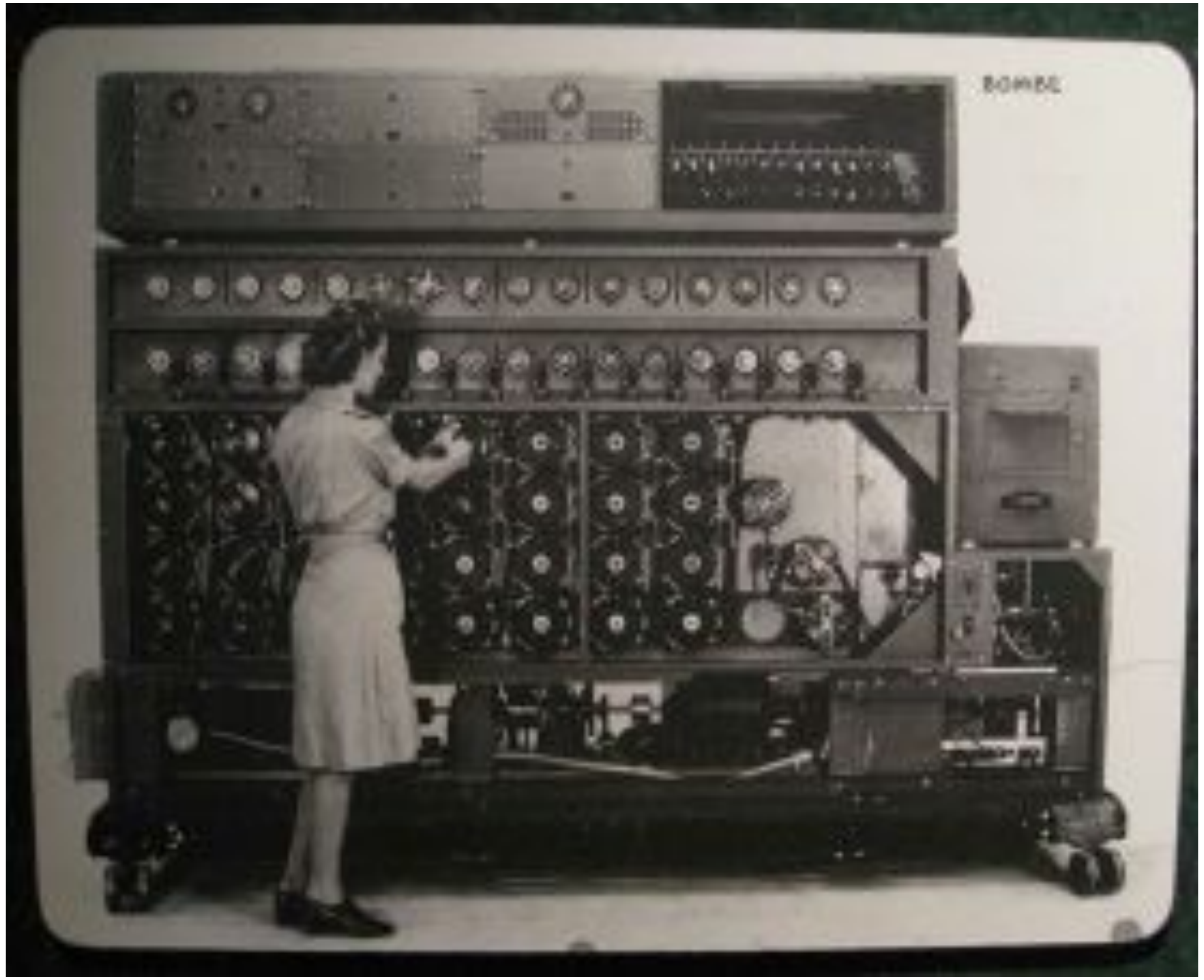
Update syslog.conf on all Nodes



Chef Solves This Problem

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

Chef is Infrastructure as Code



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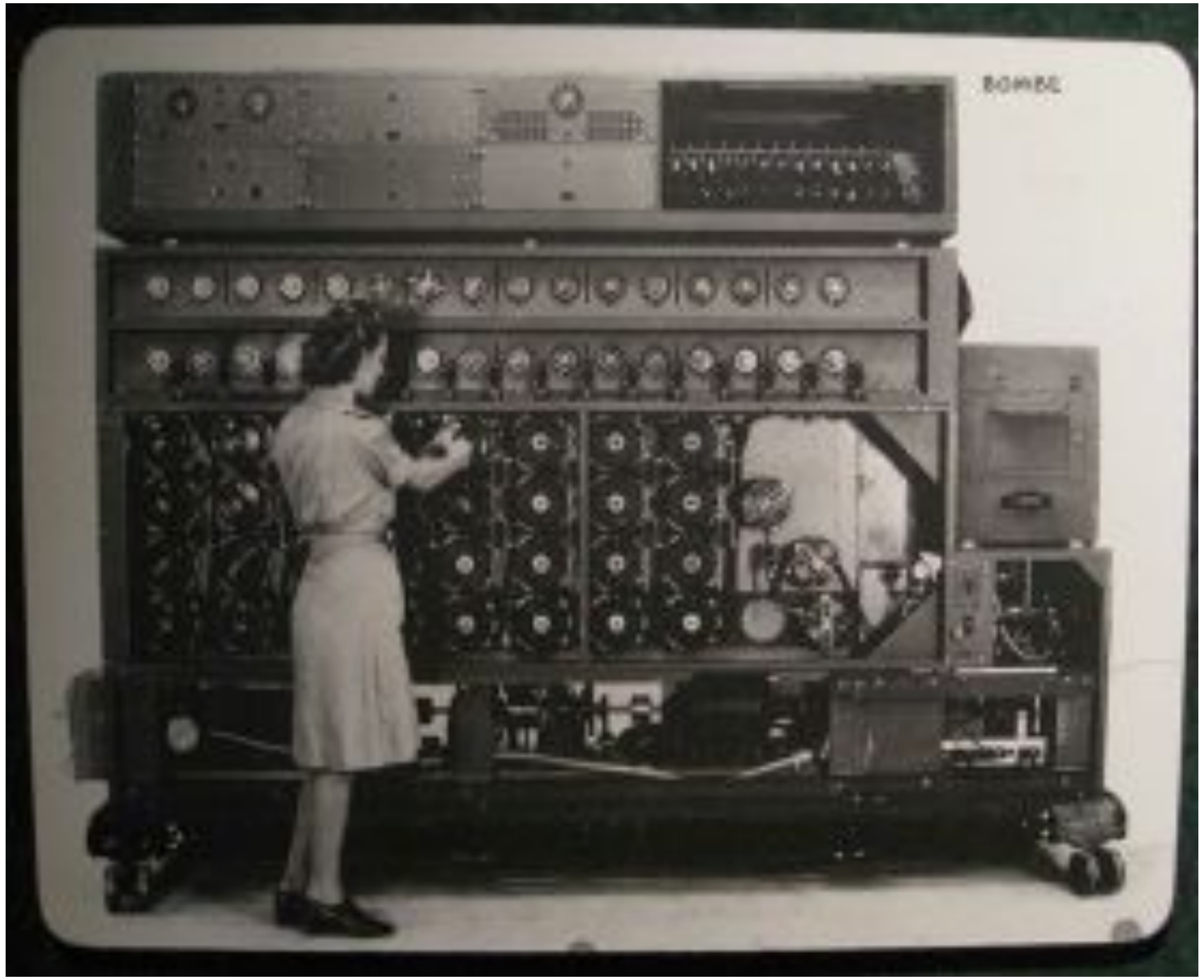
- Programmatically provision and configure components

Chef is Infrastructure as Code



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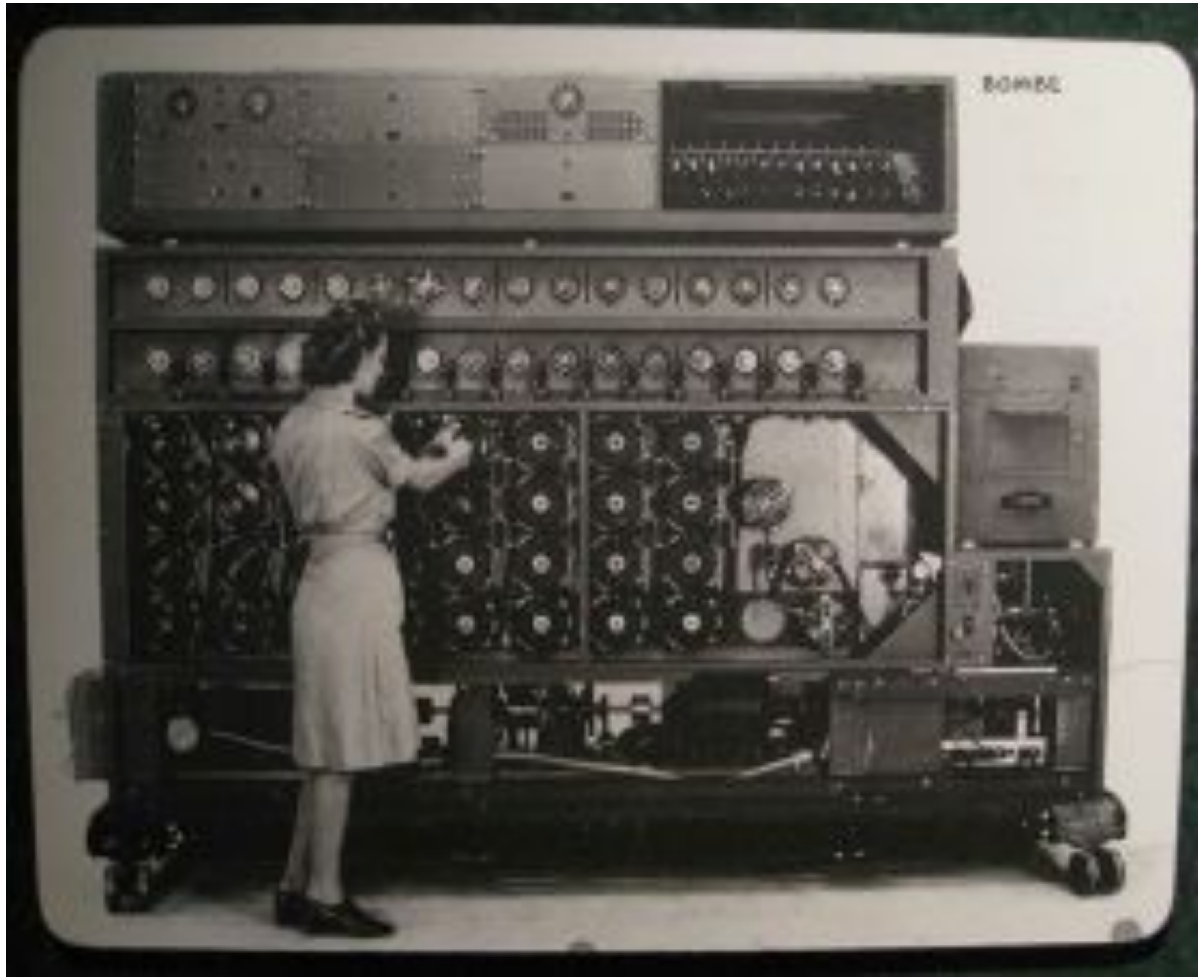
- Treat like any other code base

Chef is Infrastructure as Code



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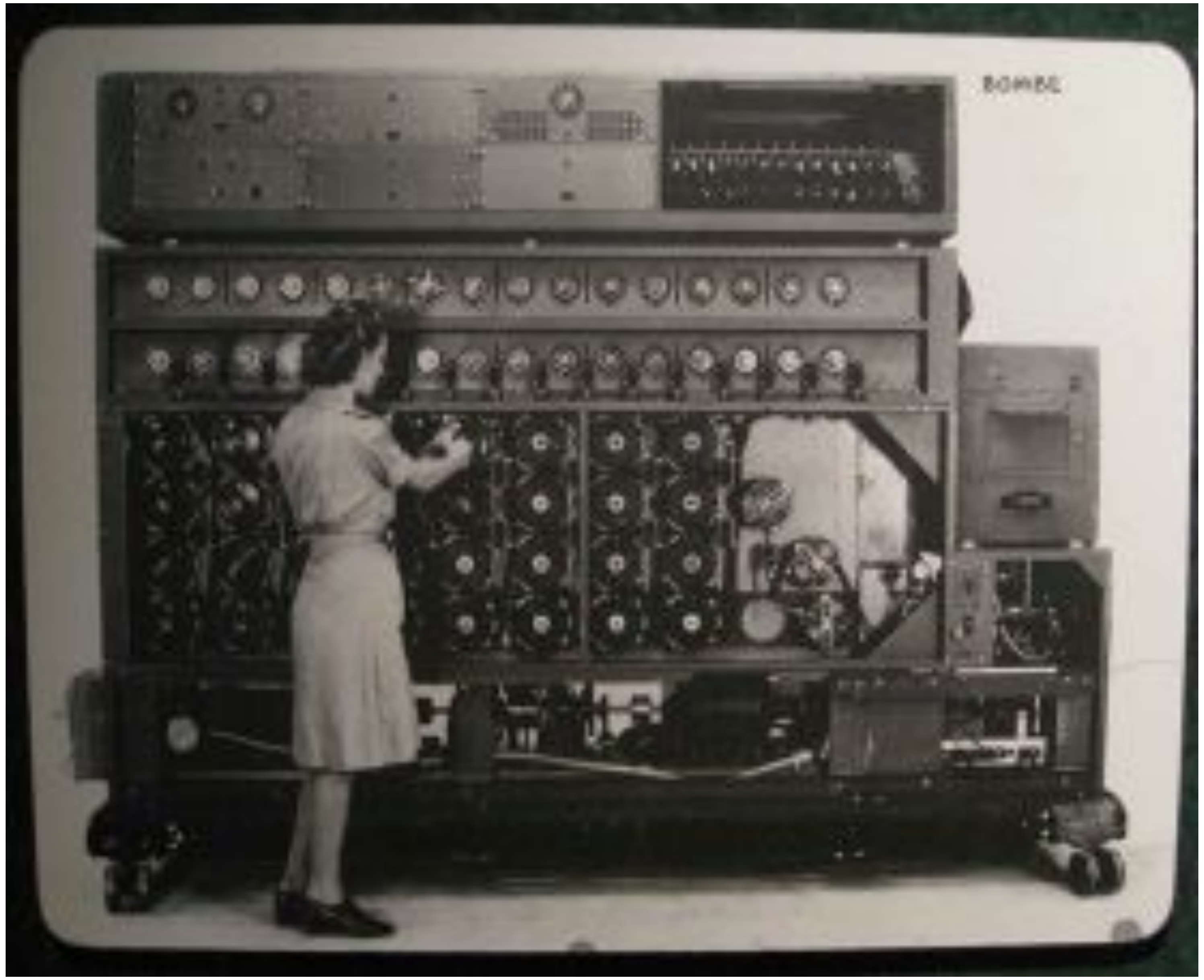
- Reconstruct business from **code repository**, **data backup**, and **compute resources**

Chef is Infrastructure as Code



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

Configuration Code

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

Declarative Interface to Resources

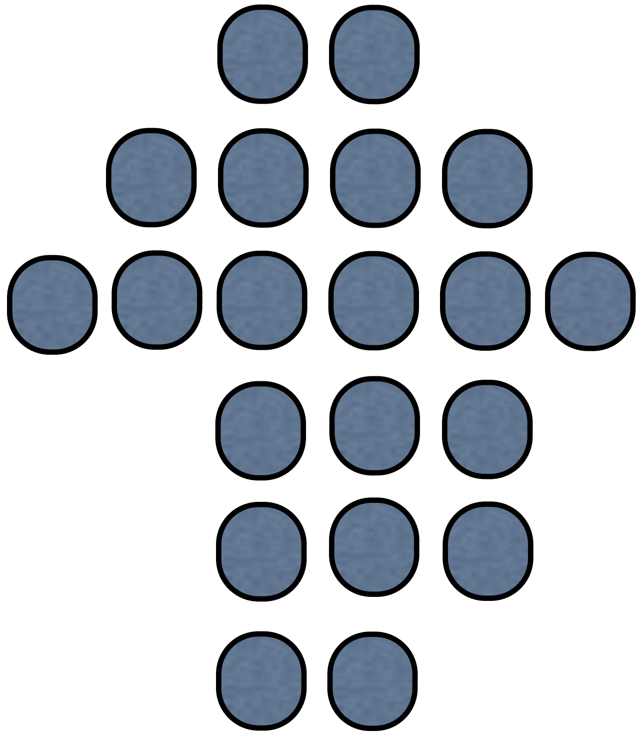
- You define the policy in your Chef configuration
- Your policy states what state each resource should be in, but not how to get there
- Chef-client will pull the policy from the Chef Server and enforce the policy on the Node

Managing Complexity

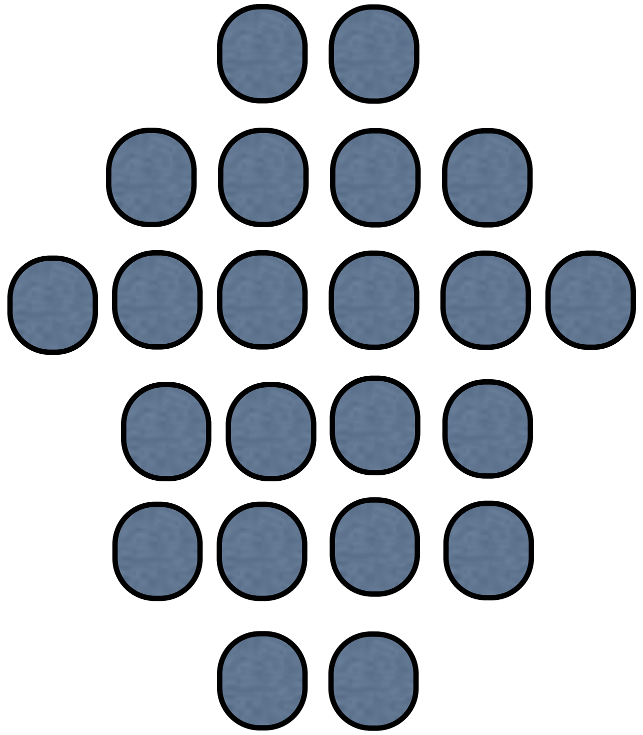
- Organizations
- Environments
- Roles
- Nodes
- Recipes
- Cookbooks
- Search

