SANOG33

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NETWORK AUTOMATION (NetDevOps) with ANSIBLE

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Sessions

- Session 1:
  - 14:00 – 15:30 (Theory with example)

- Session 2:
  - 16:00 – 17:30 (Configuration and hands on LAB)

Today's Talk

1. Devops/NetDevOps ?
2. Why automation ?
3. Tools for automation
4. Why Ansible ?
5. Ansible introduction
6. Ansible Language Basics
7. Ansible encryption decryption
8. How to run
9. Demo
10. Configuration & Hands on LAB

DevOps

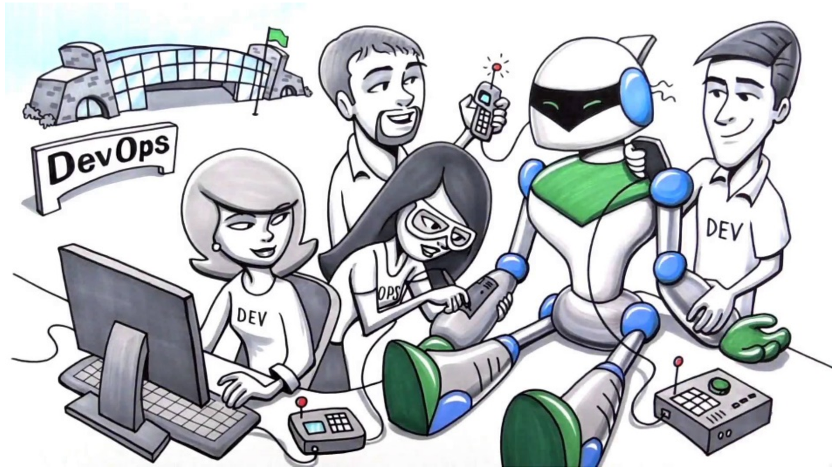
```
>devops ?
```

DevOps

```
>devops  !=
```

DevOps

DevOps integrates developers and operations teams In order to improve collaboration and productivity by automating infrastructure, automating workflows and continuously measuring application performance



Dev + Ops = DevOps

NetDevOps

NetDevOps = Networking + DevOps

infrastructure as code

Why automation ?

- Avoid repeated task
- Avoid typographical error (Typos)
- Faster deployment
- Identical configuration

Tools for automation

ANSIBLE

CFEngine

SALTSTACK

GitLab

CHEF™

CHEF.IO

puppet labs®

What is ANSIBLE?

- Open source IT automation tool
- Red hat Enterprise Linux, CentOS, Debian, OS X, Ubuntu etc.
- Need python

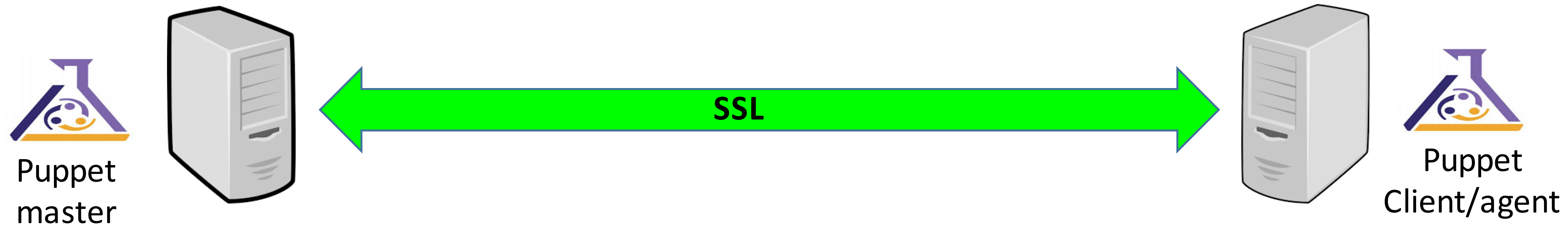
Why ANSIBLE?

