# Continuous Integration of Infrastructure

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# What Prompted This?

- As more and more things became managed via configuration management, infrastructure management became more and more like software.
- What prompted configuration management is that the bulk of my time was ultimately spent coping with change.

# Sources of Change

## Internal

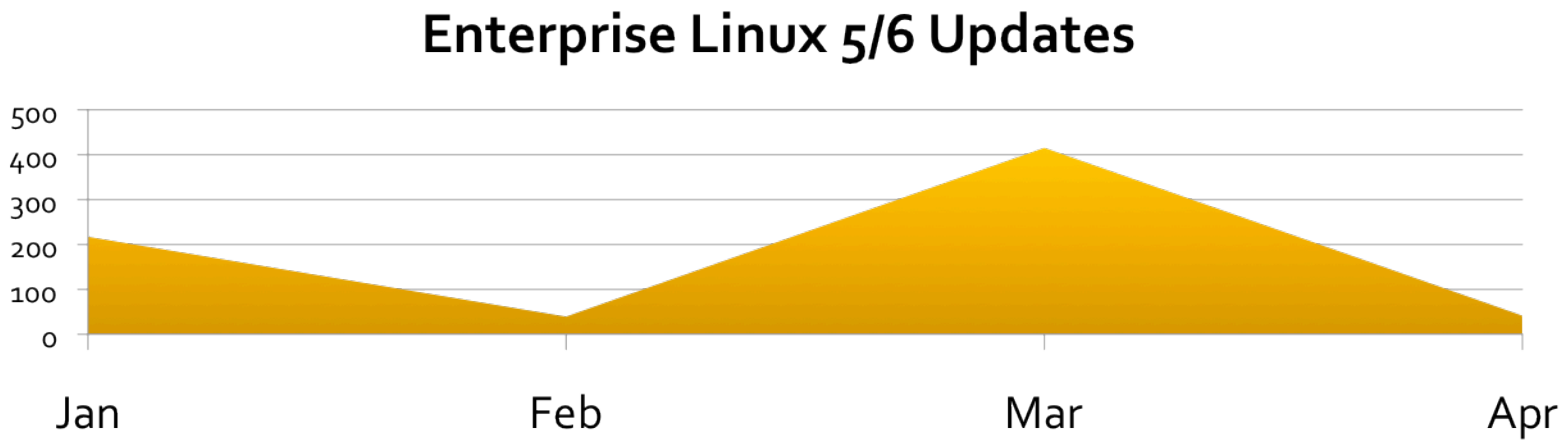
(Development, Technical Debt Load, Management, etc.)

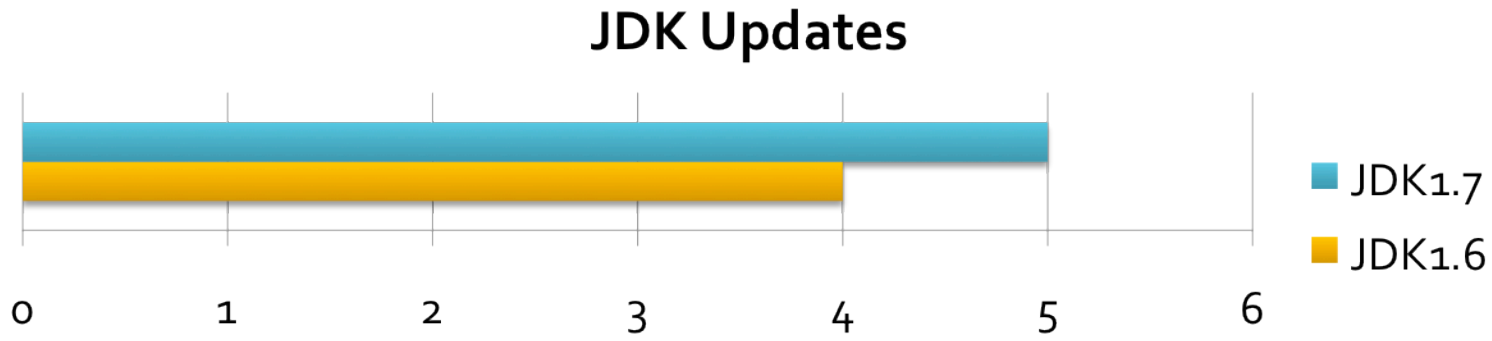
## External

(Vendors, Security Issues, Regulatory Requirements, Hardware Failure)

# External Sources of Change

Q1, 2013



# Coping with Change


- Each change should be tested
- Changes do not occur in isolation, each change likely triggers an integration problem.
- Manual testing is labor intensive
- Labor intensive means slow to do "the right way" which reduces the ability to respond quickly.
- Configuration management and change control processes help but we can do better.

