Jenkins and Chef

Infrastructure CI and Application Deployment

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www.copyright.com

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#jenkinsconf

About Me

- Software Architect
- Library & Framework Developer
- Infrastructure Lead & Product Owner
- Enemy of Inefficiency and Needless Inconsistency

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About Copyright Clearance Center

- Global licensing solutions that make © work for everyone
  - Get, share, and manage content
  - Rights broker for world's most sought after materials
  - Global company (US, Europe, Asia) – HQ in Danvers, MA
- Industry-specific software systems
  - Internal and external user base
  - Applications, services, databases
  - Organic growth over many years
- In 2011, CCC adopted a Product Platform strategy for growing its software portfolio

Agenda

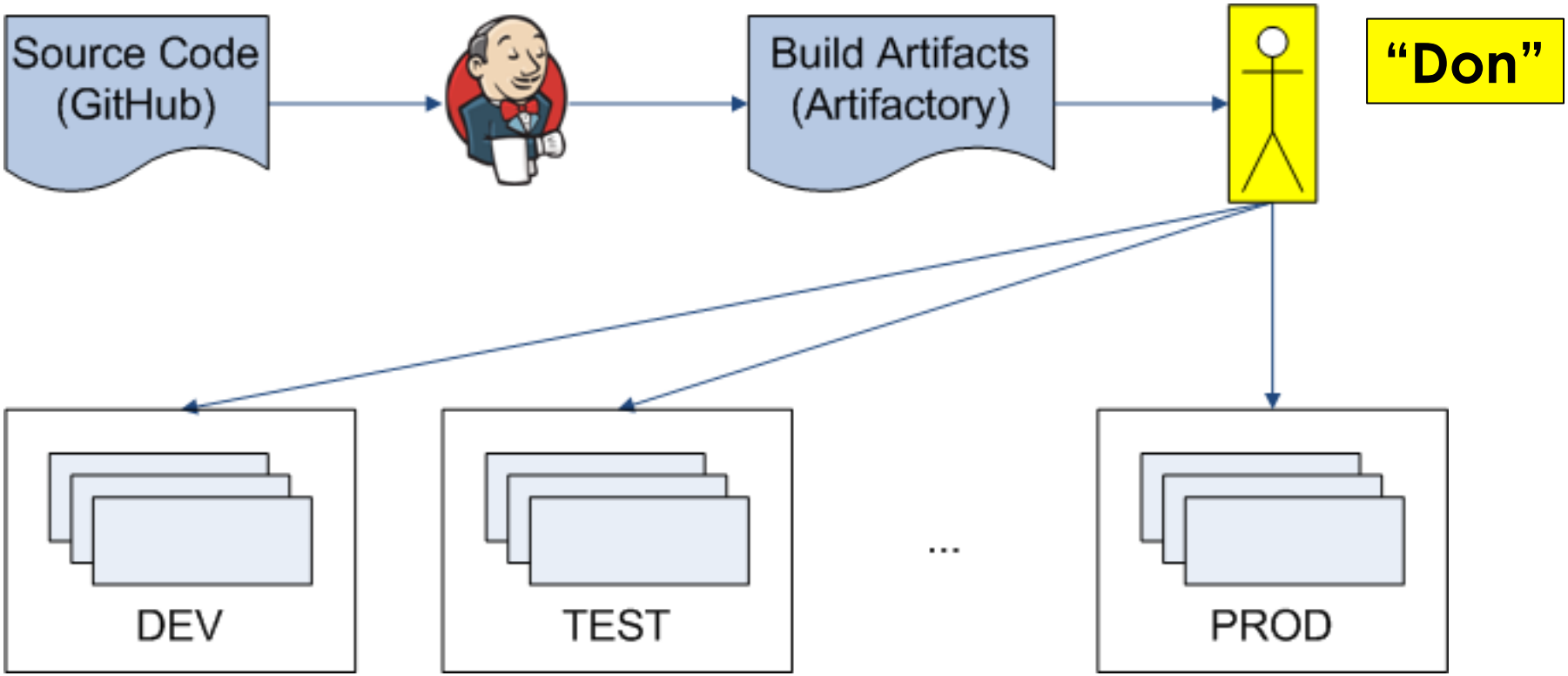
- Context
- Primer
- Deployment Process Design
- Cookbook Builds
- Application Deployment
- Wrap Up