Organizations

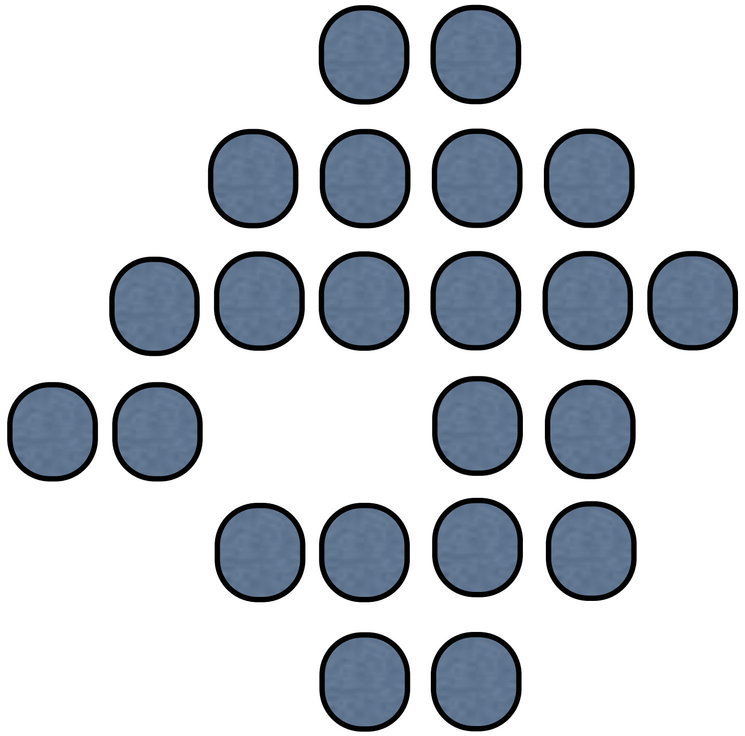
My Infrastructure



Your Infrastructure



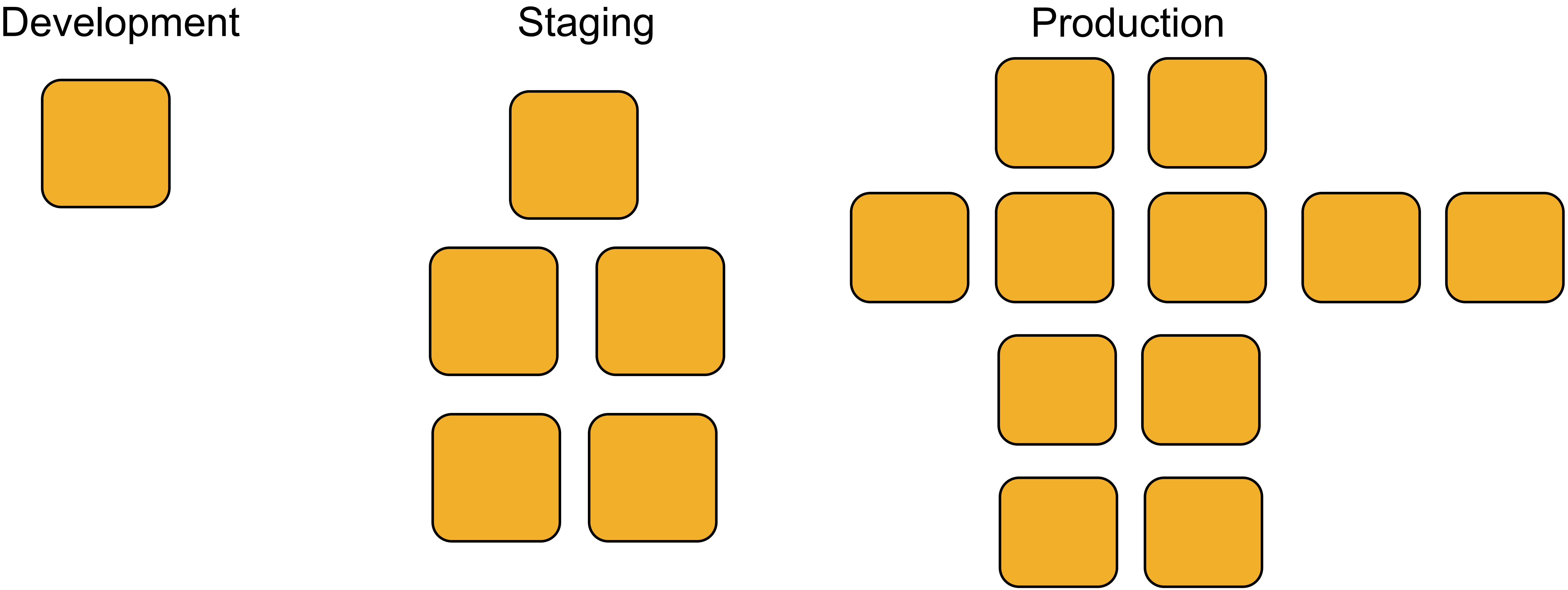
Their Infrastructure



Organizations

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

Environments



Development

Staging

Production

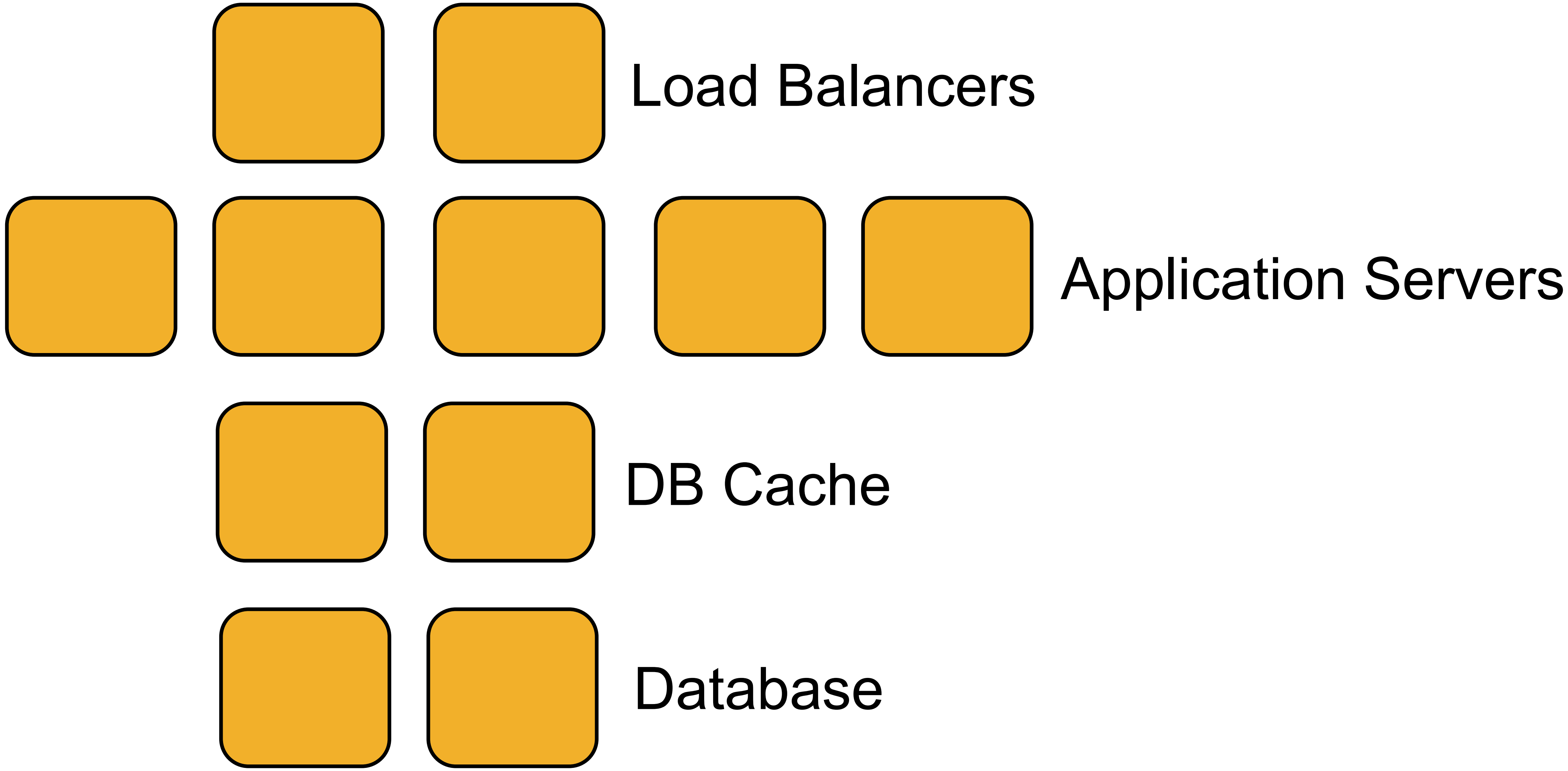
Environments

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

Environments Define Policy

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

Roles



Load Balancers

Application Servers

DB Cache

Database

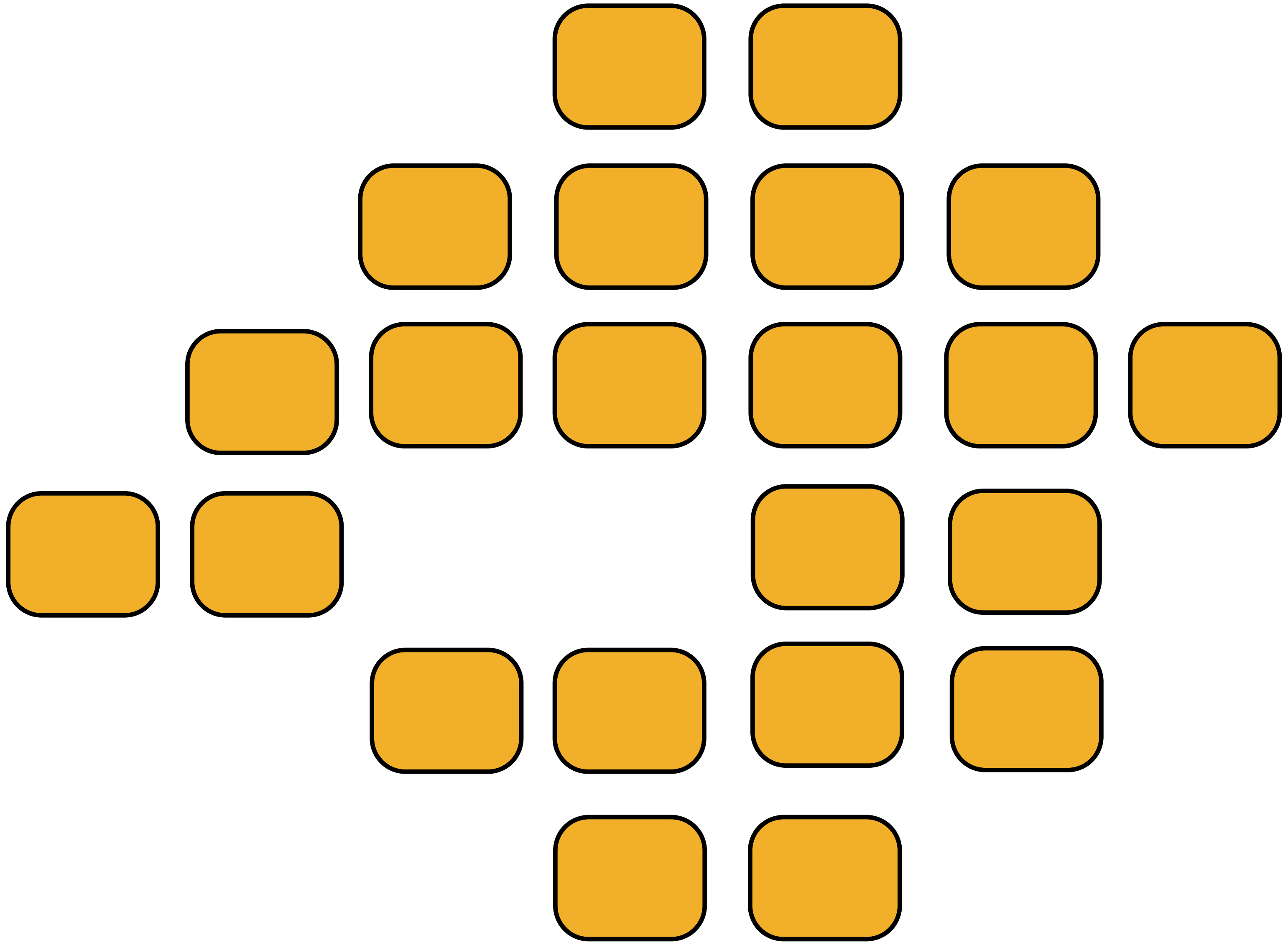
Roles

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

Roles Define Policy

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

Nodes



Nodes

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

Node

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

Nodes Adhere to Policy

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

Resources

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

Resources in Recipes

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

Recipes

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

Example Recipe

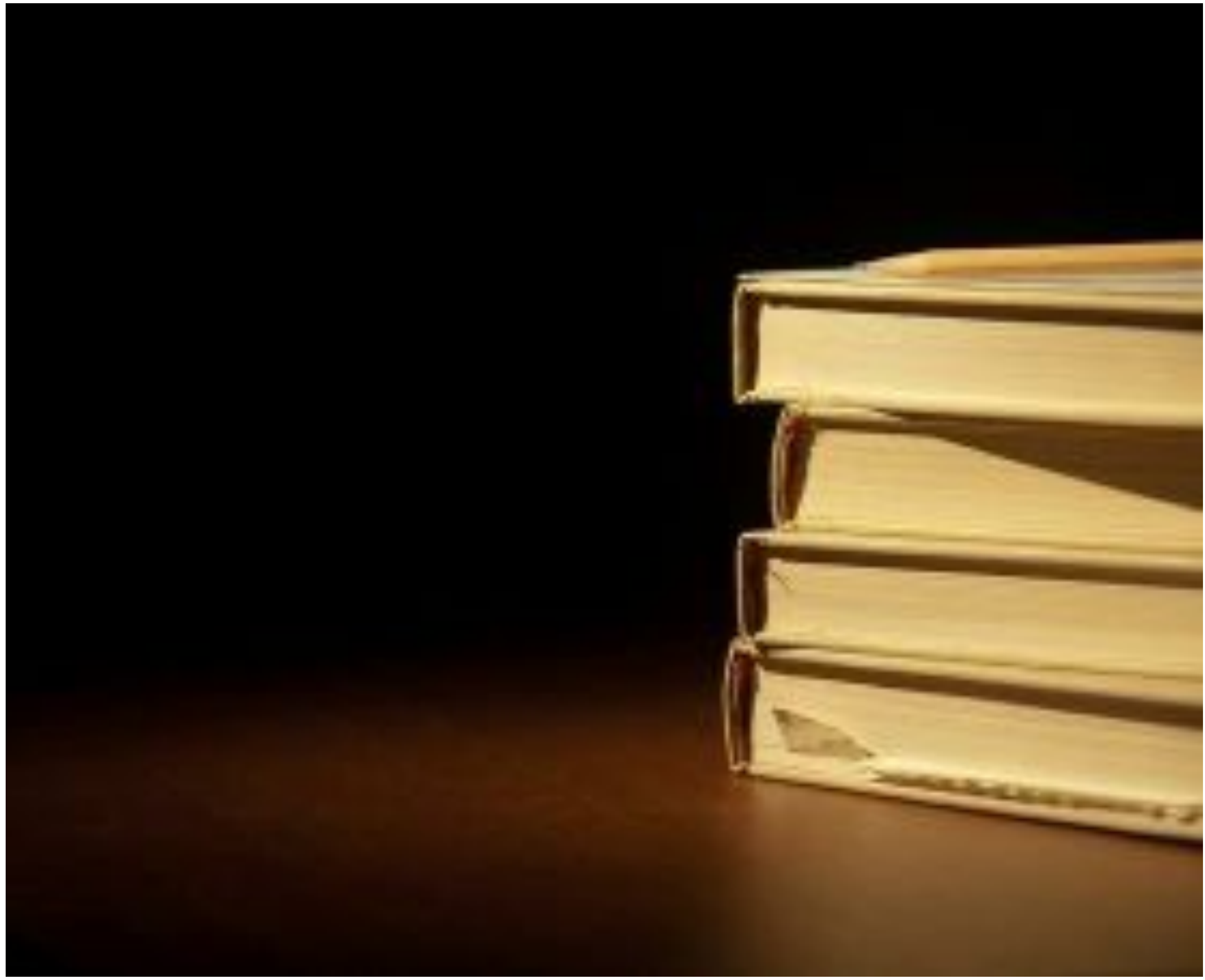
```
package "apache2"
```

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

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

Cookbooks

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



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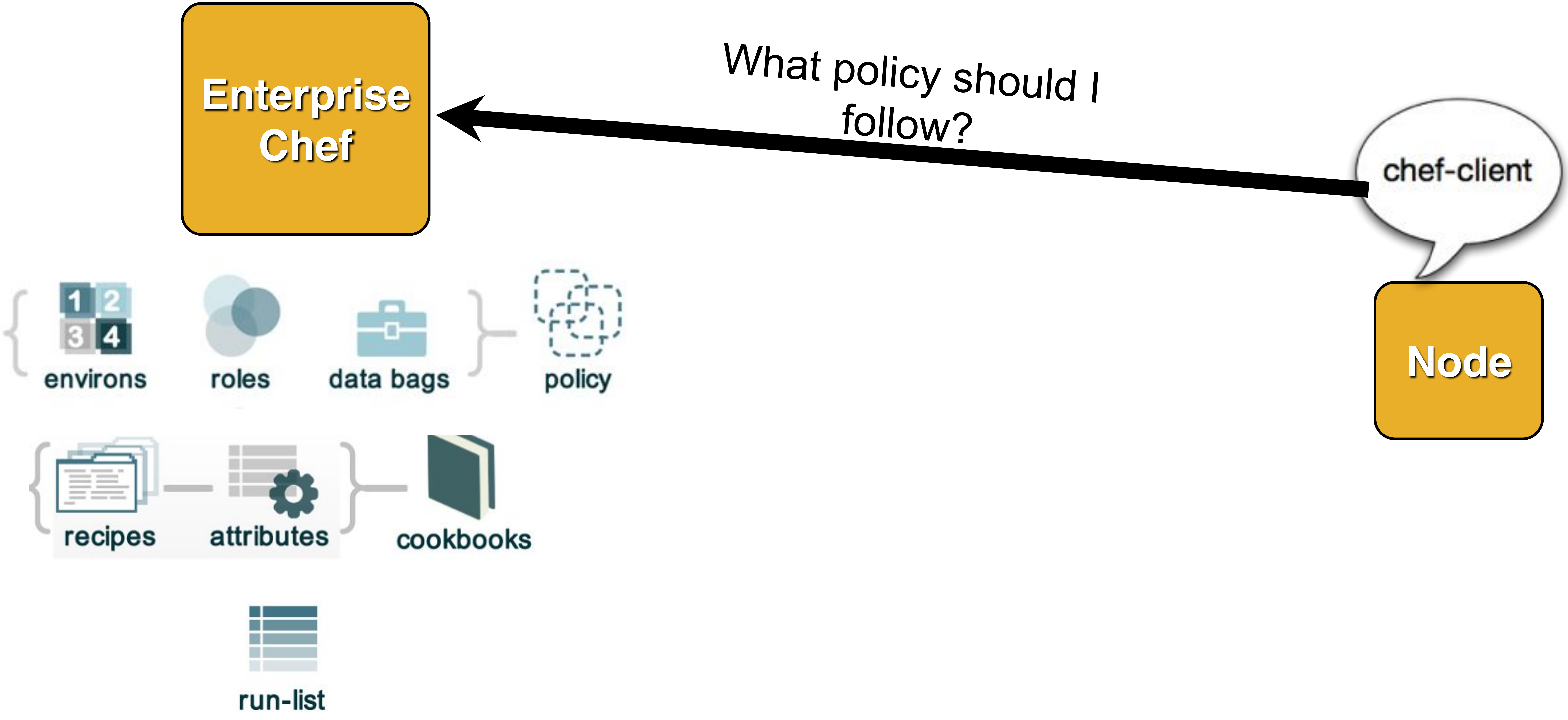
Run List



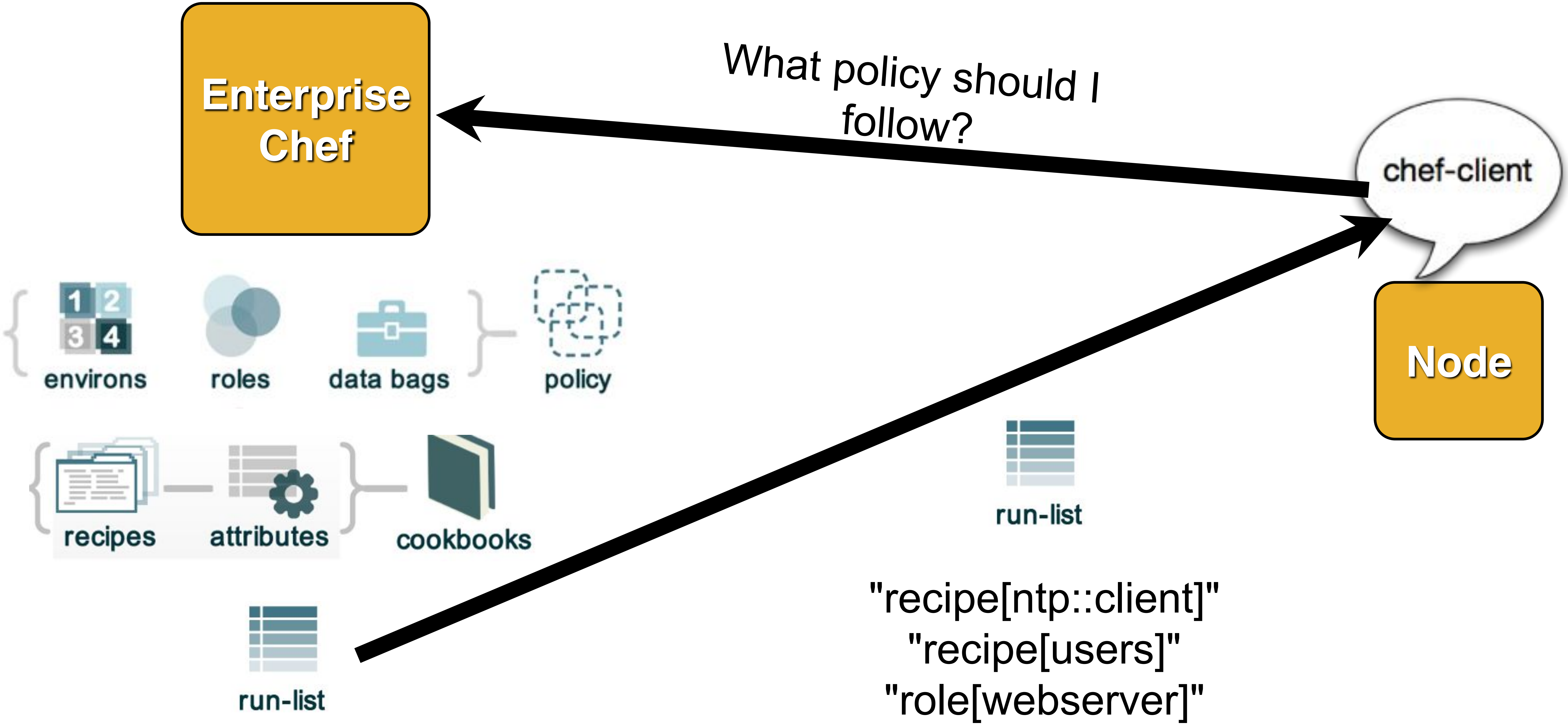
Enterprise Chef

What policy should I follow?

chef-client

Node

Run List



Enterprise Chef

What policy should I follow?

chef-client

Node

environs

roles

data bags

policy

recipes

attributes

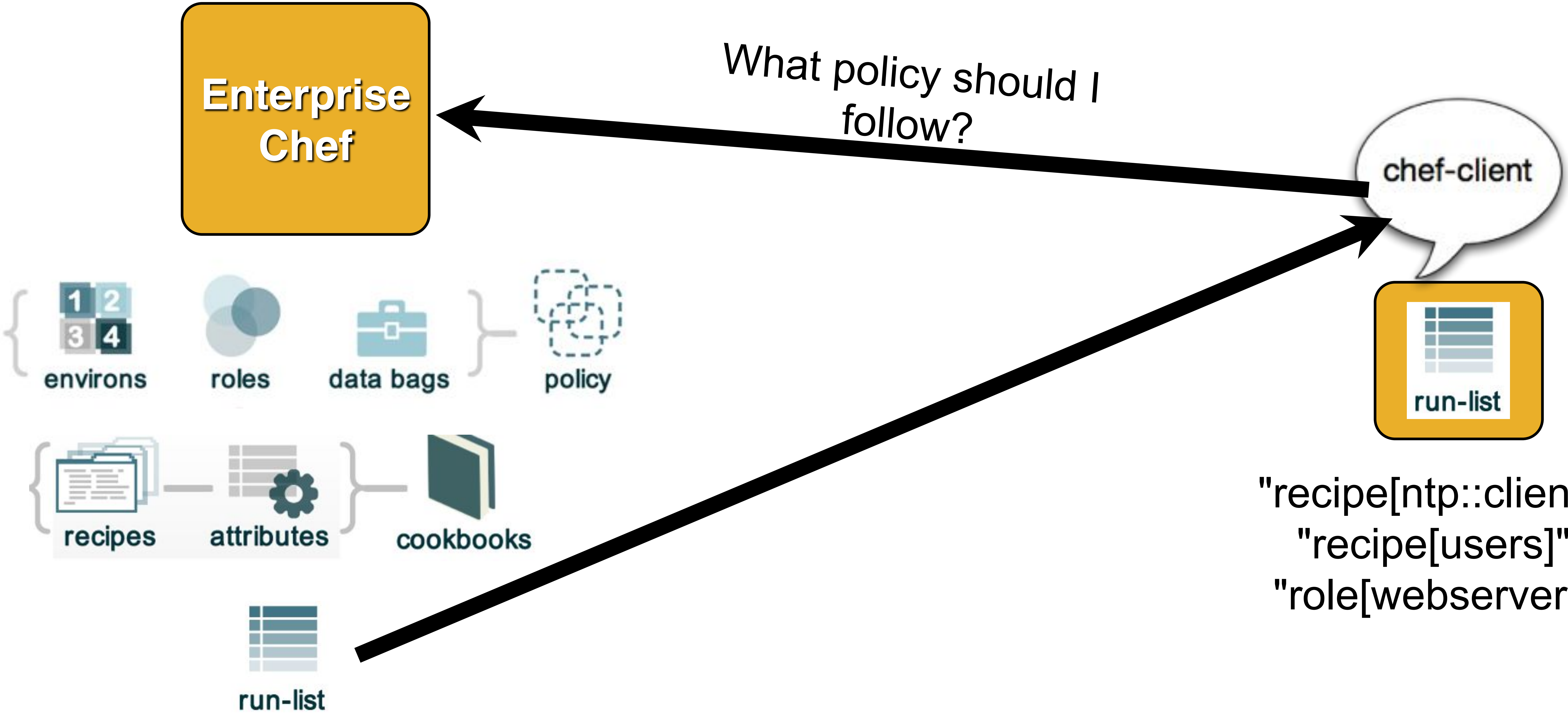
cookbooks

run-list

run-list

"recipe[ntp::client]"
"recipe[users]"
"role[webserver]"

Run List



"recipe[ntp::client]"
"recipe[users]"
"role[webserver]"