# What is an integration problem?

Imagine each of these is a jigsaw and the the nesting is a tower of hanoi puzzle
Where failure means explosions.

# Continuous Integration

| | |
|---|---|
| Update | • Developer Makes Changes<br>• Developer checks-in changes to source control |
| Integrate | • CI server triggers a job on commit, manually, or scheduled |
| Fast Build | • Builds can take a long time so sanity check them. (IE: Lint, build a subset, etc.) |
| Full Build | • Actually build the project for real. |
| Test | • Unit/regression/functional tests run. |
| Package | • Package built into a deliverable (rpm, dpkg, war, etc.) |
| Feedback | • Show the status of the build. Notify if necessary. |
| Deploy | • Operations problem now! |

# Components to integrate

- Configuration Data
  - Segmented from code in puppet via hiera or as of version 3.0 parameterized classes and an ENC
- Code which applies configuration data (IE: Puppet)
  - Puppet modules or Chef Recipes
- Upstream packages (Operating System, Internal)
  - Your yum or dpkg repositories

# What do we use to integrate?

- The same thing development probably uses: Jenkins - www.jenkins-ci.com
  - Jenkins has a rake plugin available
    - Rake can do anything within the ruby ecosystem and is task based.
    - This includes things like vagrant, rspec, etc.
  - Jenkins is trivially installed and managed(there are packages available for pretty much everything)

# Prepping the Build

- Jenkins executes rake
- A rake task does a fast build/sanity check on a complete new config.
  - This should ignore package and configuration changes but trigger a full build.
- If this succeeds another rake task runs to spin up a VM environment via vagrant.
  - A full, full build is impractical unless you can have a complete duplicate of your environment. Our full build has to be a subset.

# Dependency Resolution

- What can potentially impact what?
- If I update, say the apache package, I then obviously need to test websites which rely on apache.
  - To do this I may also need to spin up a database
  - And install additional software(IE: PHP, Tomcat, Java)
  - And a proxy
  - And…
- Most current options are bad for this, requiring much manual configuration(IE: ivy) and are basically solely dedicated to dependency resolution.

# The Build

- With dependencies known we can build out a subset of infrastructure to test the specific changes in an intelligent way.
- The build itself is really just two config management runs
  - Applying the catalog we currently have
    - Introduces a requirement that all catalogs can cleanly apply to a base system
  - Then applying the new catalog

