Puppet Tutorial

LOAD

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Antwerpen, BE

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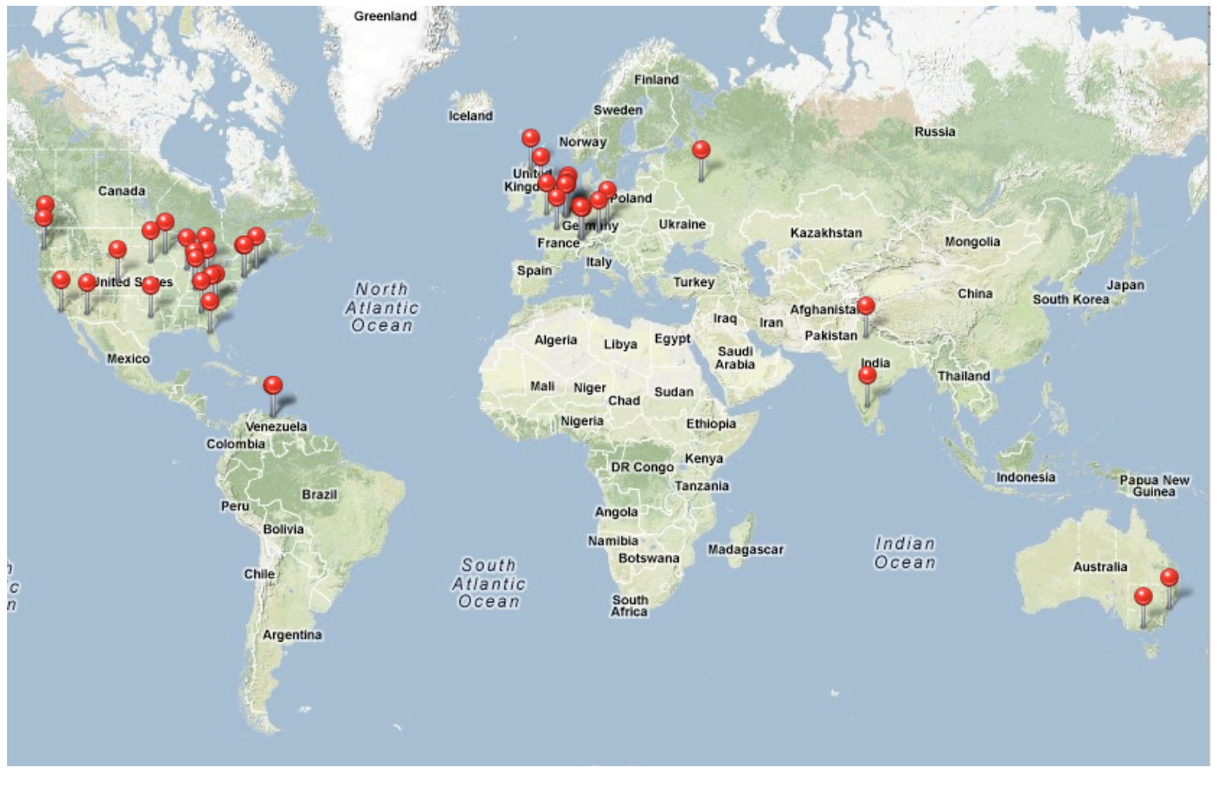
whoami

an engineer and obviously not a graphic designer



Why?

- reduce entropy

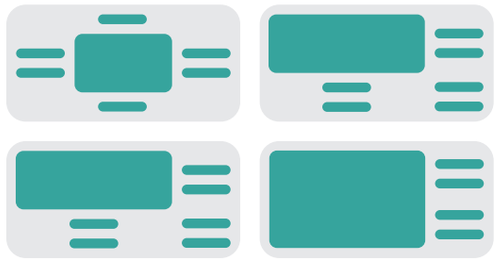
Why?

- reduce entropy
- change management

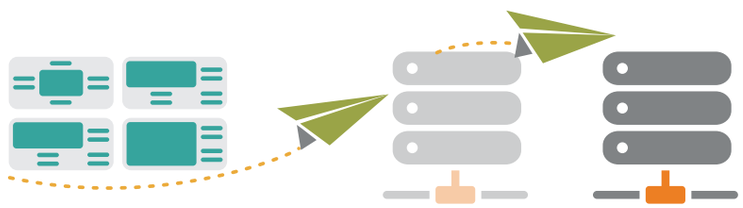
Why?

- reduce entropy
- change management
- infrastructure as code

How Puppet Works

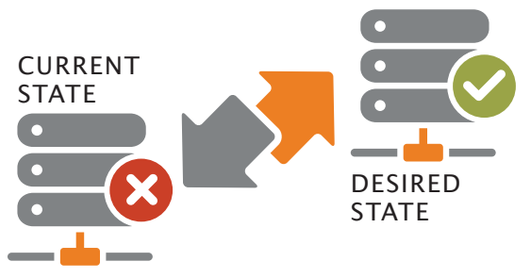


1 **Define:** With Puppet's declarative language you design a graph of relationships between resources within reusable modules. These modules define your infrastructure in its desired state.