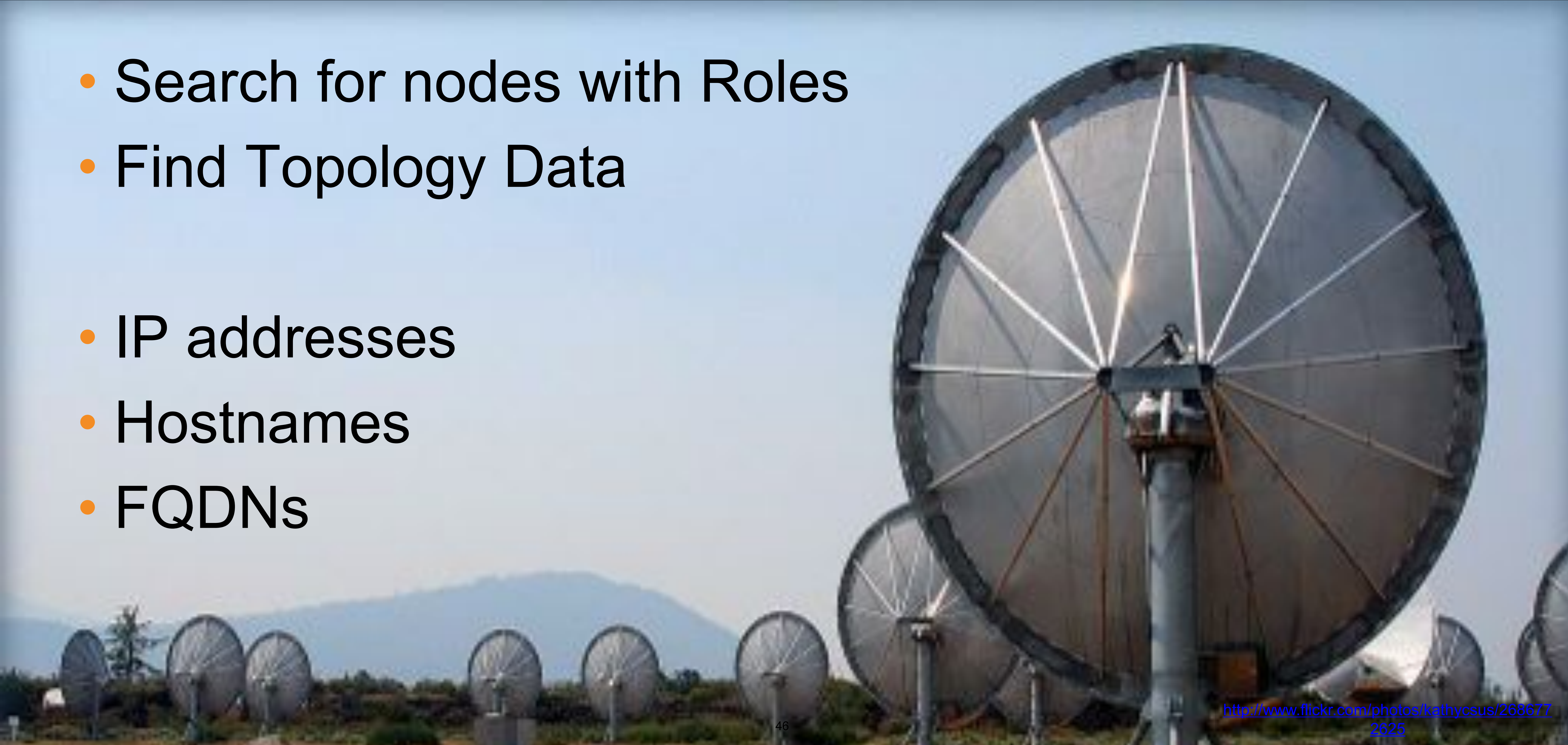
Run List Specifies Policy

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

Search

- Search for nodes with Roles
- Find Topology Data

- IP addresses
- Hostnames
- FQDNs



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Search for Nodes

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

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

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end
```

Pass results into Templates

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

Pass results into Templates

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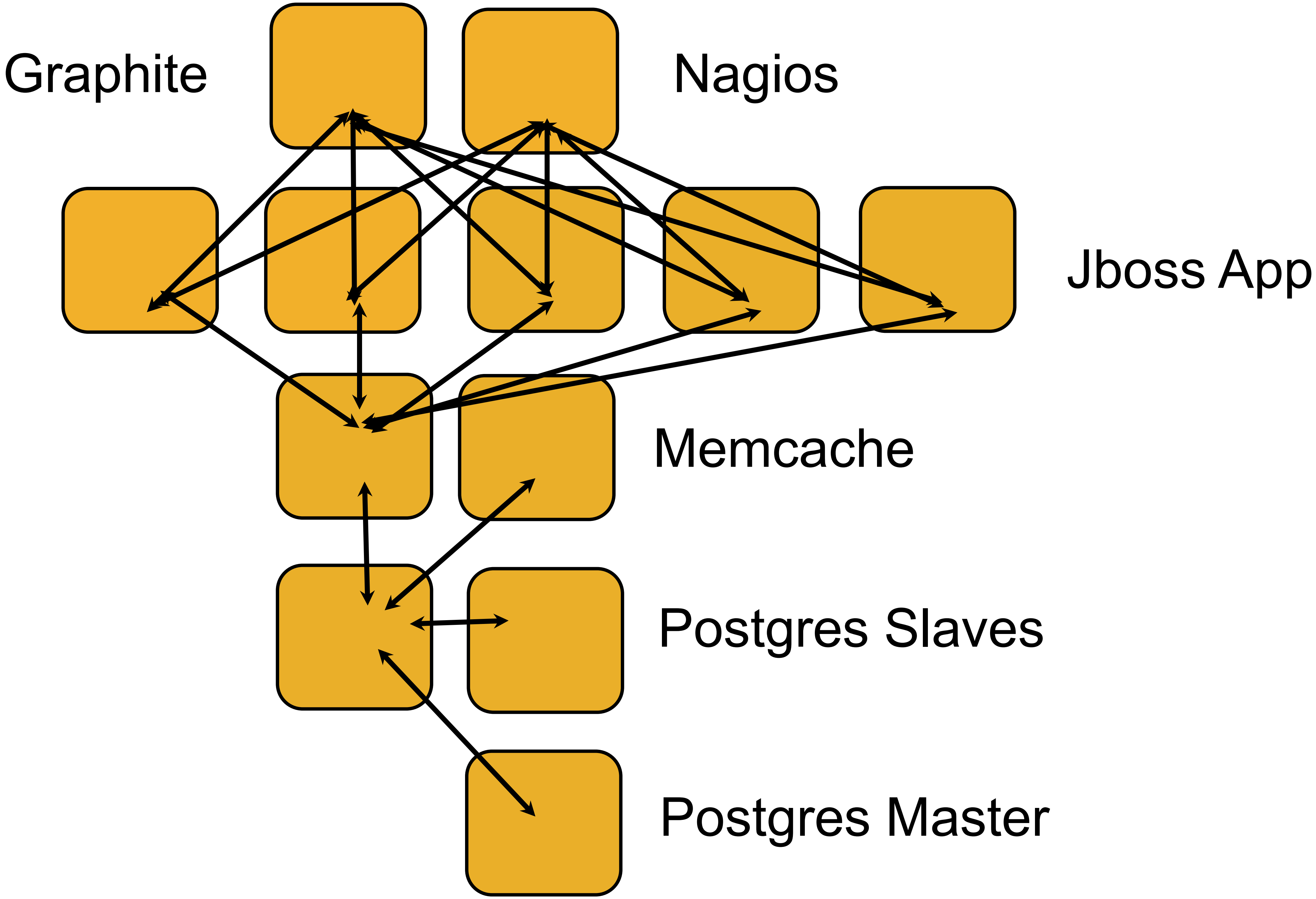
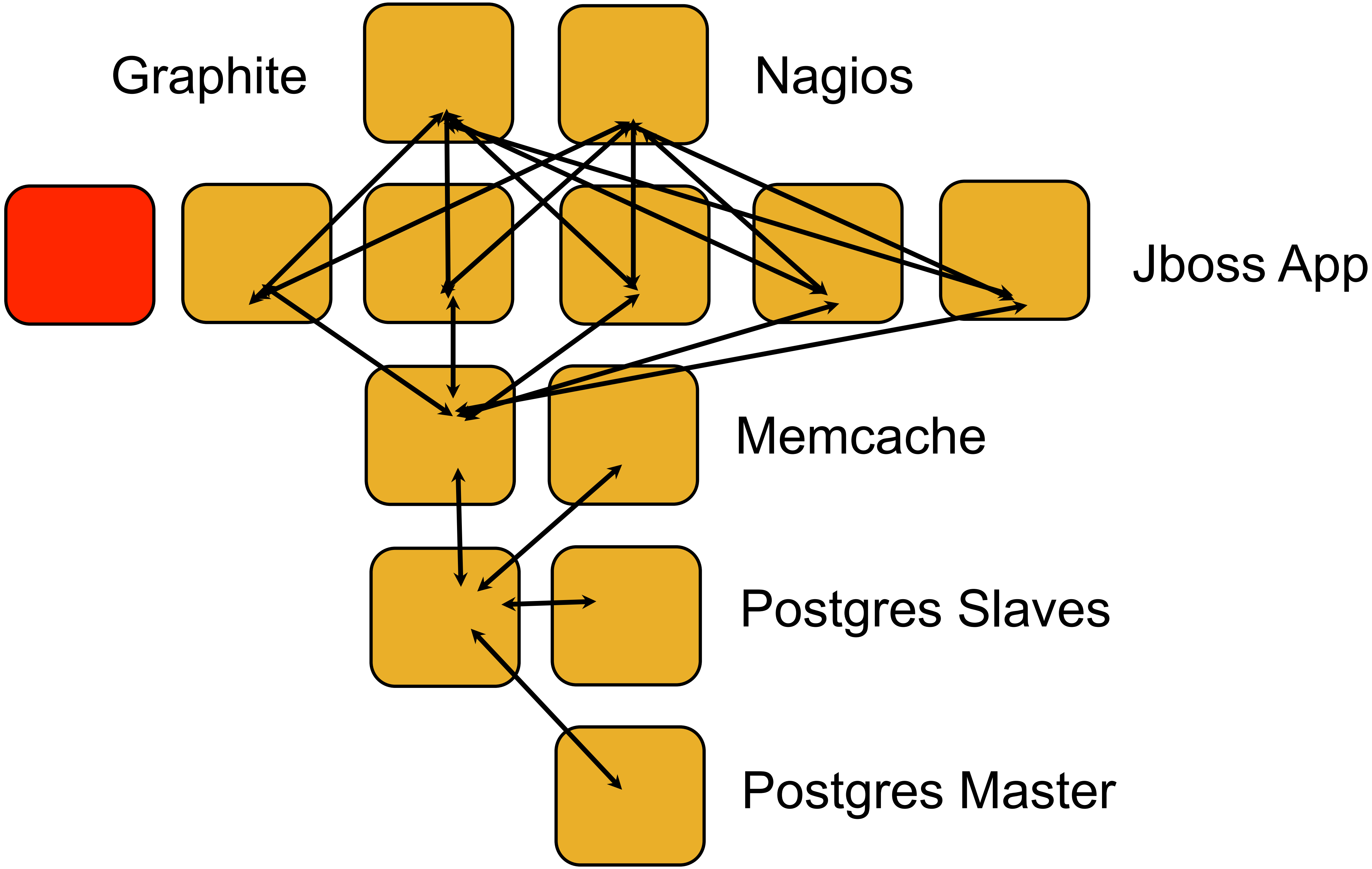
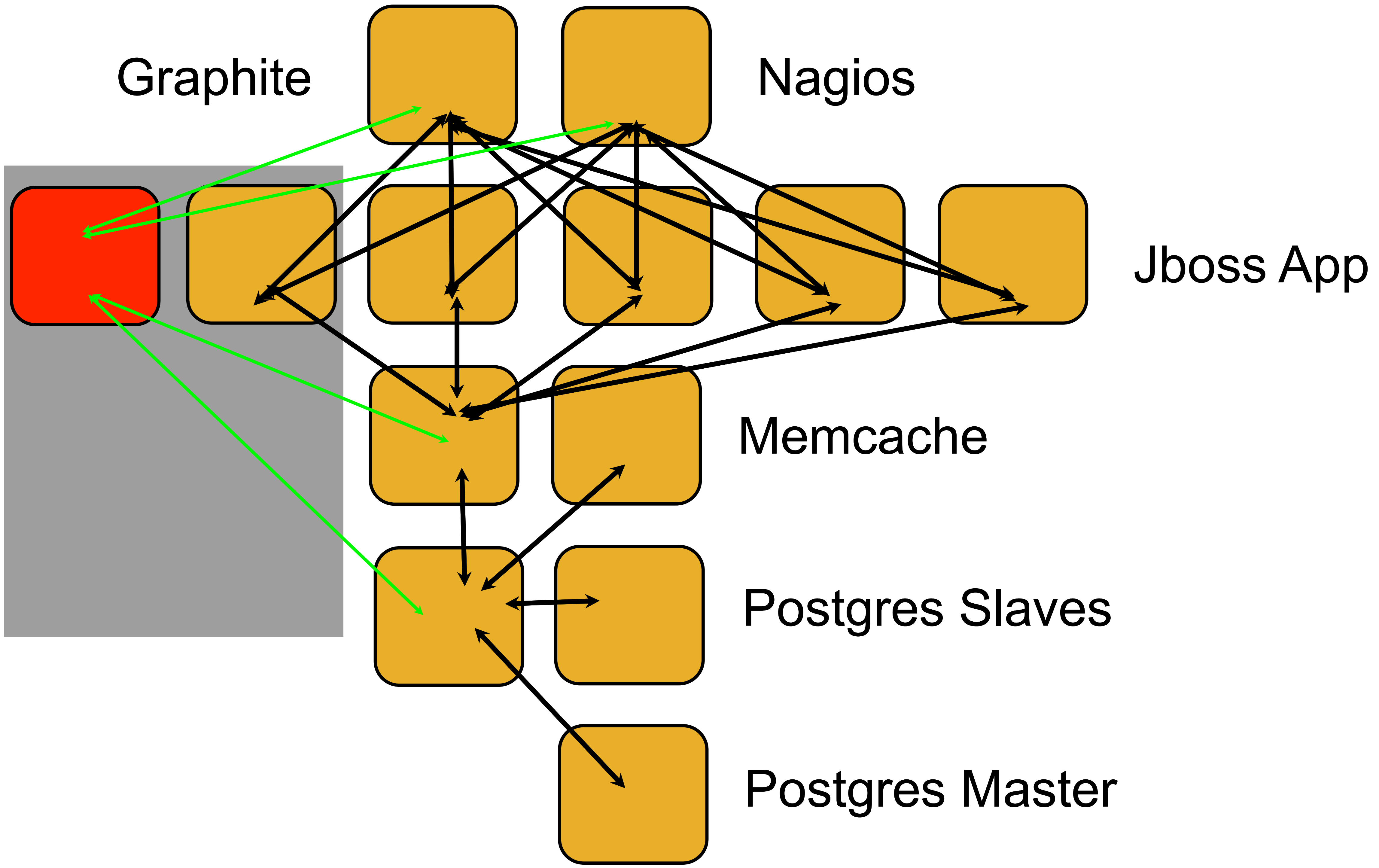
So when this...


Graphite
Nagios
Jboss App
Memcache
Postgres Slaves
Postgres Master

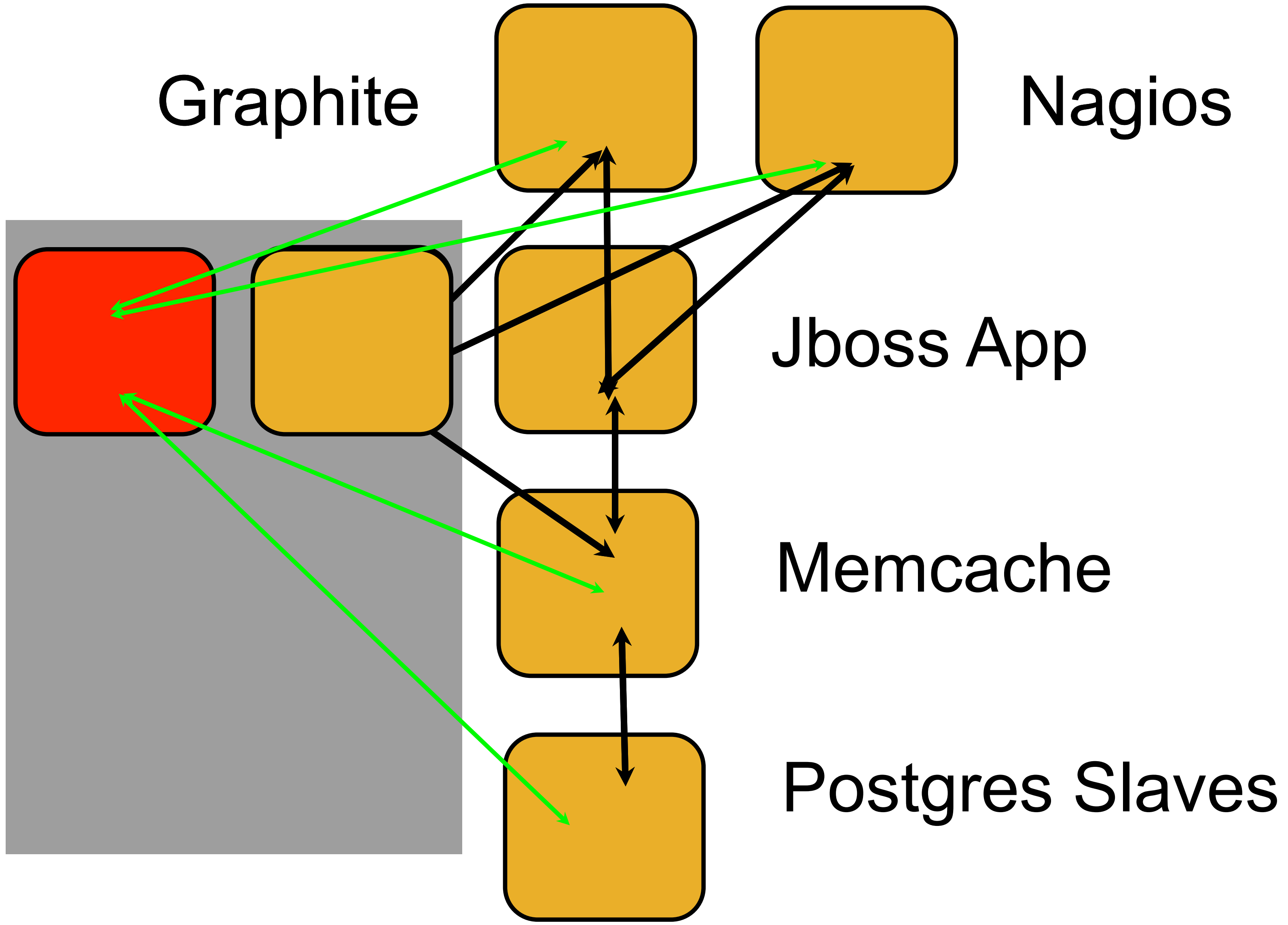
...becomes this



...this can happen automatically



Count the Resources



- 12+ resource changes for 1 node addition

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

Manage Complexity

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

Configuration Drift

- Configuration Drift happens when:
  - Your infrastructure requirements change
  - The configuration of a server falls out of policy

- Chef makes it easy to manage
  - Model the new requirements in your Chef configuration files
  - Run the chef-client to enforce your policies

Design Tenets of Chef

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

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Make WAS easy for developers!

- Ops use WAS for stability, scalability, performance …

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- Dev less so. They have other requirements

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⇒ Variety of appservers used in Dev

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WAS Developer Tools for Eclipse (WDT)

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Same reliable containers & QOS. Develop on Liberty profile and deploy to Liberty or full-profile WAS

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Add custom features and integrate 3rd party components via Liberty extensions interface

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IM or unzip to install. New option to deploy "server package" of app + config + required subset of server runtime for highest density deploy

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Web Profile Certified
Create web apps for the Java EE Web Profile standard.

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Add custom features and integrate 3rd party components via Liberty extensions interface

Unzip install and deploy
IM or unzip to install. New option to deploy "server package" of app + config + required subset of server runtime for highest density deploy

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Create web apps for the Java EE Web Profile standard.

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Powerful tools in WDT Eclipse feature. Enhanced for v8.5.5 prog models, Maven integration, ++

WAS v8.5.5 Liberty Profile & WAS Developer Tools for Eclipse (WDT)

"Developer First" Focus
Simplified, shareable XML server config. New integrated messaging server, DynaCache support, new prog. models, such as Web Services, JMS & EJB-Lite.

Start fast, run efficiently
Starts in <3s; Mem footprint <50MB; (TradeLite benchmark)

Small Download
50MB for Web Profile features

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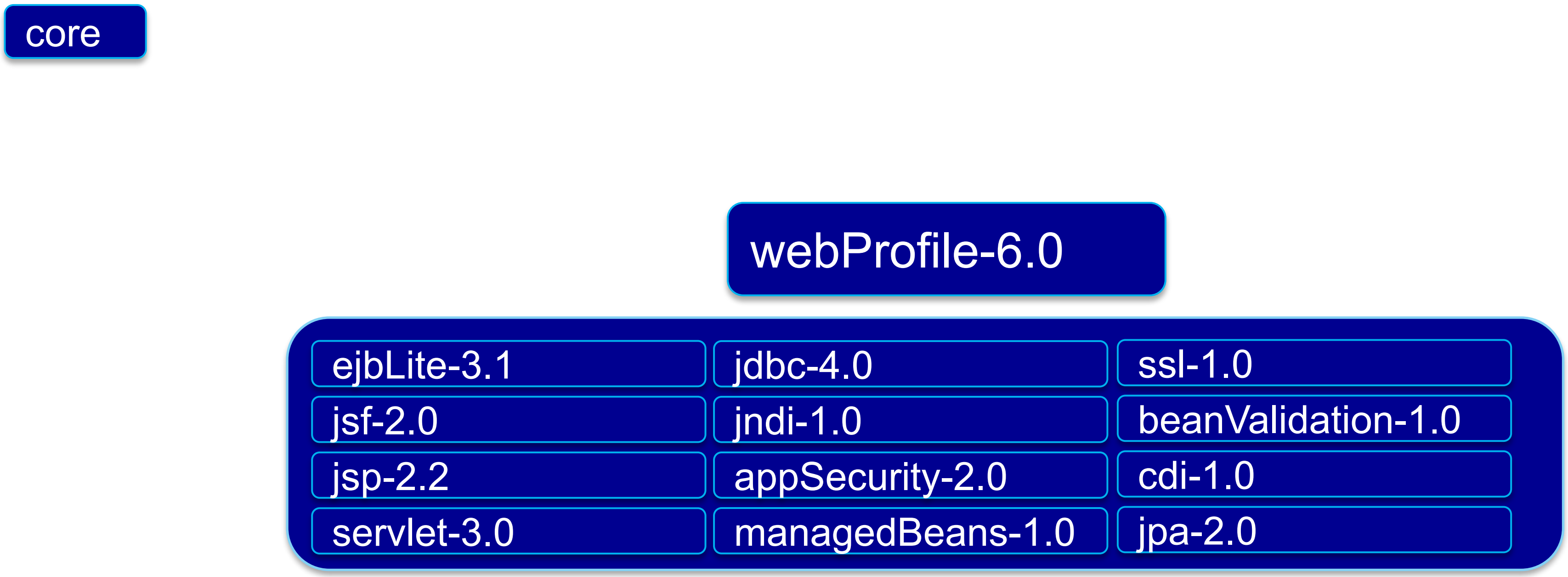

core

webProfile-6.0

ejbLite-3.1	jdbc-4.0	ssl-1.0
jsf-2.0	jndi-1.0	beanValidation-1.0
jsp-2.2	appSecurity-2.0	cdi-1.0
servlet-3.0	managedBeans-1.0	jpa-2.0

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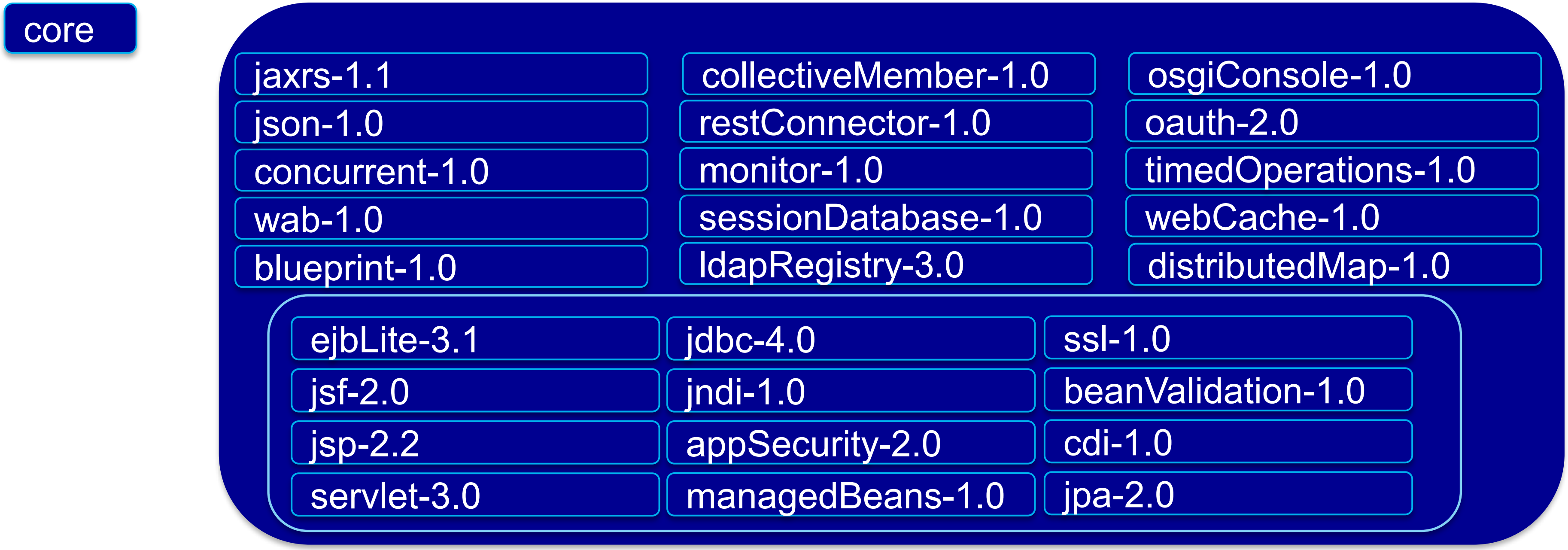

core

jaxrs-1.1
json-1.0
concurrent-1.0
wab-1.0
blueprint-1.0

collectiveMember-1.0
restConnector-1.0
monitor-1.0
sessionDatabase-1.0
ldapRegistry-3.0

osgiConsole-1.0
oauth-2.0
timedOperations-1.0
webCache-1.0
distributedMap-1.0

ejbLite-3.1
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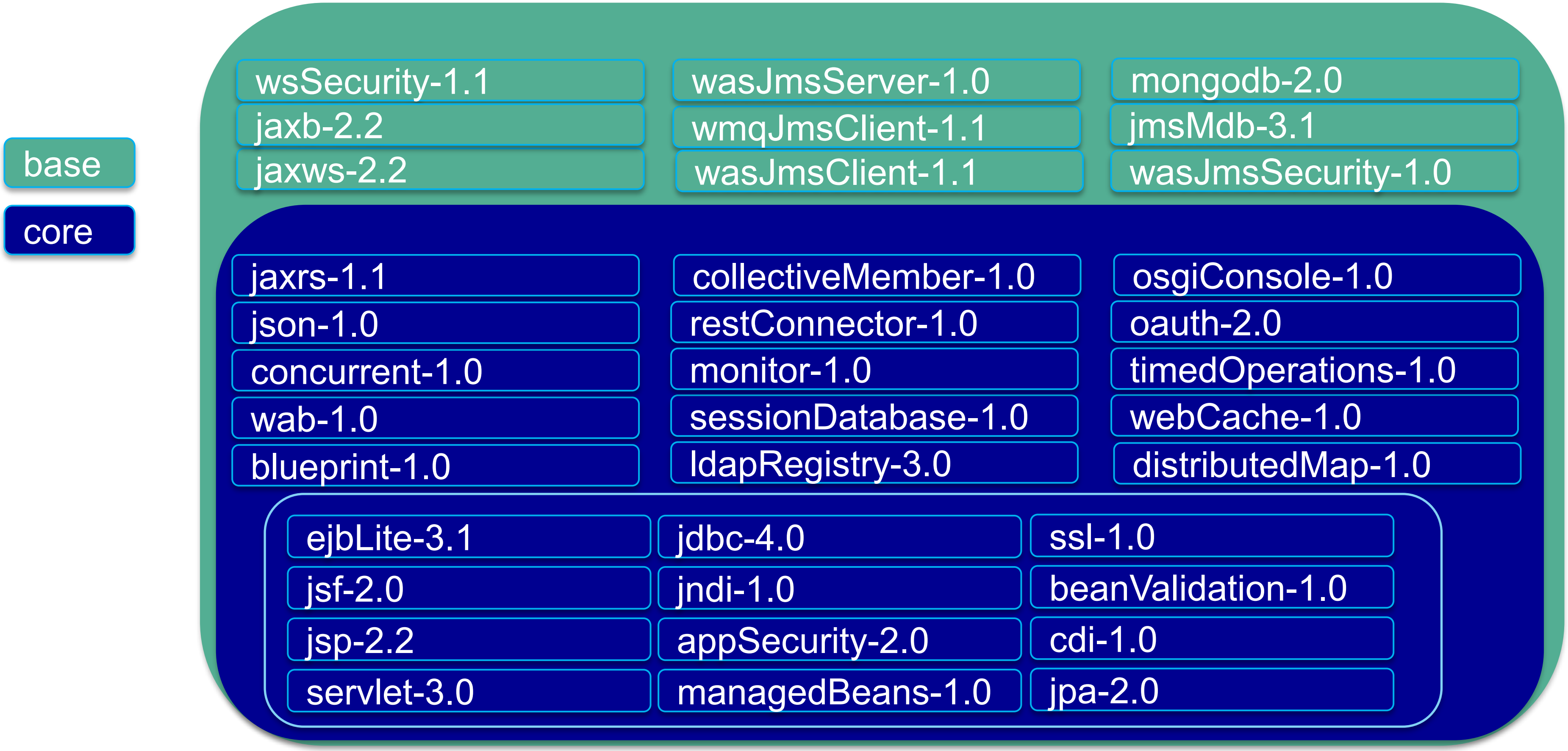

base

core

wsSecurity-1.1
jaxb-2.2
jaxws-2.2

wasJmsServer-1.0
wmqJmsClient-1.1
wasJmsClient-1.1

mongodb-2.0
jmsMdb-3.1
wasJmsSecurity-1.0

jaxrs-1.1
json-1.0
concurrent-1.0
wab-1.0
blueprint-1.0

collectiveMember-1.0
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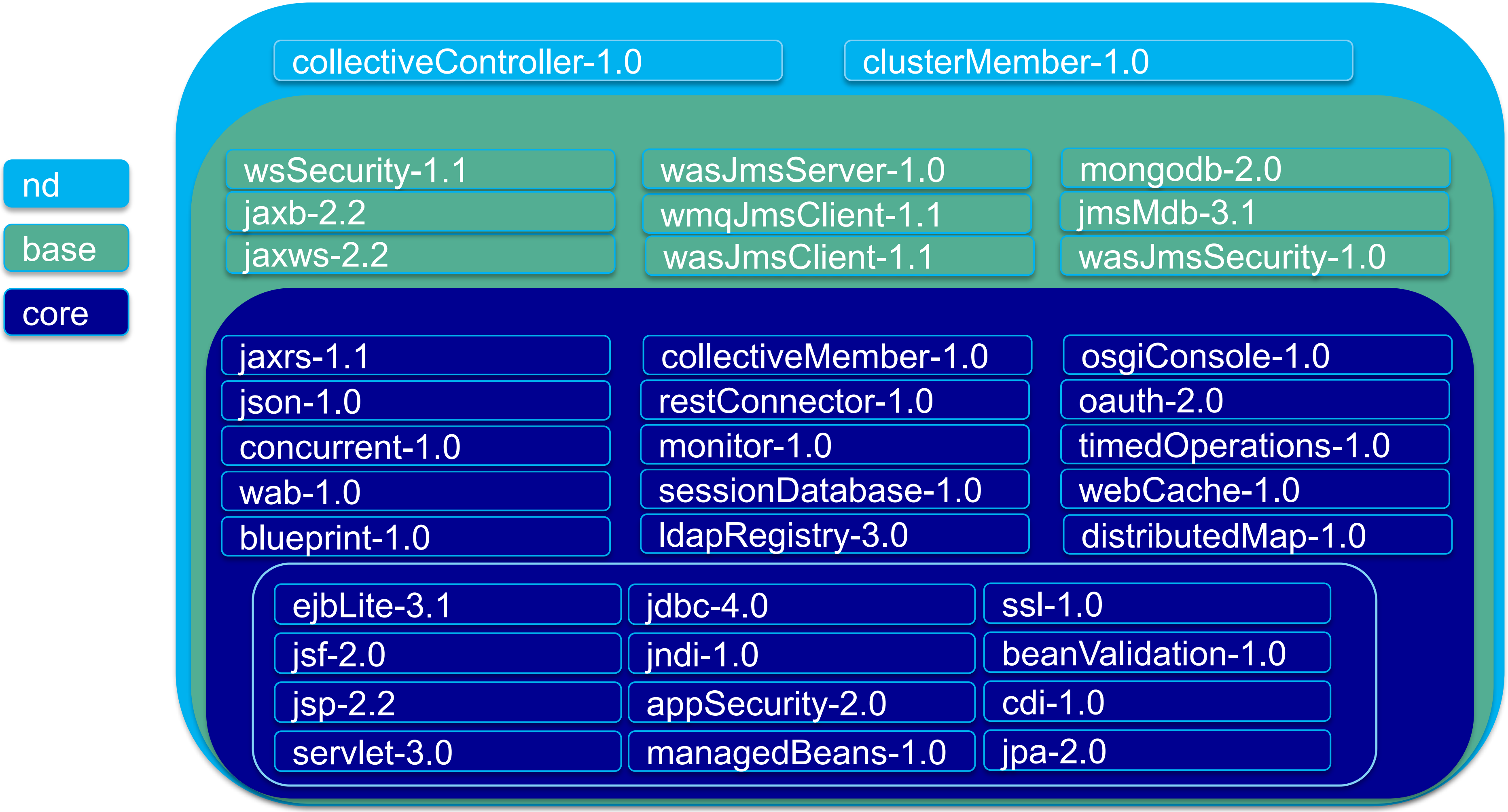

nd

base

core

collectiveController-1.0	clusterMember-1.0

wsSecurity-1.1	wasJmsServer-1.0	mongodb-2.0
jaxb-2.2	wmqJmsClient-1.1	jmsMdb-3.1
jaxws-2.2	wasJmsClient-1.1	wasJmsSecurity-1.0

jaxrs-1.1	collectiveMember-1.0	osgiConsole-1.0
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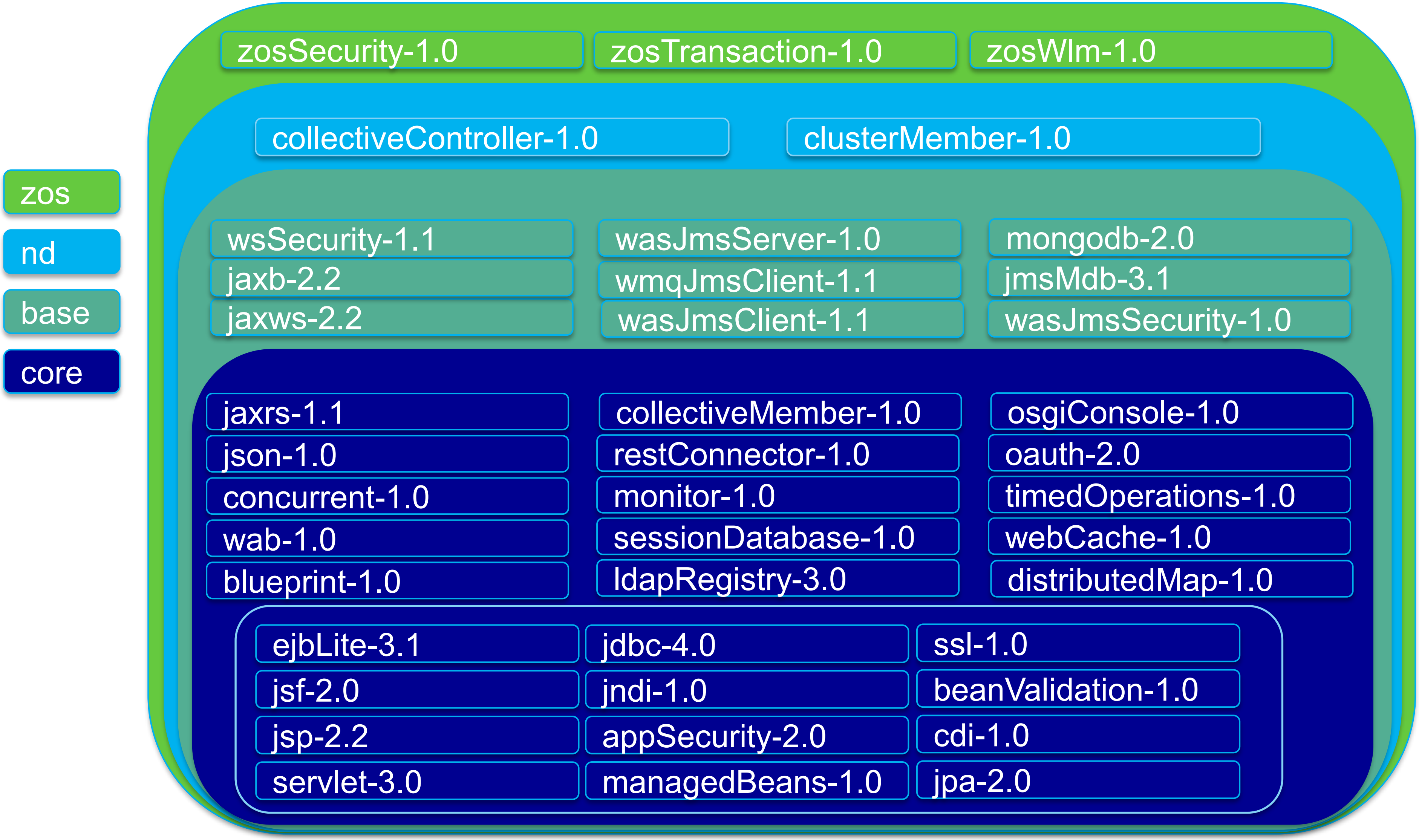

zos

nd

base

core

zosSecurity-1.0
zosTransaction-1.0
zosWlm-1.0

collectiveController-1.0
clusterMember-1.0

wsSecurity-1.1
jaxb-2.2
jaxws-2.2
wasJmsServer-1.0
wmqJmsClient-1.1
wasJmsClient-1.1
mongodb-2.0
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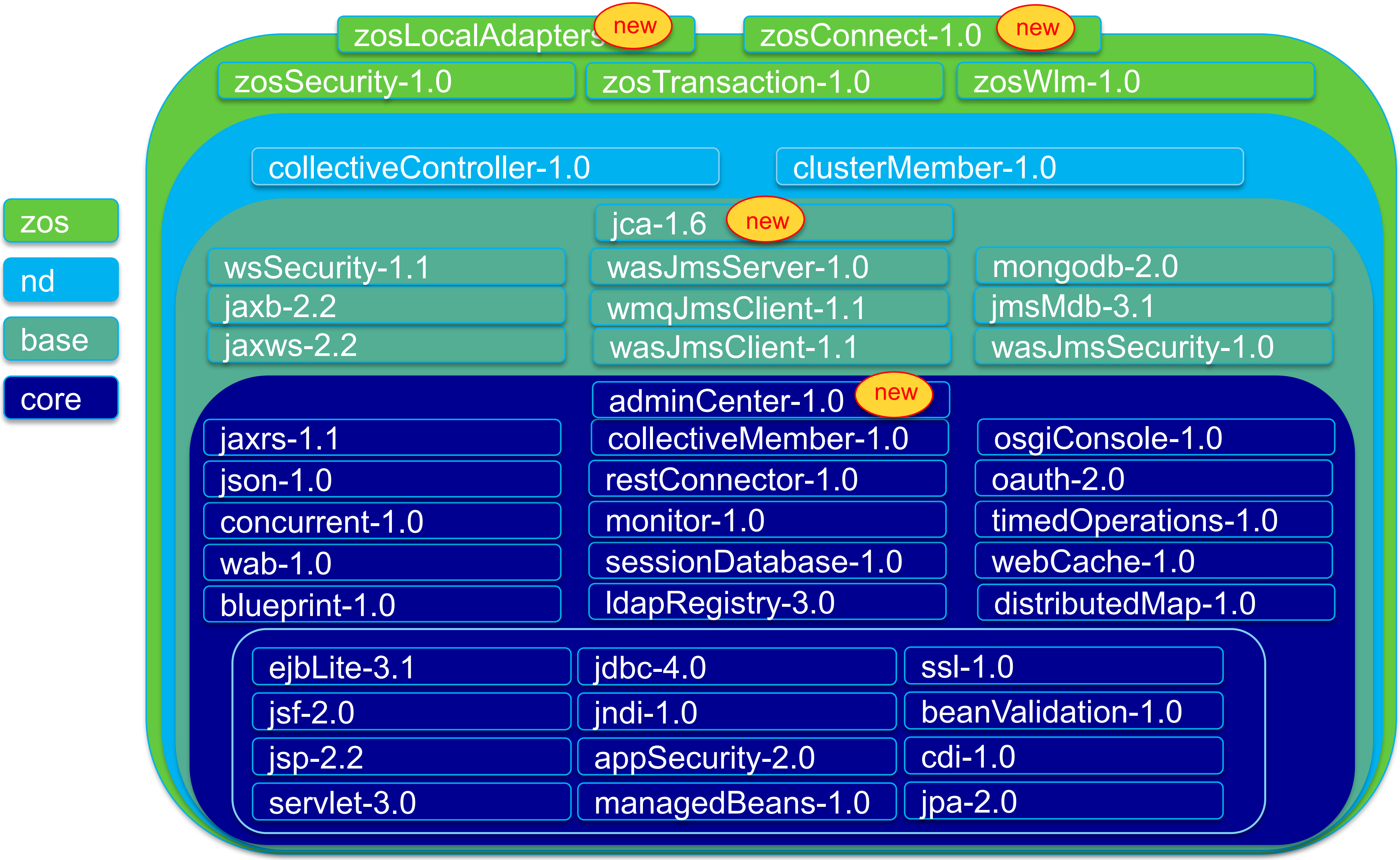

zos

nd

base

core

zosLocalAdapters new

zosConnect-1.0 new

zosSecurity-1.0

zosTransaction-1.0

zosWlm-1.0

collectiveController-1.0

clusterMember-1.0

jca-1.6 new

wsSecurity-1.1

jaxb-2.2

jaxws-2.2

wasJmsServer-1.0

wmqJmsClient-1.1

wasJmsClient-1.1

mongodb-2.0

jmsMdb-3.1

wasJmsSecurity-1.0

adminCenter-1.0 new

jaxrs-1.1

json-1.0

concurrent-1.0

wab-1.0

blueprint-1.0

collectiveMember-1.0

restConnector-1.0

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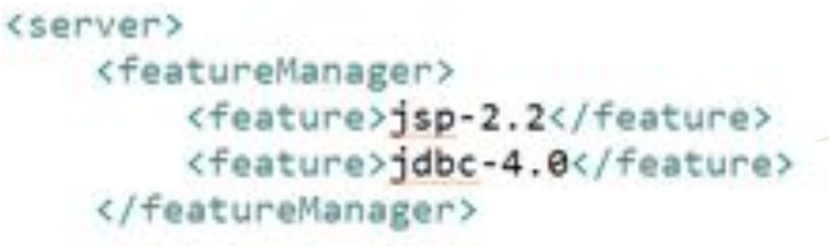
Simplified Server Configuration