CONTEXT

Standard Software Platform

- Started platform definition in 2011
  - Homogeneous by default
- Tools
  - Java, Spring, Tomcat, Postgres
  - Git/GitHub, Gradle, Jenkins, Artifactory, Liquibase
- Process
  - Standard development workflow
  - Standard application shape & operational profile

Initial Delivery Pipeline



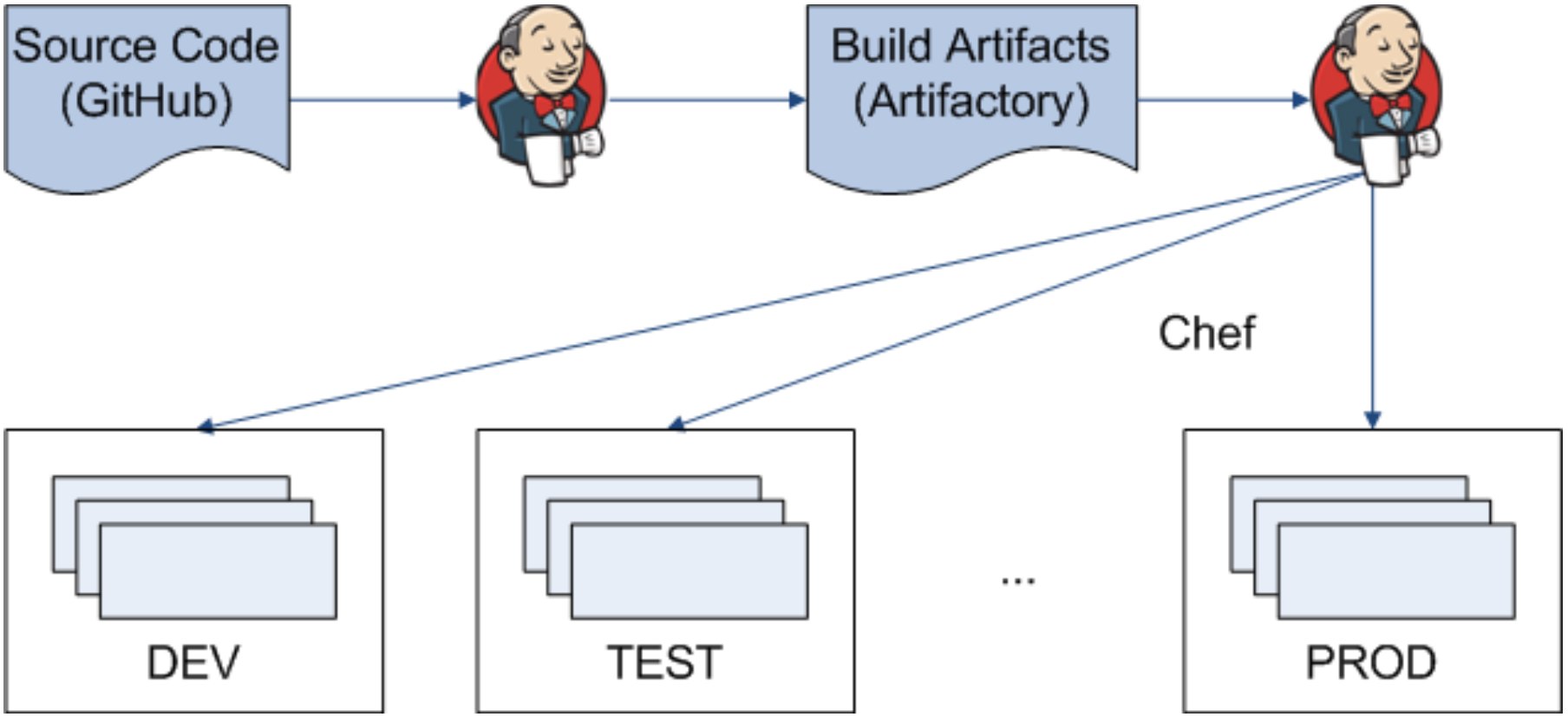
Initial Delivery Pipeline

- Automated build process
- Publish build artifacts to Artifactory
  - Application WARs
  - Liquibase JARs
- Manual deploys
  - (Many apps) x (many versions) x (multiple environments) = TIME & EFFORT
  - The more frequently a task is performed, the greater the return from improved efficiency

Improved Deployment Process

- Goals
  - Reduce effort
  - Improve speed, reliability, and frequency
  - Handle app deploys and db schema updates
  - Enable self-service
- Process Changes
  - Manual → Automated
  - Prose instructions → Infrastructure as code

Target Delivery Pipeline



PRIMER

Layers of System Management

- Orchestration
  - Processes collaborating in a distributed system
- Configuration
  - Install and configure packages and software
- Provisioning
  - Hypervisor (VMware, EC2)

Infrastructure as Code

- Develop and manage software infrastructure with practices similar to those used to develop software applications
- Examples
  - Source Code
  - Modularity
  - Abstraction
  - Testing

Configuration Management

"Process for establishing and maintaining consistency of a product's performance, functional and physical attributes with its requirements, design and operational information throughout its life" (wikipedia)

- CM tools for managing software systems
  - CFEngine, Puppet, Chef, Salt, Ansible
- Embody Infrastructure as Code principles
- Define desired state of machine
  - Each run inspects state and makes necessary changes, if any

Chef

- Configuration management tool
- Exposes DSL hosted in Ruby
  - Express “what” not “how”
  - Clean, purposeful capture of intent
- Favor DSL when writing code
  - Ruby is available, if required

Chef Terminology (1)