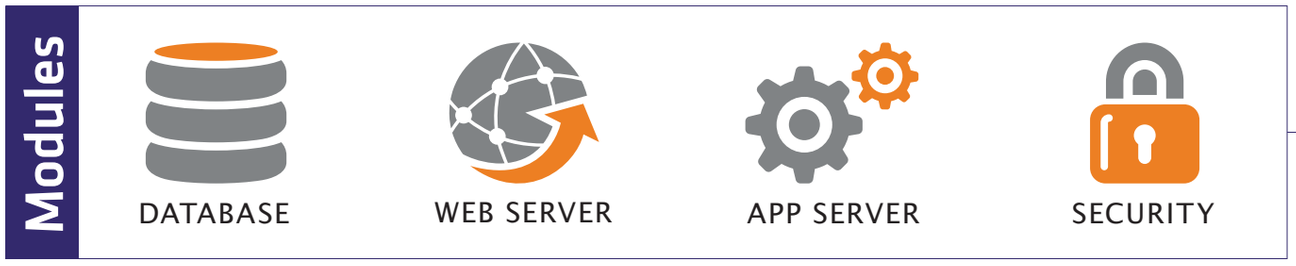
4 **Report:** Puppet Dashboard reports track relationships between components and all changes, allowing you to keep up with security and compliance mandates. And with the open API you can integrate Puppet with third party monitoring tools.

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.

Use Puppet to create composable configurations
and manage the enterprise infrastructure



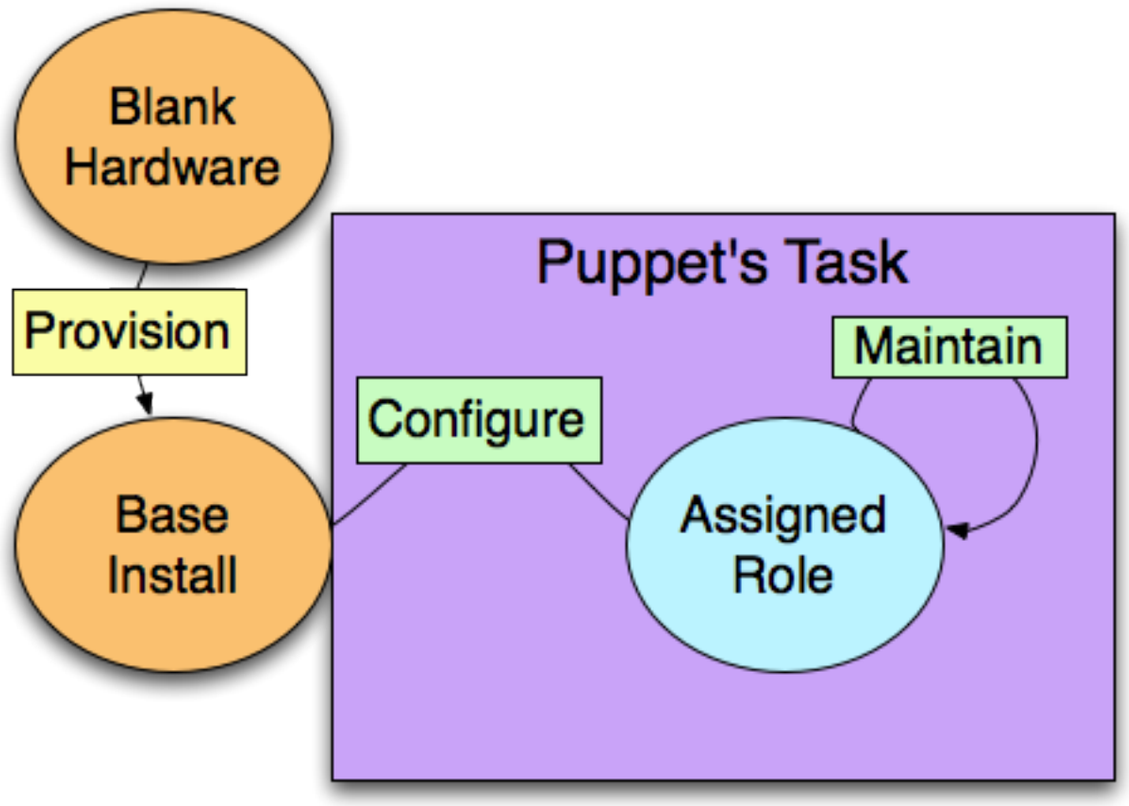
1 Define Your Resources in Modules.
With Puppet, you define your modules by node classifications, such as Web Server or Database, allowing you to define relationships between resources and configure thousands of servers at once.