```
<server>
    <featureManager>
        <feature>jsp-2.2</feature>
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Features control which capabilities (bundles) are installed in the server

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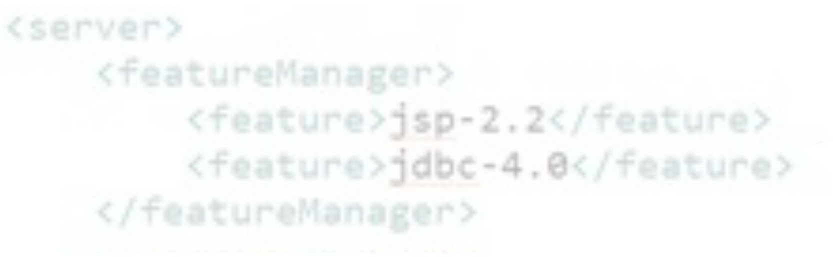

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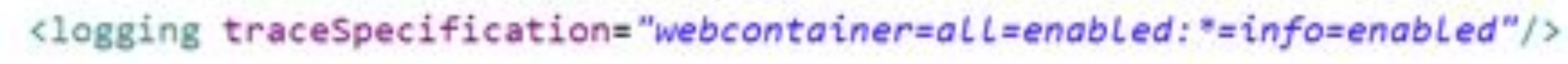

```
<logging traceSpecification="webcontainer=all=enabled:*=info=enabled"/>
```

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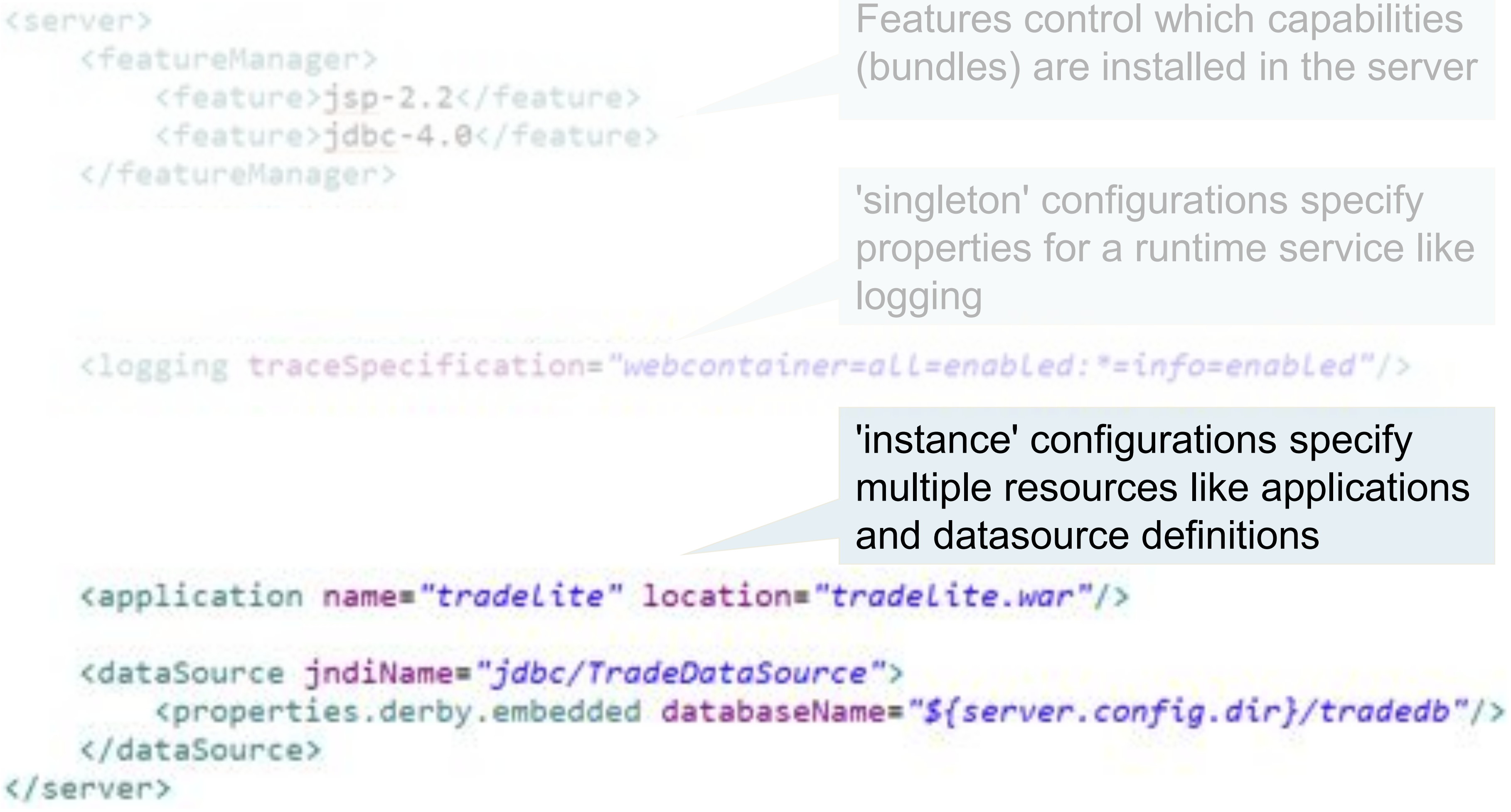

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    <logging traceSpecification="webcontainer=all=enabled:*=info=enabled"/>

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    <dataSource jndiName="jdbc/TradeDataSource">
        <properties.derby.embedded databaseName="${server.config.dir}/tradedb"/>
    </dataSource>
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```

Features control which capabilities (bundles) are installed in the server

'singleton' configurations specify properties for a runtime service like logging

'instance' configurations specify multiple resources like applications and datasource definitions

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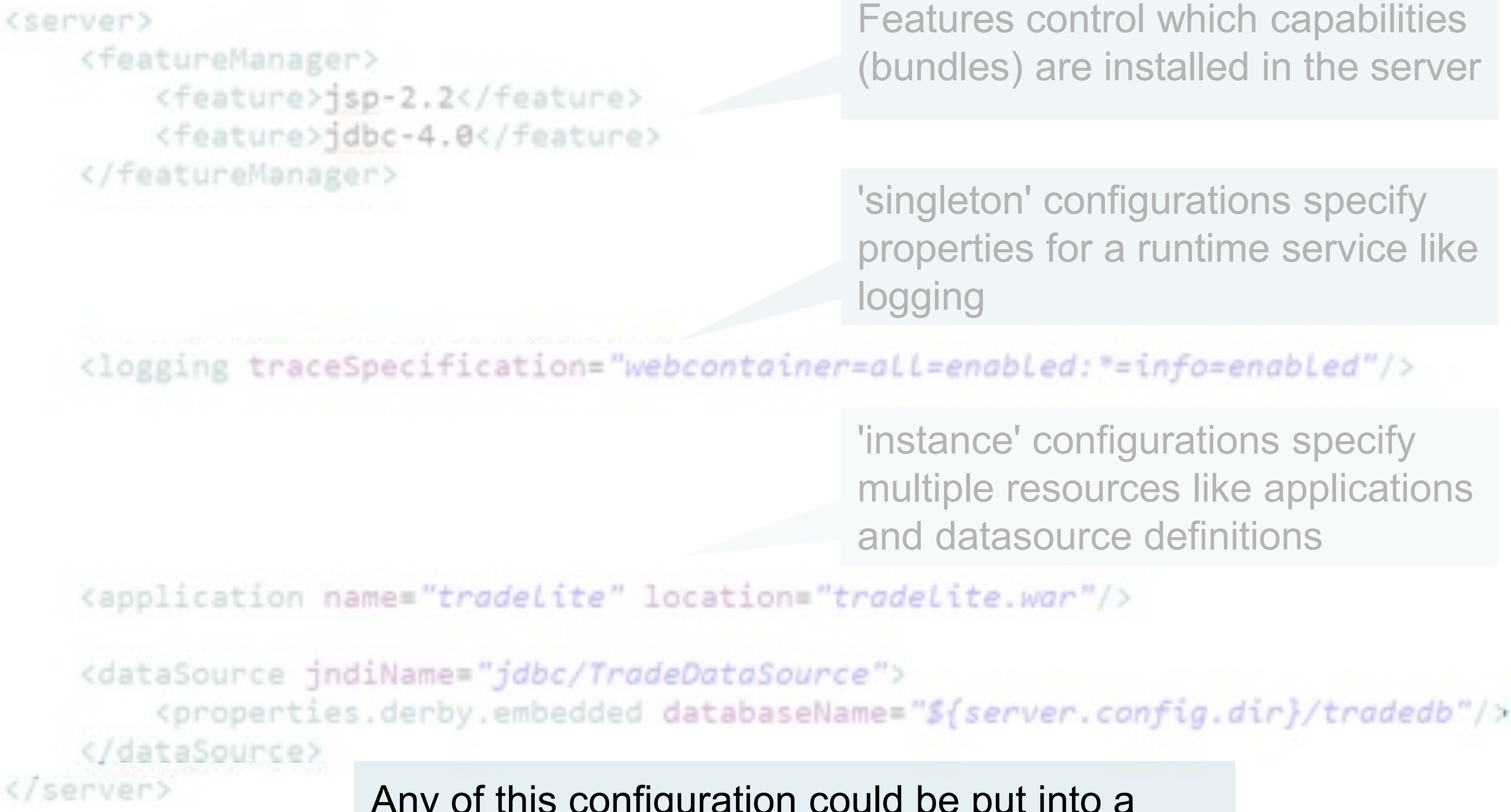

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Features control which capabilities (bundles) are installed in the server

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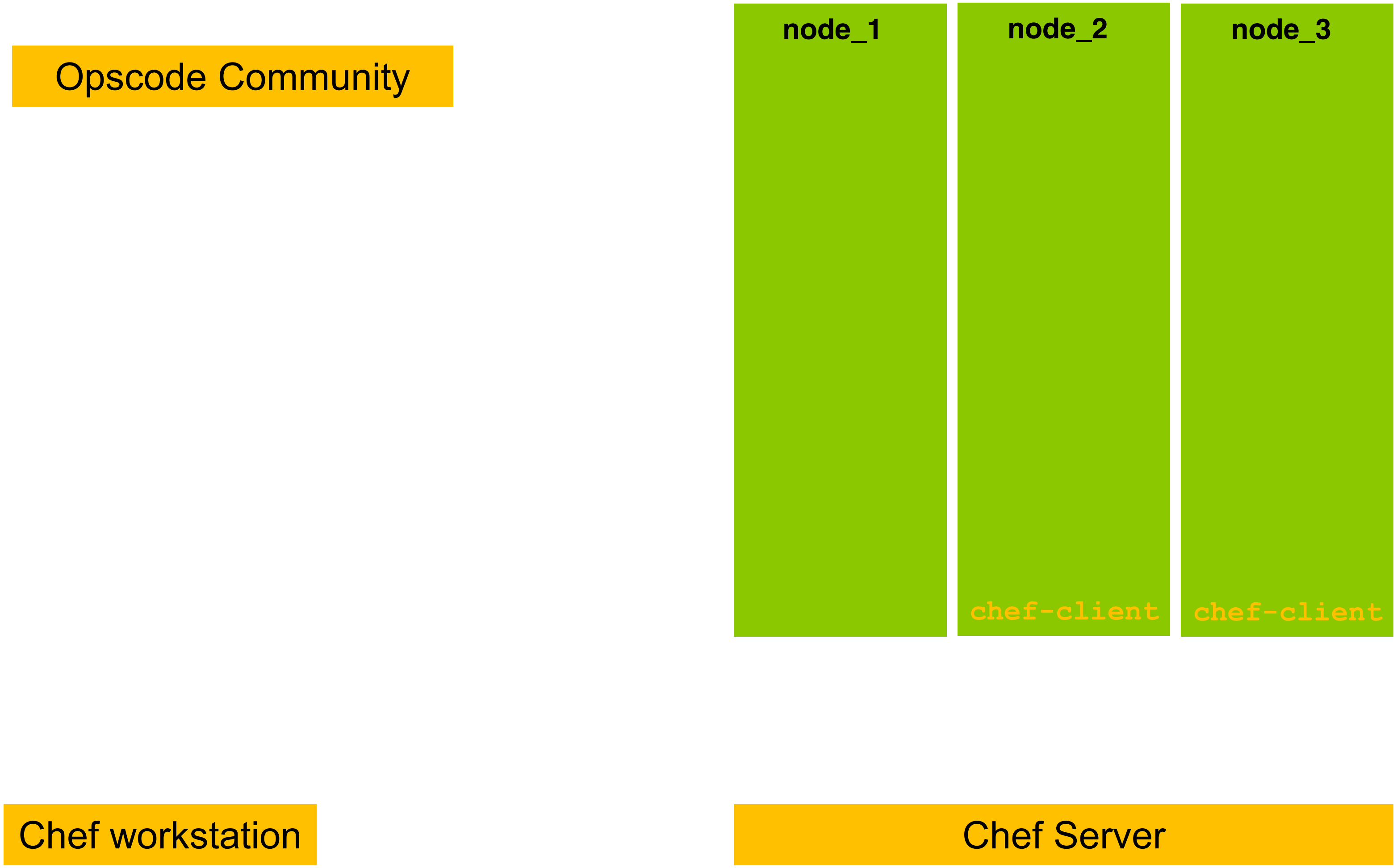
Any of this configuration could be put into a separate xml file and 'included' in this 'master' configuration file

