Expanded Introduction to Puppet for Build a Cloud Day at Ohio Linux Fest

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The one-off myth

Your systems are not beautiful snowflakes

photo from http://beesknees67.deviantart.com/
The one-off myth

• Only temporary
The one-off myth

- Only temporary
- Replicas for pre-production environments
The one-off myth

- Only temporary
- Replicas for pre-production environments
- Disaster recovery
Why?

Hosts on demand
Why?

• reduce entropy
Why?

- reduce entropy
- disaster recovery
Why?

• reduce entropy
• disaster recovery
• change management
Why?

- reduce entropy
- disaster recovery
- change management
- infrastructure as code
Puppet Open Source Ecosystem

Puppet Distribution
Bundled with major OS

Puppet Community
Active participation

Puppet Contributors
Framework enhancements

- 3,000 person mailing list
- 2,000 messages a month
- 300 people at all times in IRC
  (#puppet on freenode.net)

- 100+ people contributing to documentation and code
- 100+ modules contributed to Puppet Module Forge
Operating System Support

**Linux**
- Red Hat
- Fedora
- CentOS
- Ubuntu
- Debian
- SuSE

**Unix**
- Solaris
- OS X
- AIX
- HP-UX
- OpenBSD

**Other**
- Windows (2011)
Puppet is Pervasive

**Web**
- Google
- eBay
- digg
- Twitter
- Zynga

**Entertainment**
- Disney
- Turner
- HBO
- PlayStation

**Technology**
- Apple
- Nokia
- Motorola
- Juniper Networks
- Siemens
- Dell
- Rackspace

**Financial**
- Barclays Capital
- TransUnion
- Bank of America
- J.P. Morgan
- NYSE Euronext
- D.E. Shaw & Co

**Defense**
- Lockheed Martin
- Northrop Grumman
- Los Alamos National Laboratory
Puppet Enterprise

What it is:

- Puppet and related components packaged and integrated in one install:
  - Puppet
  - Puppet Master
  - Dashboard
  - Facter
  - Ruby
  - Apache
  - Passenger, etc.
Puppet Enterprise

- Fully QA’d stack of Puppet and dependencies
- Simplified installation
- Ease of maintenance
- Pre-configured for scalability and performance
- Predictable enhancement delivery
- Enhanced enterprise class Support
How Puppet Works

1. **Define**: With Puppet’s declarative language you design a graph of relationships between resources within reusable modules. These modules define your infrastructure in its desired state.

2. **Simulate**: With this resource graph, Puppet is unique in its ability to simulate deployments, enabling you to test changes without disruption to your infrastructure.

3. **Enforce**: Puppet compares your system to the desired state as you define it, and automatically enforces it to the desired state ensuring your system is in compliance.

4. **Report**: Puppet Dashboard reports track relationships between components and all changes, allowing you to keep up with security and compliance mandates. And with the open API you can integrate Puppet with third party monitoring tools.

[Diagram showing the cycle of define, simulate, enforce, and report for Puppet's infrastructure management process.]
Use Puppet to create composable configurations and manage the enterprise infrastructure

1. Define Your Resources in Modules.
   With Puppet, you define your modules by node classifications, such as Web Server or Database, allowing you to define relationships between resources and configure thousands of servers at once.

2. Assign resource relationships automatically.
   You can then assign and deploy configurations via Puppet Dashboard, or with your own customized CMDB tools.

3. Reusable, composable configurations.
   With Puppet you can re-use modules across multiple nodes, in whatever combination you need, reducing repetitive tasks and eliminating error-prone scripts.
Puppet Assigns and Maintains a Node’s Desired Role
Managing Configuration Drift

Node State → Desired State

Convergence

Drift

Report

Report Server
How Puppet Manages Data Flow for Individual Nodes

1. **Facts**
   - The node sends normalized data about itself to the Puppet Master.

2. **Catalog**
   - Puppet uses the Facts to compile a Catalog that specifies how the node should be configured.

3. **Report**
   - The node reports back to Puppet indicating the configuration is complete, which is visible in the Puppet Dashboard.

4. **Report Collector**
   - Puppet’s open API can also send data to third party tools.
Facts

Automatically Maintained Asset Inventory
domain => local
facterversion => 1.5.8
fqdn => sliver.local
hardwaremodel => i386
hostname => sliver
interfaces => lo0,gif0,stf0,en0,en1,fw0,vmnet1,vboxnet0
ipaddress => 192.168.174.1
ipaddress_lo0 => 127.0.0.1
ipaddress_vmnet1 => 192.168.174.1
kernel => Darwin
kernelmajversion => 10.6
kernelrelease => 10.6.0
macosx_productname => Mac OS X
macosx_productversion => 10.6.6
netmask => 255.255.255.0
netmask_lo0 => 255.0.0.0
netmask_vmnet1 => 255.255.255.0
network_lo0 => 127.0.0.0
network_vmnet1 => 192.168.174.0
operatingsystem => Darwin
operatingsystemrelease => 10.6.0
path => /opt/local/bin:/opt/local/sbin:/usr/bin:/bin:/usr/sbin:/sbin:/usr/local/bin:/usr/X11/bin:/Users/gh/bin:/Users/gh/.gem/ruby/1.8/bin/
ps => ps auxwww
puppetversion => 2.6.4
rubysitedir => /opt/local/lib/ruby/site_ruby/1.8
timezone => PST
uptime => 1 day
rubyversion => 1.8.7
sp_bus_speed => 1.07 GHz
Custom Facts

```ruby
# role.rb
require 'facter'
Facter.add("role") do
  setcode do
    Facter::Util::Resolution.exec("cat /etc/role")
  end
end
```
How Puppet Manages Data Flow for Individual Nodes

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2. **Catalog**
   - Puppet uses the Facts to compile a Catalog that specifies how the node should be configured.