- Simple
- Push model
- Agentless

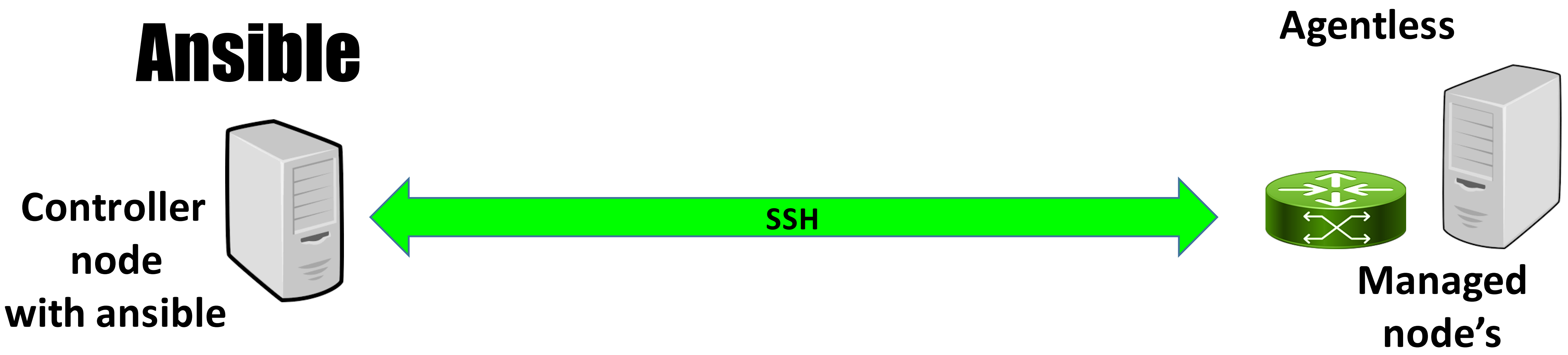
ANSIBLE

Why ANSIBLE?