Chef node setup



Opscode Community

node_1

node_2

chef-client

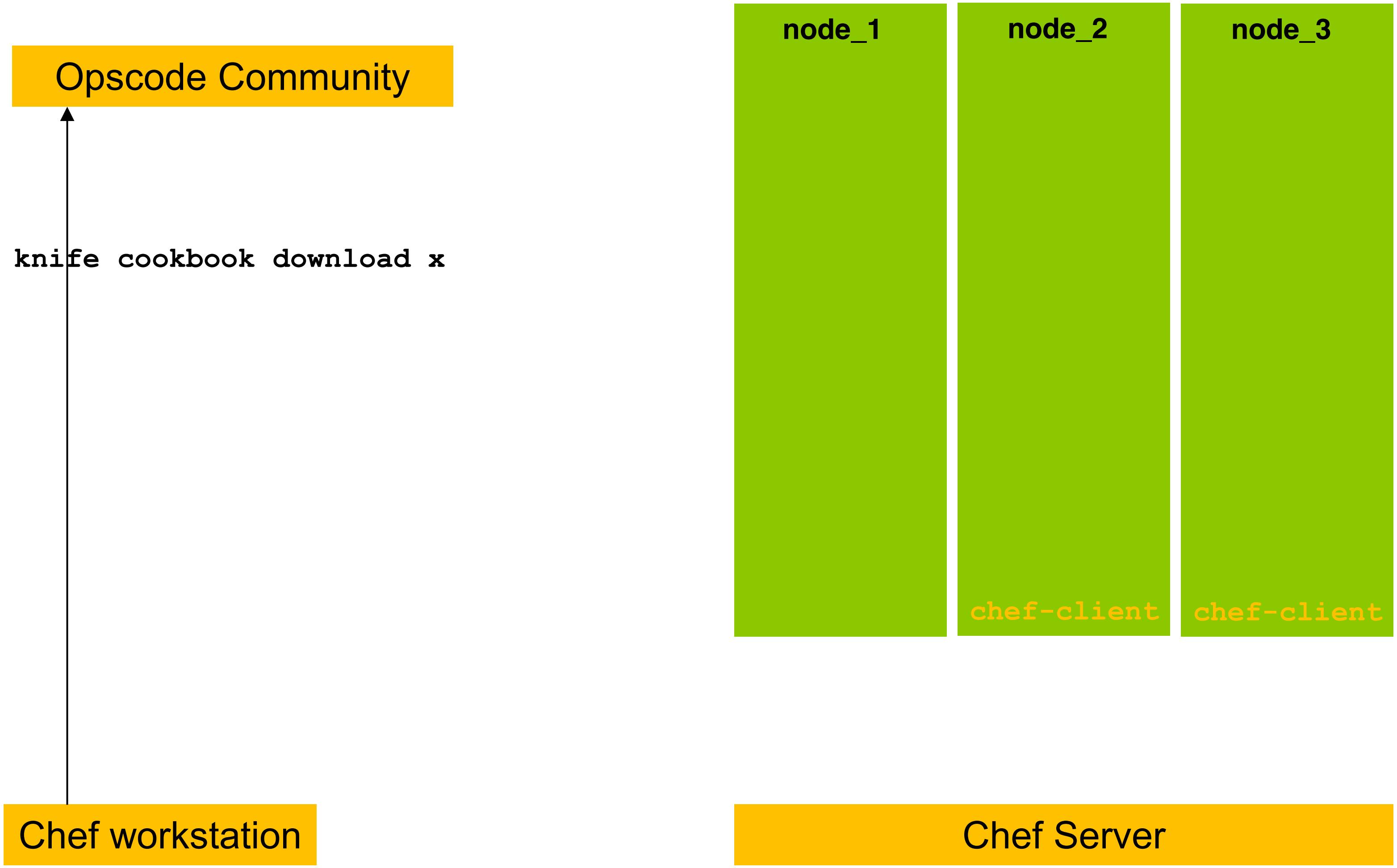
node_3

chef-client

Chef workstation

Chef Server

Chef node setup



Opscode Community

knife cookbook download x

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Chef Server

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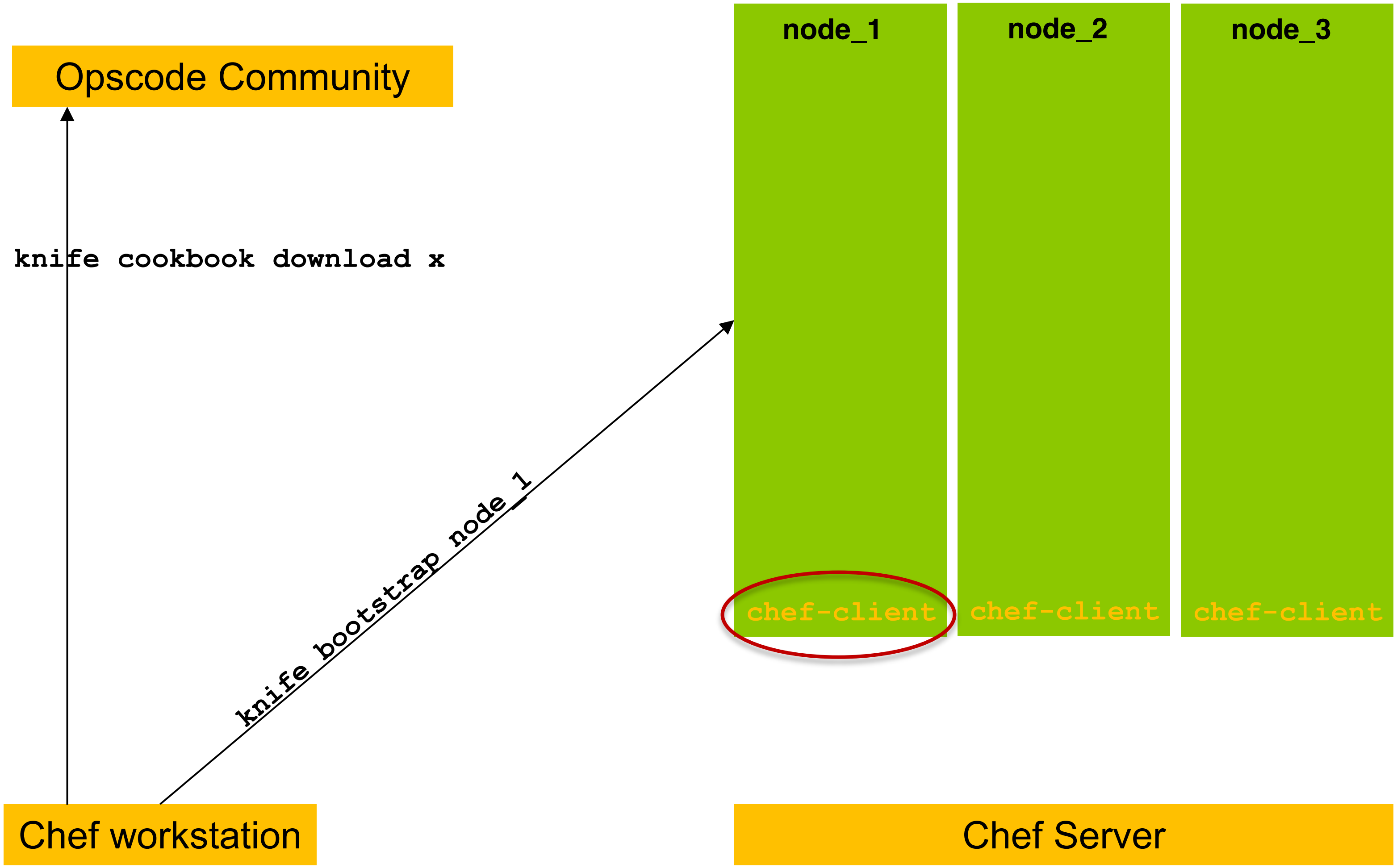
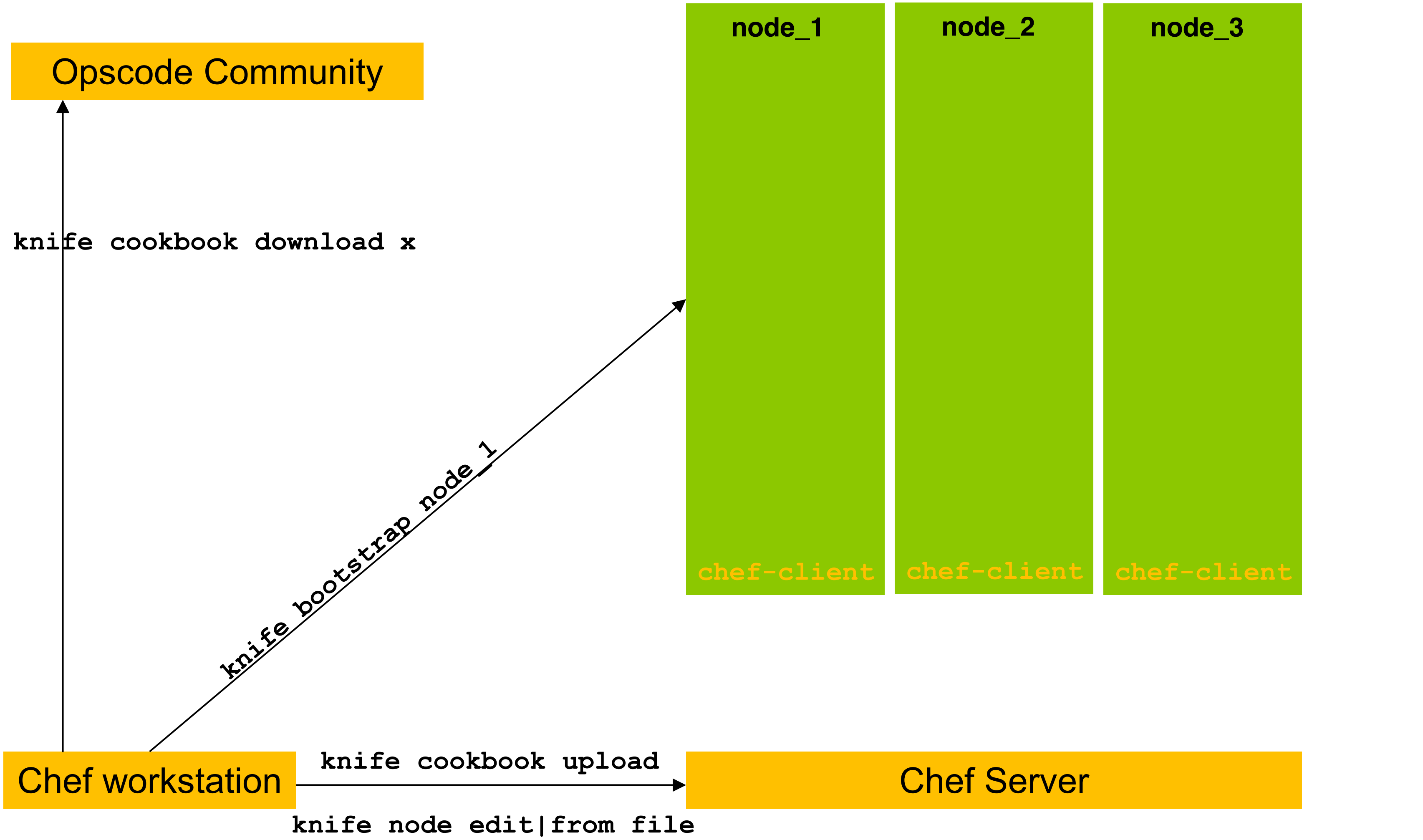


Chef node setup



Opscode Community

knife cookbook download x

node_1

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node_3

chef-client

chef-client

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knife bootstrap node_1

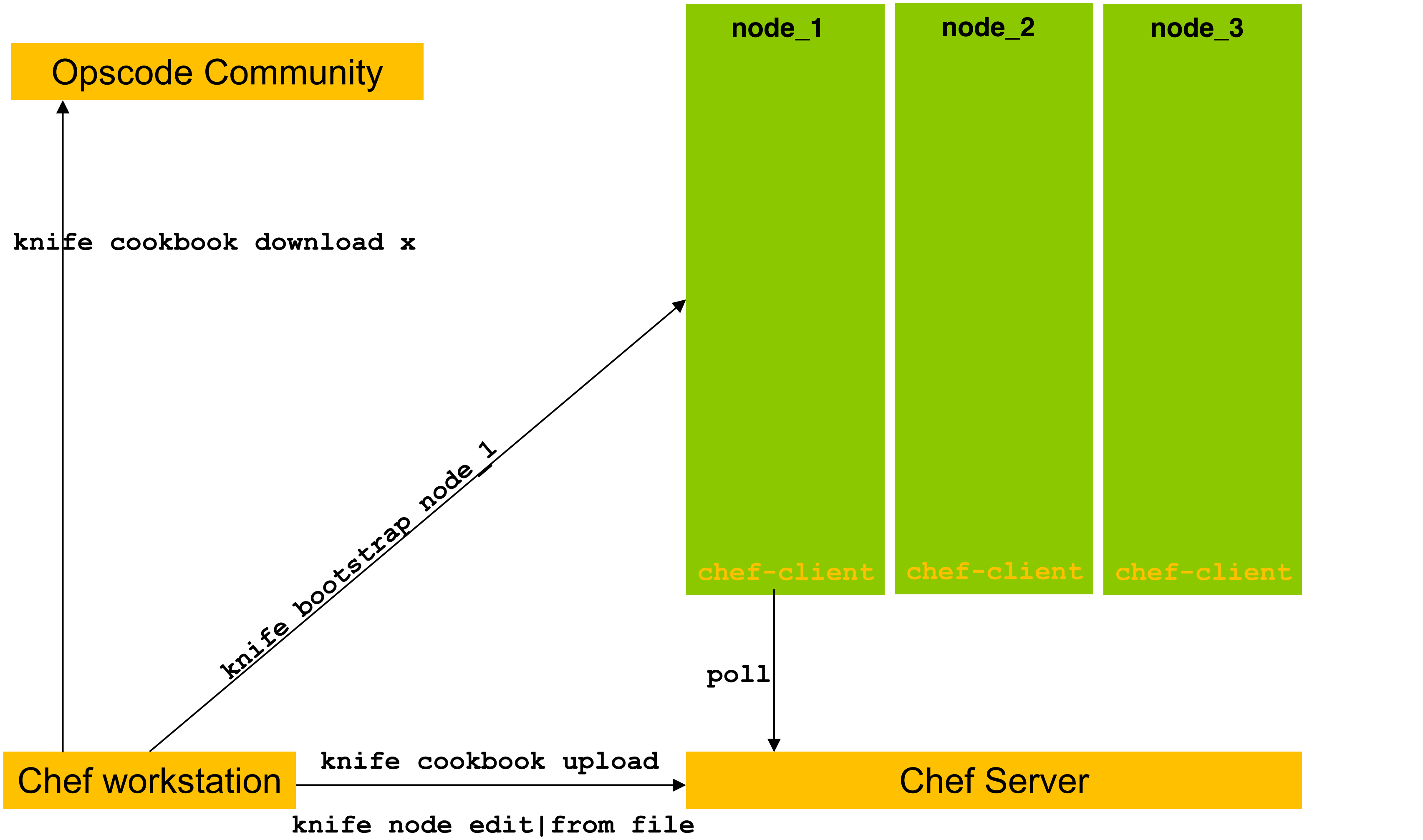
Chef workstation

knife cookbook upload

knife node edit|from file

Chef Server

Chef node setup



Opscode Community

node_1

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chef-client

chef-client

chef-client

knife cookbook download x

knife bootstrap node_1

poll

Chef workstation

knife cookbook upload

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Chef Server

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Apache 2.0 license

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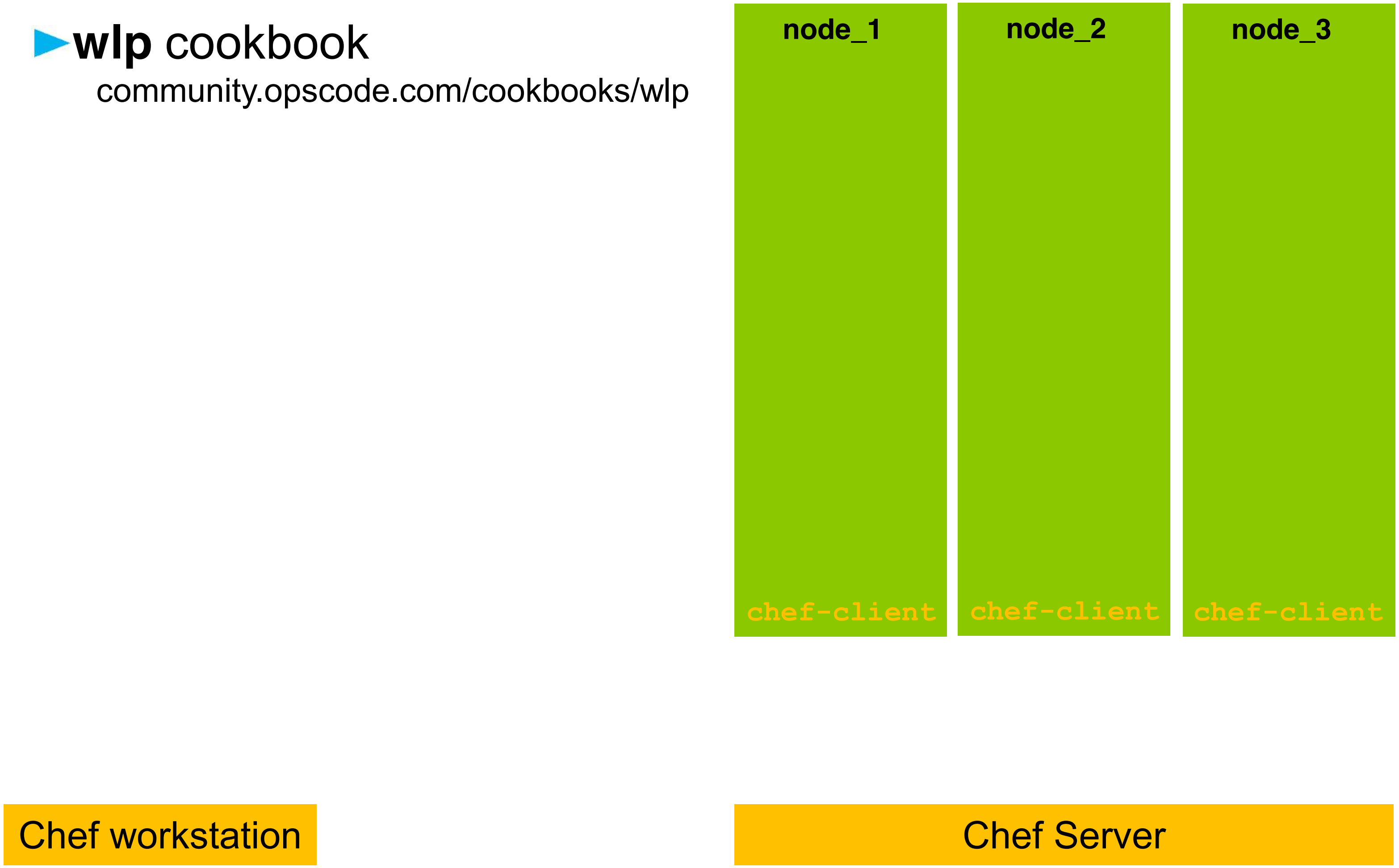

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Chef workstation

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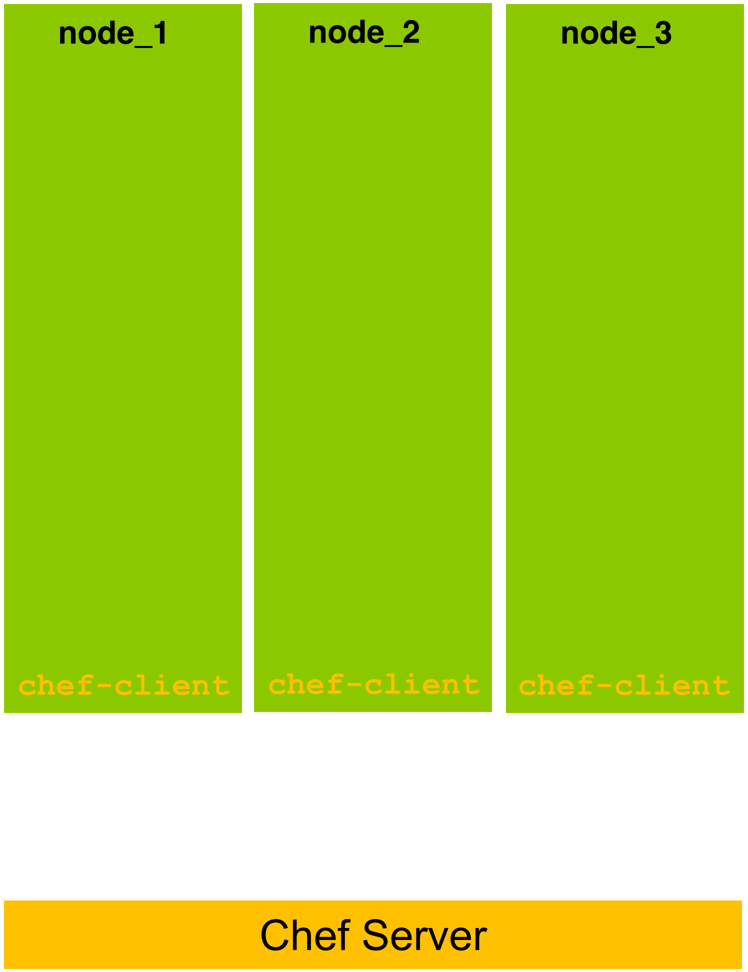

Chef workstation

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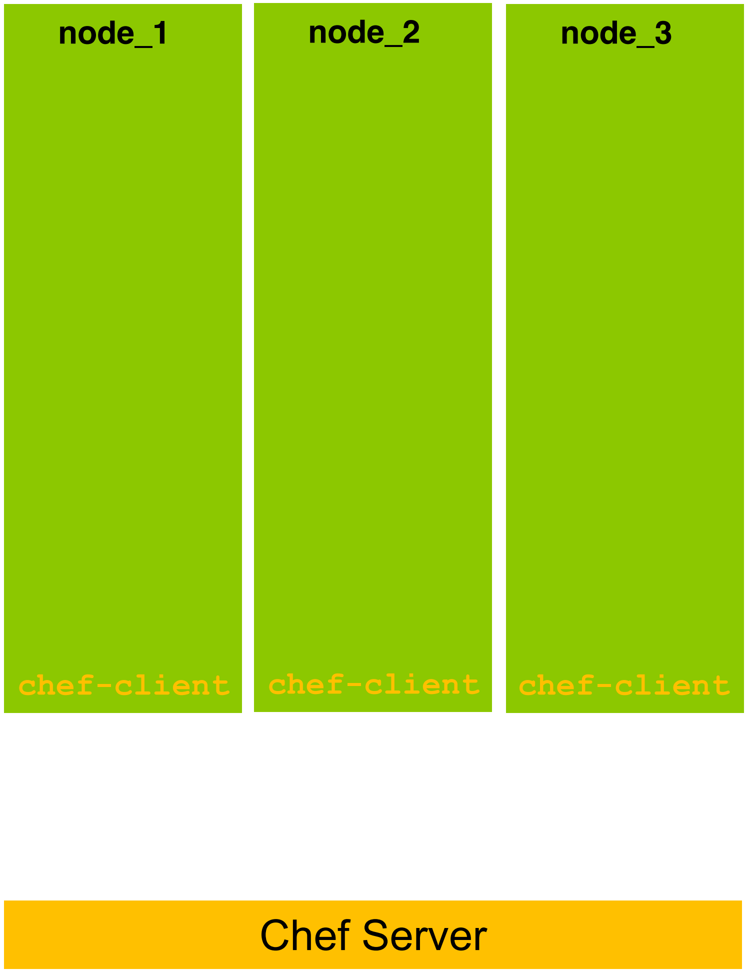

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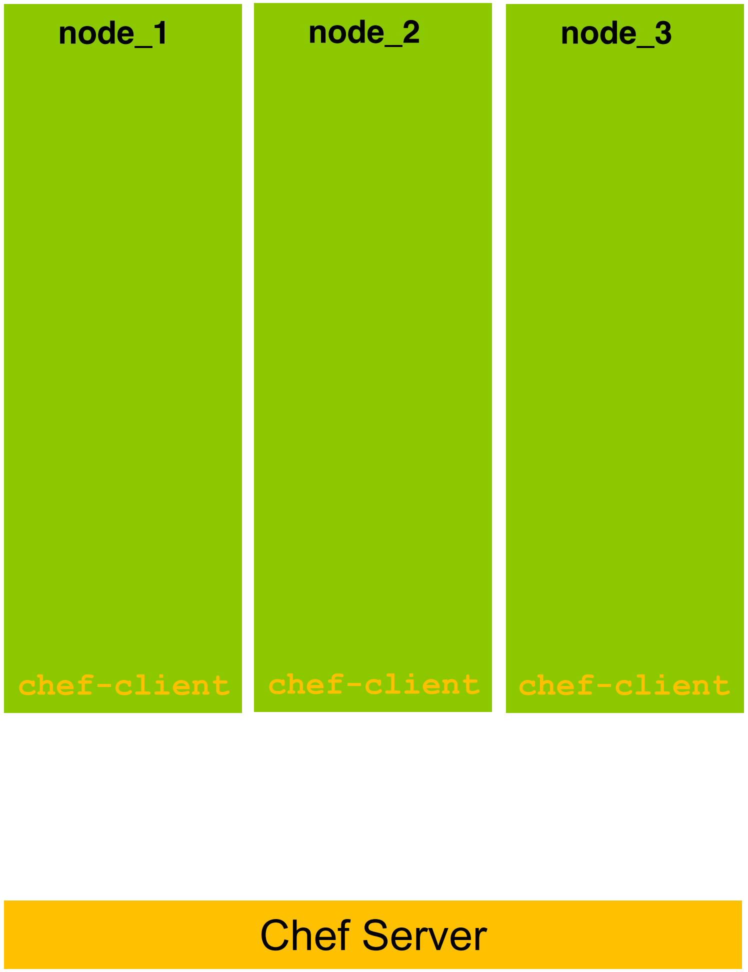

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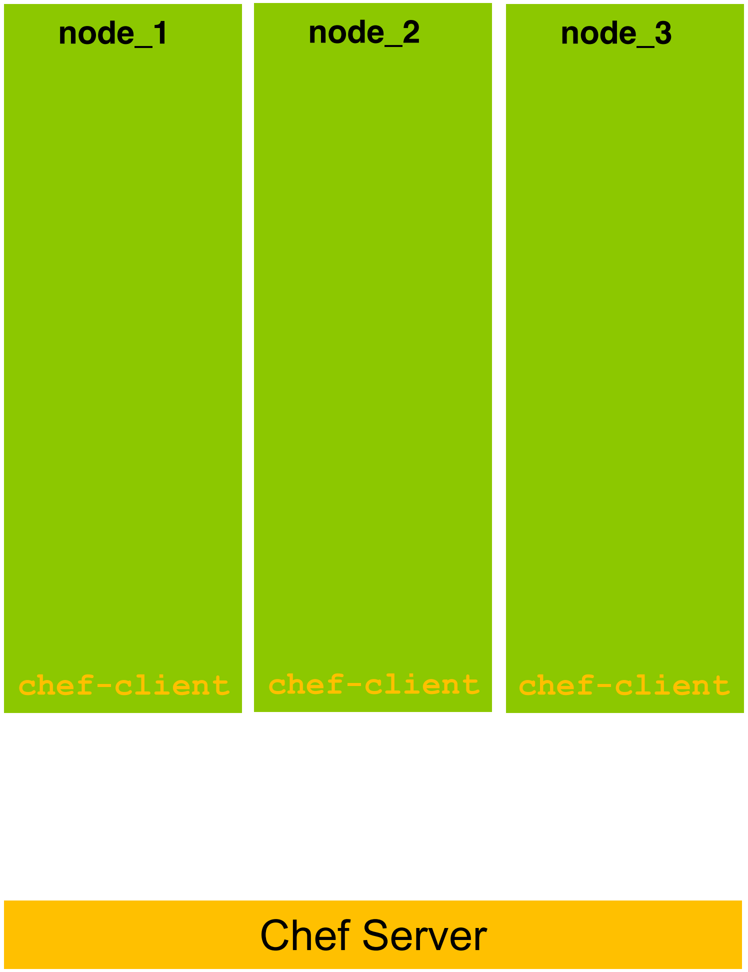

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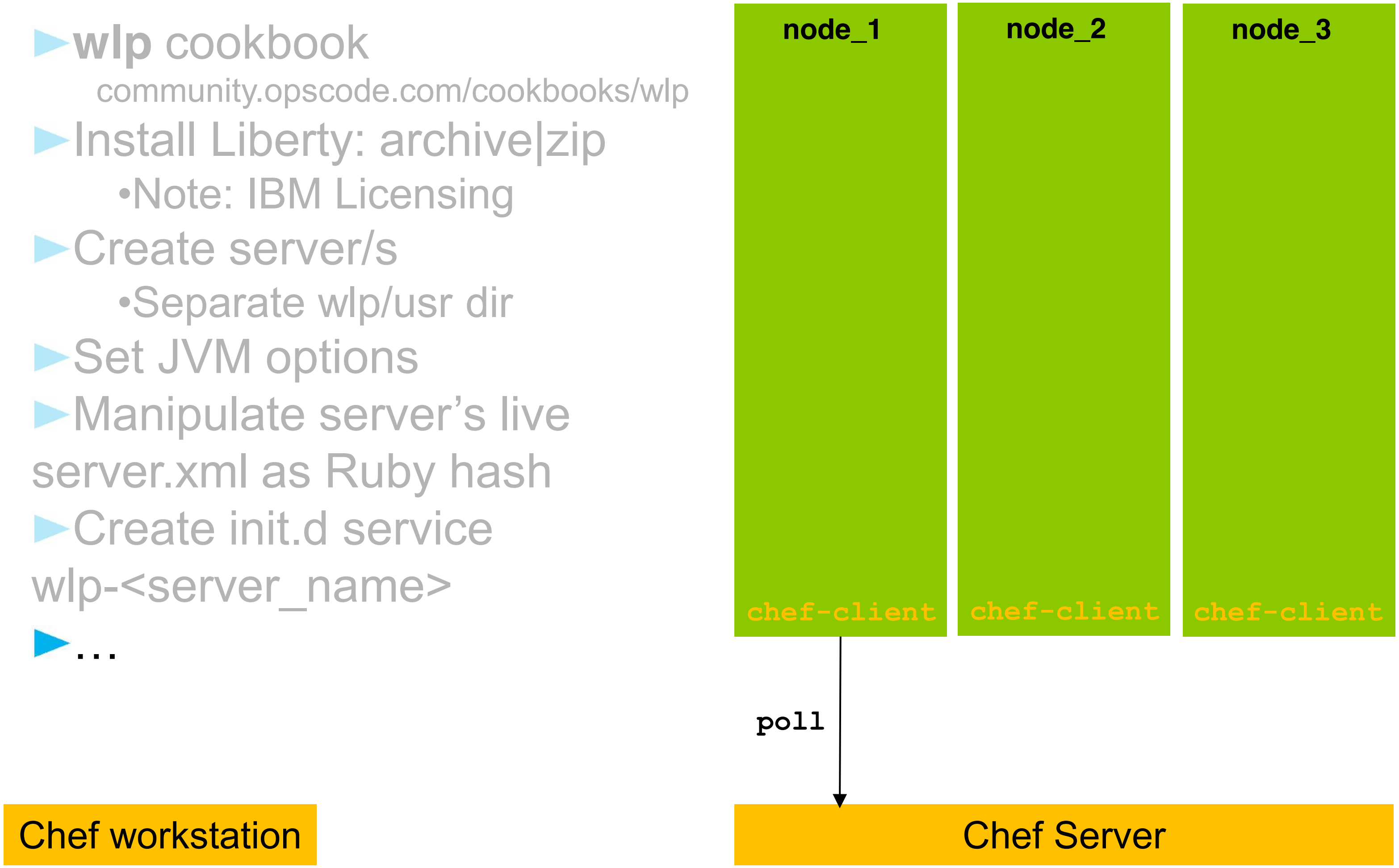

