Automation with Ansible

Automation

- Deploying complex cloud systems requires a lot of moving parts
  - Easy to forget what software you installed, and what steps you took to configure the system
  - Manual process is error-prone, can be non-repeatable
  - Snapshots are monolithic - provide no record of what has changed
- Automation
  - Provides a record of what you did
  - Codifies knowledge about the system
  - Makes process repeatable
  - Makes it programmable – “Infrastructure as Code”

Classification of Scripting tools

- Cloud-focused

  Used to interact with Cloud services.

  - Apache JClouds (Java-based - supports multiple clouds)
  - Boto (Python - supports AWS and OpenStack)
  - OpenStackClient (Python - supports OpenStack)
  - CloudFormation (YAML/JSON - supports AWS, OpenStack Heat)

- Shell scripts
  - Bash
  - Perl

Classification of Scripting Tools

- Configuration management (CM) tools

  Configuration management refers to the process of ***systematically*** handling ***changes*** to a system in a way that it ***maintains integrity*** over time.

  Automation is the mechanism used to make servers reach a desirable state, previously defined by provisioning scripts using tool-specific languages and features.

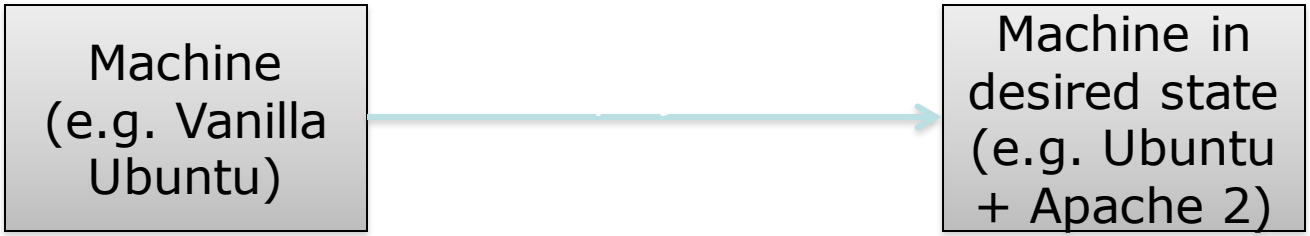
  – Chef (uses Ruby for creating cookbooks)
  – Puppet (uses its own configuration language)
  – Ansible (use YAML to express playbooks)
  – Fabric (Python library that uses SSH for application deployment and administration tasks)
  – Terraform, SaltStack, Docker, …

Ansible

- An automation tool for configuring and managing computers

  Finer grained set up and configuration of software packages
- Initial release: Feb. 2012
- Combines multi-node software deployment
- Ad-hoc task execution and configuration management

  Configuring thousands of machines manually!?



Ansible: Features

- Easy to learn
  - Playbooks in YAML, templates in Jinja2 etc.
  - Sequential execution
- Minimal requirements
  - No need for centralized management servers/daemons
  - Single command to install (*pip install ansible*)
  - Uses SSH to connect to target machine
- Idempotent (repeatable)
  - Executing N times no different to executing once
  - Prevents side-effects from re-running scripts
- Extensible

  Write your own modules

Ansible: More Features

- Supports push or pull

  Push by default but can use cron job to make it pull

- Rolling updates

  Useful for continuous deployment / zero downtime deployment

- Inventory management

  - Dynamic inventory from external data sources
  - Execute tasks against host patterns

