

# **DevOps: Crafting Reusable Infrastructure Resources**

**Jennifer Davis**

Network Name: WPOC\_WiFi

Access Code: velocity2016

# Jennifer Davis

- Software Engineer, Chef Software
- Co-author of "Effective Devops"
- Founder of CoffeeOps
- DevOpsDays Silicon Valley Organizer

O'REILLY®



## Effective DevOps

BUILDING A CULTURE OF COLLABORATION,  
AFFINITY, AND TOOLING AT SCALE

Jennifer Davis & Katherine Daniels

# Katie Rose

# Jonathan Disher

# Ian Henry

# Communication

- Jennifer Davis  
Twitter: @sigje #effectivedevops  
Email: sparklydevops@gmail.com
- Katie Rose Twitter: @RealKatieRose
- Jonathan Disher Twitter: @funjon
- Ian Henry Twitter: @Eeyun\_\_

# Feedback

- Constructive feedback
  - What did you find helpful?
  - What would you like to see more/less of?
  - Was there anything you found unclear?

# Schedule

Morning Break: 10:30 - 11:00am

Lunch: 12:30 - 1:30pm

Afternoon Break: 3:00 - 3:30pm

# Network Connectivity

Network Name: WPOC\_WiFi

Access Code: velocity2016

# Expectations

- Safe space to share experiences, learn from each other
- Code of Conduct
- Learn effective workflows for using and testing source control and configuration management

# Team Activity 1

- Meet your team!
  - What are motivations?
  - What are current beliefs?
  - Skills? Gaps in skills?
  - git, chef, docker, continuous integration, continuous delivery

<http://goo.gl/forms/M2bvntFSYqxtnlzb2>

# **What is Devops**

# What is Devops

Cultural movement that seeks to:

- change how individuals work,
- value the diversity of work done,
- develop conscious decisions in acceleration,
- plan for scale, and
- measure the effect of social and technical change.

# Folk Models

- general popularly understood meaning particular to a socio-cultural grouping but which has not been formally defined or standardized.

# Why Devops?

**High Performing Devops Teams  
are more agile  
30X more frequent deployments  
8000X faster lead times than peers**

2014 PuppetLabs State of DevOps Survey

**High Performing Devops Teams  
are more reliable  
2X change success rate  
12X faster mean time to recovery (MTTR)**

2014 PuppetLabs State of DevOps Survey

# **Foundation of Devops**

# Collaboration

*Individuals working together with shared interactions and input building towards a common goal.*

# Collaboration

- Multiple types of collaboration
- Monitoring for single points of failure
- Monitoring burnout

# Smarter Teams build better value

# Affinity

*Building inter-team relationships, empathy and trust in support of shared organizational and business goals.*

# Affinity

- Monitor organizational signal
- Monitor gating of processes
  - Shadow HR, IT, Marketing

# Tools

*Accelerators of culture that if used effectively can enhance and support a culture of collaboration and affinity.*

# Scaling

Applying the considerations of collaboration, and tooling throughout various inflection points of an organizations lifecycle.

# Foundations of DevOps

- Collaboration
- Affinity
- Tools
- Scaling

# Framing Devops Narrative

# The Devops Compact

- shared mutual understanding
- established boundaries

# Team

- Common purpose
- Defined beliefs
- Empowered

# Diversity in Teams

- Professional
- Personal
- Goals
- Cognitive Styles

# **Team Activity 2**

## **Careless Conversations (inspired by Alan Cyment)**

- Pair up
- Select one person to go first.
- For one minute, speaker talks about something passionate about. Listener stays seated, quiet, and acts disinterested.
- Switch roles and repeat.
- Repeat until both people have done this twice.

# Careless Conversations

- How does it feel not to be listened to?
- How does it feel to ignore someone?

# Cultivating Empathy

- Collect stories
- Listen
- Circle back



**Shared stories  
articulate values and ideas.**



**Shared stories  
explain historical significance.**

A dense crowd of people in a painting by Gustave Caillebotte, 'The Parisians on the Quai Voltaire'. The scene is filled with men in various attire, some wearing hats and coats, others in more casual clothing. The colors are muted, with earthy tones and greys dominating the palette.

# Shared stories passing knowledge

**Shared stories  
influence community.**

**Shared stories  
cultivate empathy.**

*A life becomes meaningful when one sees himself or herself as an actor within the context of a story.*

-- George Howard

# Mindsets

- Fixed
- Growth

# Small vs Large teams

- Large teams - roles may be highly segregated
- Small teams - one person may be responsible for many roles

# Critical Habits for Teams

- Code Review
- Pairing

# Code Review

- Max 90 minutes in one setting

# Pairing

- Agile software development
- 2 people work together on 1 workstation
- Driver - writes code
- Observer - reviews each line
- Roles switch frequently

# Types of Pairing

- Expert-expert
- Expert-novice
- Novice-novice

# **GridIronOps - Katie Rose**

# **Team Activity 2.5:**

# **Coat of Arms**

# Visualizing Work

- Break down rigid single points of knowledge failure
- Reduce Development friction
- Eliminate duplicate efforts

# A solution

- Team kanban board
- Commitments to incremental improvements

# Factors for Success

- management buy in
  - training
  - effort to minimize "pushing"
- weekly team syncs
- proximity of team

# Prepping for Success

- Environment
- Values
- Desire
- Motivation
- Connectedness

# **Team versus Individual**

# Objectives

- Defined by the team. Not management.
- Defined by the team. Not individuals.
- Everyone has voice, opportunity to speak.

# As a team...

- Discuss objectives.
- Describe work.
- Define lanes.
- Define a task.
- Define a project.

# **Elect a champion**

# Workflow

Work that is

- orchestrated
- repeatable
- organized
- moves from one state to another

# WIP

- Work in Progress
  - work that has had money or people applied to it.

# Work Identification

- name
- start date
- end date
- current state
- description
- priority

# Task Handling

- What is it?
- Can you do anything with it?
- What is the next step?

# Projects

- Same requirements as a task
- Larger in scope
- May be comprised of more than one task

# Interrupts

- Non planned work that comes in
  - customer request
  - incident
  - request for help from coworker
  - single point of knowledge (you) work
  - high priority task push from manager

# Blocked work

- Work that can progress no further:
  - dependent teams - blocked by external team
  - insufficiently qualified request - blocked by requester
  - dependent on SPOK - blocked by team
  - time dependent

# Team Activity 3

Discuss with your team:

- What is the difference between a task and a project?
- Do you have interrupts? What are they?
- How do you determine when work is done?