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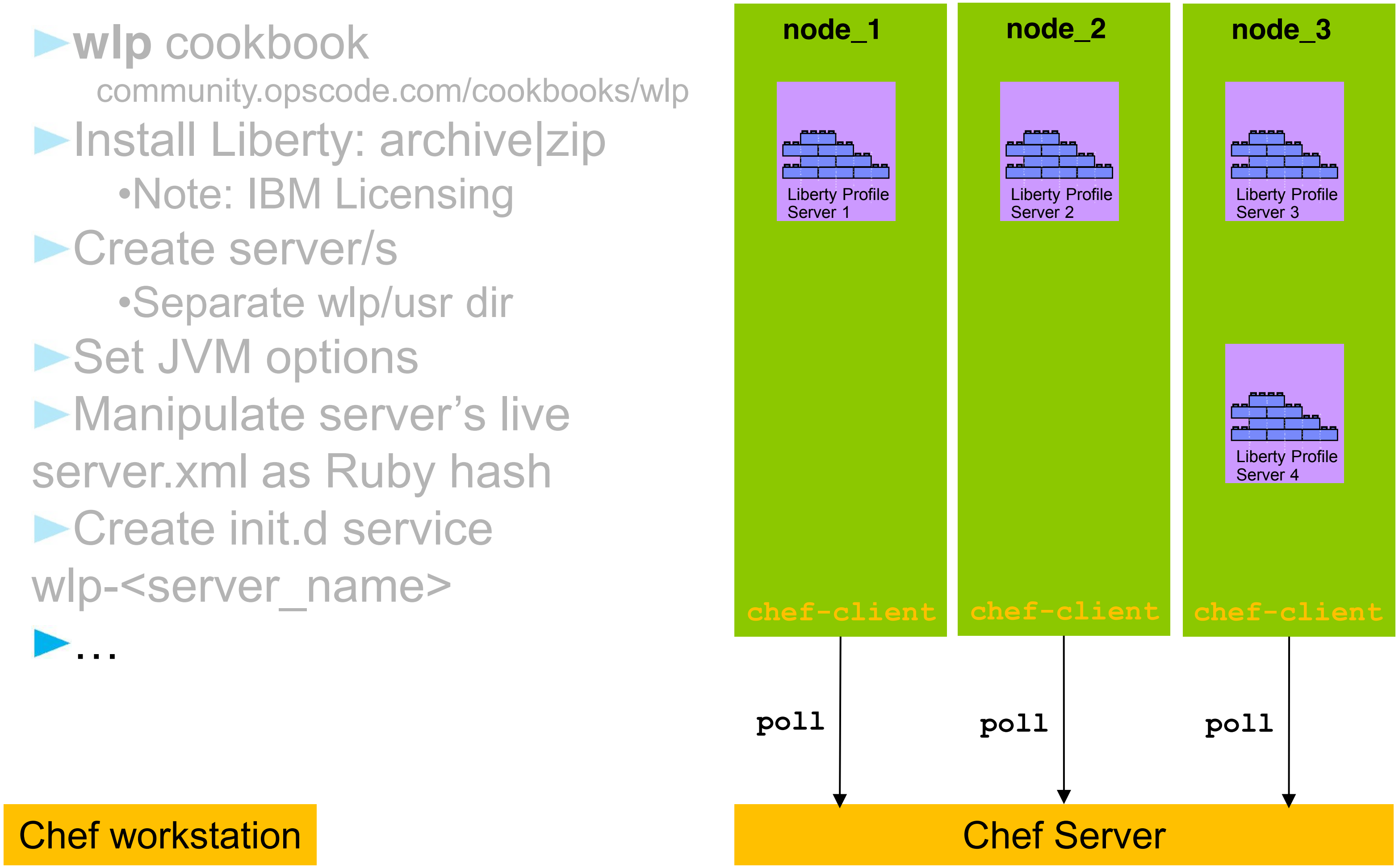

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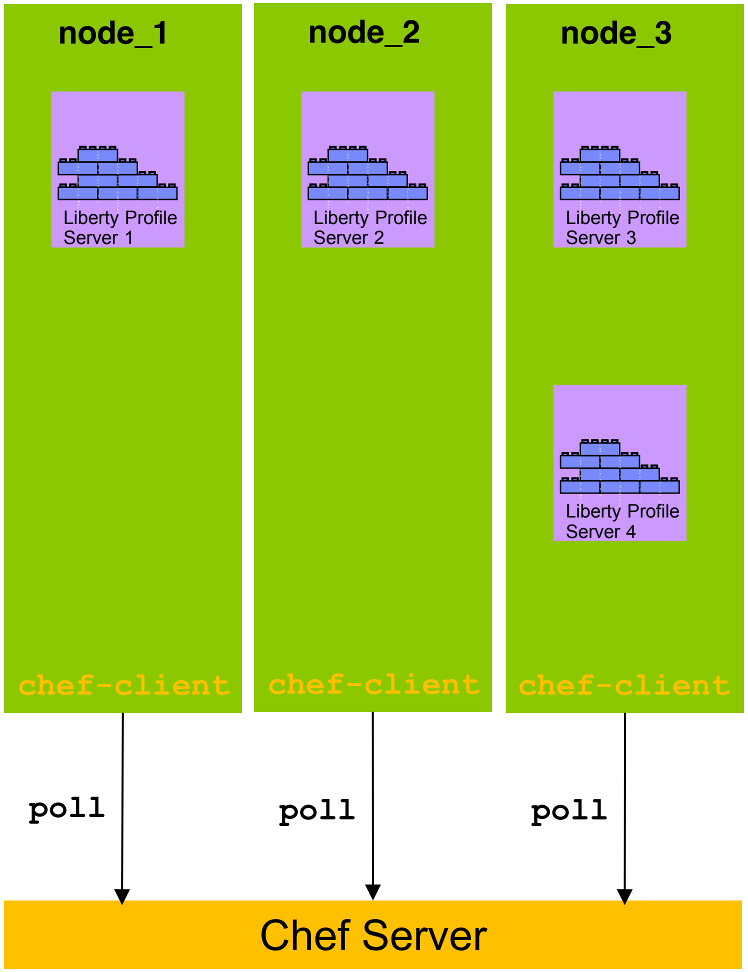
Chef workstation



Templating config files

- Erebus Ruby Gem for sophisticated ‘variable evaluation’
- Embedded Ruby code

Templating config files

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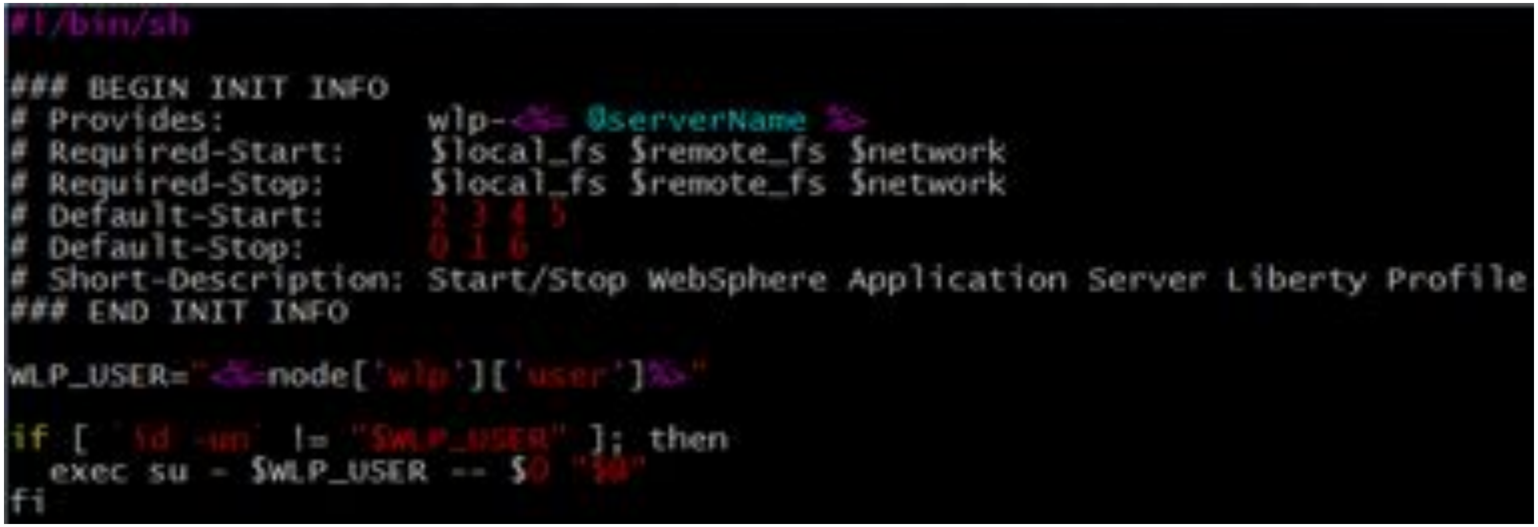
- Init.d service …



```
#!/bin/sh

### BEGIN INIT INFO
# Provides:          wlp-<%= @serverName %>
# Required-Start:    $local_fs $remote_fs $network
# Required-Stop:     $local_fs $remote_fs $network
# Default-Start:     2 3 4 5
# Default-Stop:      0 1 6
# Short-Description: Start/Stop WebSphere Application Server Liberty Profile
### END INIT INFO

WLP_USER="<%=node['wlp']['user']%>"

if [ `id -un` != "$WLP_USER" ]; then
  exec su - $WLP_USER -- $0 "$@"
fi
```

Deploy application … cookbook “application_wlp”

- **application_wlp** cookbook
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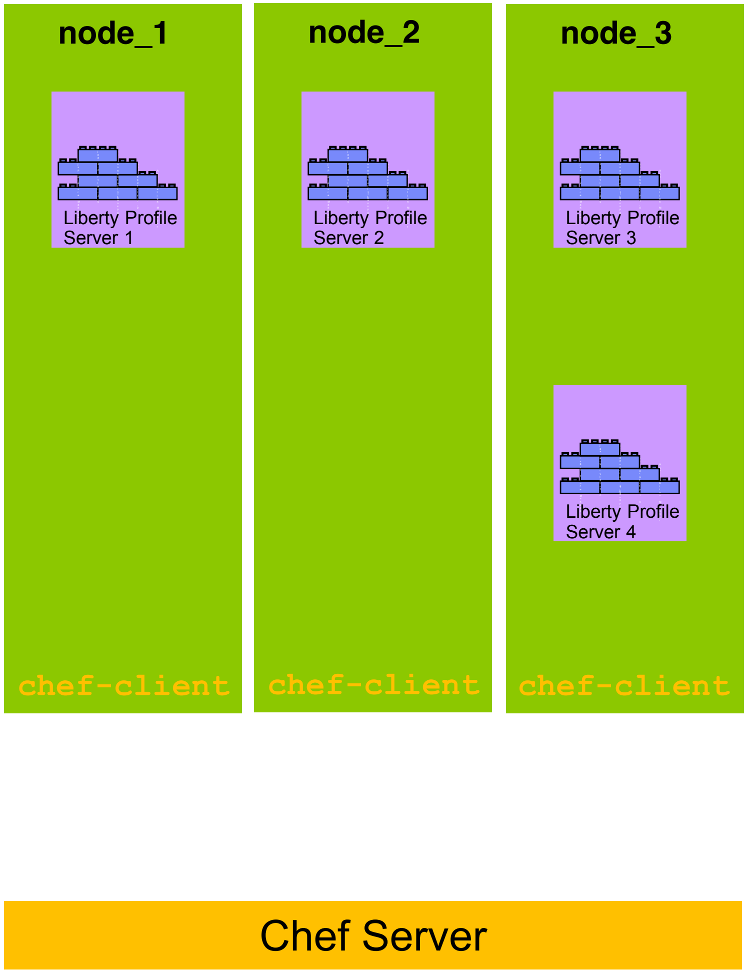

Deploy application … cookbook “application_wlp”

- **application_wlp** cookbook
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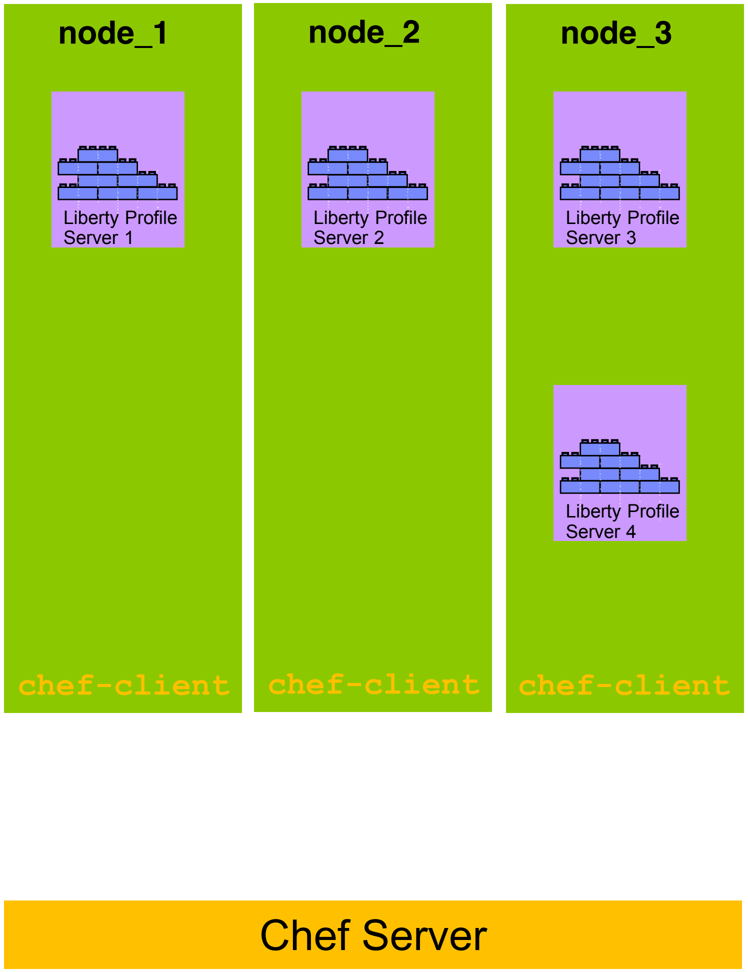
- Extends ‘application’
  - •Template Method pattern



node_1

Liberty Profile Server 1

chef-client

node_2

Liberty Profile Server 2

chef-client

node_3

Liberty Profile Server 3

Liberty Profile Server 4

chef-client

Chef Server

Deploy application … cookbook “application_wlp”

- **application_wlp** cookbook
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- Extends ‘application’
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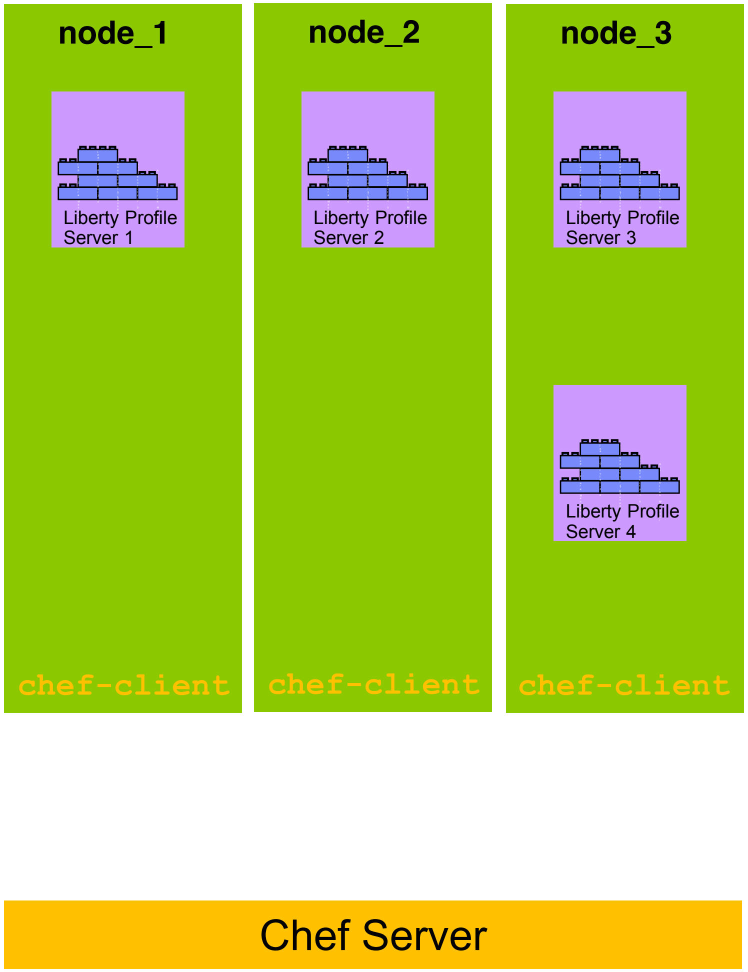
- Deploy application of any type
  .ear | .war | .eba



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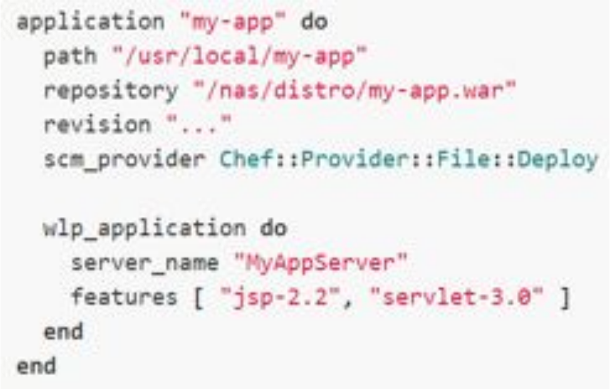
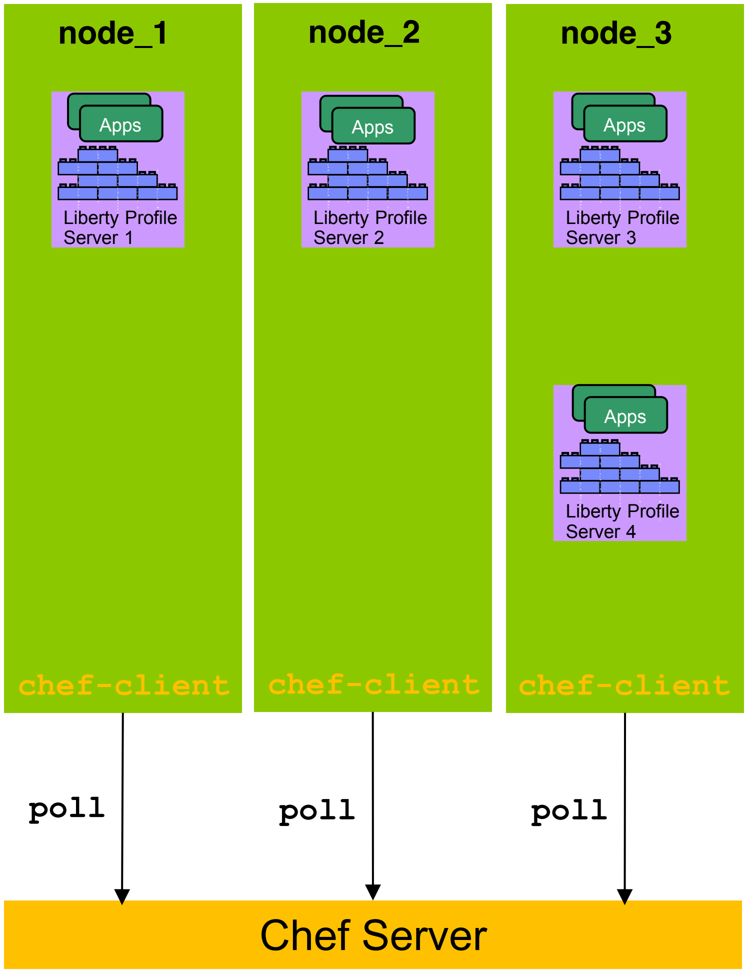


```
application "my-app" do
  path "/usr/local/my-app"
  repository "/nas/distro/my-app.war"
  revision "..."
  scm_provider Chef::Provider::File::Deploy

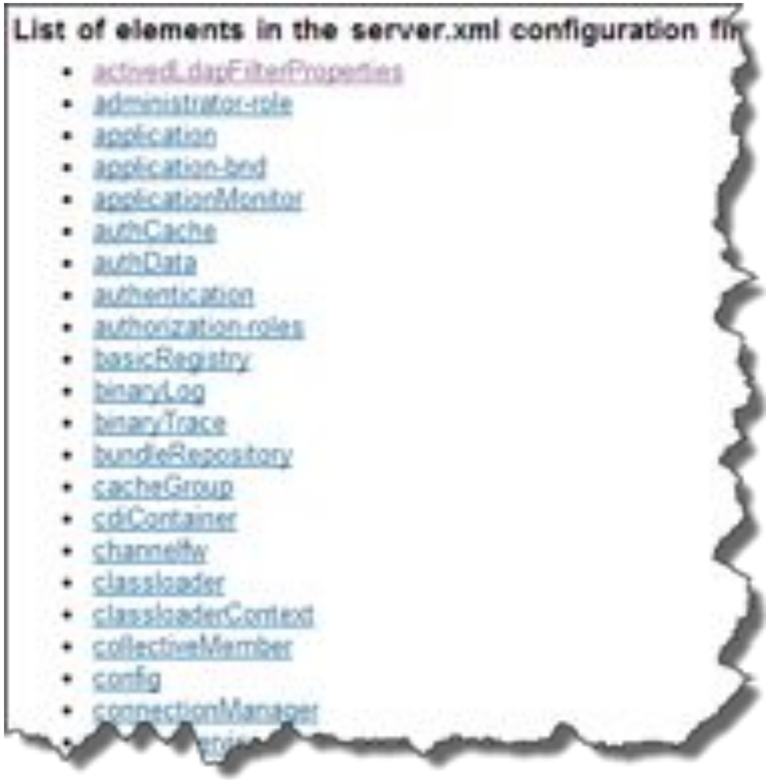
  wlp_application do
    server_name "MyAppServer"
    features [ "jsp-2.2", "servlet-3.0" ]
  end
end
```

Chef workstation



Modelling server.xml … and `<include>`s

- Simple, minimal, but rich (!!)
  - 94 different element types
- Represent server config in code



List of elements in the server.xml configuration fi

- activedLdapFilterProperties
- administrator-role
- application
- application-bnd
- applicationMonitor
- authCache
- authData
- authentication
- authorization-roles
- basicRegistry
- binaryLog
- binaryTrace
- bundleRepository
- cacheGroup
- cdiContainer
- channelfw
- classloader
- classloaderContext
- collectiveMember
- config
- connectionManager

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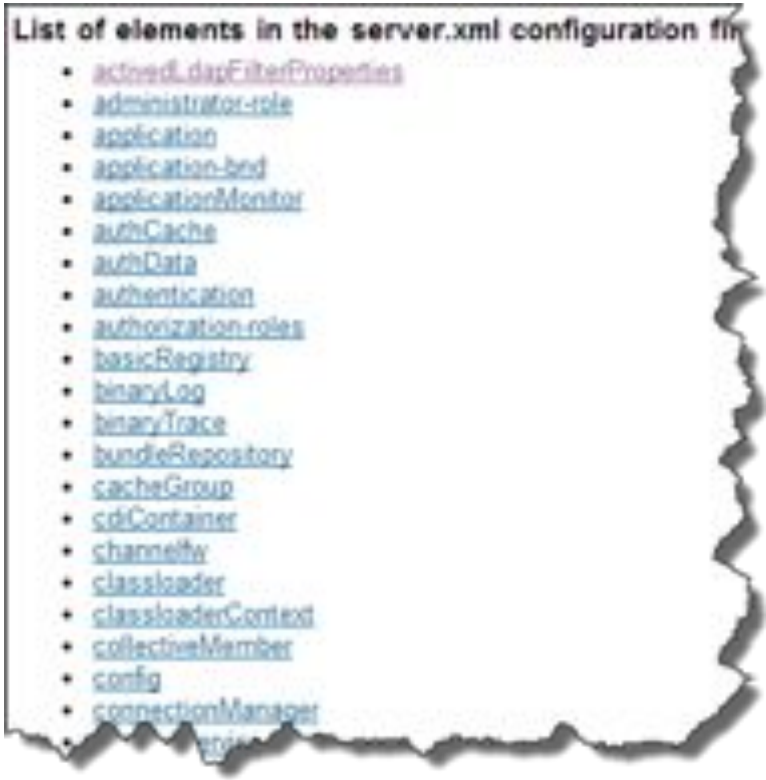

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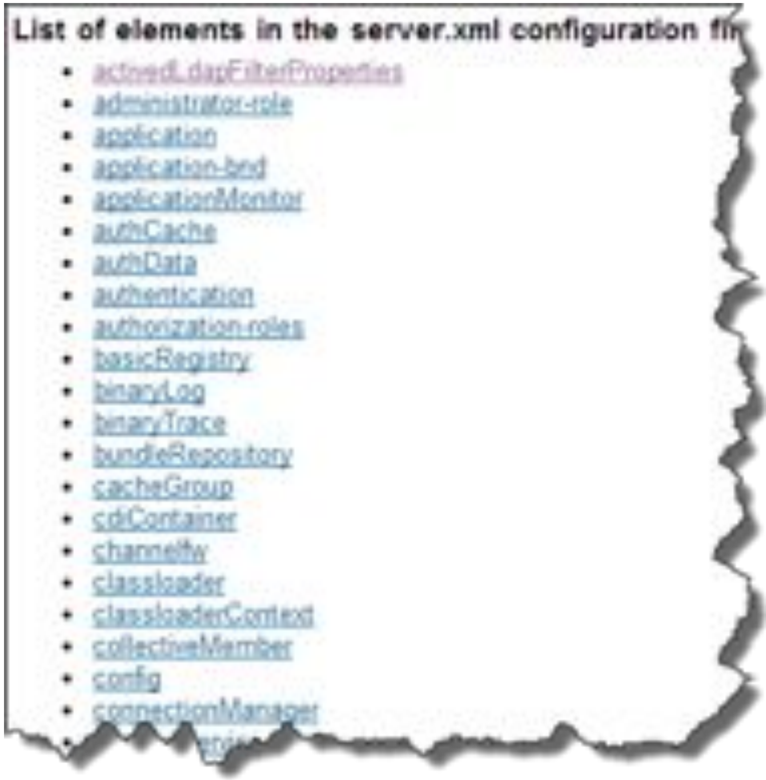

