Provisioning & Deployment

Automation and Configuration Management

Provisioning

Provisioning, the action of providing or supplying something for use.

- Server provisioning
- Storage provisioning
- Network provisioning
- VM provisioning
- User provisioning

Provisioning is … Boring (after first iteration)

- Repetitive process
    - So, it’s a great target for automation
- May spread across multiple systems
    - Better keep a systems inventory and run tasks sequentially or parallelized
- Will probably require tweaks overtime
    - Well, versioning might be a good idea
- Sometimes a time consuming task
    - Let the machine do it and go do something else
    - https://www.xkcd.com/303/

Deployment

Deployment, the process of installing or upgrading an *application/service* into a server.

- Installing or upgrading a web application
    - Files
    - Migrations
    - Assets
- Network service installation or upgrade
- The scope is the **service** or **application**

Deployment is Also … Boring (after first iteration)

Regarding execution, provisioning and deployment are very much alike.

- Repetitive
- Sometimes dealing with heterogeneous systems
- Distributed
- Change overtime

Configuration Management

Configuration Management

A way of handling systematic system changes while maintaining integrity throughout its lifecycle.

- Express configuration through a common dialect
- Predictable configuration result
- Configuration evolves with the infrastructure
- Infrastructure documentation as a positive side effect
- Full history of changes overtime when used with source code management
- Changes are observable
- Process Automation
- Each unit of work is expressed as a recipe

Recipes / Reuse / Automation

Define task automation via a set of directives expressed in a given language.

```
#!/bin/sh
username=deployer
apt-get -y update
apt-get -y upgrade
apt-get -y install vim-nox openntpd sudo whois aptitude
useradd -G sudo -p "password" -s /bin/bash -m $username
mkdir -p /home/$username/.ssh
chmod 700 /home/$username/.ssh
chown $username: /home/$username/.ssh
echo "public_key" >> /home/$username/.ssh/authorized_keys
chmod 600 /home/$username/.ssh/authorized_keys
chown $username: /home/$username/.ssh/authorized_keys
```

Tools of the Trade

Use the right tool for the job

ANSIBLE

SALTSTACK

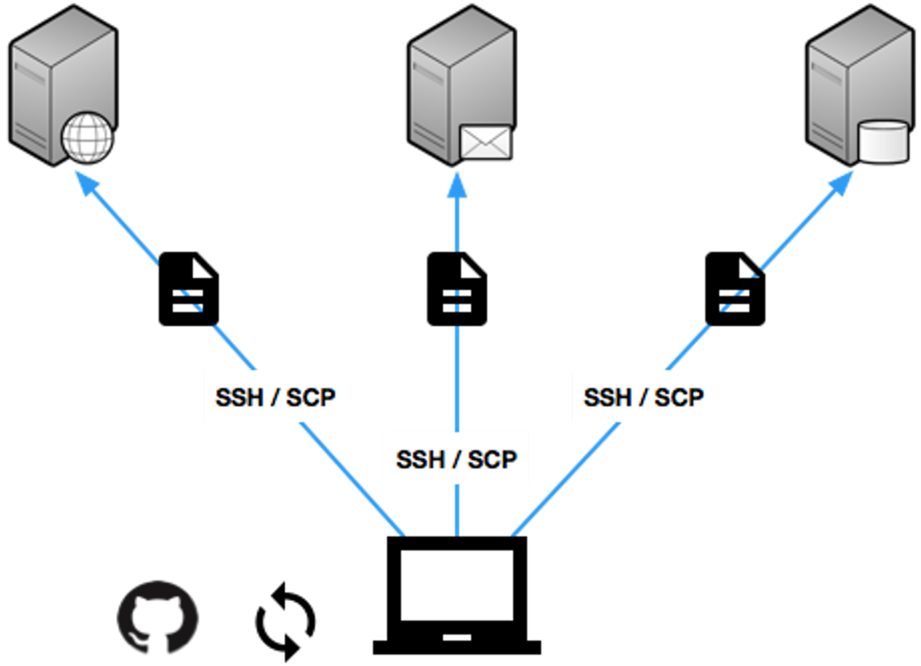
puppet

CHEF

Tools Comparison

	Language	**Agent**	**Agentless**	**SSH**
Ansible	YAML	No	Yes	Yes
Chef	Ruby	Yes	Supported	Yes
Puppet	Puppet’s Dec. Lang.	Yes	Supported	Yes
SaltStack	YAML	Yes	Supported	Yes