- Chef client is installed on nodes (machines) which are registered with the Chef server
- Developers write code on workstations and use tools such as knife to interact with server
- Chef models node configuration as a set of DSL resources (e.g. package, service, directory) which are mapped to internal providers (actual code to execute)
  - Can define custom resources

Example Chef Code

This resource declaration

```
directory '/a/b/c' do
  owner 'admin'
  group 'admin
  mode '0755'
  action :create
  recursive true
end
```

ensures that

```
$ ls -ld /a/b/c
drwxr-xr-x. 5 admin admin 4096 Feb 14 11:22 /a/b/c
```

Chef Terminology (2)

- A recipe declares a set of resources with desired configuration
- A cookbook contains a set of semantically-related code and is the fundamental unit of distribution for Chef code
  - Compare to JAR for Java code
- A data bag holds JSON information in one or more data bag items accessible from Chef code
- Chef environments model deployed environments
- Each node has a run list containing recipes

DEPLOYMENT PROCESS DESIGN

Basic Approach

- Deploy custom applications with Chef
- Execute schema updates with Liquibase
- Coordinate everything with:

Jenkins

Jenkins as Coordinator

- General purpose job executor
  - Shell script steps for Chef API
  - Gradle steps for Liquibase updates
  - Arbitrary code at any point in lifecycle
- UI
  - Smooth integration with Active Directory
  - Authentication and authorization
- Administration
  - Familiar with Jenkins from application build jobs

CCC Application Group

- Set of deployable units that are versioned and released together
- For example, a group might have
  - UI
  - REST service
  - Message consumer
  - DB
- Build with a single command
- Deploy with a single command

Technical Design Goals

- Provide clean API
  - Specify only essential differences between apps
  - Custom Chef resource is the interface
  - Codify & enforce standards
- Balance consistency & flexibility
  - Code in semantically-versioned cookbooks
  - Configuration in data bags
- Controlled cookbook promotion
  - Chef environment specifies cookbook version constraint