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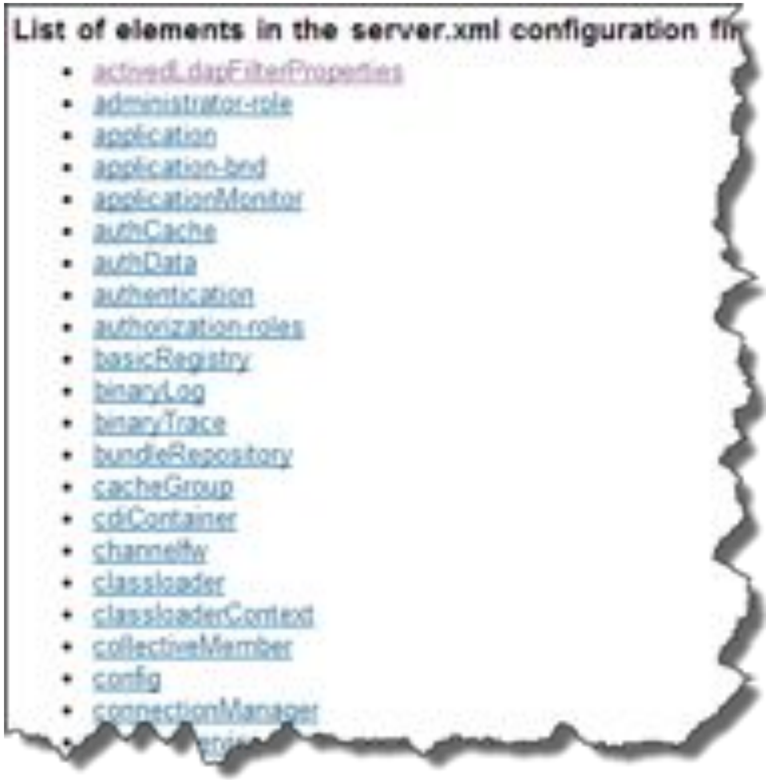
3. Simple, good enough:
   - Manipulate config in Ruby
   - Server config hash -> server.xml



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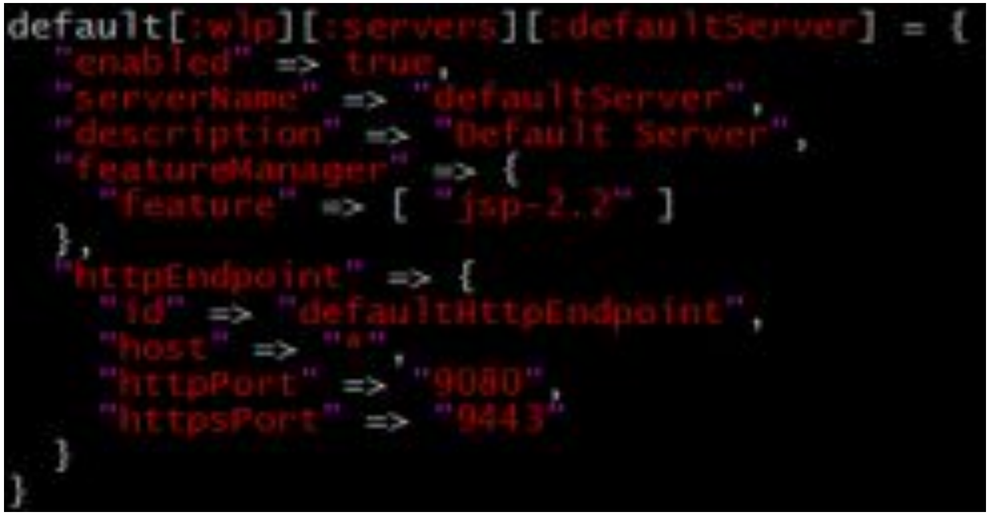
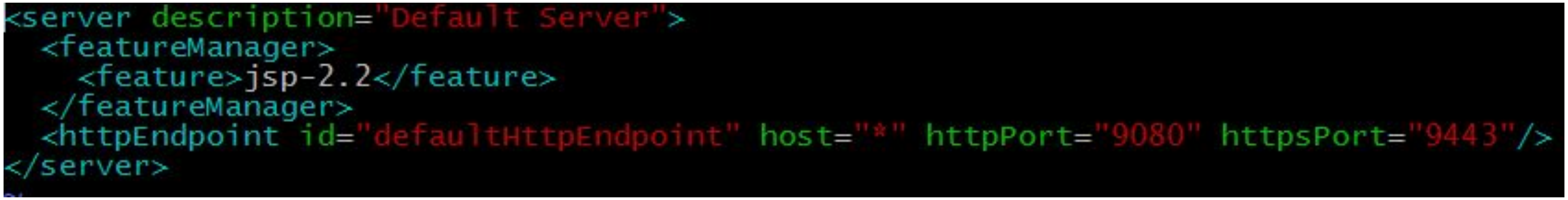
Hash to XML



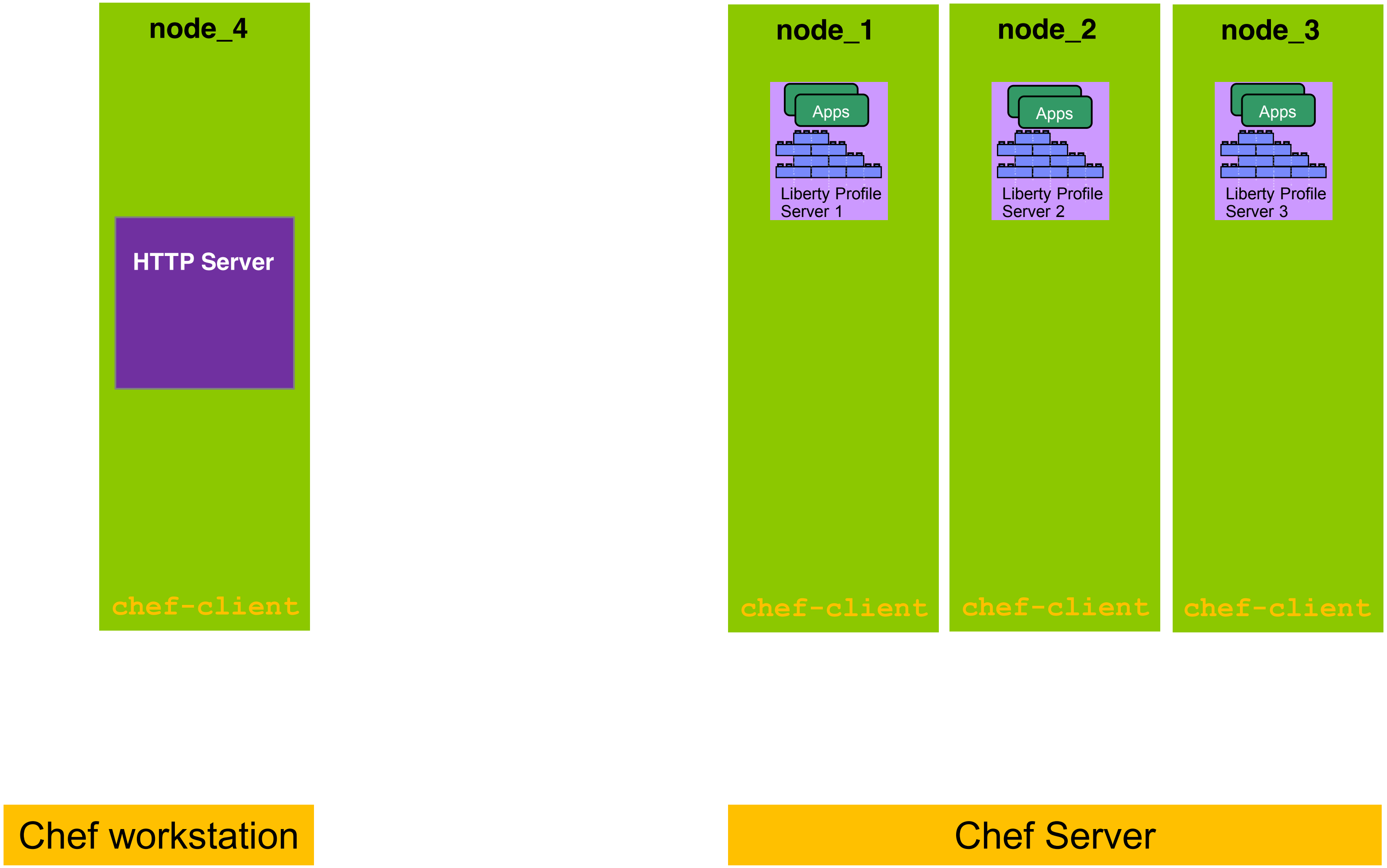
```
default[:wlp][:servers][:defaultServer] = {
  "enabled" => true,
  "serverName" => "defaultServer",
  "description" => "Default Server",
  "featureManager" => {
    "feature" => [ "jsp-2.2" ]
  },
  "httpEndpoint" => {
    "id" => "defaultHttpEndpoint",
    "host" => "*",
    "httpPort" => "9080",
    "httpsPort" => "9443"
  }
}
```

Converted by wlp cookbook



```
<server description="Default Server">
  <featureManager>
    <feature>jsp-2.2</feature>
  </featureManager>
  <httpEndpoint id="defaultHttpEndpoint" host="*" httpPort="9080" httpsPort="9443"/>
</server>
```

Load balancing … add in “apache2” cookbook



node_4

HTTP Server

chef-client

node_1

Apps

Liberty Profile Server 1

chef-client

node_2

Apps

Liberty Profile Server 2

chef-client

node_3

Apps

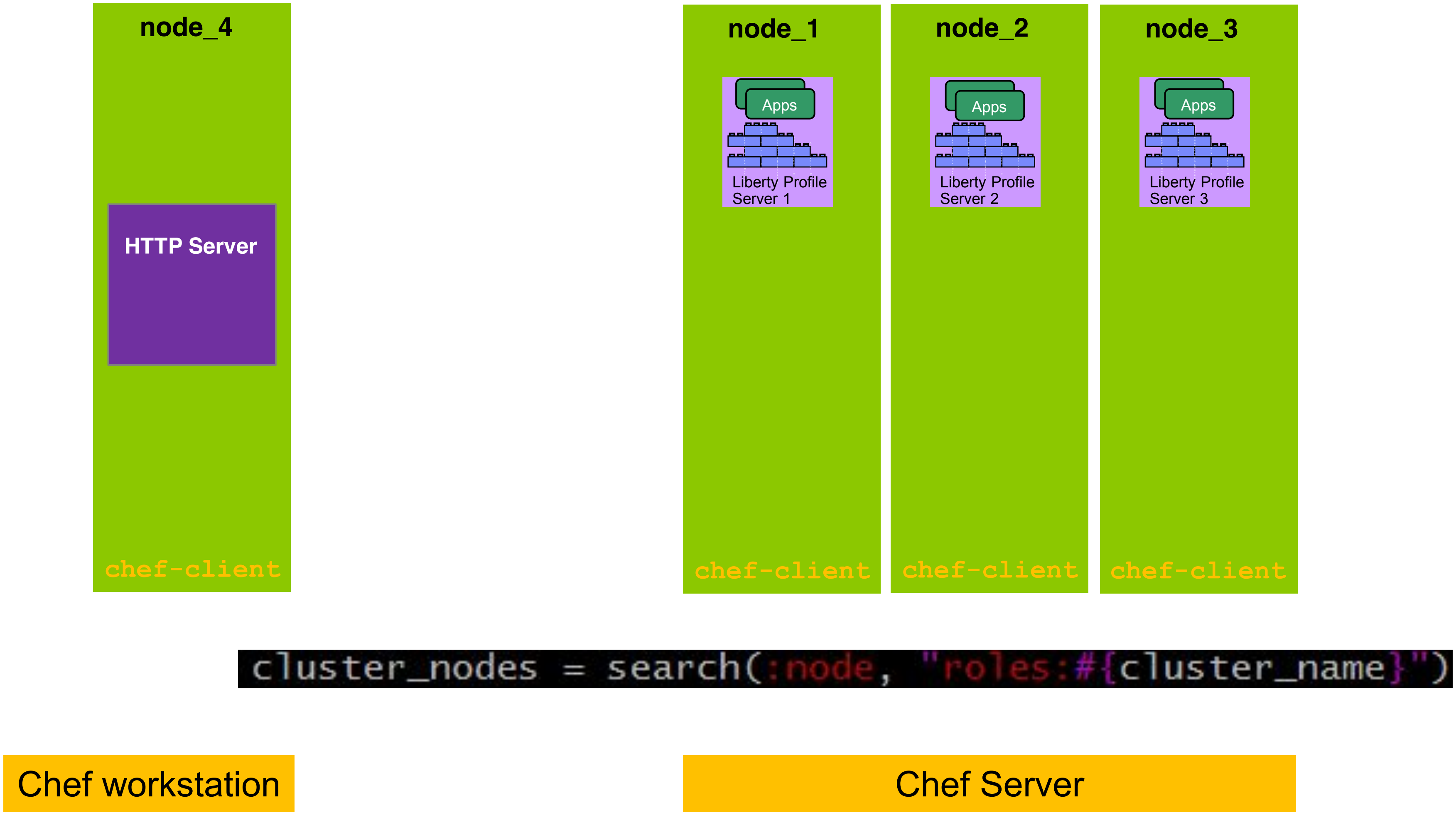
Liberty Profile Server 3

chef-client

Chef workstation

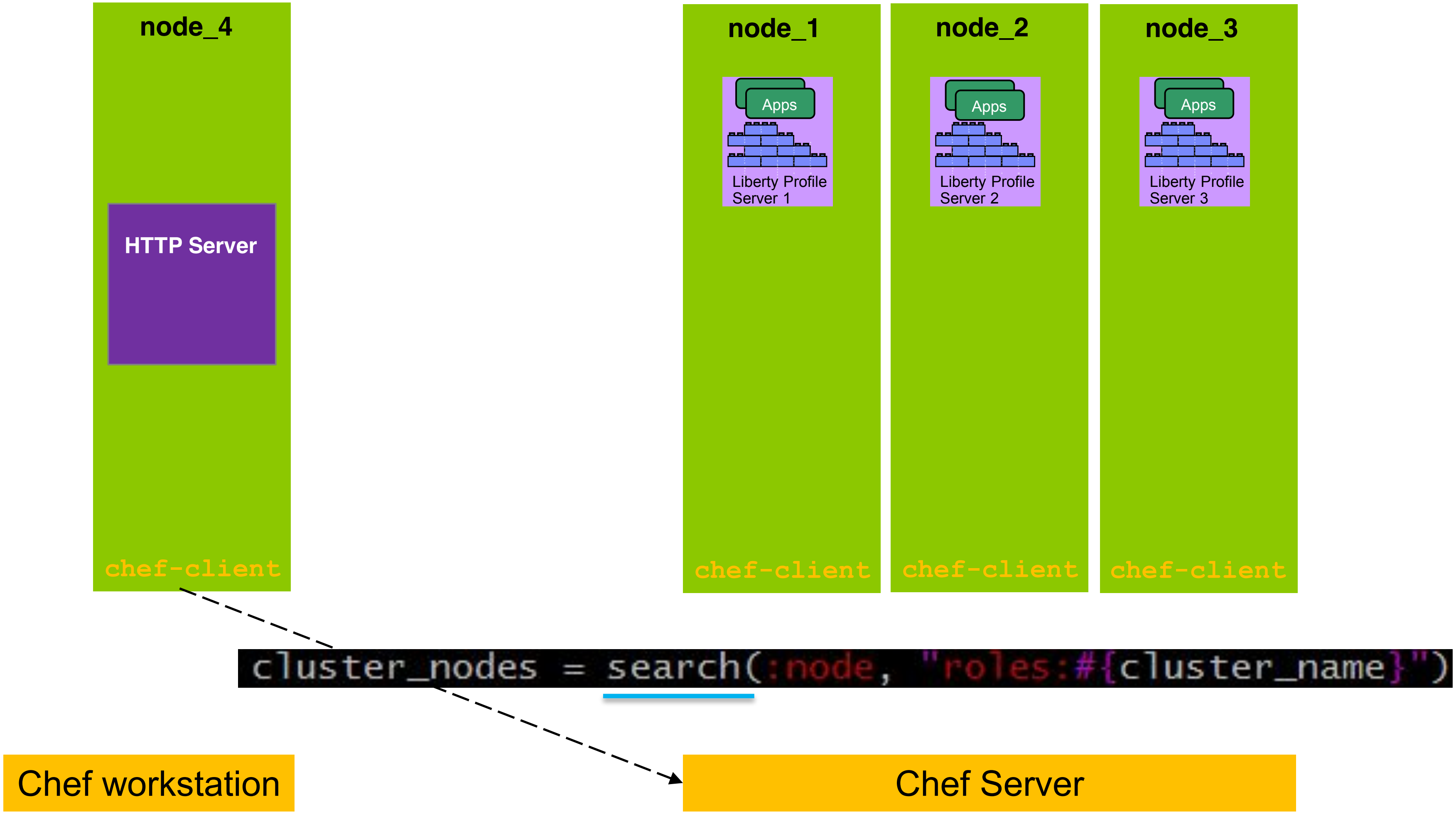
Chef Server

Load balancing … search for nodes in cluster role



```
cluster_nodes = search(:node, "roles:#{cluster_name}")
```

Load balancing … search for nodes in cluster role



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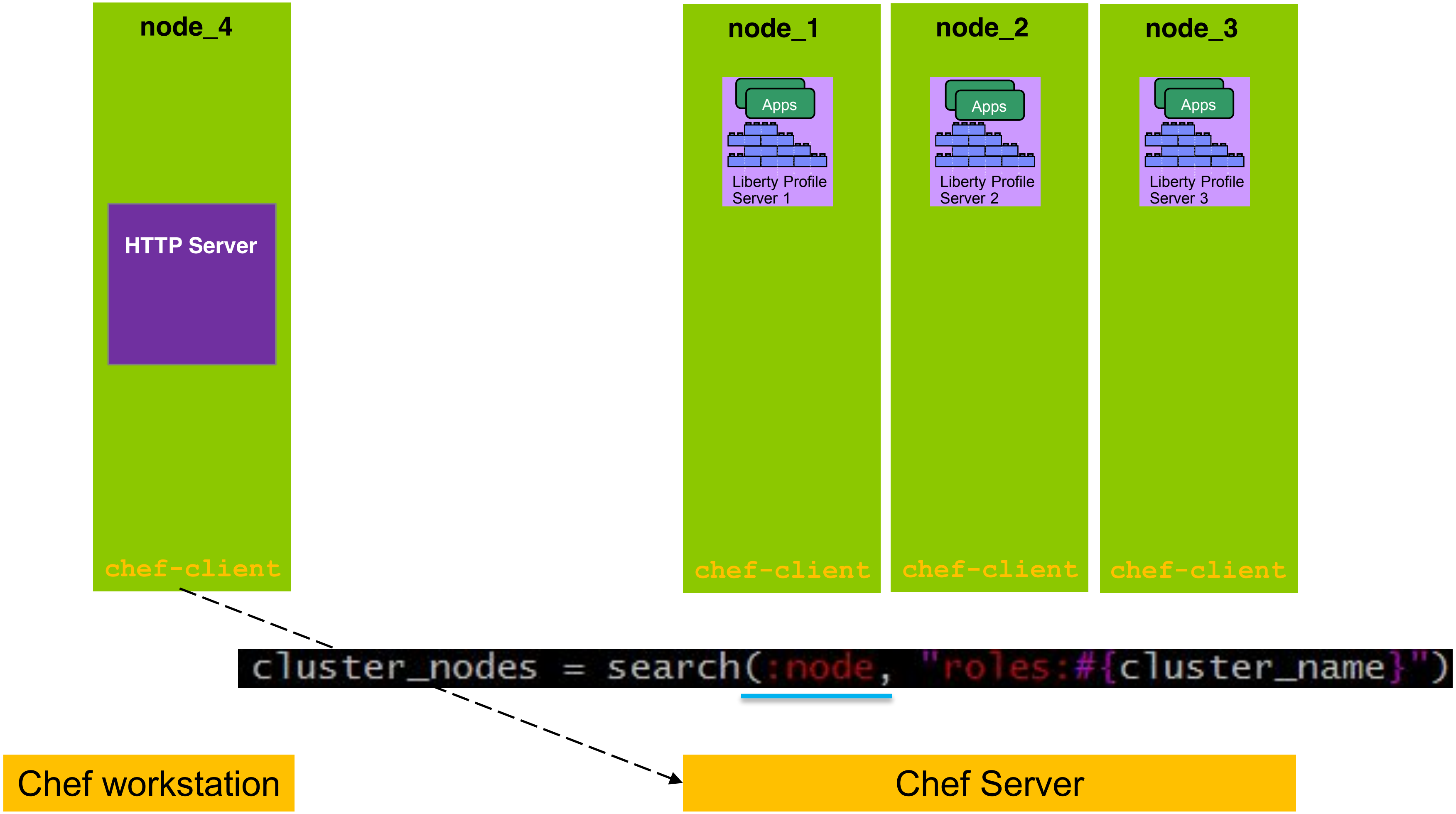

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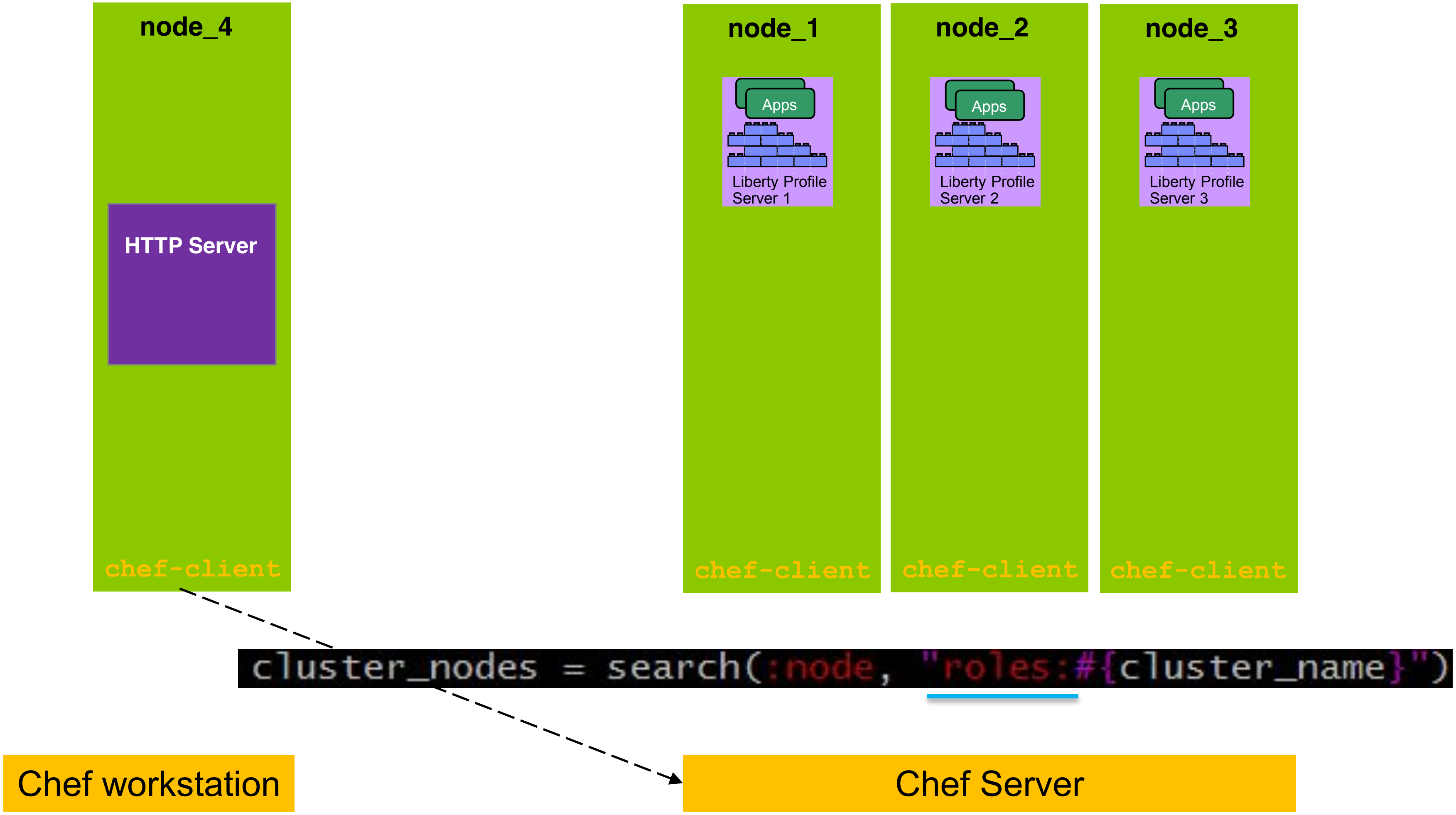

node_4

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Apps

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chef-client

node_3

Apps

Liberty Profile Server 3

chef-client

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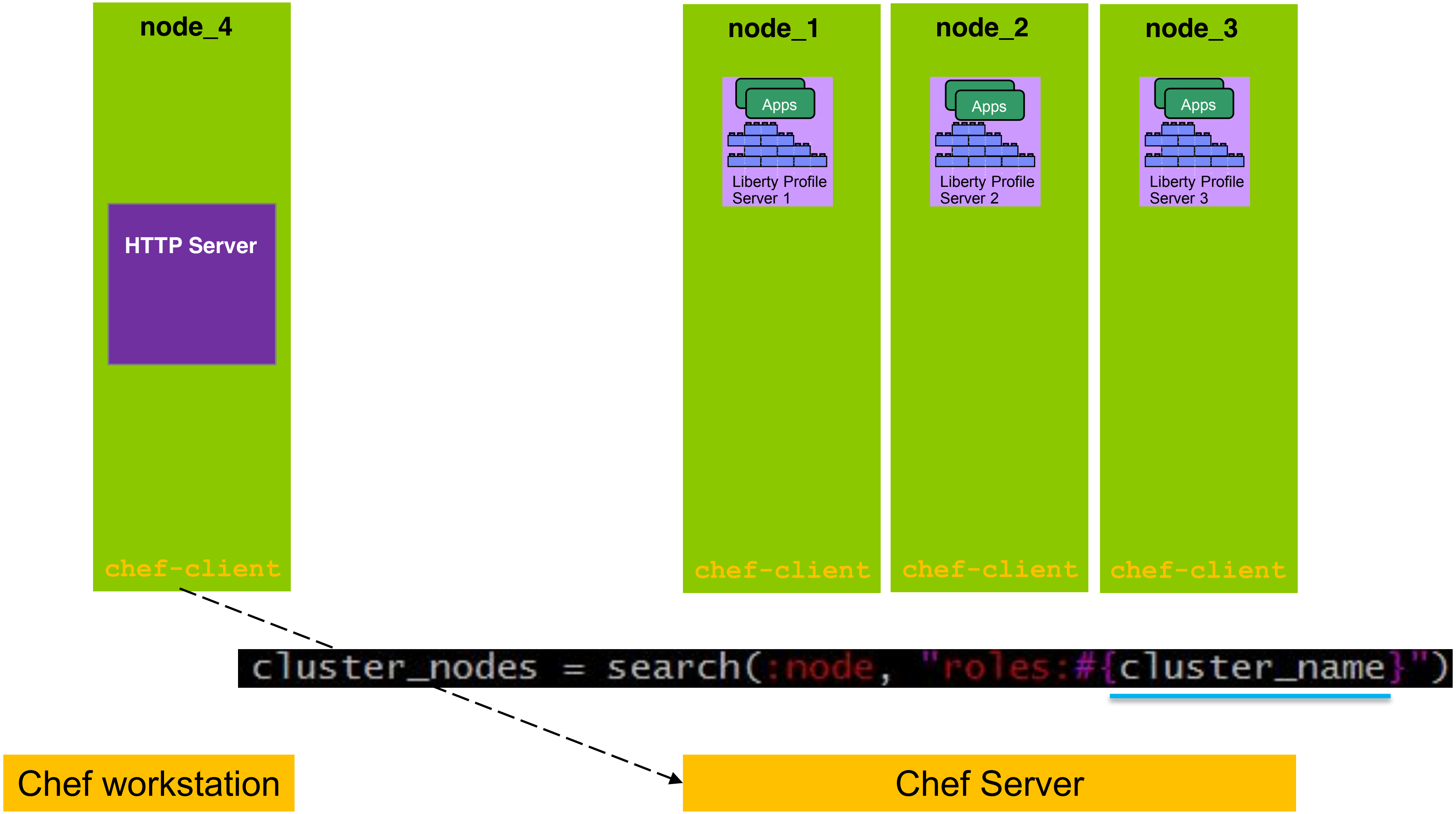
Chef workstation