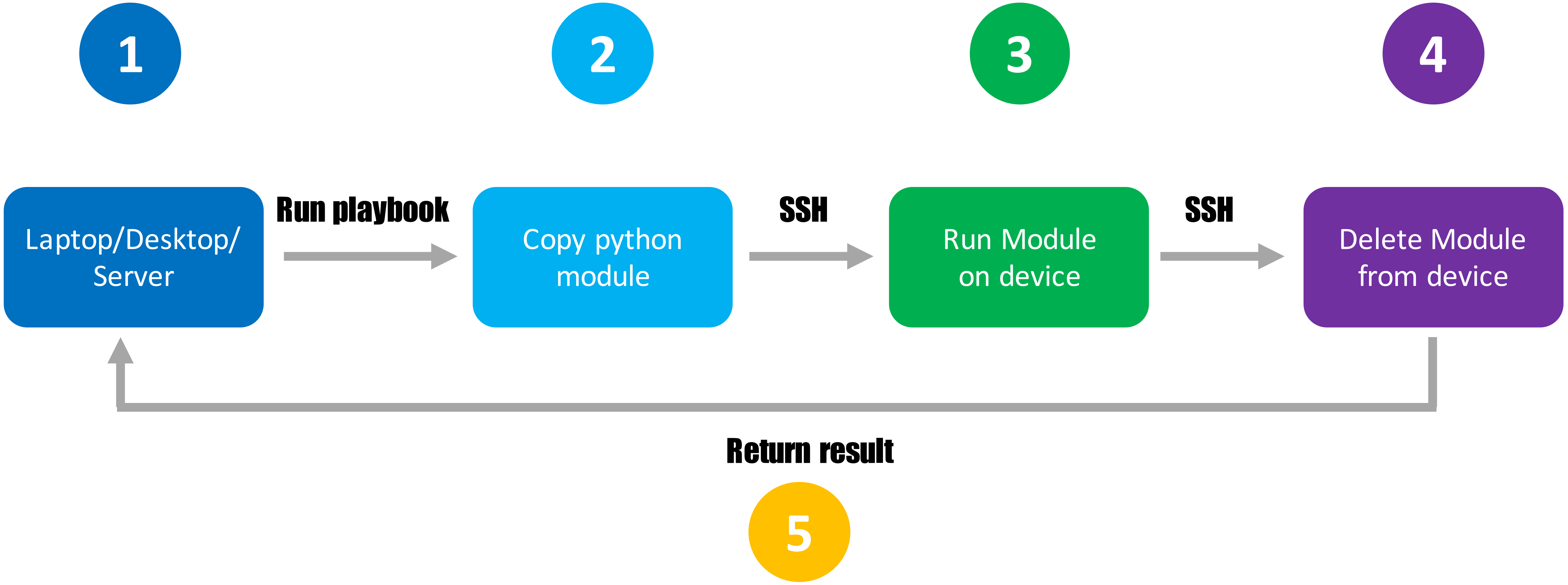
Puppet



Ansible



How it works


1
2
3
4
Laptop/Desktop/ Server
Run playbook
Copy python module
SSH
Run Module on device
SSH
Delete Module from device
Return result
5

What can be done??

- Configuration Management
- Provisioning VMs or IaaS instances
- Software Testing
- Continuous Integration/ Continuous Deployment (CI/CD)
- Configure hardware switches, routers, firewall etc.
- Other (Ansible can do all of that and much more)

Ansible Container

- Build container images from ansible playbook
- No more Dockerfile
- Create container the same way you deploy to servers
- Deploy to container orchestration platform
- Currently support Docker, OpenShift and Kubernetes

Why use Ansible Container ??

Dockerfile

```
RUN apt-get update && apt-get install -y \
      aufs-tools \
      automake \
      build-essential \
      curl \
      dpkg-sig \
      libcap-dev \
      libsqlite3-dev \
      mercurial \
      reprepro \
      ruby1.9.1 \
      ruby1.9.1-dev \
      s3cmd=1.1.* \
&& rm -rf /var/lib/apt/lists/*
```

Ansible task

```
- name: Install Packages
  package:
      name: "{{ packages }}"
      state: present
```

ANSIBLE terms

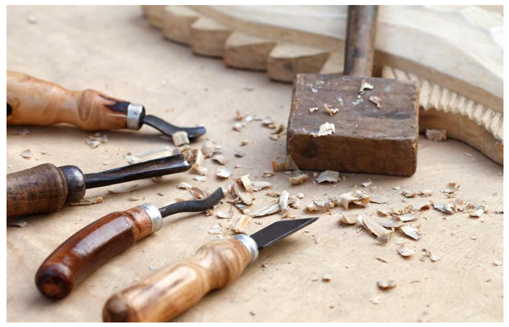
ANSIBLE Introduction

Real world

Build a house

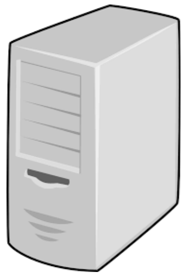
Master Plan
(small plan)

work



tools

Ansible world



Configure a device

```
---

- hosts: ios-routers
    gather_facts: no
    connection: local
```

playbook
(play, play)

```
name: load new acl
  ios_config:
    lines:
name: Add banner
  ios_config:
    lines:
```

tasks

```
ios_config
ios_command
```

modules

ANSIBLE Introduction

YAML

- Start with - - -
- File extention .yml/.yaml
- Easy for a human to read

```
---

- hosts: ios-routers
      gather_facts: no
      connection: local

      tasks:
         - name: Save Configuration
            ios_command:
                commands:
                 - write memory
                host: "{{ ansible_host }}"
```

ANSIBLE Introduction

Playbook

- Tell Ansible what to do
- Send commands to remote devices
- Plain text YAML file
- Each playbook contains one or more plays