Cookbook Types

- Library Cookbooks
  - Encapsulate common re-usable logic
  - Define custom resource to install an app
    - And the implementing provider
- Application Cookbooks
  - Depend on library cookbooks
  - One cookbook per application group
    - One recipe per application
    - Recipes use custom resource
  - Lightweight

Data Bags

- Contain application configuration
  - Service endpoints, JAVA_OPTS, etc.
- One data bag per application group
  - One data bag item per environment
- "Live" reflection of deployed configuration
  - Edit → push to Chef server → deploy
  - Master always matches state of Chef server

Custom Resource Usage

Ensure my-app-ui WAR is deployed:

```
ccc_webapp "my-app-ui" do
  provider :ccc_webapp

  artifact_group          'com.copyright.myapp'
  artifact                'my-app-ui'

  container               'MY-APP-UI'
  http_port               '8080'
  shutdown_port           '8900'

  properties_template     'ccc.properties.erb'
  app_group_data_bag      'my_app'
end
```

Custom Resource Actions

- Retrieves Java, Tomcat & WAR from Artifactory
- Installs Java and Tomcat in standard locations
- Creates and configures Tomcat container
- Installs WAR in the container
- Opens port in host firewall
- Generates application properties file
- Starts container

(Each action taken only if necessary)

Data Bag Structure

data_bags/my_app/DEV.json (data bag item)

```
  "version": "1.4.9",
  "runtime": {
    "my-app-ui": {
      "java_opts": "-Xmx2G -XX:MaxPermSize=1024m"
    }
  },
  "app_config": {
    "db.url":      "jdbc:postgresql://devdb:5432/myapp",
    "svc.foo.url": "http://devsvc:9000/foo"
  }
```

data_bags/my_app/TEST.json

...

data_bags/my_app/PROD.json

Cookbook Data Bag Code *


```
ccc/providers/webapp.rb   (library cookbook)

  app_group_data = data_bag_item(app_group_data_bag,
   node.chef_environment)

  java_opts = app_group_data['runtime'][artifact]['java_opts']
  // pass java_opts to Tomcat container

  app_config = app_group_data['app_config']
  // pass app_config to template resource declaration


my_app/templates/ccc.properties.erb  (application cookbook)

  db.url=<%= @app_config['db.url'] %>
  svc.foo.url=<%= @app_config['svc.foo.url'] %>
```