Chef Server

Load balancing … search for nodes in cluster role



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cluster_nodes = search(:node, "roles:#{cluster_name}")
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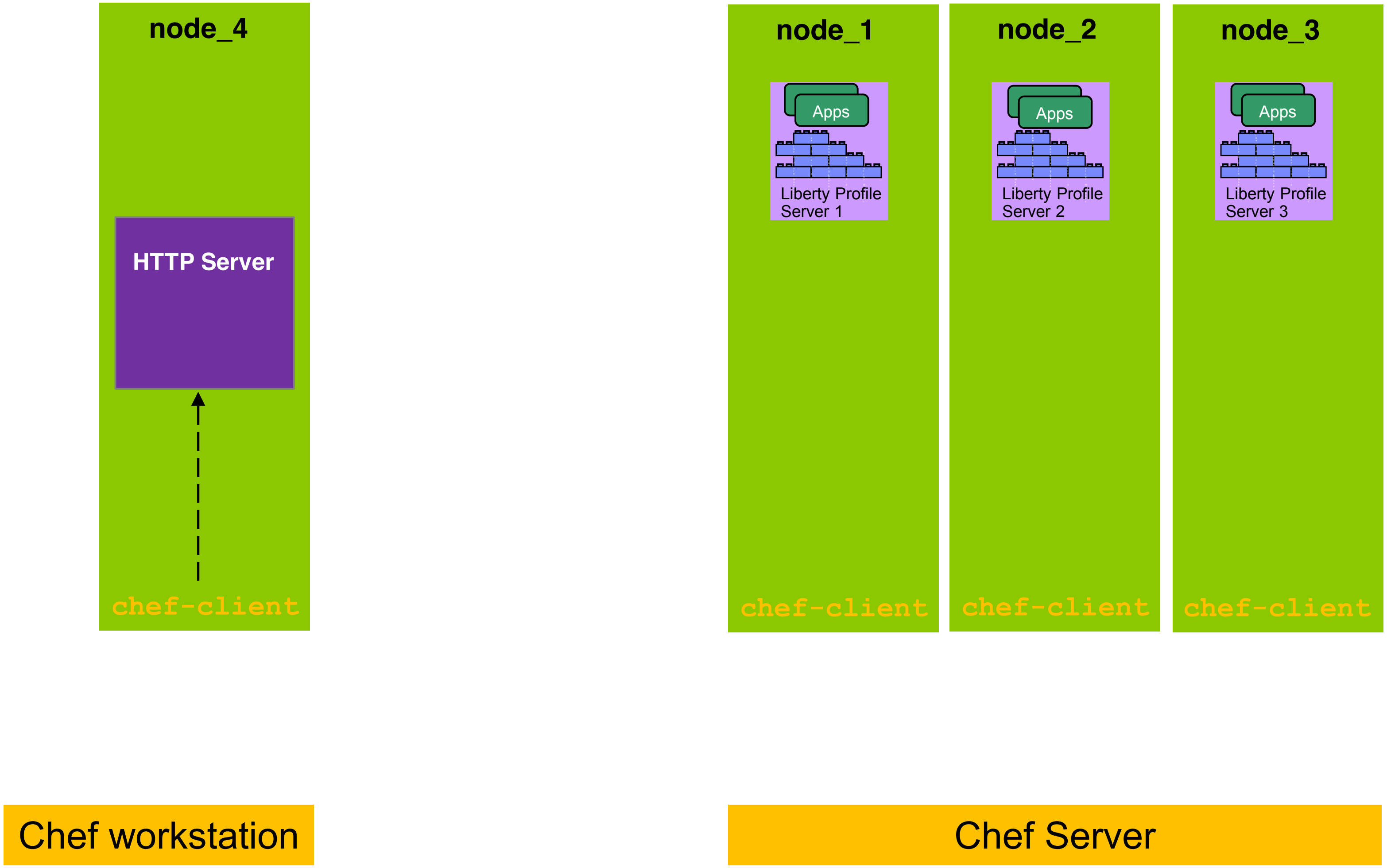
Load balancing … configure web server



node_4

HTTP Server

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node_3

Apps

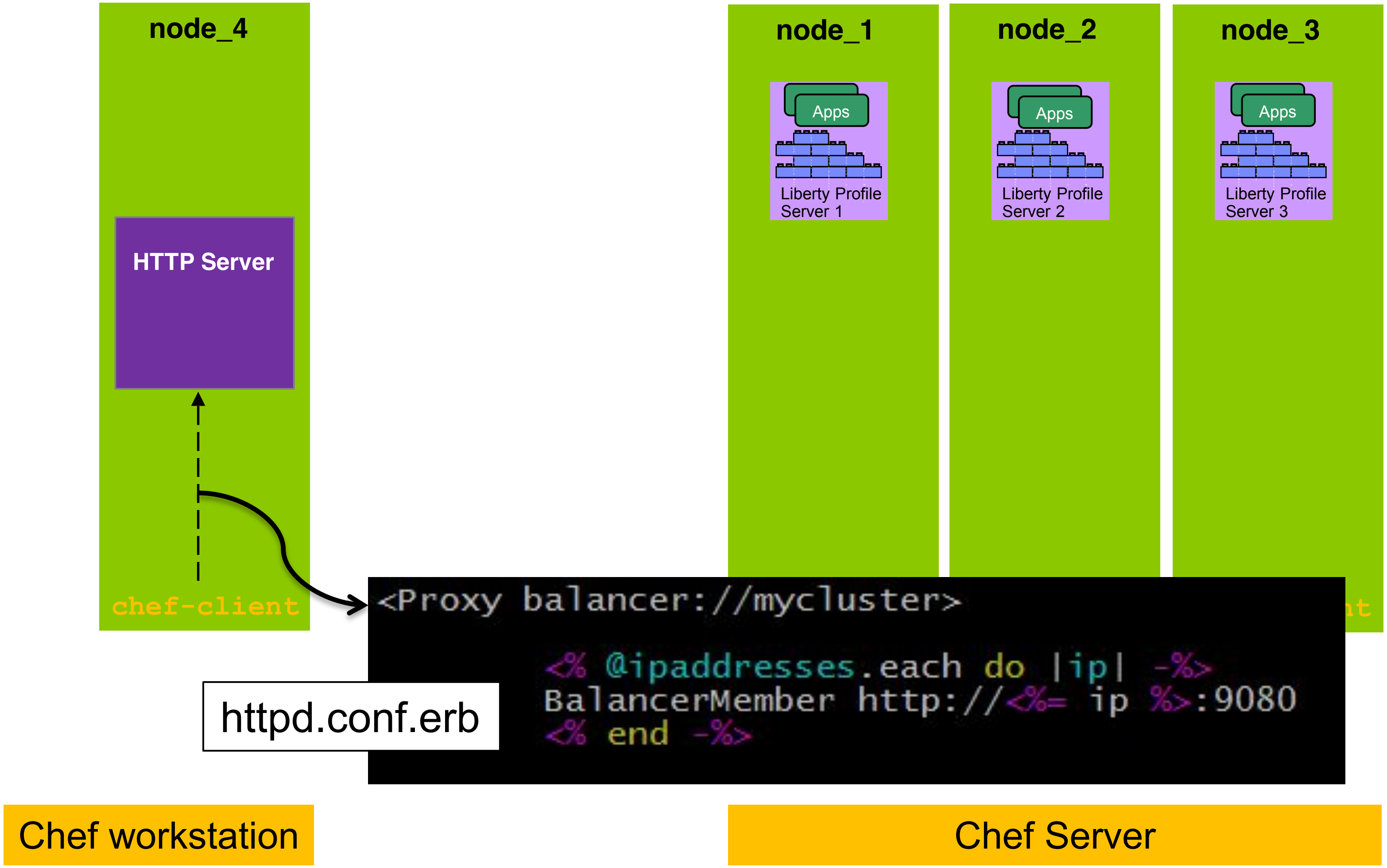
Liberty Profile Server 3

chef-client

Chef workstation

Chef Server

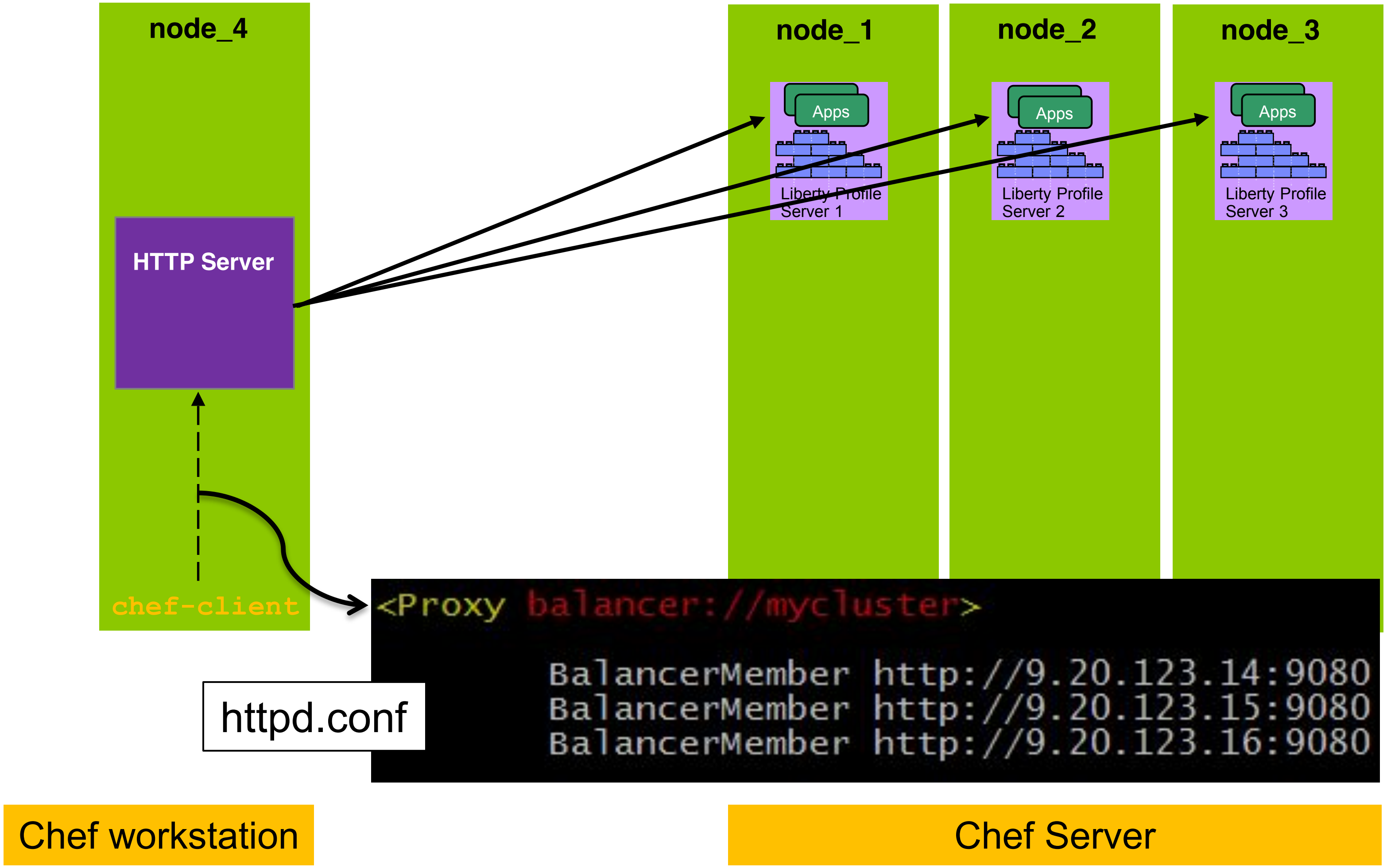
Load balancing … configure web server



```
<Proxy balancer://mycluster>

      <% @ipaddresses.each do |ip| -%>
      BalancerMember http://<%= ip %>:9080
      <% end -%>
```

Load balancing … configure web server

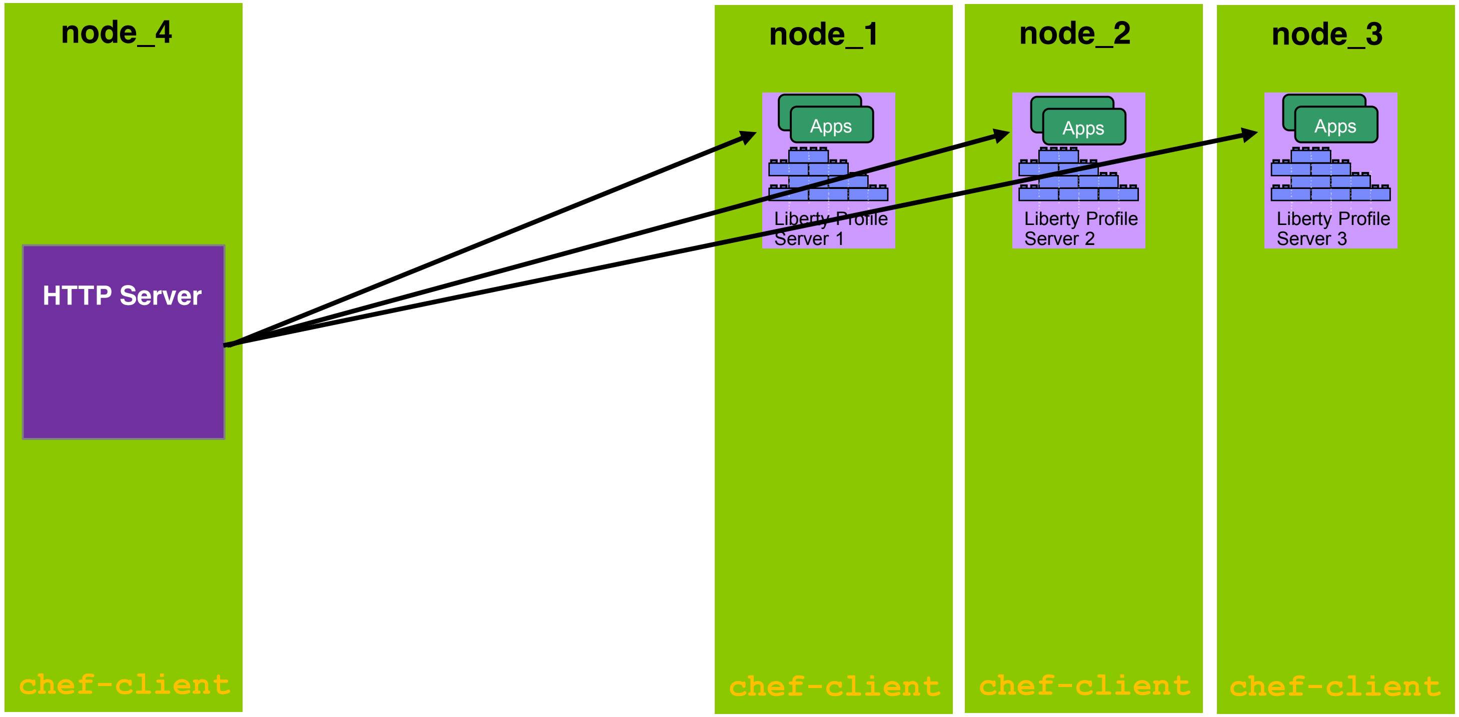


```
<Proxy balancer://mycluster>

        BalancerMember http://9.20.123.14:9080
        BalancerMember http://9.20.123.15:9080
        BalancerMember http://9.20.123.16:9080
```

Load balancing … sample

Apache 2.0 license

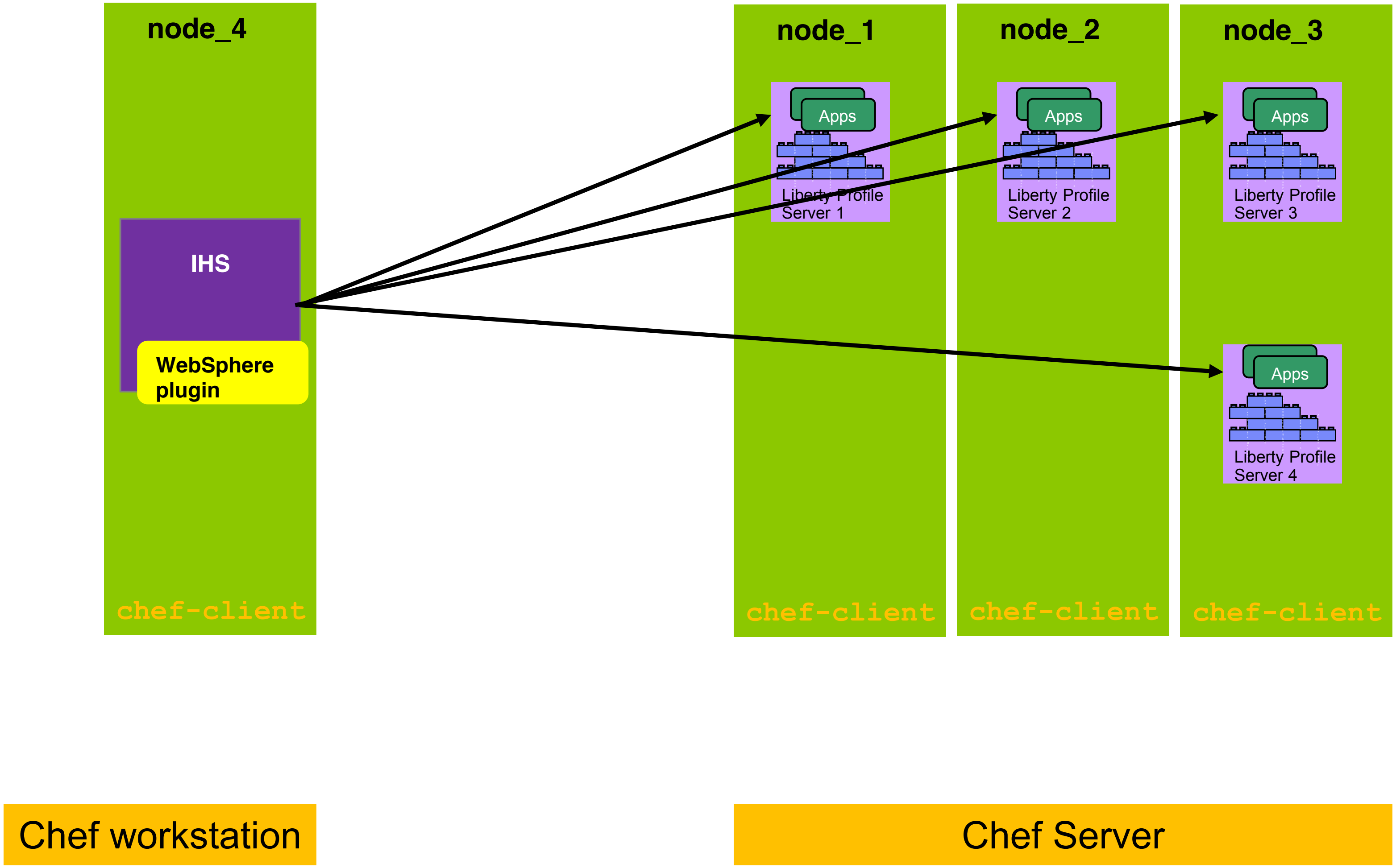


Chef recipe:
https://github.com/WASdev/**ci.chef.wlp.samples**/blob/master/recipes/**proxy.rb**

Chef workstation

Chef Server

What’s next: IBM HTTP Server



What’s next?

In development

- IBM Installation Manager
  https://github.com/WASdev/ci.chef.iim

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- WebSphere eXtreme Scale
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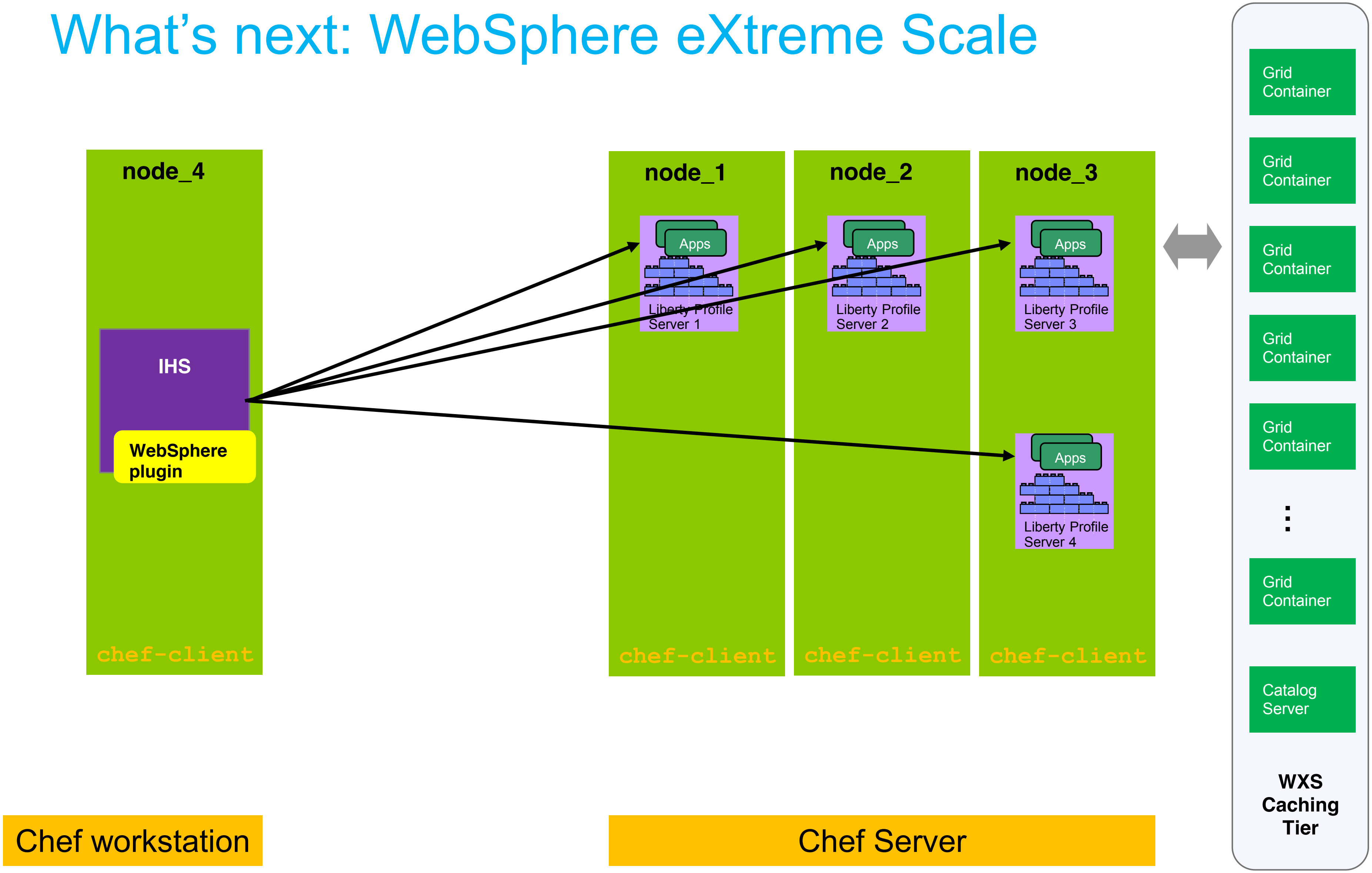
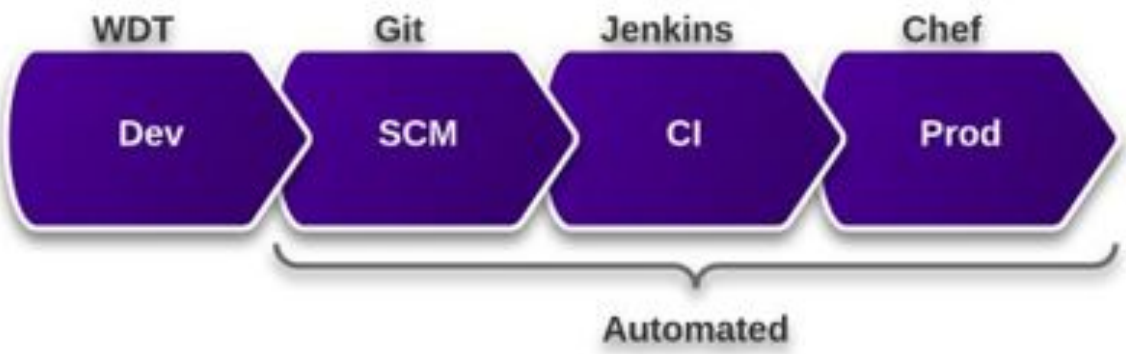
- WebSphere eXtreme Scale
  https://github.com/WASdev/ci.chef.wxs
- Full WebSphere Application Server
  https://github.com/WASdev/ci.chef.was

What's next: WebSphere eXtreme Scale



Walk through 'lab'

- Continuous development pipeline example on wasdev.net



- http://ibm.biz/liberty-devops

Chef & Liberty Profile: no-charge downloads

- Chef is Infrastructure as Code
  - model your infrastructure as code. www.getchef.com
- WebSphere Liberty Profile
  - designed for Developers, ideal for Ops
- Visit us at WASdev and our GitHub org

standards.jsr352.jbatch

lib.rtcomm.clientjs

ci.maven.tools

ci.chef.wlp

github.com/WASdev

Liberty profile

September beta!

What's new

Connect & Contribute

GOTO: Aarhus, Denmark

wasdev.net

Questions?

We Value Your Feedback

- Don’t forget to submit your session and speaker feedback! Your feedback is very important to us – we use it to continually improve the event.

Thank You

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