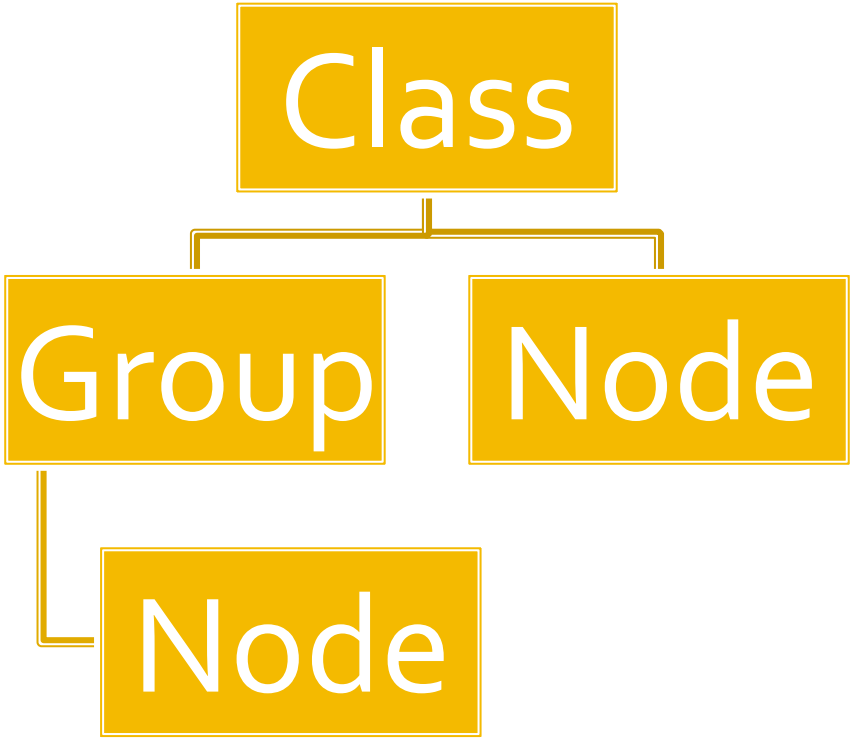
# Testing

- Monitoring is effectively functional testing
  - Apache is supposed to be running, is it?
  - Is it responding on this port?
  - Do I get the right responses?
- As long as we deal with monitoring services in the service itself will be configured when the catalog is applied
  - So all we really need to do is invoke it via a rake task and parse the results

# Requirements Met

- Configuration Management
- Continuous Integration Server
- The capability to virtualize test systems and provision them automatically
- Monitoring Software tied into configuration management
- Version Control
- Promotion Method

# Current ENC Data Structure

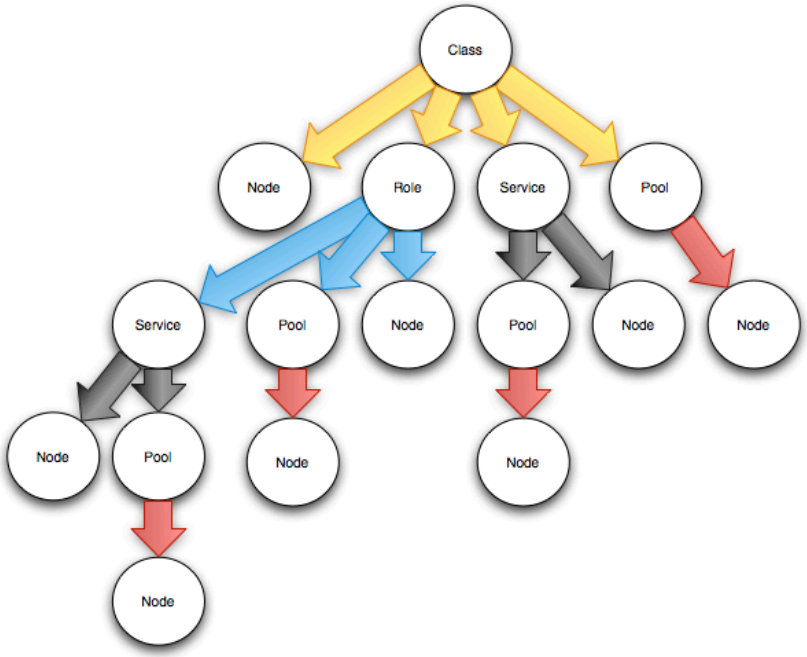



- Parameters are defined at each level
- Parameters inherit
- Parameters are sourced

# Dependency Resolution

- Getting a list of nodes that classes or groups of classes have been applied to is trivial.
  - But an entire "service" rarely lives on single server or even a pool of servers.
  - We need a higher level object that links these things for dependency resolution.
- Simultaneously under-eager and over-eager
  - We probably don't need to build out all 20 servers in an app pool – but they'll share classes