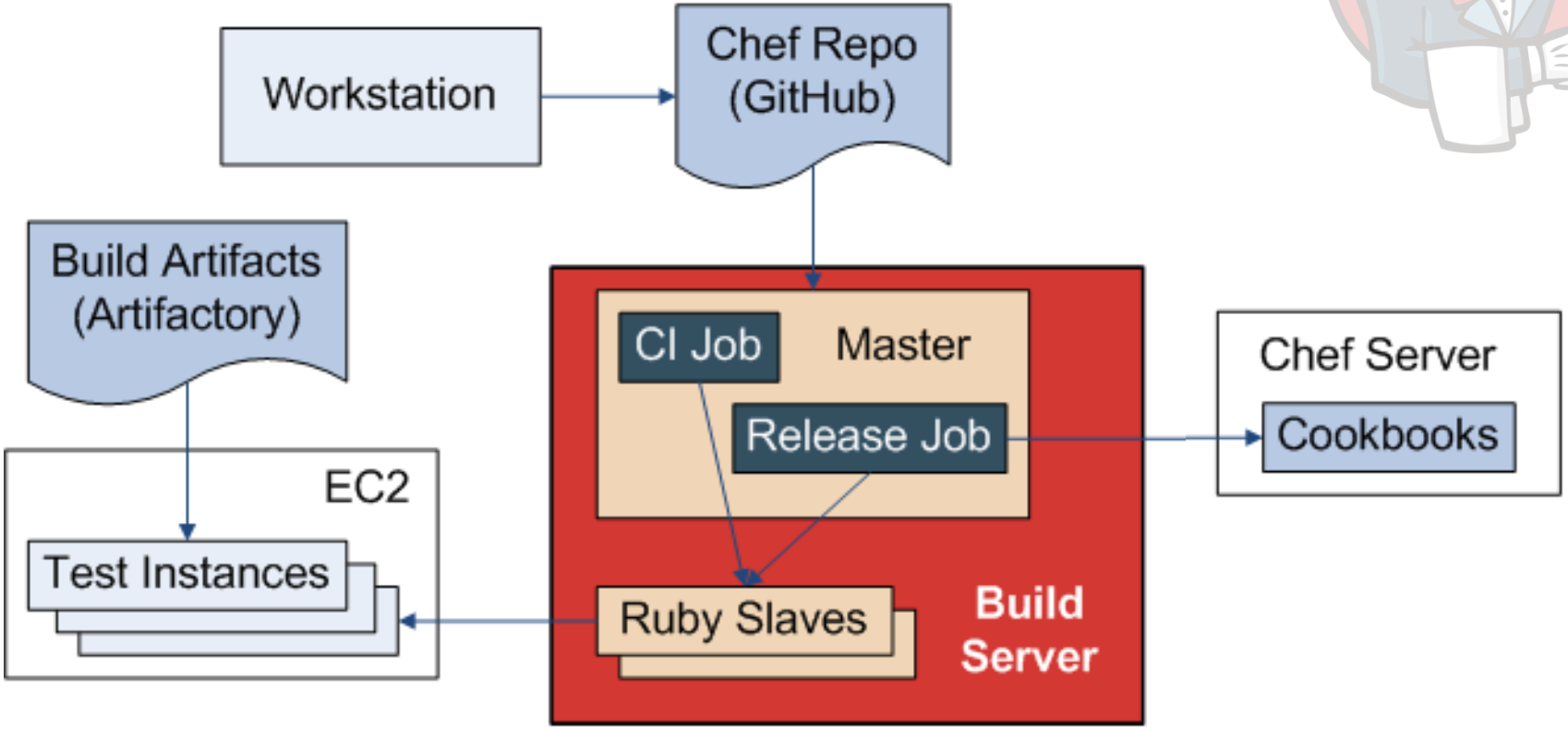
* Included for future reference

Roles

- Deployers
  - Update data bags & environment files
  - Initiate deployments
- Tech leads
  - Maintain application cookbooks
- Framework developers
  - Maintain library cookbooks
  - Maintain framework
  - Process improvement

COOKBOOK BUILDS

Cookbook Build Process



Jenkins Build Server

- For each application group
  - Cookbook CI job
  - Cookbook release job
  - Same master as application build jobs
- New class of slaves
  - Ruby with required gems
  - Chef with credentials for Chef server
  - EC2 credentials to create test nodes

Cookbook CI Job

- Triggered when new Chef code is merged
- Static analysis
  - JSON syntax (json gem)
  - Ruby syntax and style (Tailor)
  - Chef syntax (Knife)
  - Chef style and correctness (Foodcritic)
- Integration testing
  - Test Kitchen with kitchen-ec2 plugin

Integration Testing Lifecycle

- Spin up EC2 instance(s) to mimic actual deployment topology of application group
- Run Chef on each instance (node)
- Execute asserts – pass or fail
- Dispose of instance(s)