3. **Report**
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4. **Report Collector**
   - Report Collector (Puppet or 3rd party tool)

SSL secure encryption on all data transport
Catalog

• Automatically maintained comprehensive resource list
• Easily validated against compliance requirements prior to client configuration
How Puppet Manages Data Flow for Individual Nodes

1. **Facts**
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2. **Catalog**
   - Puppet uses the Facts to compile a Catalog that specifies how the node should be configured.

3. **Report**
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4. **Report Collector**
   - Puppet’s open API can also send data to third party tools.
Report

• Comprehensive report of every change ever made, correlated to every resource being managed

• Easily validated against compliance requirements after each run
Report

- http
- log
- store
- tagmail
Report

---

### Groups
- **No Groups**

### Classes
- **No Classes**

### Daily Run Status

- **Run Time (ms)**

### Recent Reports (153)

<table>
<thead>
<tr>
<th>Reported at</th>
<th>Total</th>
<th>Failed</th>
<th>Runtime</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/12/09 05:25pm</td>
<td>126</td>
<td>0</td>
<td>7.76</td>
</tr>
<tr>
<td>03/12/09 04:54pm</td>
<td>126</td>
<td>0</td>
<td>8.08</td>
</tr>
<tr>
<td>03/12/09 04:24pm</td>
<td>126</td>
<td>0</td>
<td>7.29</td>
</tr>
<tr>
<td>03/12/09 03:54pm</td>
<td>126</td>
<td>0</td>
<td>7.54</td>
</tr>
</tbody>
</table>
What not How

```plaintext
package { "ntp":
    ensure => installed,
}
```
What not how

```
$ ls puppet/lib/puppet/provider/package
aix.rb   blastwave.rb   hpux.rb   ports.rb   up2date.rb
appdmg.rb darwinport.rb nim.rb portupgrade.rb urpmi.rb
apple.rb dpkg.rb       openbsd.rb rpm.rb yum.rb
apt.rb   fink.rb       pkg.rb     rpm.rb     yumhelper.py
aptitude.rb freebsd.rb pkgdmg.rb portage.rb zypper.rb
aptrpm.rb gem.rb       portage.rb sun.freeware.rb
```
Example Resource Types

- cron
- exec
- file
- group
- host
- zfs
- mount
- package
- service
- sshkey
class ntp {
  package { "ntp":
    ensure => installed,
  }

  file { "/etc/ntp.conf":
    owner   => "root",
    group   => "root",
    mode    => "0644",
    require => Package["ntp"],
  }

  service { "ntpd":
    ensure   => running,
    enable   => true,
    subscribe => File["/etc/ntp.conf"],
  }
}

File Serving

class motd {
  file { 
    /etc/motd:
      owner => "root",
      group => "root",
      mode => "0644",
      source => "puppet:///modules/motd/generic_motd",
  }
}

Templates

```erb
# motd.erb
Welcome to <%= fqdn %>
My uptime is <%= uptime %>
```
Templates - Advanced

```ruby
search <%= dnssearchpath %>
options ndots:2 timeout:3
<% nameservers.each do |nameserver| -%>
nameserver <%= nameserver %> <% end -%>
```
Syntax Checking

```bash
# puppet template syntax checking
function pt()
{
    if [ -z $1 ]; then
        echo "usage: pt <puppet_template_file.erb>"
        return;
    fi
    /usr/bin/erb -P -x -T '-' $1 | /usr/bin/ruby -c
}

# puppet manifest syntax checking
function pc()
{
    if [ -z $1 ]; then
        puppet --ignoreimport --parseonly init.pp
    else
        puppet --ignoreimport --parseonly $1
    fi
}
```
Storeconfigs

Ability to pass data between nodes, via a database acting as a proxy
Storeconfigs

Ability to pass data between nodes, via a database acting as a proxy

- MySQL
- SQLite3
- PostgreSQL
- Oracle
Storeconfigs

- Puppet node: exporter
- Puppet node: collector 2
- Puppet node: collector 1
- @@host{}
- Host<<ll>>
- Host<<ll>>

storeconfigs

Puppet Master
External Node Classifier

- Puppet Dashboard
- Your own CMDB
External Node Classifier

A script that takes $certname as an argument and outputs YAML to STDOUT
External Node Classifier

node "somenode.puppetlabs.net" {
$puppet_server = "puppet.puppetlabs.net"
$dns_server = "ns.puppetlabs.net"
$datacenter = "slicehost"
include common, puppet, dns, ntp
}

External Node Classifier

classes:
- common
- puppet
- dns
- ntp

parameters:
puppet_server: puppet.puppetlabs.net
dns_server: ns.puppetlabs.net
datacenter: slicehost
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