Time: 15 minutes

# Kanban is a system.

- Visual process management
  - what to do
  - when to do it
  - how much to do

# Kanban is a method.

- incremental, evolutionary process improvement

# 3 principles

- Current Process
- Incremental, evolutionary change
- Respect

# Current Process

- Do you know what the current process is?
- Is it documented? Is it explicit? Is it clear?
- Has it been evaluated with the team?

# Incremental Evolutionary Change

- How are you measuring current process?
- Is the value clearly understood?
  - Is work defined in value or cost?

# Respect

- Find the current value.
- Not forceful in nature.
- What people want versus how to get there

# Kanban

- Start with what you do now
- Agree to incremental, evolutionary change
- Respect
- Everyone is a leader

# Kanban Practices

- Visualize
- Limit WIP
- Manage flow
- Make policies explicit
- Implement feedback loops

# Visualize

- Intent
- Alignment
- Coherence

# Limit WIP

- Pull (don't push)

# Manage Flow

- Monitor/measure/report
- Incremental change

# Make Policies Explicit

- Document processes
- Group signoff

# Implement Feedback Loops

- Collaboration
- Retrospectives

# Team Activity 4

Talk through workflow for tasks for your team. How will you figure out what work needs to be done, who will work on the work, and when it is done. Use postits to mock up a legend for types of work items. Use pad to mock up your work items board. Use blue tape to mark off lanes.

Time: 30 minutes

# Affinity

# Devops Tools

- Establish local development environment
- Version control
- Manual -> Automation -> Continuous
  - Artifacts
  - Infrastructure
  - Sandbox

# **Local Development Environment (LDE)**

- Consistent set of tools across the team
- Ability to quickly onboard new engineers

# Provisioned Node - LDE

- AWS instance node
- Chef DK
  - Test Kitchen
  - Ruby
  - ChefSpec, ServerSpec
- Git

# Configuration Management

- Process of identifying, managing, monitoring, and auditing a product through its entire life including the processes, documentation, people, tools, software, and systems.

# Version Control

- Records changes to files or sets of files stored within the system
- Enable revisions
- Integrity checking
- Collaboration

# Artifact Repository

- Secure
  - Trusted
  - Stable
  - Accessible
  - Versioned
- (artifactory, nexus, yum, package.io, rubygems)

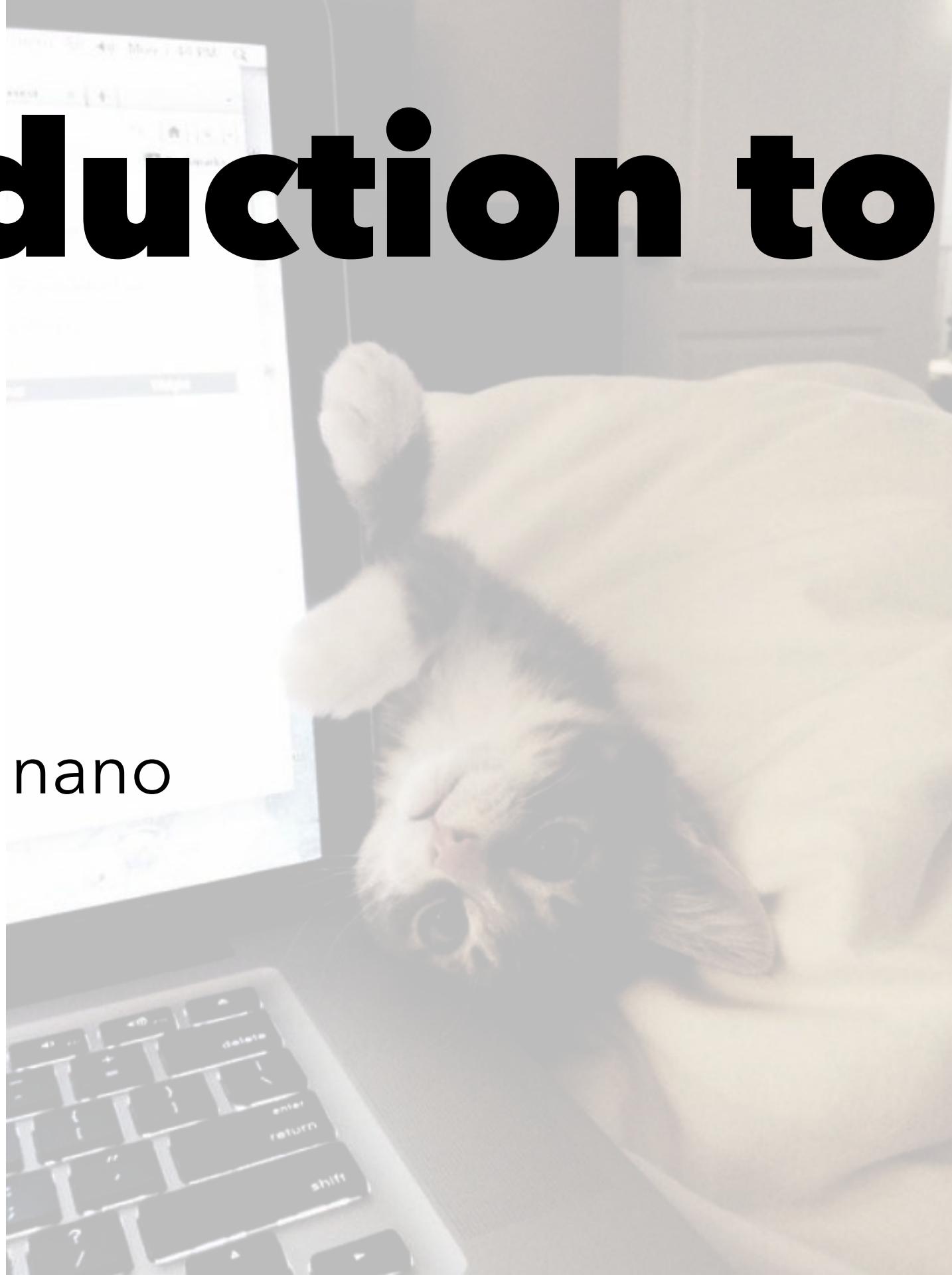
# Introduction to Lab 1

## Lab 1

User: chef

Password: chef

sudo yum install nano



# Lab 1

## Lab 1

Time: 15 minutes

# Team Activity 5

In pairs, discuss your current work environment.

- Who are the members of your team (at work)?
- Who are the people who have commit access?
- What's the flow of code from design to deploy?