Integration Testing Details

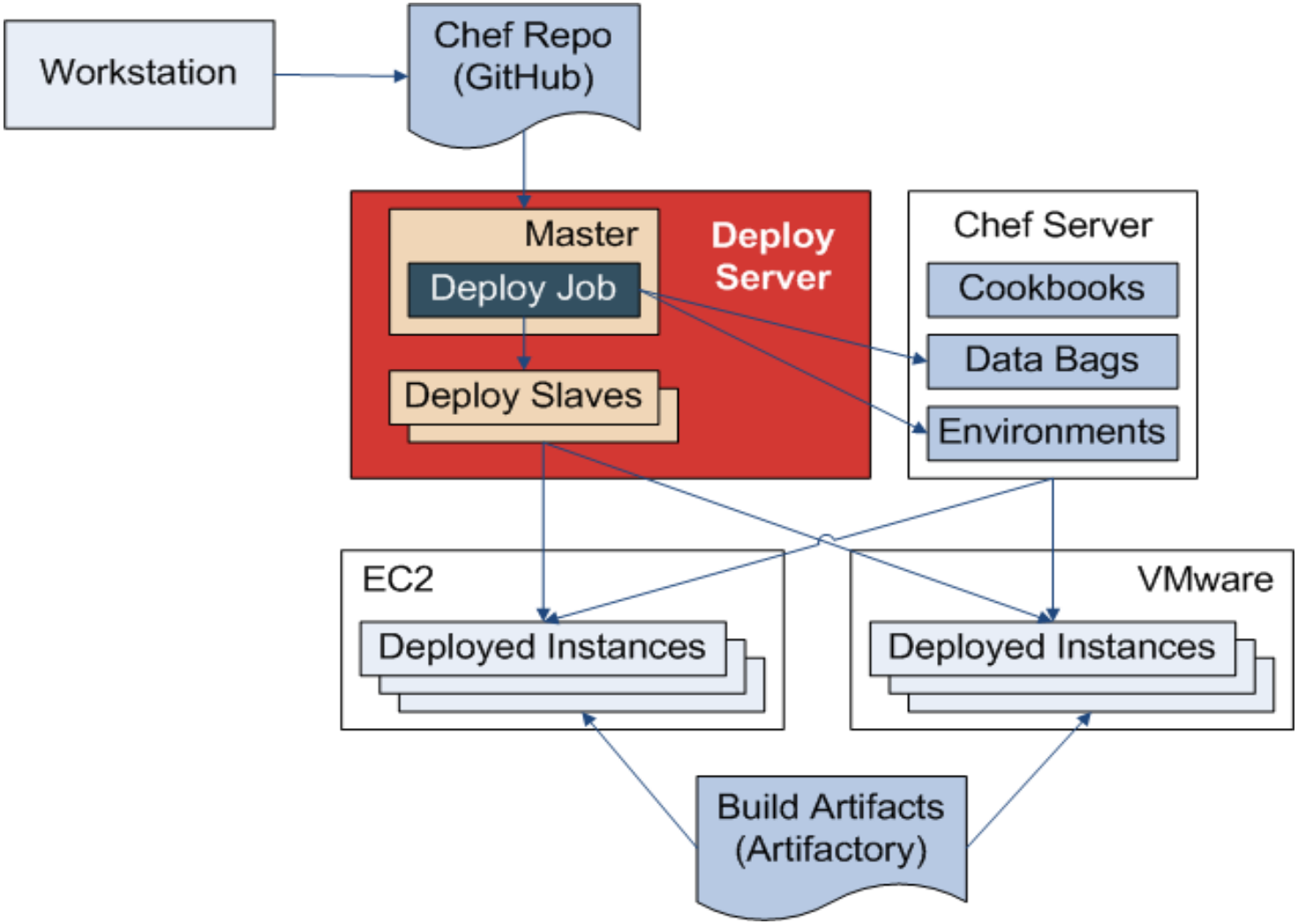
- Instances created from AMI
  - Preconfigured with Ruby and Chef
- Using Chef Solo
  - Avoid adding ephemeral nodes to Chef server
- Faux Chef environment “CHEFDEV”
  - JSON for real environments is reserved
- Tag EC2 instances for traceability
- Troubleshoot by running Test Kitchen from workstation

Cookbook Release Job

- Triggered manually
- Runs same tests as CI job
- Uploads new cookbook version to Chef server
- Tags Git repo

APPLICATION DEPLOYMENT

Application Deploy Process



Jenkins Deploy Server

- Separate master for deploys
- Slaves
  - Ruby with required gems
  - Chef with credentials for Chef server
  - SSH keys for nodes

Deploy Job Types

- Each app group has two deploy jobs
  - DEV deploy for Development
  - Non-DEV deploy for Operations
  - Will provide more flavors over time
- Job parameters
  - Environment (non-DEV jobs only)
  - Application group version