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

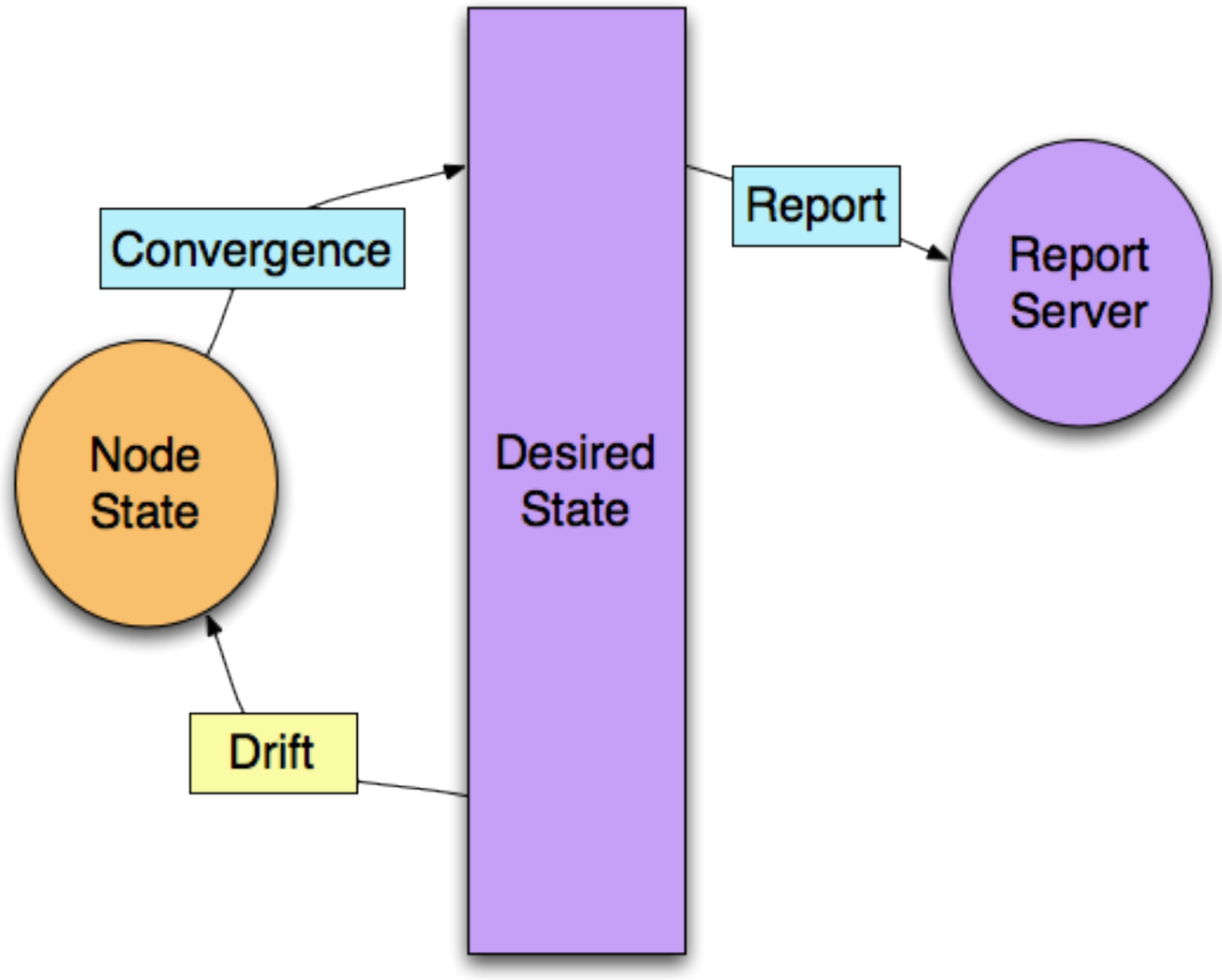
3 Reusable, composable configurations.
With Puppet you can re-use modules across multiple nodes, in whatever combination you need, reducing repetitive tasks and eliminating error-prone scripts.