- *Ansible Vault* for encrypted data

  $ ansible-vault create demo.yaml

  $ ansible-vault decrypt demo.yaml

  $ ansible-vault encrypt demo.yaml

  $ ansible-vault rekey demo.yaml

Ansible: More Features

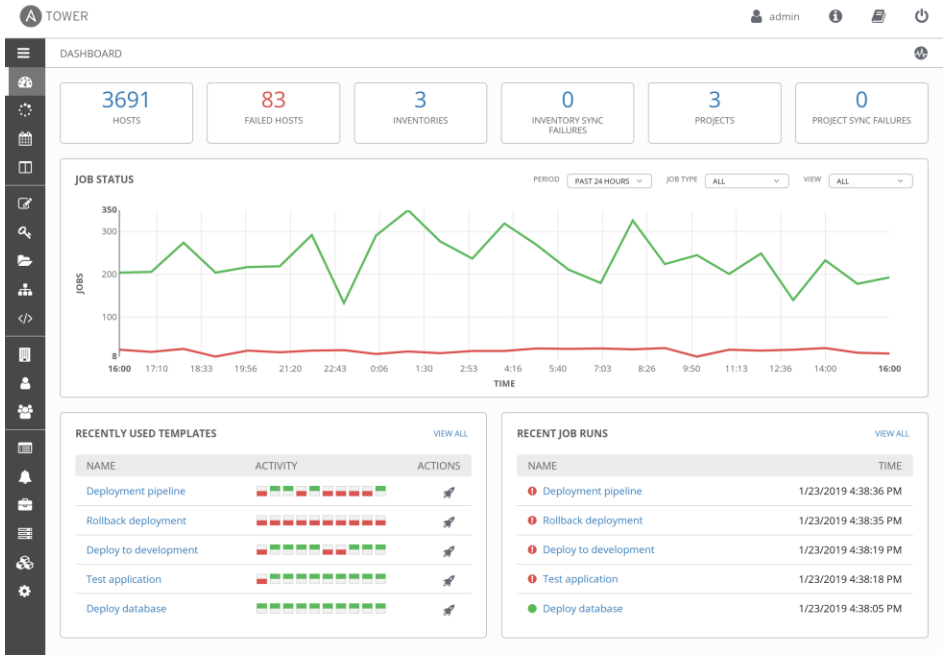
- Ad-hoc commands

  Execute a one-off command against your inventory

  $ ansible -i inventory_file -u ubuntu -m shell -a "reboot"

- Ansible Galaxy (https://galaxy.ansible.com/)
- Ansible Tower: Enterprise mission control for Ansible

  Dashboard, System Tracker, etc.



Ansible: YAML & Jinja2

- Ansible Playbooks are expressed in YAML.
  - YAML: **Y**AML **A**in't **M**arkup **L**anguage
  - YAML is a human friendly data serialization standard for all programming languages.
  - YAML Syntax: https://docs.ansible.com/ansible/latest/reference_appendices/YAMLSyntax.html

- Ansible uses Jinja2 templating for dynamic expression
  - Jinja2 is a modern and designer-friendly templating language for Python, modelled after Django's templates.
  - Jinja2 introduction: https://docs.ansible.com/ansible/latest/user_guide/playbooks_templating.html#templating-jinja2

Ansible: Installation Guide

- Linux (Ubuntu)

  $ sudo apt-get update && sudo apt-get install software-properties-common

  $ sudo apt-add-repository --yes --update ppa:ansible/ansible

  $ sudo apt-get install ansible

- macOS
  - Brew (https://brew.sh/)

    $ brew install ansible
  - Pip

    $ sudo pip install ansible

Ansible: Installation Guide

- Windows 10 (WSL)
  - Install Windows Subsystem for Linux

    https://docs.microsoft.com/en-us/windows/wsl/install-win10
  - Install Ansible

    See guide for Linux (Ubuntu)
  - Tutorial

    https://www.youtube.com/watch?v=9g0IGoRJtzM

- Ansible documentation:

https://docs.ansible.com/ansible/latest/installation_guide/intro_installation.html

Ansible: Structure

- Ansible scripts are called *playbooks,* written as simple YAML files
- Structured in a simple folder hierarchy

```
Playbook folder
|- variables
|    |_ vars.yml
|- inventory
|    |_ inventory.ini
|- roles
|    |- defaults
|    |- tasks
|    |    |- task1.yml
|    |    |_task2.yml
|    |_ templates / files
|_ playbook.yml
```

```
[webservers]
foo.example.com
128.250.0.1

[dbservers]
one.example.com
two.example.com
```