While one person shares their environment, the other person should draw a diagram to represent the information shared. Use circles to represent people, triangles to represent code

# Introduction to Lab 2

Lab 2



# Lab 2

## Lab 2

Time: 15 minutes

# Extending Git Understanding

- Highly recommend: Git for Teams <http://gitforteams.com/>  
Emma Jane Westby

# Infrastructure

- Aggregate of applications, configurations, access control, data, compute nodes, network, storage, processes, and people.

# Infrastructure Automation

- Systems that reduce the burden on people to manage services and increase the quality, accuracy and precision of a service to the consumers of a service

# Infrastructure Automation Tools

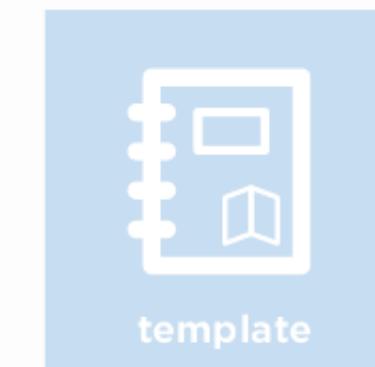
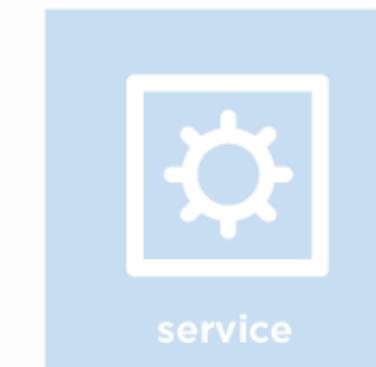
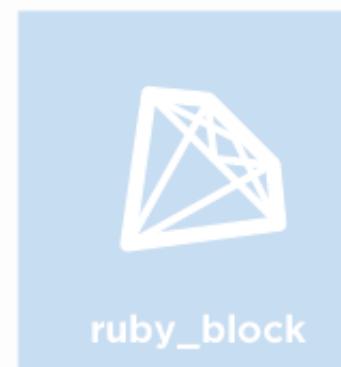
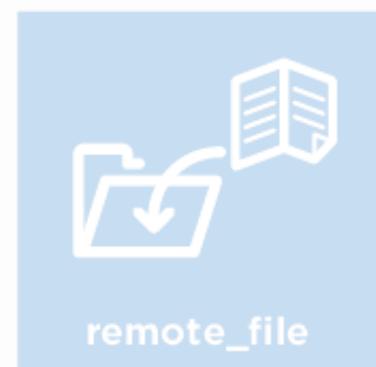
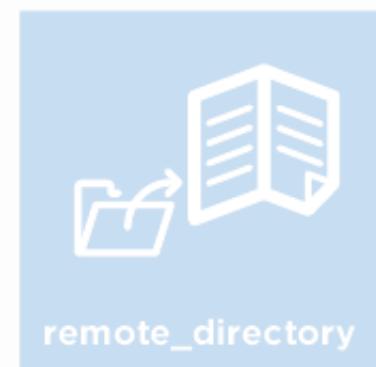
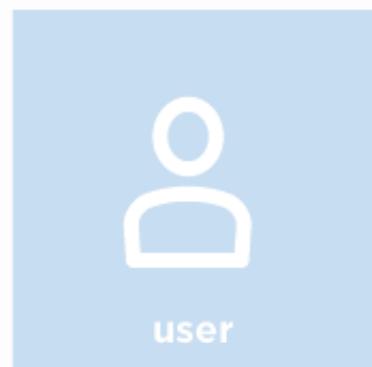
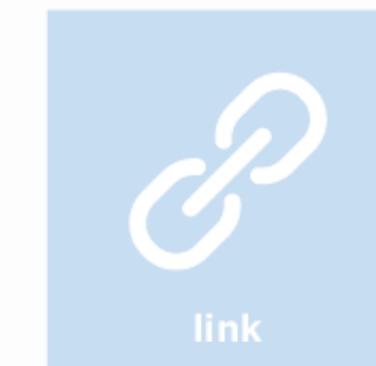
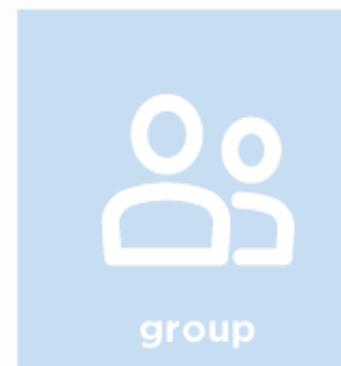
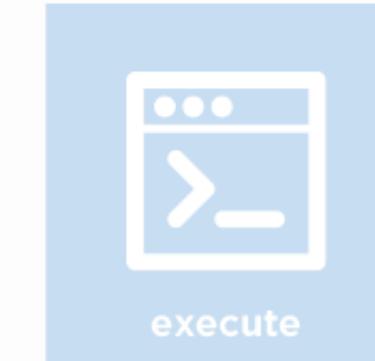
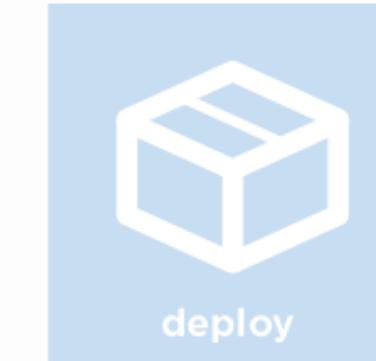
- Chef
- Puppet
- Ansible
- Salt
- CFEengine

# Introduction to Chef

, Baking Cookies

# Resources

- Ingredients of infrastructure



# Resource Declaration

```
RESOURCETYPE "RESOURCE_NAME" do  
    PARAMETER PARAMETER_VALUE  
end
```

# Example Resource Type - package

A package to be installed:

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

# Example Resource Type - service

A service that should be started:

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

# Resources

A resource is a statement of policy that:

- Describes the desired state for an element
- Specifies a resource type---such as package, template, or service
- Lists additional details (also known as parameters), as necessary
- Are grouped into recipes

# Recipes

- Collection of ordered resources
- Combination of ruby and Chef DSL

# Cookbooks

- Thematic
- Collection of recipes and other supporting files

# Roles

- Abstraction describing function of system
- Name
- Description
- Run list (ordered list of recipes and roles)

# Run List

- Ordered list of recipes and roles
- Specific to a node

# Nodes

- Machine (virtual, physical, cloud server, or other device) that is managed by Chef

# Environments

- Abstraction models workflow
- Name
- Description
- Cookbook version pinning

# Supermarket

- Community site with a number of cookbooks
- Read before using in your environment

# Chef DK

- Chef development kit
- Includes a number of utilities and software to facilitate cookbook creation
- Free download off of the website

# Berkshelf

- Dependency management
- Included with Chef DK

# Review of Day 1

Slides, Labs, Activities

\* <http://bit.ly/28Mu8fe>

# Schedule

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# **Foundations of DevOps**

# Foundations of DevOps

- Collaboration
- Affinity
- Tools
- Scaling

# Collaboration

*Individuals working together with shared interactions and input building towards a common goal.*

# Affinity

*Building inter-team relationships, empathy and trust in support of shared organizational and business goals.*

# Tools

*Accelerators of culture that if used effectively can enhance and support a culture of collaboration and affinity.*

# Scaling

Applying the considerations of collaboration, and tooling throughout various inflection points of an organizations lifecycle.