# An ENC to be Named Later




**Class**

- Assignable to all objects
- Corresponds to a puppet module

**Node**

- Assigned to service or pool
- Corresponds to a server

**Pool**

- Collection of nodes assignable to a service

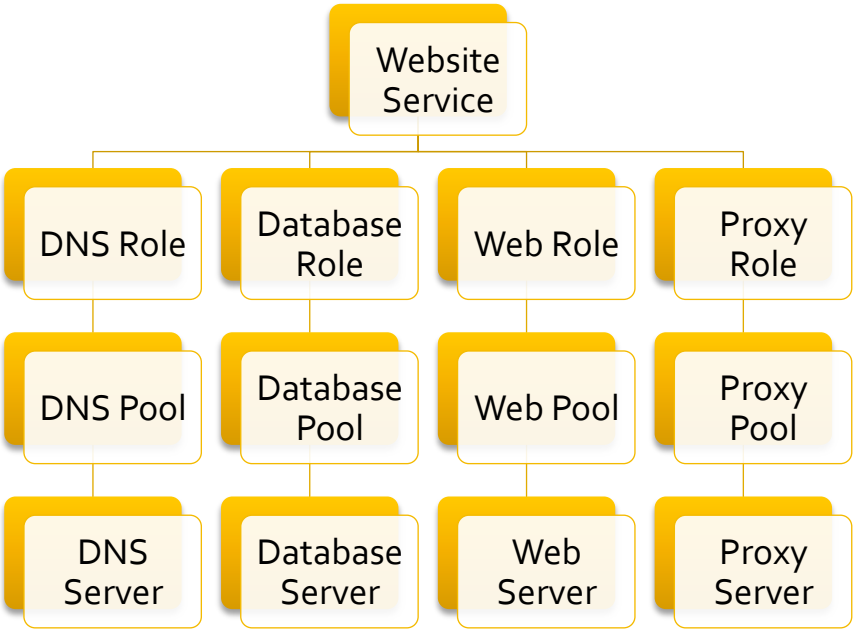
**Role**

- Collections of classes which may extend or override class parameters
- Assigned to nodes and services

**Service**

- Specific configuration linking roles/pools and classes/nodes

# Example Service




- Service object consists of configuration specific to that service split by role (more on this later)
- Roles are collections of classes
- Pools are collections of servers with largely identical configuration.
- Pools or nodes are implicitly assigned to a Service

# Advantages of new model

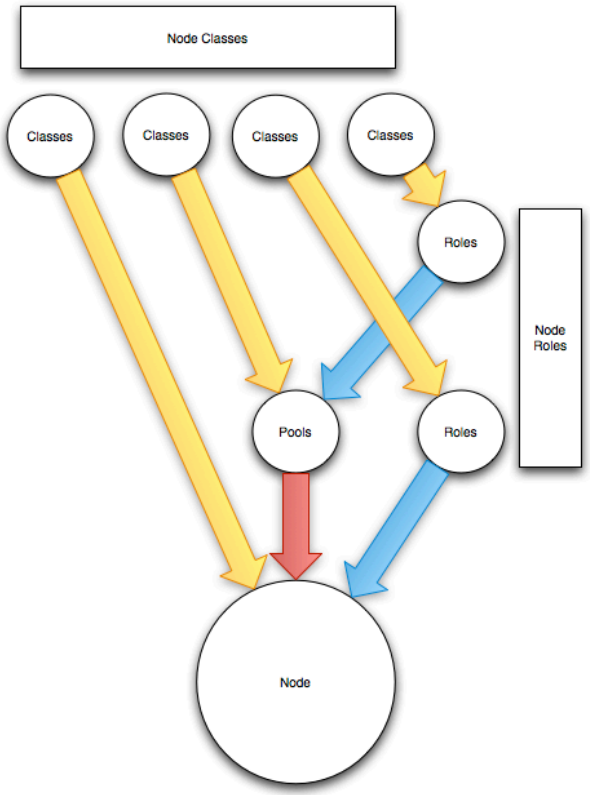
- Can retrieve dependent nodes at any level.
  - Through directly assigned roles or classes as in the current ENC
  - And indirectly through linked services
- Can deduplicate via pools
  - IE: If we have 12 database servers in a pool we can define that we only need 1 or 2.

# A bit about Hiera

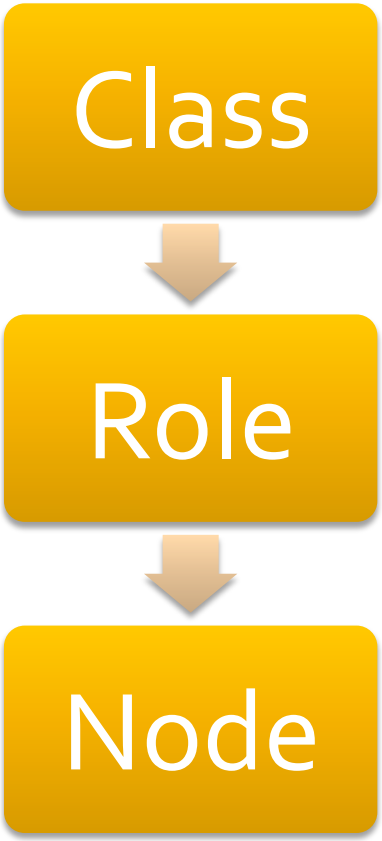
- The goal of hiera is to keep site-specific data out of manifests.
  - Multiple levels of overrides
    - You define the overrides in sequence
  - Array joins and Hash merges
  - Reduces the need to edit code
  - Eases ability to share modules
- Avoids repetition