Multi Node

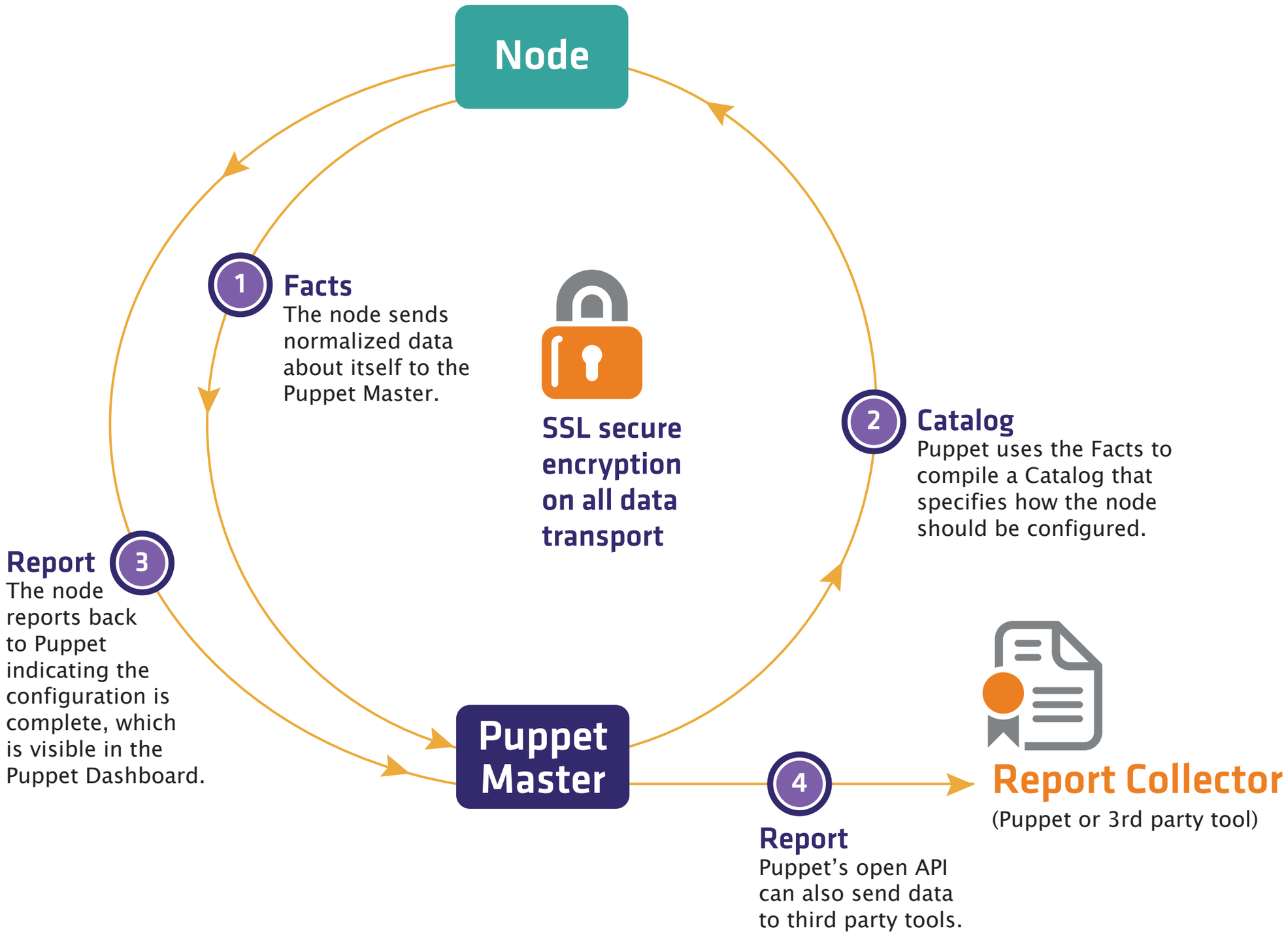
Puppet Assigns and Maintains a Node's Desired Role



Managing Configuration Drift



How Puppet Manages Data Flow for Individual Nodes



Facts

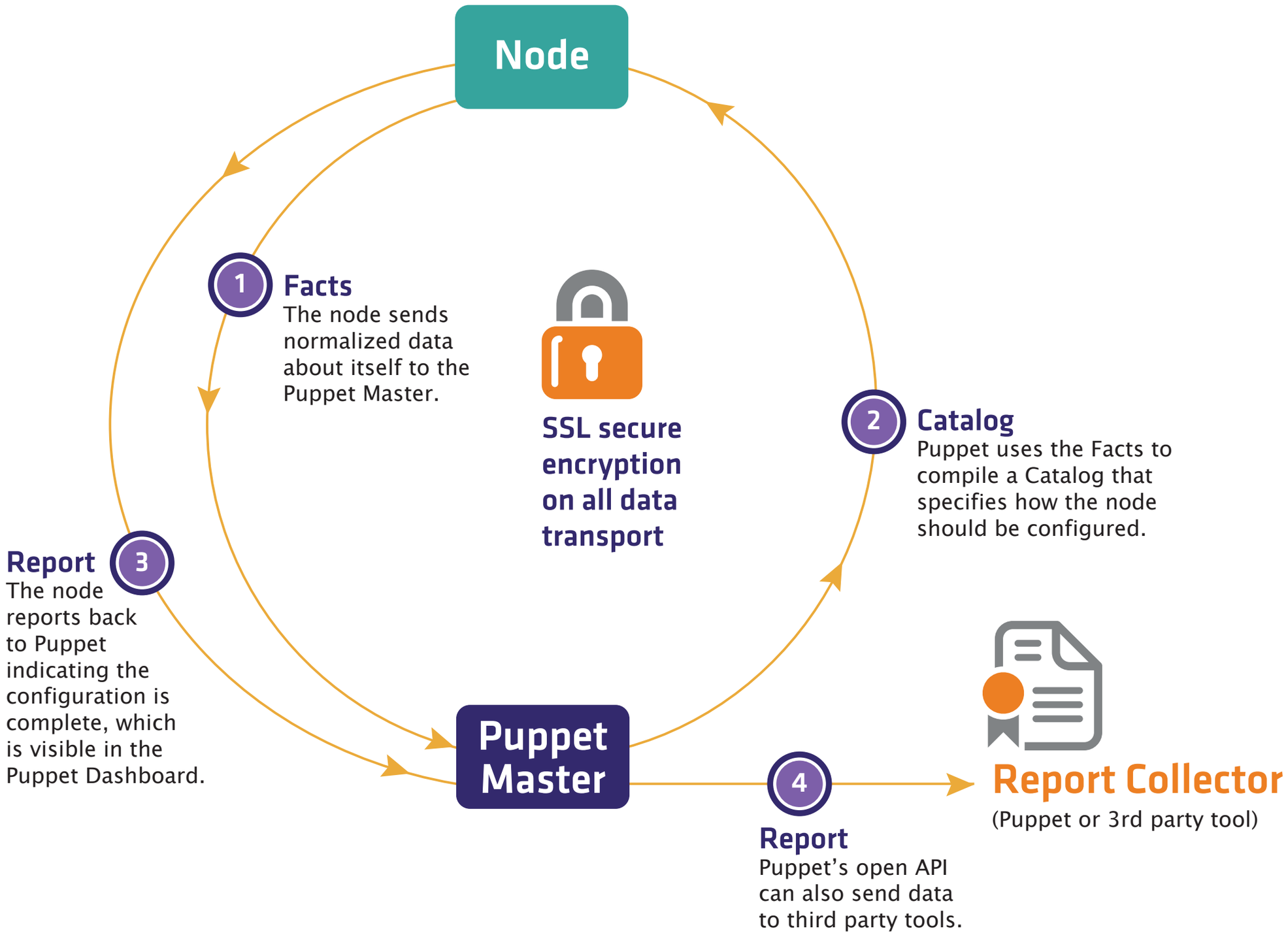
Automatically Maintained Asset Inventory