# Collaboration

- Shared stories
- Cultivating Empathy
- Diversity in teams

# Affinity

# Tools

- Local development environment - Chef DK
- Version Control - git
- Infrastructure Automation - chef
- Sandbox Automation - Test Kitchen

# Test Kitchen

- Included with Chef DK
- Sandbox automation
- Test harness

# Test Kitchen

- Execute code on one or more platforms
- Driver plugins supporting various cloud and virtualization providers

# .kitchen.yml

- driver
- provisioner
- platforms
- suites

# .kitchen.yml driver

- virtualization or cloud provider

Example: vagrant, docker

# .kitchen.yml provisioner

- application to configure the node

Example: chef\_zero

# .kitchen.yml platforms

- target operating systems

Example: centos-6.5

# .kitchen.yml suites

- target configurations

Example:

```
name: default
  run_list:
    - recipe[apache::default]
  attributes:
```

# Kitchen commands (1/2)

- kitchen init
- kitchen list
- kitchen create
- kitchen converge

# Kitchen commands (2/2)

- kitchen verify
- kitchen destroy
- kitchen test

# Introduction to Lab 3

Lab 3

# Lab 3

Time: 30 minutes

# **Runbook to Recipes**

# Introducing MongoDB

# MongoDB terminology

- document - basic unit of data for MongoDB, ordered set of keys with associated values
- collection - group of documents. analogous to table.
- instance - MongoDB can host multiple independent databases, each of which can have its own collections.
- `_id` - special key unique within a collection.

# MongoDB Shell

- mongo
- full featured JavaScript interpreter

# Introduction to Lab 4

Translate a runbook for installing MongoDB into chef.

Lab 4

# Lab 4

Time: 30 minutes

# Introduction to Lab 5

Translate our MongoDB cookbook from recipes into resources.

Lab 5

# Lab 5

Time: 30 minutes

# Managing Risk

- Test
- Small frequent releases

# Linting

- Ensure code adheres to styles and conventions
- Weave expectations into development
- Encourages collaboration

# Testing

- Documenting objectives and intent
- Measuring "done"

# Code Correctness

- foodcritic
- rubocop

# Integration Tests

- ServerSpec
- InSpec

# Rubocop

- Ruby linter
- Analyzes source code to verify the syntax and structure of our cookbooks.
- [Ruby style guide](#)
- Included with ChefDK

# Why

- identify simple errors early
- improve the review process by eliminating stylistic issues

# Rubocop Example

```
$ rubocop cookbooks/COOKBOOK1 cookbooks/COOKBOOK2 cookbooks/COOKBOOK4
```

# Reading Rubocop Output

Inspecting 8 files  
CWCWCCCC

- . means that the file contains no issues
- C means a issue with convention
- W means a warning
- E means an error
- F means an fatal error

# Rubocop Cops

- Lint
- Rails
- Style

Example: rubocop --lint.

# Disabling Rubocop cops

Any configuration in `.rubocop.yml` is disabled.

To disable string literals:

```
StringLiterals:  
  Enabled: false
```

# Foodcritic

- Chef linter
- Chef style guide
- Included with ChefDK

# Foodcritic Example

```
$ foodcritic cookbooks/setup
```

# Reading Foodcritic Output

FC008: Generated cookbook metadata needs updating: ./metadata.rb:2

# ServerSpec

- Tests to verify servers functionality
- Resource types
  - Package, service, user, and many others
- Integrates with Test Kitchen
- <http://serverspec.org>

# ServerSpec Generic Form

```
describe "<subject>" do
  it "<description>" do
    expect(thing).to eq result
  end
end
```

# ServerSpec Potential Tests

- Is the service running?
- Is the port accessible?
- Is the expected content being served?

# ServerSpec Example

```
describe 'apache' do
  it "is installed" do
    expect(package 'httpd').to be_installed
  end
  it "is running" do
    expect(service 'httpd').to be_running
  end
end
```

# Reading ServerSpec Output

```
app::default
  httpd service is running
```

```
Finished in 0.26429 seconds (files took 0.7166 seconds to load)
1 example, 0 failures
```

# InSpec

- infrastructure specification
- open-source testing framework for infrastructure
- human and machine readable
- compliance, security, and policy requirements
- Based off of ServerSpec

# InSpec Example

```
describe service 'ssh-agent' do
  it { should be_running }
end
```

# InSpec Example Run

```
$ inspec exec test.rb
```

.

```
Finished in 0.00901 seconds (files took 0.98501 seconds to load)
1 example, 0 failures
```

# InSpec Remote Run

```
$ inspec exec test.rb -i ~/.aws/YOUR.pem -t ssh://ec2-user@54.152.7.203
```

# InSpec Remote Run on Windows

```
$ inspec exec test.rb -t winrm://Admin@192.168.1.2 --password super
```

# InSpec Docker Containers

```
$ inspec exec test.rb -t docker://3dda08e75838
```

# More info on InSpec

[https://github.com/chef/inspec/blob/master/docs/ctl\\_inspec.rst](https://github.com/chef/inspec/blob/master/docs/ctl_inspec.rst)

# InSpec Audit Rules

- lots of resources to facilitate auditing nodes

# InSpec host resource example

```
describe host('example.com', port: 80, proto: 'tcp') do
  it { should be_reachable }
end
```

# InSpec login\_defs resource example

```
describe login_defs do
  its('PASS_MAX_DAYS') { should eq '180' }
  its('PASS_MIN_DAYS') { should eq '1' }
  its('PASS_MIN_LEN') { should eq '15' }
  its('PASS_WARN_AGE') { should eq '30' }
end
```

# InSpec References

- InSpec Reference Guide
  - [https://docs.chef.io/inspec\\_reference.html](https://docs.chef.io/inspec_reference.html)
- Windows infrastructure testing using InSpec
  - <http://datatomix.com/?p=236>
  - <http://datatomix.com/?p=238>
- Example of SSH

# Introduction to Lab 6

Lab 6

# Lab 6

Time: 20 minutes

# Introduction to Lab 7

## Lab 7

# Lab 7

Time: 30 minutes

# Test, Monitor, or Diagnostic<sup>2</sup>

1. Where is it going to run?
2. When is it going to run?
3. How often will it run?
4. Who is going to consume the result?
5. What is the entity going to do with it?