Ansible: Playbooks

- Executed sequentially from a YAML file

```
- hosts: webservers
  vars:
    package: ['httpd', 'python-dev']

  tasks:
    - name: Ensure the latest Apache and Python are installed
      apt:
          name: "{{ package }}"
          state: latest
    - name: Write the Apache config file
      file:
          src: /srv/httpd.conf
          dest: /etc/httpd.conf
    - name: Ensure Apache is restarted
      service:
          name: httpd
          state: restarted
```

```
[webservers]
www[01:50].example.com
192.168.0.[1:254]
```

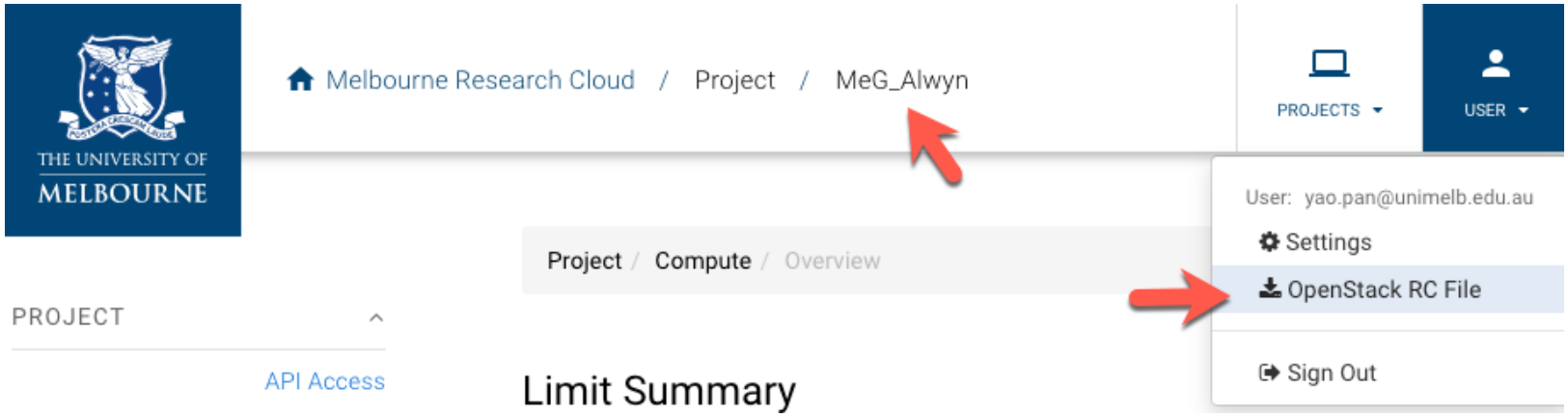
Ansible Demo: Melbourne Research Cloud

Ansible Demo 1:

- Connect to Melbourne Research Cloud
- List all images
- Create volumes
- Create security groups with security rules
- Launch an instance and attach the volume and security groups
- Create snapshots of the volumes