architecture => i386
domain => local
facterversion => 1.6.6
fqdn => sliver.local
hardwareisa => i386
hardwaremodel => i386
hostname => sliver
id => gh
interfaces => lo0,gif0,stf0,en0,en1,fw0
ipaddress => 192.168.101.185
ipaddress_en1 => 192.168.101.185
ipaddress_lo0 => 127.0.0.1
is_virtual => false
kernel => Darwin
kernelmajversion => 10.8
kernelrelease => 10.8.0
kernelversion => 10.8.0
memoryfree => 102.80 MB

Custom Facts

```ruby
# role.rb
require 'facter'
Facter.add("role") do
  setcode do
    Facter::Util::Resolution.exec("cat /etc/role")
  end
end
```

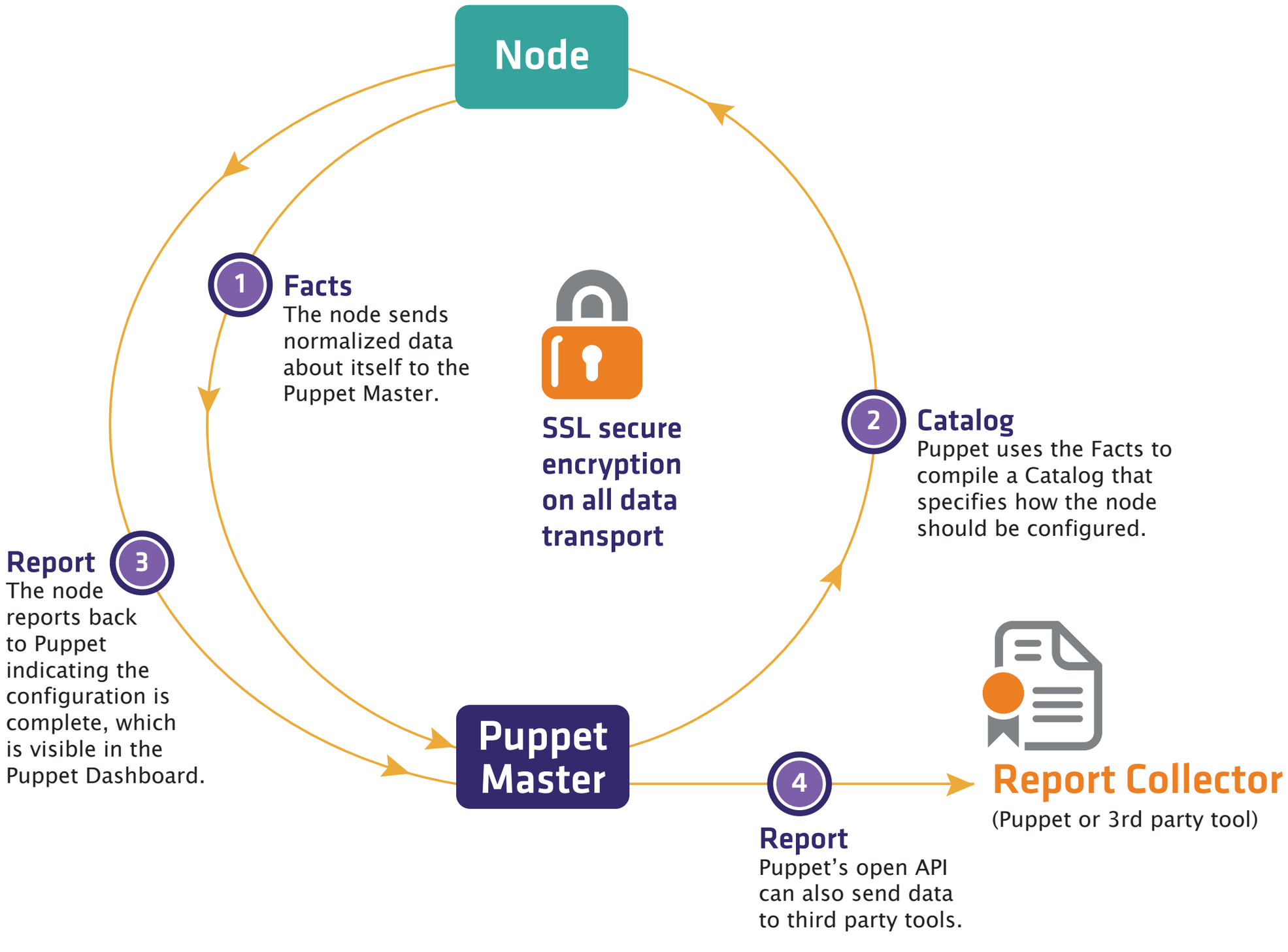
How Puppet Manages Data Flow for Individual Nodes