# Node Inheritance

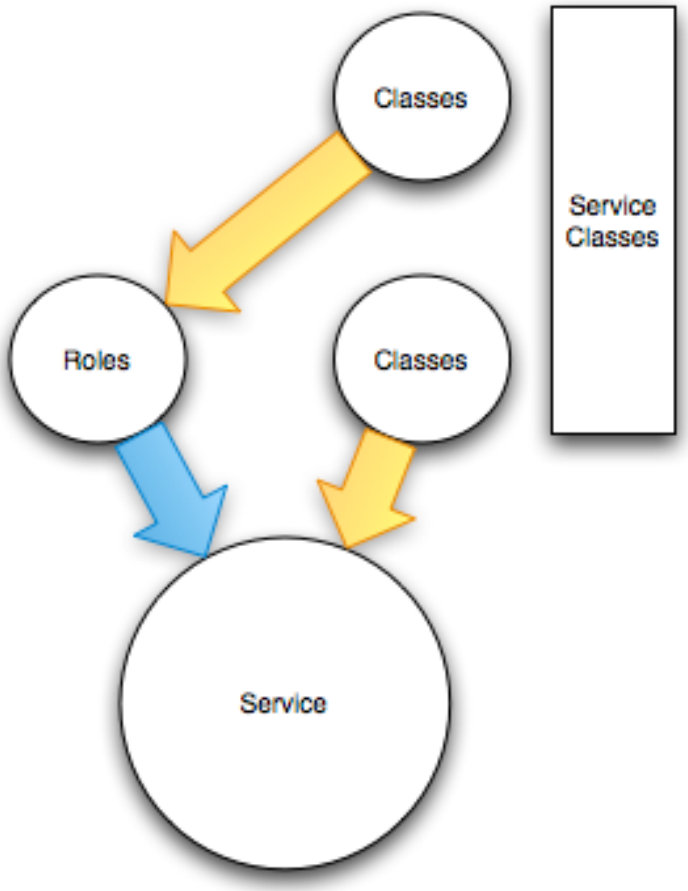
## ASSOCIATION INHERITANCE




## PARAMETER HIERARCHY

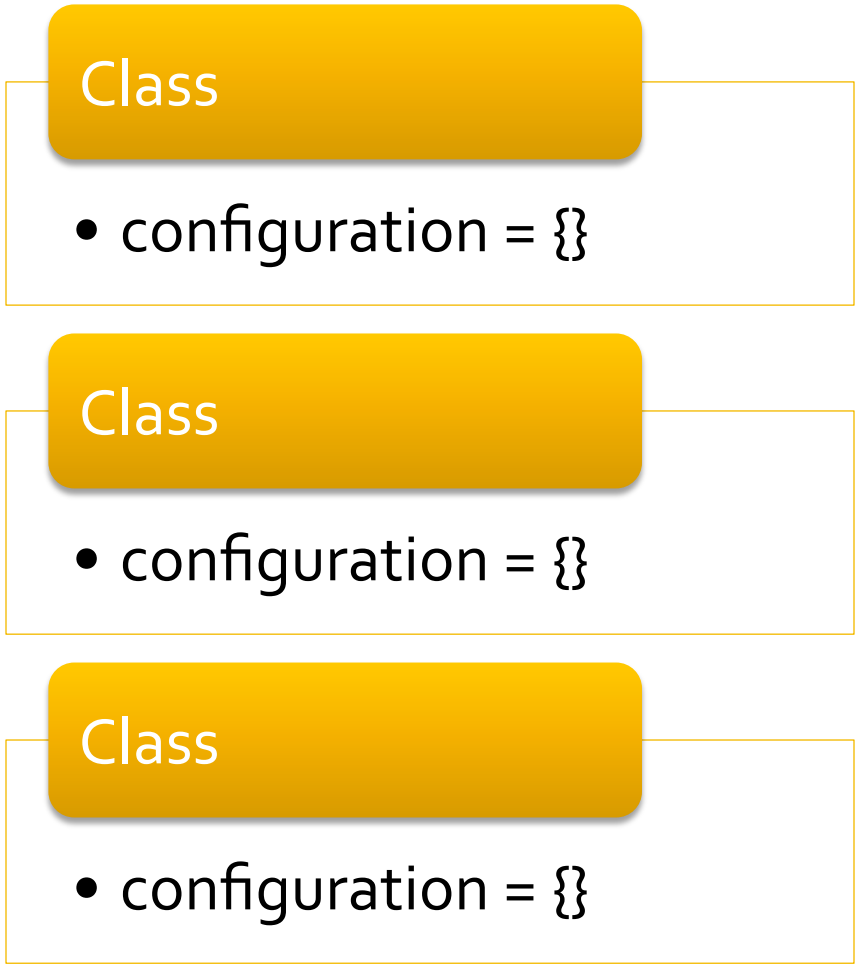


# The Service Object



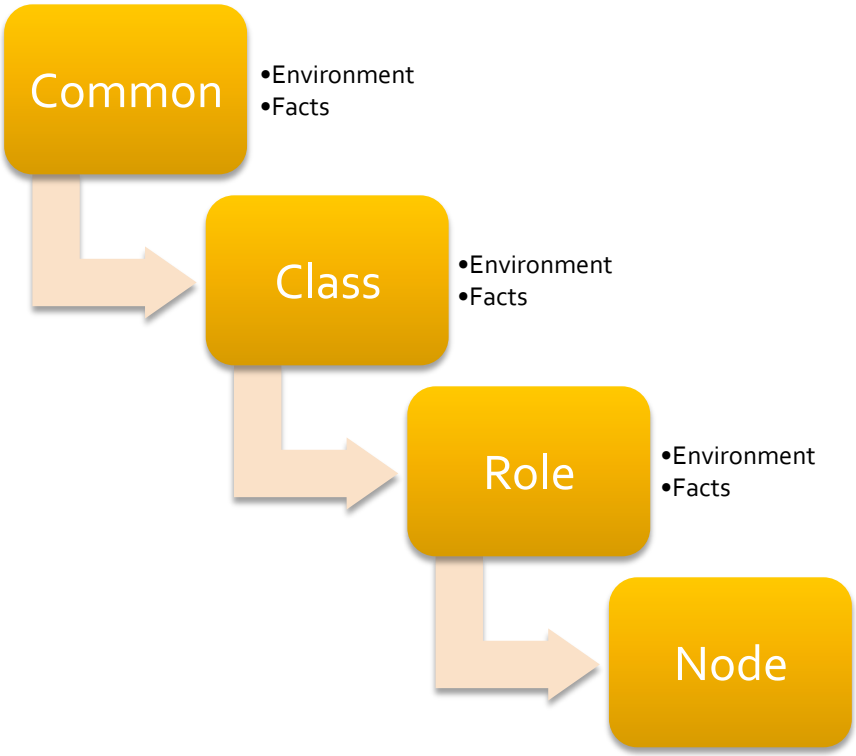

- Nodes and pools available for assignment are determined by service classes
- Configuration elements correspond to things like site configs, fileshares, dns entries, etc.
- It does maintain the node hierarchy as it does not inherit parameters.
- The point of a service from the perspective of hiera is to ADD data not override it.

# The Service Object(continued)




- Configuration for each class that is assigned or inherited from assigned roles.
- Is namespaced to ${class}:service

# Configuration Hierarchy




- Services are collected last and joined as namespaced arrays of hashes.
  - ${class}:services => [{}]

# Continued Problems (the TODO list)

- Finish development of the ENC/Hiera back-end
- The network equipment issue AKA we hit a brick wall in layer 3.
  - Lack of virtualization options means that we need another way to test networking configs
  - Idea currently under consideration is:
    - Translation table for the config and then realizing the config via virtual routers.

# Further Reading


- Paul M. Duval, with Steve Matyas and Andrew Glover. *Continuous Integration: Improving Software Quality and Reducing Risk.* Boston: Addison-Wesley, 2007
- Jez Humble and David Farley. *Continuous Delivery: Reliable Software Release through Build, Test and Deployment Automation.* Boston: Addison-Wesley, 2010
- David Chelimsky, with Zach Dennis, Aslak Hellesoy, Bryan Helmkamp and Dan North. *The RSpec Book: Behavior Driven Development with Rspec, Cucumber and Friends.* Raleigh: The Pragmatic Bookshelf, 2010
- James Turnbill and Jeffrey McCune. *Pro Puppet.* New York: Apress, 2011