ANSIBLE Introduction `playbook sample`

```yaml
---

- name: PLAY START
  hosts: ios-routers
  gather_facts: no
  connection: local

  tasks:

   - name: LOGIN INFORMATION
     include_vars: secrets.yml

   - name: ADD BANNER
     ios_config:
       provider: "{{ provider }}"
       lines:
         - banner motd ^Welcom to SANOG 33^
```

ANSIBLE Introduction

Module

- Modules control system resources, packages, files.
- Can be executed directly on remote hosts or through Playbooks
- Over 450 ships with Ansible
- User can also write their own modules

ANSIBLE Introduction (Network modules)

- asa_acl - Manage access-lists on a **Cisco ASA**
- asa_command - Run arbitrary commands on Cisco ASA devices
- eos_banner - Manage multiline banners on **Arista EOS** devices
- eos_config - Manage Arista EOS configuration sections
- bigip_command - Run arbitrary command on **F5** devices.
- bigip_hostname - Manage the hostname of a BIG-IP.
- ios_banner - Manage multiline banners on **Cisco IOS** devices
- ios_command - Run commands on remote devices running Cisco IOS
- ios_config - Manage Cisco IOS configuration sections
- iosxr_command - Run commands on remote devices running **Cisco IOS XR**
- iosxr_config - Manage Cisco IOS XR configuration sections
- junos_command - Run arbitrary commands on an Juniper **JUNOS** device
- junos_config - Manage configuration on devices running Juniper JUNOS

http://docs.ansible.com/ansible/list_of_network_modules.html

ANSIBLE Introduction

Task

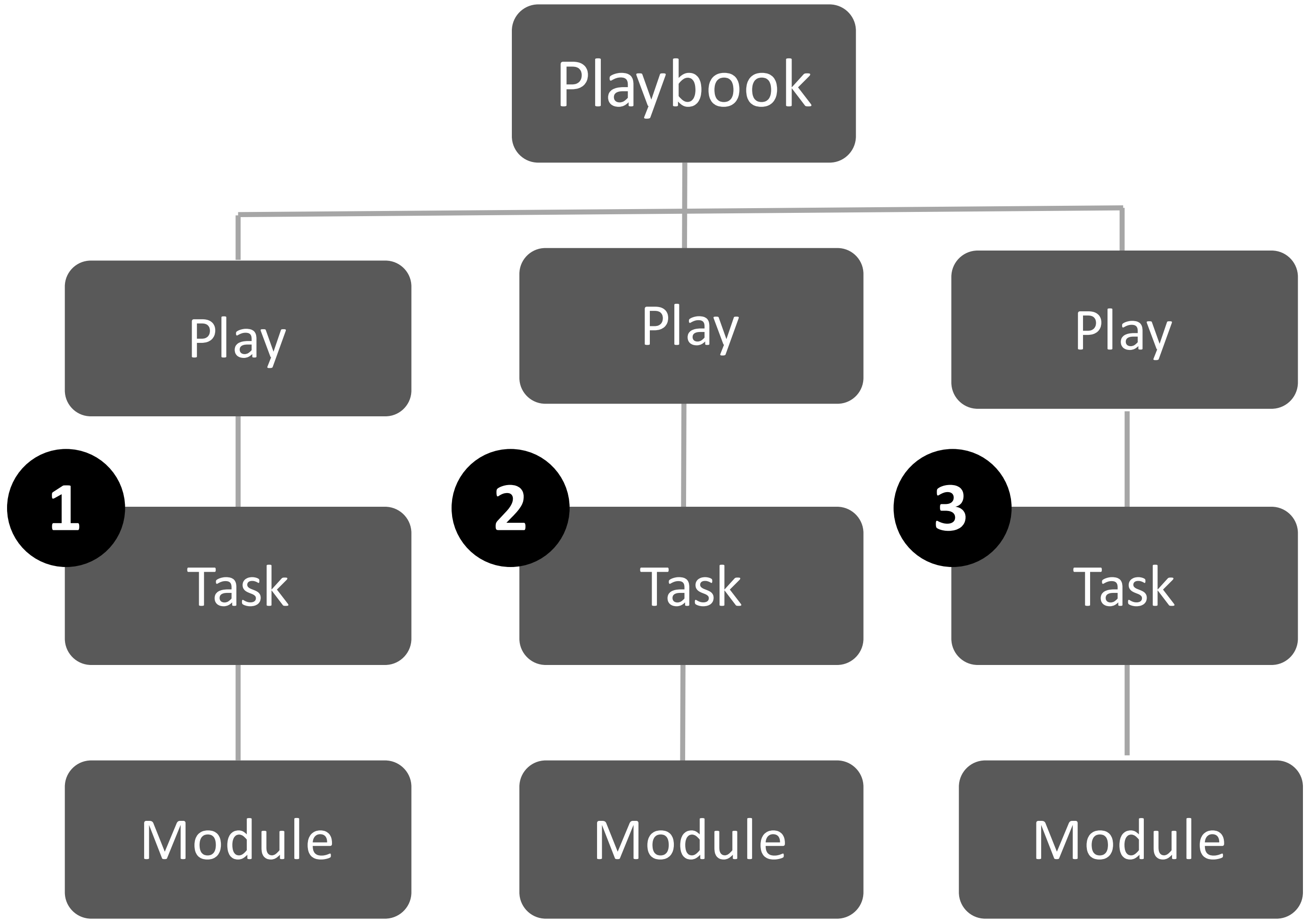
- At a basic level, a task is nothing more than a call to an ansible module