Catalog

- Automatically maintained comprehensive resource list
- Easily validated against compliance requirements prior to client configuration

How Puppet Manages Data Flow for Individual Nodes



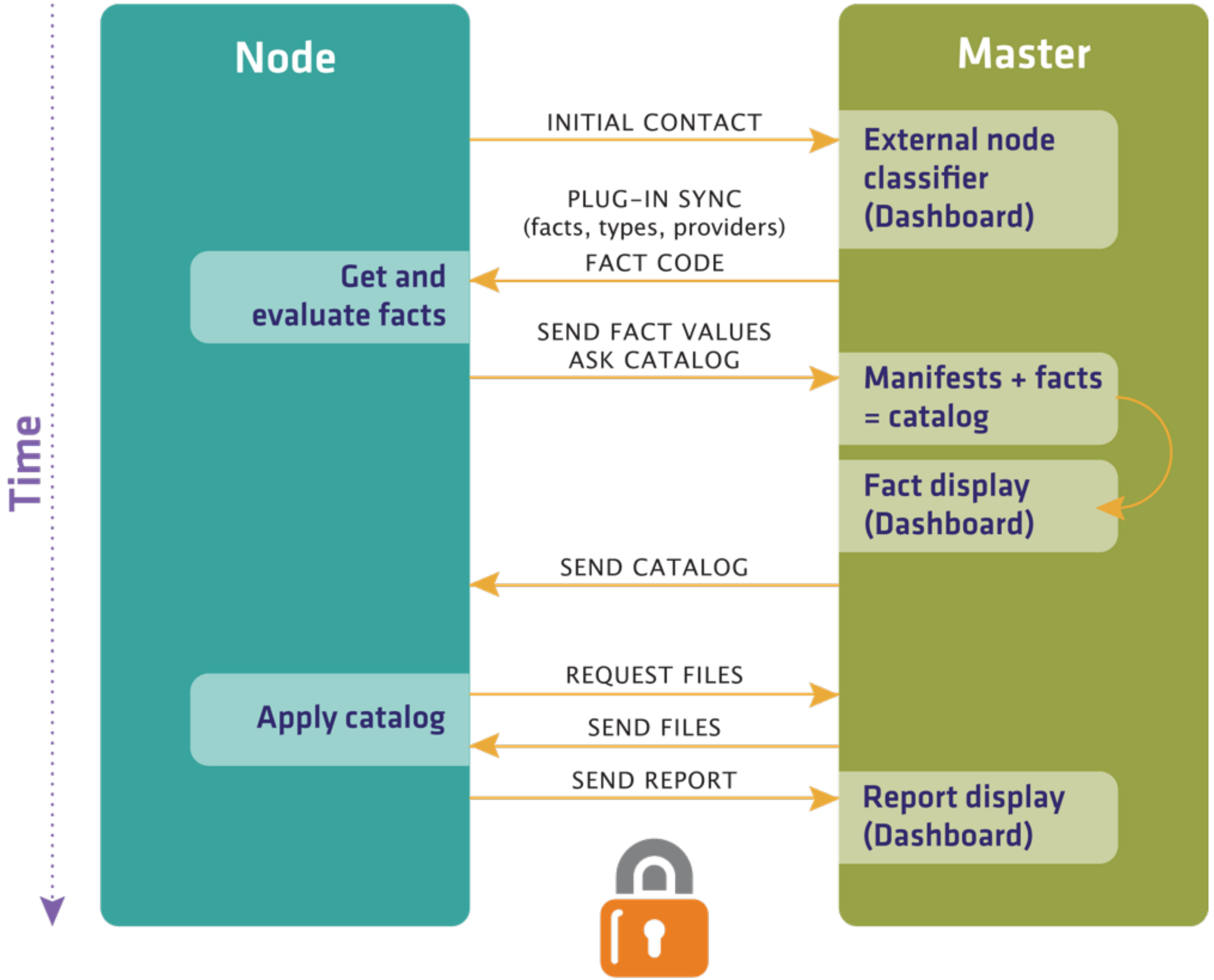
Reporting

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

Reporting

- http/https
- log
- store
- tagmail
- custom processors
    - irc
    - twitter
    - jabber
    - growl

Data Flow Technical View



What not How

```
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          rug.rb          yumhelper.py
aptitude.rb     freebsd.rb      pkgdmg.rb       sun.rb          zypper.rb
aptrpm.rb       gem.rb          portage.rb      sunfreeware.rb
```