Ansible Demo: Melbourne Research Cloud

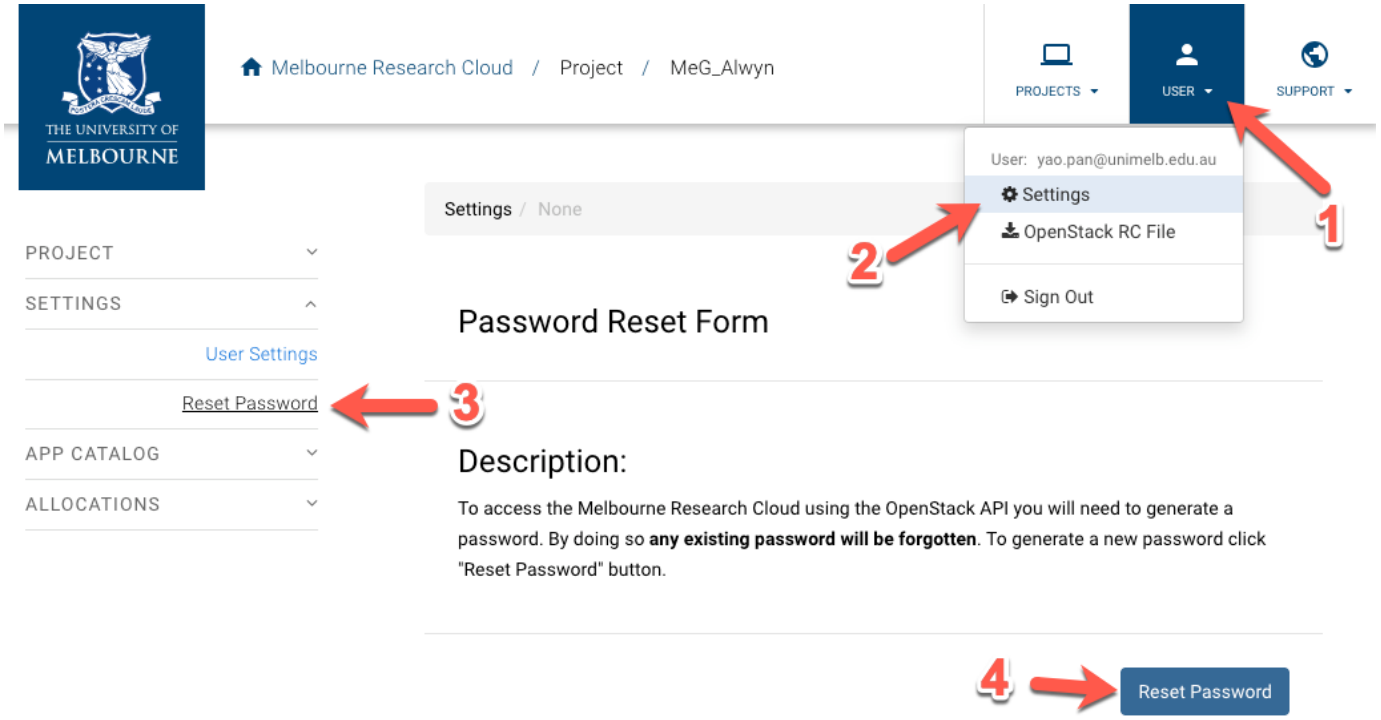
- Prerequisites:
  1. Login to https://dashboard.cloud.unimelb.edu.au
  2. Download *openrc.sh* from Dashboard
     - Make sure the correct project is selected
     - Download the OpenStack RC File