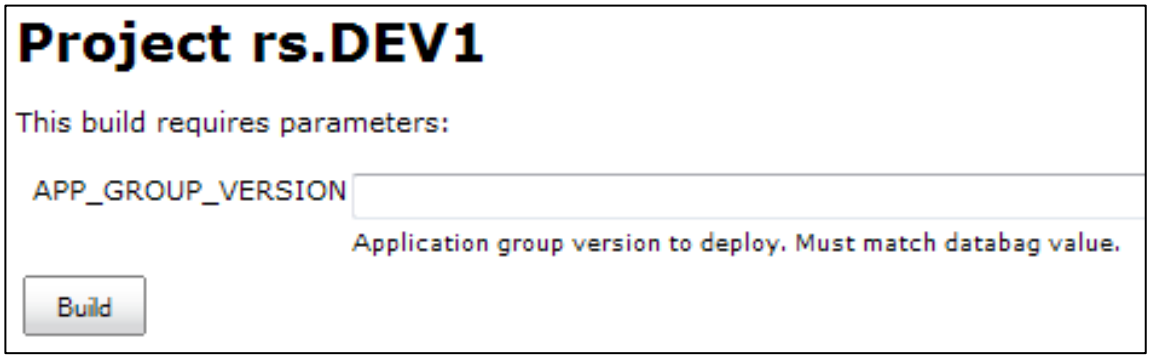
What Does a Deployer Do?

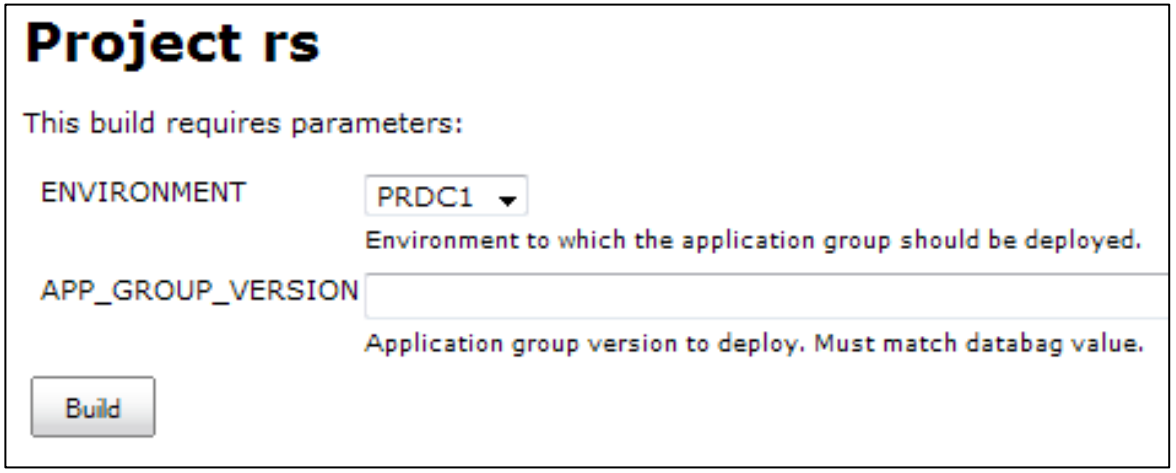
- Makes configuration changes
  - Edits application data bag item
  - Edits environment file (if necessary)
  - Merges code
- Executes job in Jenkins

Example Deploy Job Run

- Deployer enters parameters
  - Application version = 1.4.9
  - Environment = TEST
- Then automation takes over
  - Confirms my_app data bag has TEST version 1.4.9
  - Uploads TEST environment file and my_app data bag item for TEST to Chef server
  - Finds all nodes in TEST environment with run list containing my_app recipes
  - Runs Chef client on each found node
  - Sends email notification