Provisioning Workflow



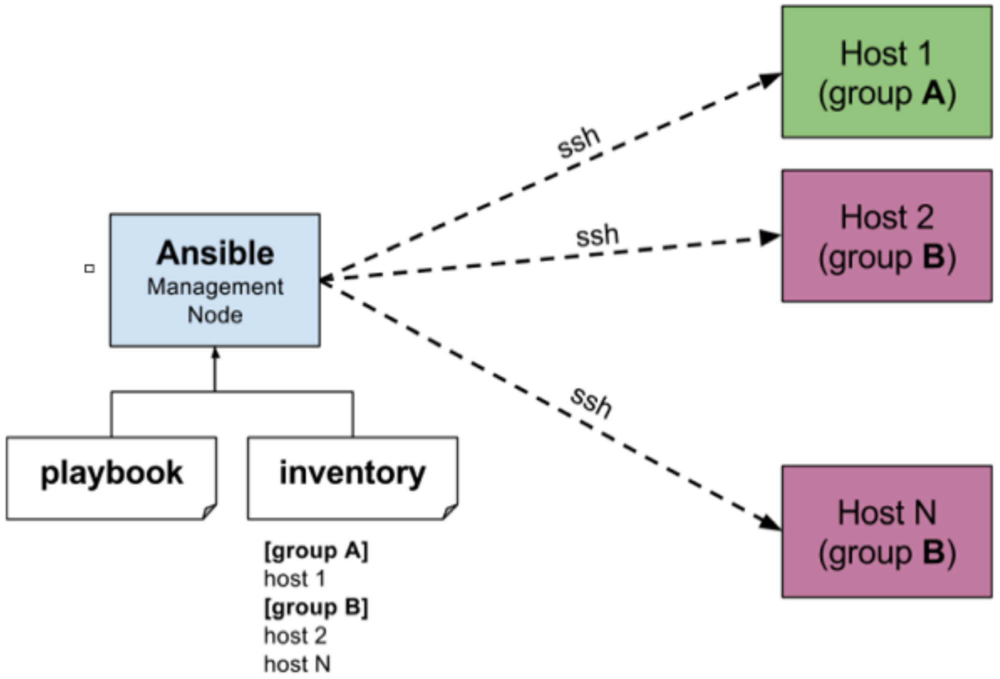
Ansible

Vocabulary

- Inventory
  - Grouped deployment targets (hosts)
- Module
  - Reusable work unit distributed with Ansible or developed for it
- Task
  - Combination of a module and given arguments in order to create an action
- Playbook
  - Describe policies for remote systems to enforce (set of tasks)
- Handlers
  - Special kind of task that responds to a notification
- Role
  - Reusable component that encapsulates variables, tasks and handlers (configurable)

Overview

- Agentless recipe execution via SSH or locally
- Recipes are expressed in YAML
- Recipes are created via module directives
- Directives define how modules should execute remotely
- Recipes are organized into playbooks and roles
- Target hosts are defined in the inventory
- Tasks only run if the target differs from the expected result (idempotency)
- Templates are created with Jinja2 (The Python Template Engine)



```
[group A]
host 1
[group B]
host 2
host N
```

Inventory

hosts.inv:

```
[web]
host-[01:99].example.com

[database]
db-01.example.com
Staging.example.com
```

Module

Template Module Documentation

```
- template: module for parsing a Jinja template and copy the result to a target host
    Src: relative path to local template
    dest: absolute path for rendered template on remote host
    owner: file owner at destination
    group: file group at destination
    mode: file permissions at destination
```

Task

```
- template:
    src: etc/ssh/sshd_config.j2
    dest: /etc/ssh/sshd_config
    owner: root
    group: root
    mode: 0600
```

Playbook

```
- hosts: all
  vars:
    username: someuser
    shell: /bin/bash
  tasks:
    - name: create unprivileged user
      user:
        name: ‘{{username}}’
        password: 'secretpasswordhash'
        shell: ‘{{shell}}’
    - name: Set SSH authorized_key
      authorized_key:
        user: ‘{{username}}’
        state: present
        key: "{{ lookup('file', ‘/home/’ + someuser + ‘/.ssh/id_rsa.pub’) }}"
```

Handlers

```
- name: template configuration file
  template:
    src: template.j2
    dest: /etc/nginx/nginx.conf
  notify:
     - restart nginx

handlers:
    - name: restart nginx
      service:
        name: nginx
        state: restarted
```

Role

```
hosts.inv
provision.yml
roles
  |
  |- role
      |- files (static files)
      |- templates (Jinja2 templates)
      |- tasks (task definition - main.yml)
      |- handlers (handlers that trigger on notify - main.yml)
      |- defaults (role scoped default variables - main.yml)
      |- vars (role scoped variables which override defaults - main.yml)
      |- meta (role dependency definitions - main.yml)
```

Playbook With Roles

```
- hosts: webserver
  roles:
    - config
    - users
    - ssh-server
    - ntp-client
    - …
```

ansible.cfg

Optional configuration file we can use to define some command line defaults.