Ansible Demo: Melbourne Research Cloud

- Prerequisites:
  3. Reset API password

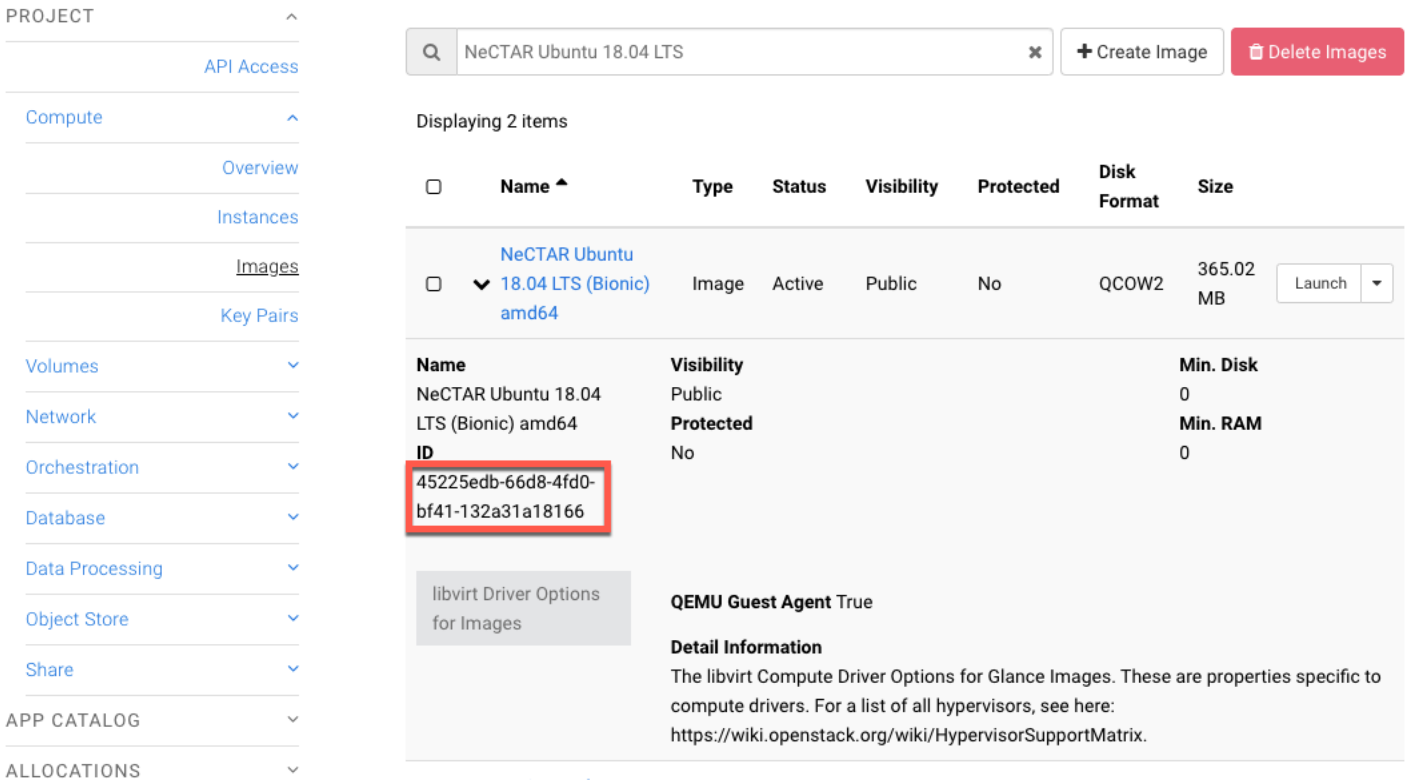
     Dashboard -> User -> Settings -> Reset Password



Ansible Demo: Melbourne Research Cloud

- Prerequisites:
  4. Instance Flavor: *uom.general.2c8g*
  5. Availability Zone: *melbourne-qh2-uom*
  6. Image Id: *45225edb-66d8-4fd0-bf41-132a31a18166*

  Dashboard -> Compute -> Images



Ansible Demo: Melbourne Research Cloud

- *playbook* to interact with Melbourne Research Cloud
  - List all images

    os_image_info
  - Create a volume

    os_volume
  - Create a security group with rules

    os_security_group, *os_security_group_rule*
  - Launch an instance and attach the volume and security group

    os_server
  - Create a snapshot of the volume

    os_volume_snapshot
  - Other Ansible modules used

    apt, *pip*, *become*, *register*, *set_fact*, *debug*, *loop*
    when, *wait_for*, *add_host*, *gather_facts*
- Run playbook:

  $ . ./openrc.sh; ansible-playbook [--ask-become-pass] nectar.yaml

Ansible Demo: Quiz

- Retrieve facts about the instance created
  - Create an instance and retrieve facts about that instance
- Attach existing volume(s) to an existing instance
  - Create a new volume
  - Attach the new volume to an existing instance

  Hint:
    - *Go to the Ansible Documentation and search docs for "os_"*
    - *Find relevant Ansible module*
- Add / remove existing Security Group to existing instance
  - Create a new Security Group
  - Add Security Group Rules
  - Attach the Security Group to an existing instance

  Hint: os_server

Ansible Demo: Wordpress

- Simple *playbook* to deploy a *WordPress* instance with *Docker**
  - Install dependencies

    apt, *pip*
  - Mount volumes and make filesystems

    filesystem, *stat*, *file*, *mount*
  - Install *Docker* on one of the volumes

    apt_key, *apt_repository*
  - Deploy a *WordPress* instance with *Docker*

    template, *docker_compose*

** Docker will be introduced in the coming workshops*

References

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