Example Resource Types

- **cron**
- **exec**
- **file**
- group
- host
- zfs
- mount
- **package**
- **service**
- sshkey

Package-File-Service

```
class ntp {
  package { 'ntp':
    ensure => installed,
  }

  file { '/etc/ntp.conf':
    owner   => 'root',
    group   => 'root',
    mode    => '0644',
    source  => 'puppet:///modules/ntp/ntp.conf',
    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

```
# motd.erb

Welcome to <%= fqdn %>

kernel version = <%= kernelversion %>
puppet version = <%= puppetversion %>
facter version = <%= facterversion %>
```

Templates - Advanced

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

Syntax Checking

```
$ puppet parser validate
```

Bootstrap Puppet Master VM

- ensure date is correct
  - `# ntpdate us.pool.ntp.org`
- set hostname
  - `# hostname puppet.labs.priv && bash`
- modify /etc/hosts
  - `1.2.3.4 puppet.labs.priv puppet`
  - `10.10.10.10 yum.labs.priv yum`

Bootstrap Puppet Master VM

- install puppet-server
  - `# yum -y install puppet-server`
- start puppet master service
  - `# service puppetmaster start`
- run agent
  - `# puppet agent -t`

Bootstrap agent VM

- ensure date is correct
  - `# ntpdate us.pool.ntp.org`
- set hostname
  - `# hostname yourname.labs.priv && bash`

Bootstrap agent VM

- modify /etc/hosts on master and then scp to agent
  - `1.2.3.4 puppet.labs.priv puppet`
  - `10.10.10.10 yum.labs.priv yum`
  - `1.2.3.5 yourname.labs.priv yourname`

Bootstrap agent VM

- run agent
  - `# puppet agent -t`
- oh noes!!!

SSL

- on master
  - `# puppet cert list`
  - `# puppet cert --list --all`
  - `# puppet cert --sign --all`
  - `# puppet cert --list --all`
- on agent
  - `# puppet agent -t`

useful agent flags

- Run one time, verbose, in the foreground
- `# puppet agent -t`
- add -d for debug
- `# puppet agent -t -d`

Facter

- all facts
  - `# facter`
- specific fact
  - `# facter fqdn`

puppet resource

- Specific resource
  - `# puppet resource <resource type> <specific resource>`
  - `# puppet resource user root`
- All resources of that type
  - `# puppet resource <resource type>`
  - `# puppet resource group`

puppet resource

- add a user
  - `# puppet resource user gh ensure=present`
- modify their password (hint use `grub-md5-crypt` to generate hash)
- modify their shell

puppet resource

- start and stop sysstat service
  - `# puppet resource service sysstat ...`

configs

- /etc/puppet/puppet.conf
- `# puppet config print`
- `# puppet config print |grep modulepath`

modulepath

- where to look for modules
- acts like $PATH - stop at first match
- great for working with multiple teams, just put your path first

modules

- manage specific parts of your system
- directory structure for finding your code

modules

- Create our first module
- `# cd /etc/puppet/modules`
- `# puppet module generate yourname-motd && mv yourname-motd motd`

modules

- What's all here?
- `# tree motd`

Modulefile

- meta data
- semver.org
- dependencies

Forge

- search for packages
  - `# puppet module search mysql`
- http://forge.puppetlabs.com

Forge

- install a package
  - `# puppet module install ghoneycutt-dnsclient`

site manifest

- create `/etc/puppet/manifests/site.pp`
- add entries for both of your nodes

site manifest

- include dnsclient class
- `# puppet agent -t`
- check out /etc/resolv.conf
- `# cat /etc/resolv.conf`

classes

- contains the code
- can be included in site manifest or in other classes
- check out motd

Resources

```
type { ‘title’:
  attribute => value,
}
```

file

```
file { ‘/etc/motd’:
  ensure => file,
}
```

file

```
file { ‘/etc/motd’:
  ensure => file,
  owner  => ‘root’,
  group  => ‘root’,
  mode   => ‘0644’,
}
```

motd

- include motd in site manifest
- `# puppet agent -t`
- mess with owner/group/mode
- `# puppet agent -t; ls -la /etc/motd`

idempotency

- run puppet
- run it again
- nothing happened!!
- make a change
- run puppet
- ensures state

are your shell scripts idempotent?

- probably not, if you run it 2x... boom!

test module

- generate a new module called test
- associate it with your agent

file - directory

```
file { ‘/tmp/testdir’:
  ensure => directory,
  owner  => ‘root’,
  group  => ‘root’,
  mode   => ‘0755’,
}
```

test module

- add two files
  - `/tmp/testdir/one`
  - `/tmp/testdir/two`

resource defaults

```
File {
  owner => ‘root’,
  group => ‘root’,
  mode  => ‘0644’,
}
```

test module

- refactor code to use resource defaults
- what about the directory? 0644 would not be good!

file - symlink

```
file { ‘/tmp/symlink’:
  ensure => symlink,
  target => ‘/tmp/testdir/one’,
}
```

validation

- parser check
  - `# puppet parser validate <file.pp>`
- style guide - http://docs.puppetlabs.com/guides/style_guide.html
  - `# puppet-lint <file.pp>`
- add these to your pre-commit scripts!

file serving

- create directory `/etc/puppet/modules/motd/files`
- create a file, `motd`, with some text

file serving

```
file { ‘/etc/motd’:
  ensure => file,
  source => ‘puppet:///modules/motd/motd’,
  owner  => ‘root’,
  group  => ‘root’,
  mode   => ‘0644’,
}
```

file serving

```
puppet:///modules/<module_name>/<file_name>
```

```
puppet looks for <module_name> in $modulepath and <file_name> under
files directory.