---

<sup>2</sup> Lam, Yvonne. 'Sysadvent: Day 5 - How To Talk About Monitors, Tests, And Diagnostics'. Sysadvent.blogspot.com. N.p., 2014. Web. 26 May 2015.

# Intro to Jenkins

- continuous integration server to build and test software.
- integrated with source control (svn, git, ..)
- integration with build systems
- worker nodes to scale out systems
- plugins (complex and community maintained)

# Layers of Infrastructure Management

- Orchestration
  - Coordination
  - Scheduling
- Configuration packages and software
- Provisioning

# Jenkins terminology

- job - base unit of work.

# General workflow

- source control change
- jenkins polls source control, triggers a build
- job runs, reports failure or success

# Difference between jenkins and chef

- jenkins generally for build and test
- chef for automation of configuration, node deploy to comply to policy

Jenkins can deploy! Jenkins as coordinators.

# Closer comparison

Chef delivery versus Jenkins!

# Introduction to Lab 8

## Lab 8

# Lab 8

Time: 30 minutes

# Introduction to Lab 9

## Lab 9

# Lab 9

Time: 20 minutes

# **Measuring Impact and Value of Change**

# **Impact of Change**

# Impact on Availability

- Overall site/app availability
- Individual service availability

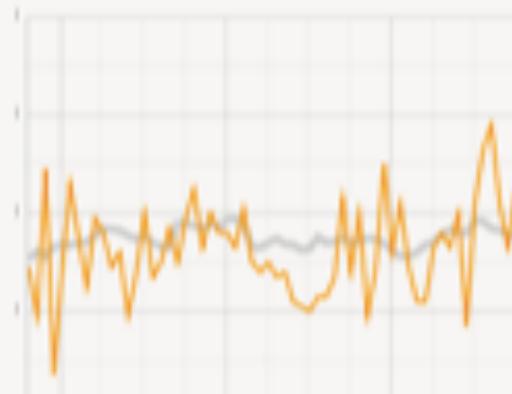
# Availability Monitoring

- Uptime:
- Pingdom, Monitis, Uptrends, etc
- Vertical Line Technology:
- Availability after deploys/changes

## End-User (1 hour) ☰

Three-Armed Sweaters ⚡ ⓘ 🔎

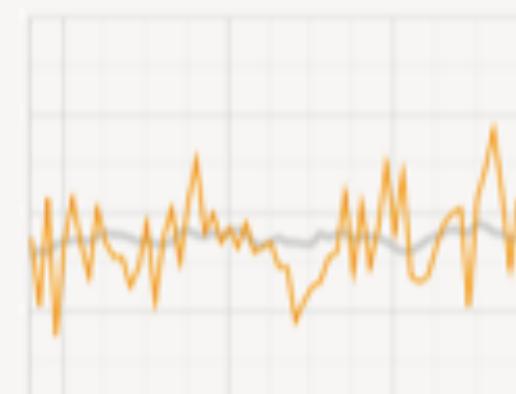
ages · historical



17:00 17:20 17:40

Screwed Users ⚡ ⓘ 🔎

unique users · historical



17:00 17:20 17:40

HTTP 404 (0.27%) ⚡ ⓘ 🔎

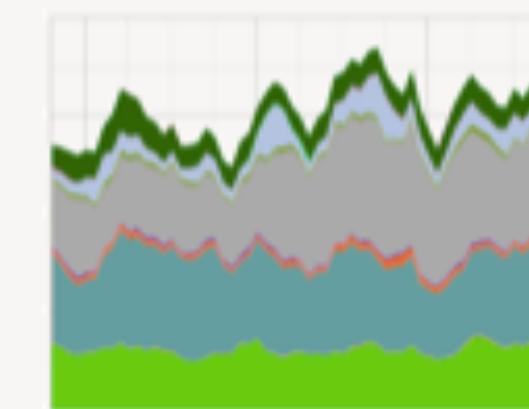
current · historical



17:00 17:20 17:40

HTTP Errors (0.25%) ⚡ ⓘ 🔎

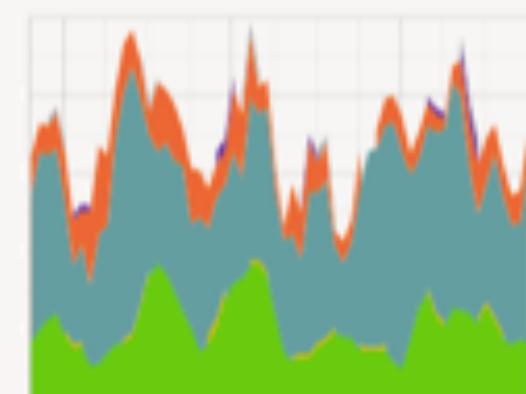
201 · 202 · 206 · 303 · 304 · 400 · 401 ·  
403 · 405 · 409 · 410 · 416 · 429 · 439 ·  
500 · 501