Push-Button Deploys





Deploy History

Build History	(trend)	
#33	May 29, 2014 3:37:06 PM	184 KB
	[DEV1] 3.1.5	
#32	May 21, 2014 11:20:21 AM	245 KB
	[DEV1] 3.1.4	
#31	May 14, 2014 4:02:46 PM	155 KB
	[DEV1] 3.1.3	
#30	May 13, 2014 2:32:31 PM	149 KB
	[DEV1] 3.1.2	
#29	May 13, 2014 12:00:44 PM	197 KB
	[DEV1] 3.1.2	
#28	May 6, 2014 4:25:20 PM	199 KB
	[DEV1] 2.1.29	
#27	May 1, 2014 4:04:00 PM	244 KB
	[DEV1] 2.1.27	
#26	Apr 10, 2014 9:15:28 AM	132 KB
	[DEV1] 2.1.27	
#25	Apr 9, 2014 11:12:55 AM	130 KB
	[DEV1] 3.1.1	
#24	Apr 9, 2014 10:12:14 AM	129 KB
	[DEV1] 3.1.0	
#23	Apr 9, 2014 10:02:18 AM	70 KB
	[DEV1] 3.1.0	
#22	Apr 4, 2014 1:21:34 PM	157 KB
	[DEV1] 2.1.26	

Build History	(trend)	
#50	May 30, 2014 5:47:41 PM	128 KB
	[PRDC1] 2.1.31	
#49	May 30, 2014 5:38:36 PM	129 KB
	[PRDC2] 2.1.31	
#48	May 30, 2014 3:42:07 PM	137 KB
	[PS1] 2.1.31	
#47	May 30, 2014 12:47:01 PM	135 KB
	[QA1] 2.1.31	
#46	May 29, 2014 10:28:04 AM	124 KB
	[PRDC2] 2.1.30	
#45	May 29, 2014 10:06:02 AM	145 KB
	[PRDC2] 2.1.30	
#44	May 29, 2014 9:53:16 AM	166 KB
	[PRDC1] 2.1.30	
#43	May 22, 2014 11:05:57 AM	128 KB
	[PS1] 2.1.30	
#42	May 22, 2014 10:56:09 AM	289 KB
	[PS1] 2.1.30	
#41	May 15, 2014 2:00:35 PM	222 KB
	[QA1] 2.1.30	
#40	May 9, 2014 11:32:42 AM	145 KB
	[PREC1] 2.1.29	
#39	May 5, 2014 3:43:50 PM	130 KB
	[QA1] 2.1.29	

WRAP UP

Most Important Advice

- Beware of overly prescriptive “lessons learned” and “best practices”
- Synthesize a solution for your context
- That said…

Principles & Guidelines (1)

- Standardize wherever possible
  - Technology, design, process
  - Achieve economies of scale
  - Exceptions are permissible but rare
- Every tool must have an API
  - Avoid “hitting the wall” down the road
  - Tradeoff some out-of-the-box capabilities

Principles & Guidelines (2)

- Use multiple communication paths
  - All-hands presentations
  - Kickoff meetings with each team
  - Developer walkthroughs
  - Documentation
- Be opportunistic
  - Find and nurture your early adopters

Principles & Guidelines (3)

- Balance process and progress
  - Must provide tangible results
  - And also build foundation for future
  - Just like with application development!
- Start with a big pain point
  - Providing relief builds credibility going forward
  - Hopefully recoups bandwidth to reinvest

"When Will You Be Done?"

- DONE is a dangerous word
  - Business won't stop evolving
  - Neither will the supporting applications
  - Nor should the supporting infrastructure
- X is a journey, not a destination
  - For many values of X
    - Deployment automation
    - Continuous delivery
    - DevOps

Thank You

- Copyright Clearance Center Engineering Team

- Jenkins User Conference Organizers and Sponsors

Resources

- "Infrastructure in the Cloud Era"

  Adam Jacob and Ezra Zygmuntowicz

  http://www.slideshare.net/adamhjk/infrastructure-in-the-cloud-era

  http://www.youtube.com/watch?v=HaABapTwQ2c

- Chef cookbook versioning policy

  http://chef-community.github.io/cvp/

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