- Task run sequentially

ANSIBLE Introduction `task sample`

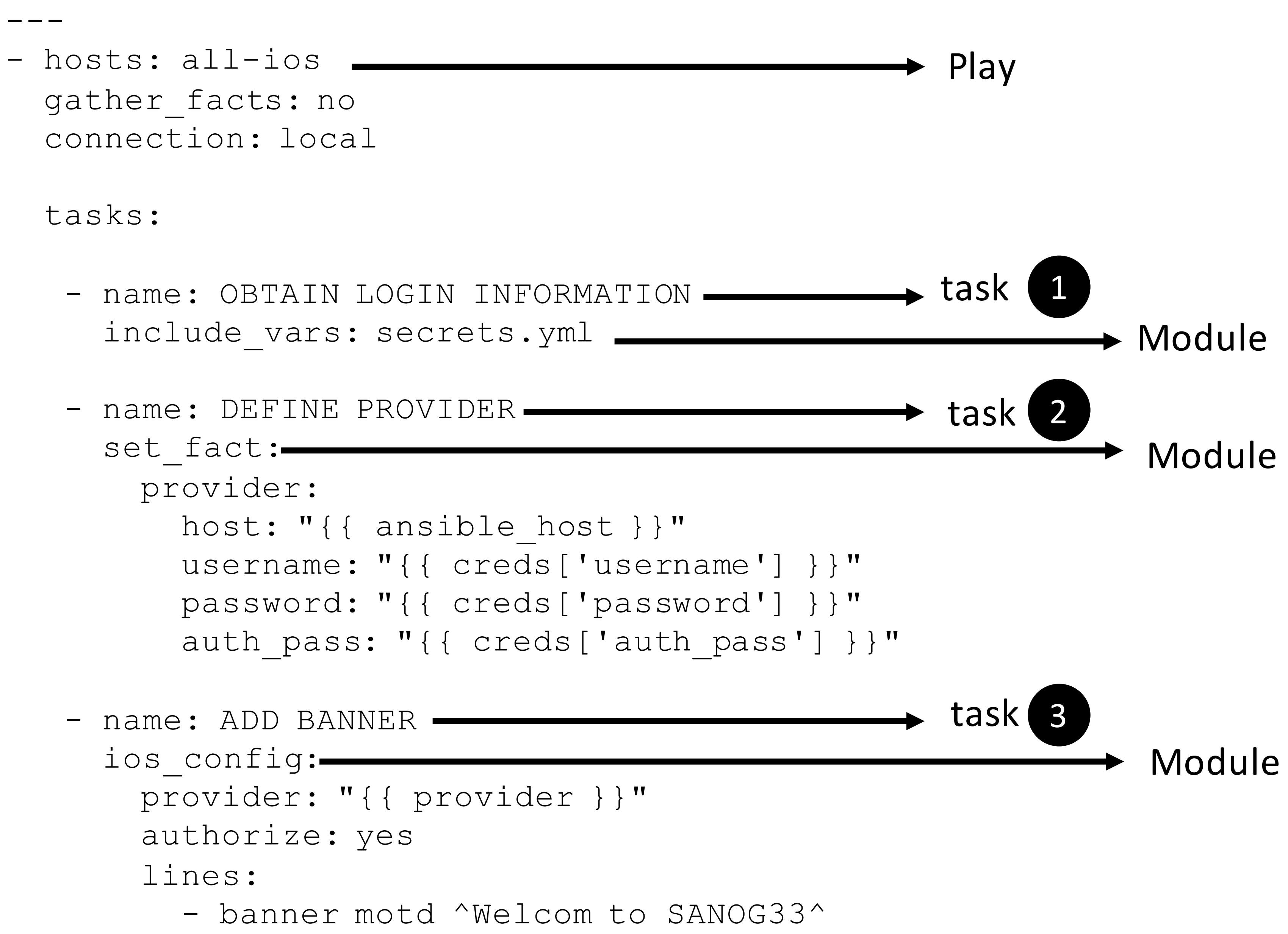
```
- name: configure interface settings
  ios_config:
    lines:
      - description test interface
      - ip address 172.31.1.1 255.255.255.0
    parents: interface Ethernet1

- name: load new acl into device
  ios_config:
    lines:
      - 10 permit ip host 1.1.1.1 any log
      - 20 permit ip host 2.2.2.2 any log
  parents: ip access-list extended test
  before: no ip access-list extended test
  match: exact
```