17:00 17:20 17:40

Native Apps HTTP Errors ⚡ ⓘ 🔎

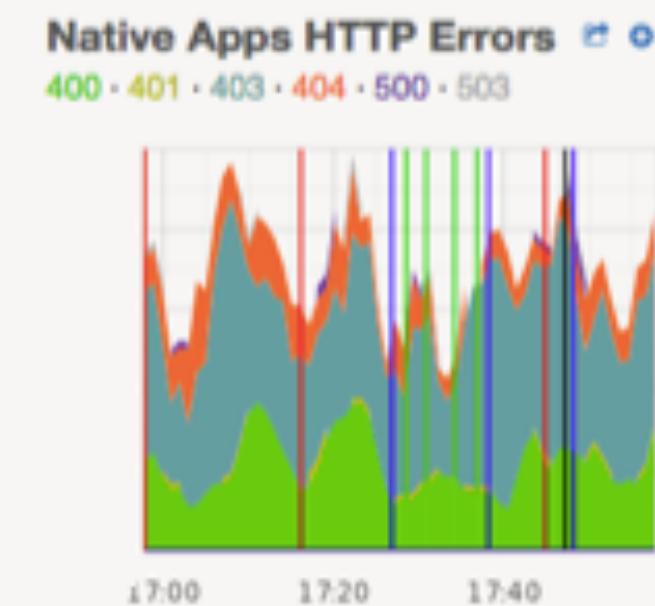
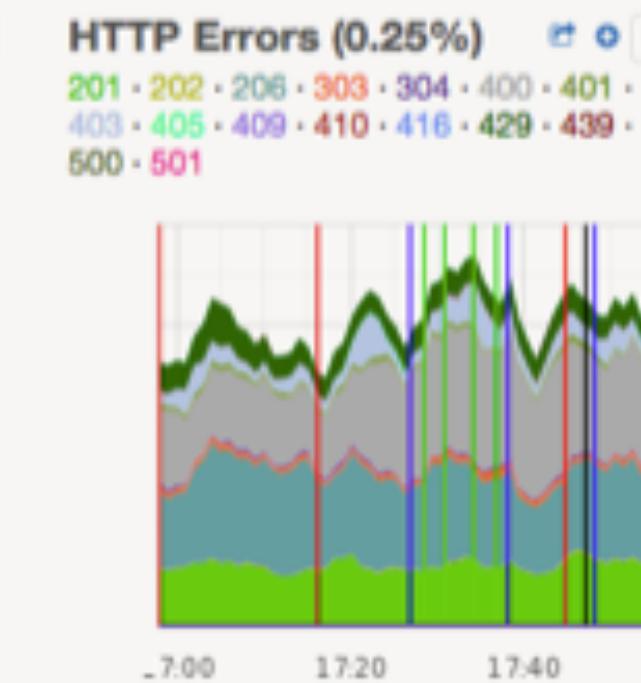
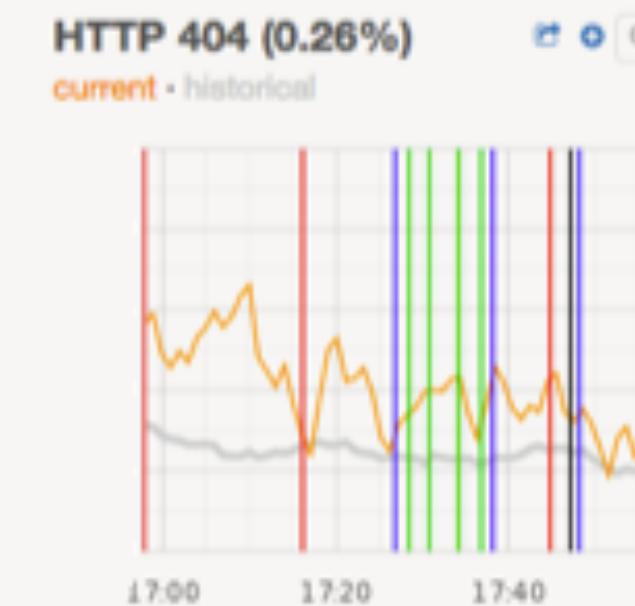
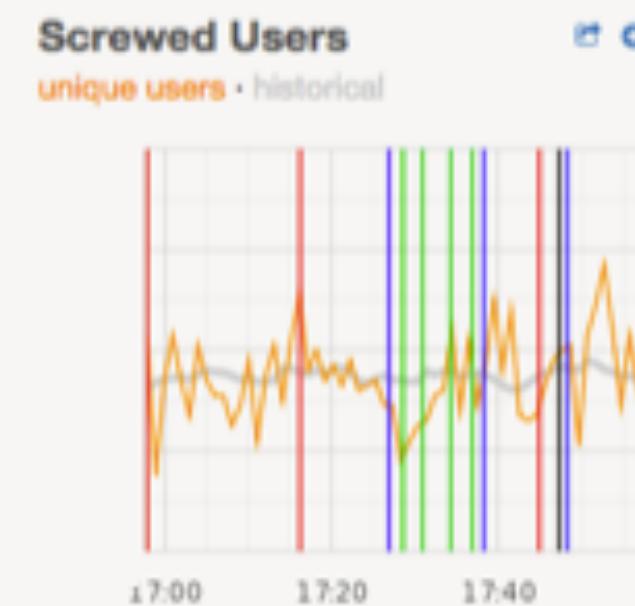
400 · 401 · 403 · 404 · 500 · 503



17:00 17:20 17:40

# Eventinator

## End-User (1 hour) ■



# Service Availability

- Nagios: Service-level monitoring and alerting
- Nagios-herald: Alert context
- OpsWeekly: Historical alert data

# Nagios

```
define command {
    command_name      check_mongodb_query
    command_line      $USER1$/nagios-plugin-mongodb/check_mongodb.py
                      -H $HOSTADDRESS$ -A $ARG1$ -P $ARG2$
                      -W $ARG3$ -C $ARG4$ -q $ARG5$
}

define service {
    use                  generic-service
    hostgroup_name       Mongo Servers
    service_description  Mongo Connect Check
    check_command        check_mongodb!connect!27017!2!4
}
```

```
define servicedependency{
    host_name                               WWW1
    service_description                     Apache Web Server
    dependent_host_name                   WWW1
    dependent_service_description        Main Web Site
    execution_failure_criteria          n
    notification_failure_criteria      w,u,c
}
```