This is how it finds /etc/puppet/modules/motd/files/motd
```

variables

```
# assign a value to variable
$variable = ‘value’

# use a variable
notify { “variable is ${variable}”: }

# facts are variables
notify { “my fqdn is ${::fqdn}”: }
```

variables - arrays

```
# defining a variable with an array of values
$nameservers = [‘4.2.2.1’, ‘4.2.2.2’, ‘8.8.8.8’]
```

file - content

```
$message = “Welcome to ${::fqdn}.\nTry not to break anything”

file { ‘/etc/motd’:
  ensure  => file,
  content => $message
  owner   => ‘root’,
  group   => ‘root’,
  mode    => ‘0644’,
}
```

templates

- uses the `template()` function
- which uses erb for the templating engine
- files go under `<module_name>`/templates/ with .erb as the suffix

templates

- copy `/etc/puppet/modules/motd/files/motd` to `templates/motd.erb`
- `content => template('motd/motd.erb'),`
- do an agent run

templates

```
content => template(‘module_name/template.erb’),
```

puppet looks for <module_name> in $modulepath and <template.erb> under templates directory.

This is how it finds /etc/puppet/modules/motd/templates/motd.erb

template validation

- `/usr/bin/erb -P -x -T '-' <filename.erb> | /usr/bin/ruby -c`
- or use the bash function `` `pt` `` from `/root/.bashrc`

templates

```
# use a variable

<%= @message %>
```

templates

```
# iteration
<% @nameservers.each do |nameserver| -%>
nameserver <%= nameserver %>
<% end -%>
```

templates

```
# conditionals
<% if @lsbdistid == 'CentOS' %>
This system is running CentOS
<% end %>
```

templates

- refactor motd template and use the following.
- variable interpolation
- iteration
- conditional logic

ordering

- before and require

- refactor test module to notify “first” and “after first” in correct order

ordering - ntp module

- generate ntp module
- copy /etc/ntp.conf to ntp/templates/ntp.conf.erb
- manage /etc/ntp.conf as a template

ordering - ntp

```
# manage service and ensure it happens before file{}

service { ‘ntpd’:
  ensure     => running,
  enable     => true,
  hasstatus  => true,
  hasrestart => true,
  require    => File[‘/etc/ntp.conf’],
}
```

ordering - ntp module

- subscribe and notify
- change service{} to use subscribe
- modify ntp.conf
  - `echo “#junk >> /etc/ntp.conf”`
- run puppet agent

Package - File - Service

- Without automation you would:
  - `# yum -y install ntp`
  - `# vim /etc/ntp.conf`
  - `# service ntpd start`
  - hope it works

Package - File - Service

```
# most common design pattern

package { ‘ntp’:
  ensure => present,
}

file { ‘/etc/ntp.conf’:
  ...
  require => Package[‘ntp’],
}

service { ‘ntpd’:
  ...
  subscribe => File[‘/etc/ntp.conf’],
}
```

Package - File - Service

- Refactor ntp module to use this design pattern

Parameterized Classes

```
# define a class

class say (
  $msg,
) {
  notify { “message = ${msg}”: }
}
```

```
# declare a class
# just like ‘include say’ except you can also specify msg

class { ‘say’:
  msg => ‘automation is fun’,
}
```

Parameterized Classes

- create say module
- declare say class in site manifest for one node
- include say class in site manifest for other node

Parameterized Classes

```
# oh noes!!
# we need a default
```

```
class say (
  $msg = ‘boring default’,
) {
  notify { “message = ${msg}”: }
}
```

Hiera

- hierarchical data lookup system with pluggable backends
- separate data from code, yay!
- Defaults to YAML, also has
  - json
  - mysql
  - redis
  - gpg encrypted files
- CLI demo

Hiera

- can lookup parameters
- add to a hiera file
  - `say::msg: from hiera`
- run puppet

Custom facts

- environment variables
- `export FACTER_zzz=somevalue; facter zzz`

Custom facts

- write facts in ruby
- placed in `lib/facter/factname.rb`

Custom Facts

```ruby
# role.rb
require 'facter'
Facter.add("role") do
  setcode do
    Facter::Util::Resolution.exec("cat /etc/role")
  end
end
```

Custom Facts

```
# fact for each cciss device
# example: cciss_c0d0 => present
#
require 'facter'
if File.exists?("/dev/cciss")
  Dir.foreach("/dev/cciss") { |entry|
    if entry =~ /^c[0-9]d[0-9]$/
      Facter.add("cciss_#{entry}") do
        # only run on systems where the kernel fact is linux
        confine :kernel => :linux
        setcode do
          "present"
        end
      end
    end
  }
end
```

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