File Search Order:

1. **ANSIBLE_CONFIG** (environment variable)
2. **ansible.cfg** (current directory)
3. **.ansible.cfg** (homedir)
4. **/etc/ansible/ansible.cfg**

Example: ansible.cfg

ansible.cfg:

```
[defaults]
hostfile = hosts.inv
remote_user = someusername
private_key_file = /home/gsd/.ssh/someuser_private_key
```

Execution

Without ansible.cfg:

```
ansible-playbook playbook.yml -b -i hosts.inv -u someuser -K --private-key=/path/to/private_key
```

With ansible.cfg (ansible.cfg):

```
ansible-playbook playbook.yml -b -K
```

Flags:

-b -> become, privilege elevation with *sudo* command
-i -> inventory file to use
-u -> login username
-K -> ask *sudo* password

Shell Script

```
#!/bin/sh
username=someuser
useradd -G sudo -p "password" -s /bin/bash -m $username
mkdir -p /home/$username/.ssh
chmod 700 /home/$username/.ssh
chown $username: /home/$username/.ssh
echo "public_key" >> /home/$username/.ssh/authorized_keys
chmod 600 /home/$username/.ssh/authorized_keys
chown $username: /home/$username/.ssh/authorized_keys
```

Ansible Playbook

```
- hosts: all
  vars:
    username: someuser
    shell: /bin/bash
  tasks:
    - name: create unprivileged user
      user:
        name: ‘{{username}}’
        password: 'secretpasswordhash'
        shell: ‘{{shell}}’
    - name: Set SSH authorized_key
      authorized_key:
        user: ‘{{username}}’
        state: present
        key: "{{ lookup('file', ‘/home/’ + someuser + ‘/.ssh/id_rsa.pub’) }}"
```

Level Up

Inventory Variables

```
[webservers]
web-[01:03].example.com balancer=lbl.example.com timeout=10s

[databases]
db.example.com
```

```
[webservers]
web-[01:03].example.com

[databases]
Db.example.com

[webservers:vars]
balancer=lbl.example.com timeout=10s
```

Host Facts

Facts can be accessed and used within tasks and templates allowing for more dynamic playbooks.

```
{% for host in groups['webservers'] %}
   {{ hostvars[host]['ansible_all_ipv4_addresses'] | join }}
{% endfor %}
```

```
{{ ansible_distribution }}
{{ ansible_os_family }}
{{ ansible_processor_vcpus }}
```

Conditionals

```
- name: Common Debian
  include_tasks: debian.yml
  when: ansible_os_family == "Debian"

- name: Common RedHat
  include_tasks: rh.yml
  when: ansible_os_family == "RedHat"
```

```
when:
  - condition
  - condition

when: condition or condition

when: somevar|failed

when: somevar is defined
```

Loops I

```
- name: Install Packages
  apt: name=”{{ item }}” update_cache=yes state=latest
  loop:
    - vim-nox
    - aptitude

- name: Install Packages
  apt: name=”{{ item }}” update_cache=yes state=latest
  loop: “{{ list_variable_with_packages }}”

- name: Copy Files
  copy: src=”{{ item.source }}” dest=”{{ item.destination }}”
  loop:
    - { source: ‘motd’, destination: ‘/etc/motd’ }
    - { source: ‘sshd’, destination: ‘/etc/ssh/sshd_config’ }
```

Loops II

```
- name: Nested Values
    user: name=”{{ item[0] }}” groups=”{{ item[1] }}” append=yes
    loop:
      - [‘some_user’, ‘other_user’]
      - [‘qemu’, ‘www-data’, ‘audio’]
```

- More at https://docs.ansible.com/ansible/latest/user_guide/playbooks_loops.html

Vault

- Allows keeping sensitive data such as passwords or keys in encrypted files, rather than as plaintext in playbooks or roles.
- More at https://docs.ansible.com/ansible/2.6/user_guide/vault.html

Provisioning GCP With Ansible

- A GCP VM is comprised of multiple resources:
    - At least one **disk** for operating system installation
    - A **network** for VM communication *(there is already a default entry)*
    - An internal/external **address** attached to the network
    - An optional **firewall** entry for traffic control *(there is already a default entry)*
- Ansible Modules
    - gcp_compute_disk
    - gcp_compute_network
    - gcp_compute_address
    - gcp_compute_firewall
    - gcp_compute_instance
- https://docs.ansible.com/ansible/latest/scenario_guides/guide_gce.html

Dynamic Inventory

- When provision happens dynamically the addresses are unknown
- Problem has two solutions
  - Manually (go into the console and look at the addresses)
  - Automatic (use a dynamic inventory)
- Ansible provides the *gcp_compute* plugin
  - Queries GCP
  - Allows filters
  - Enables dynamic grouping