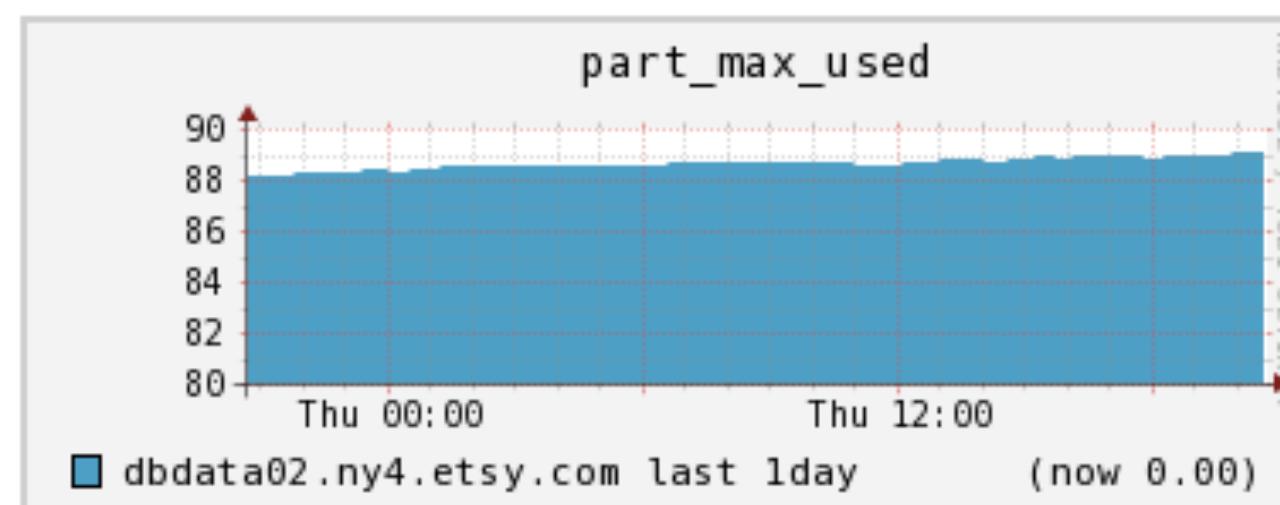
# Nagios-herald

nagios@etsy.com

to me ▾

Host: dbdata02.ny4 Service: Disk Space

State is now: **WARNING** for 0d 0h 2m 53s (was WARNING) after 3 / 3 checks



```
THRESHOLDS - WARNING:10%;CRITICAL:5%;  
Filesystem      Size  Used Avail Use% Mounted on  
/dev/cciss/c0d0p2    29G  2.4G  25G  9%  /  
/dev/cciss/c0d0p4  516G  459G  57G  90%  /var  Free disk space (10%) is <= WARNING threshold ( 10%).  
/dev/cciss/c0d0p1   190M   12M  169M  7%  /boot  
tmpfs            12G     0   12G  0%  /dev/shm
```

Alert Frequency

✨ @sigje #effective devops ✨

HOST 'dbdata02.ny4' has experienced 1 WARNING alerts for SERVICE 'Disk Space' in the last 7 days.

Problematic volume

Ganglia graph

Threshold exceeded

Alert frequency

# opsWeekly

Date/Time	Host	Service	Output	State
Fri 13 Jun 14:04:29 EDT	logarchive02	Disk Space	DISK WARNING - free space: /logs 6616027 MB (10% inode=99%):	WARNING
	No action taken: Threshold adjustmer		Notes: Threshold is too low, increased	<input type="checkbox"/>
Fri 13 Jun 04:51:31 EDT	virt14	Disk Space	DISK CRITICAL - /var is not accessible: Input/output error	CRITICAL
	Action taken: Service Issue (View cle:		Notes: RAID failure caused machine to die	<input type="checkbox"/>
Thu 12 Jun 20:36:19 EDT	localhost	Aggregate MySQL Slave	OK=46 WARNING=0 CRITICAL=1 UNKNOWN=0 services=/^MySQL Slave/ hosts=/^db(shard	CRITICAL
	Action taken: Service Issue (View cle:		Notes: MySQL slave failure on host	<input type="checkbox"/>
Thu 12 Jun 19:12:43 EDT	database001b	Host Check	(Host Check Timed Out)	DOWN
	Action taken: Service Issue (View cle:		Notes: Machine died, hardware failure	<input type="checkbox"/>
Wed 11 Jun 12:57:21 EDT	api05	Memory	CHECK_NRPE: Socket timeout after 30 seconds.	UNKNOWN

Ops Weekly Updates - Rep x

opsweekly.etsycorp.com/report.php

Opsweekly Overview + Add Reports Meeting Search Reports and Notifications Set Date Timezone Idleness

# On Call Reporting

Week Year

## Week Stats

for week Friday 16th May 2014 - Friday 23rd May 2014

60 notifications received this week

### Alert Status Distribution

Breakdown of the type of notifications received during the week



CRITICAL	29 (48.33%)
WARNING	20 (33.33%)
DOWN	7 (11.67%)
UNKNOWN	4 (6.67%)

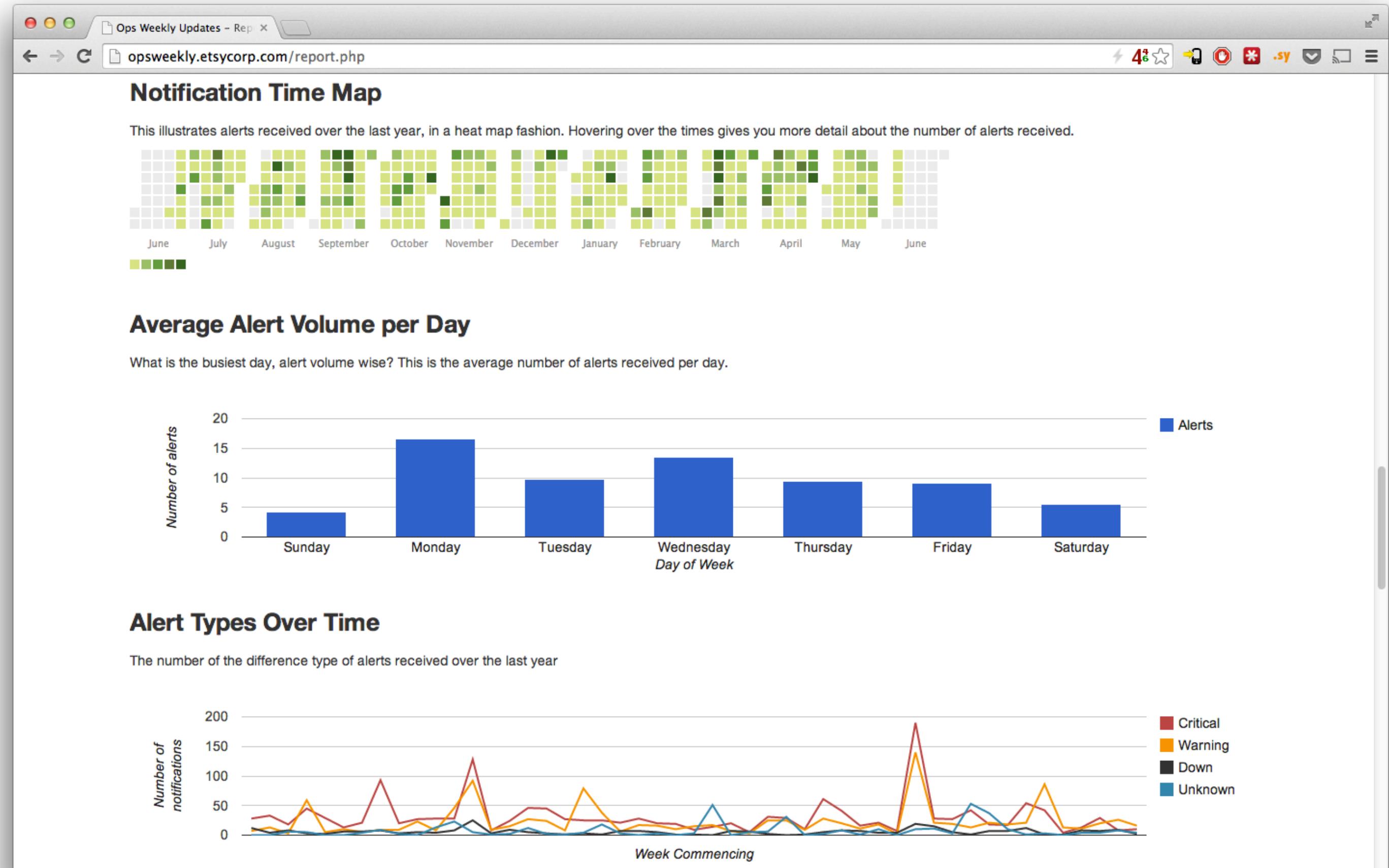
### Tag Status Summary

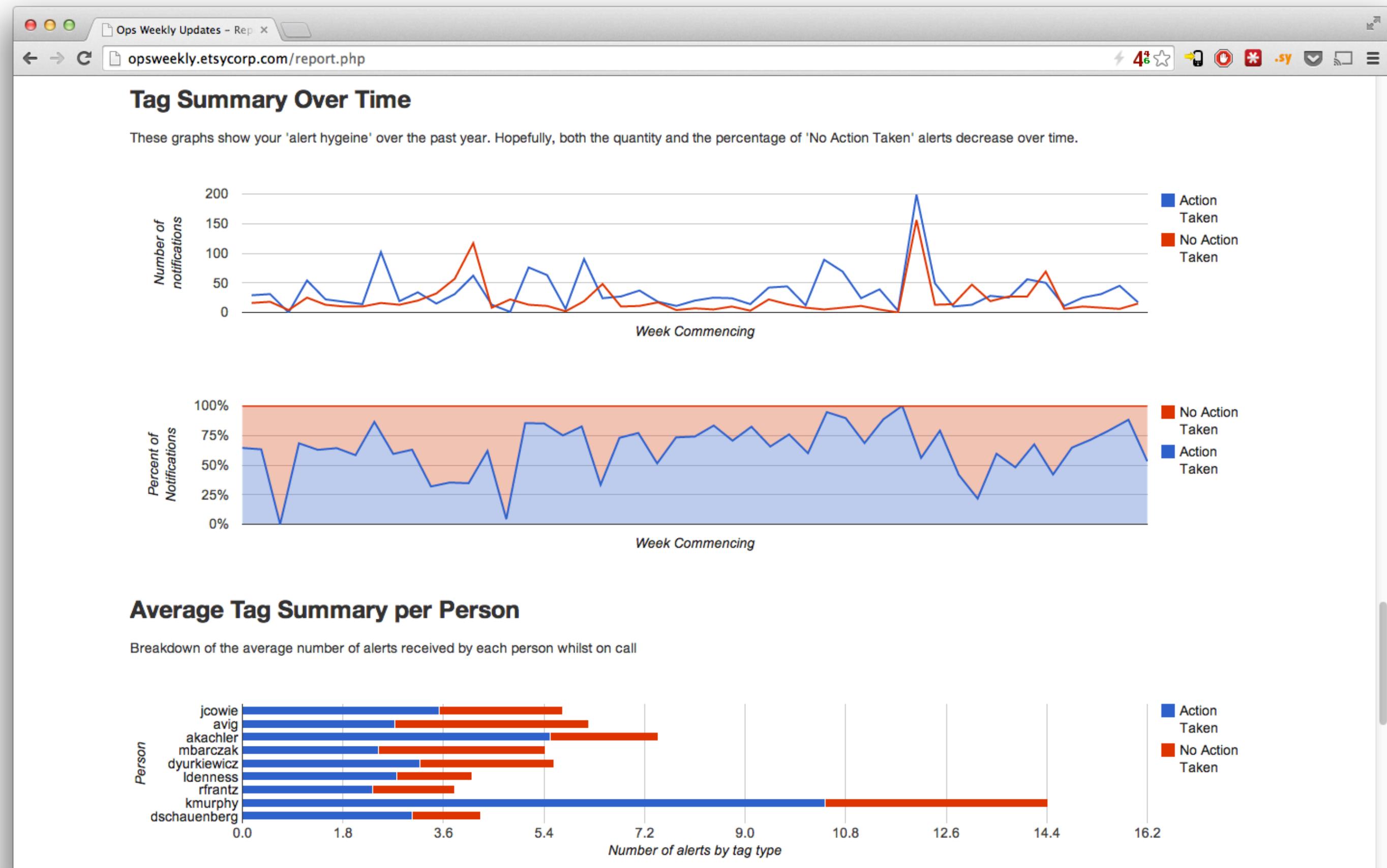
Breakdown of the tags applied to the notifications received during the week

No action taken: Check is faulty/requires modification	3 (5%)
N/A	20 (33.33%)
Action taken: Service Issue (View clean)	31 (51.67%)
No action taken: Work ongoing, downtime not set	5 (8.33%)
Untagged	1 (1.67%)

Breakdown of the tags applied (normalised)

No Action Taken	8 (13.33%)
Untagged	21 (35%)





# Impact on Quality

- Service quality (SLAs)
- Visibility of quality

# Statsd

```
>>> import statsd  
>>>  
>>> timer = statsd.Timer('MyApplication')  
>>>  
>>> timer.start()  
>>> # do something here  
>>> timer.stop('SomeTimer')
```

```
>>> import statsd  
>>>  
>>> counter = statsd.Counter('MyApplication')  
>>> # do something here  
>>> counter += 1
```

```
>>> import statsd  
>>>  
>>> average = statsd.Average('MyApplication', connection)  
>>> # do something here  
>>> average.send('SomeName', 'somekey:%d'.format(value))
```

# Graphite

# **value of change**

# **Value of Availability**

- Better for customers
- Better for employees (internal services)
- Fewer pages

# **Value of Quality**

- Deploys take less time
- Also better for customers
- More visibility into issues

# Retrospective



# Review

- Recognizing your Devops Narrative
- Application Deployment Planning
- Infrastructure as code
- Introducing repeatable, testable change
- Measuring impact and value of change

# Next Steps

- Manual, Automation to Continuous "X"
- Be the storylistener and storyteller in your org
- Effective Devops



# thank you! ❤

**@sigje**