ANSIBLE Introduction



ANSIBLE Introduction

Playbook



```
---
- hosts: all-ios
  gather_facts: no
  connection: local

  tasks:

   - name: OBTAIN LOGIN INFORMATION
     include_vars: secrets.yml

   - name: DEFINE PROVIDER
     set_fact:
       provider:
         host: "{{ ansible_host }}"
         username: "{{ creds['username'] }}"
         password: "{{ creds['password'] }}"
         auth_pass: "{{ creds['auth_pass'] }}"

   - name: ADD BANNER
     ios_config:
       provider: "{{ provider }}"
       authorize: yes
       lines:
         - banner motd ^Welcom to SANOG33^
```

ANSIBLE Introduction

Hosts

- List of devices or group of devices where ansible push configuration
- Name and variable assign
- Default location `/etc/ansible/hosts`
- Can make your own

ANSIBLE Introduction `Hosts file sample`

`INI`**-like (one of Ansible defaults)**

```
[ios-routers]         →  groups
R_2691 ansible_host=192.168.45.3
R_3745 ansible_host=192.168.45.4

[v6-router]           →  groups
R_7200 ansible_host=2001:db8::1001::1
```

ANSIBLE Introduction

Inventory

- **Collections of files or directories inside a directory**
- `ansible-playbook -i <directory-name> playbook.yml`
- **Can have (not mandetory)**
  - `hosts (file)`
  - `host_vars (dir)`
  - `group_vars (dir)`
- **Can be accessed across multiple roles**

ANSIBLE Introduction

Roles

- Ansible roles are a special kind of playbook that are fully self-contained with tasks, variables, configuration templates and other supporting files

- Has it’s own directory structure

ANSIBLE Introduction `roles sample`

```
├── router_config
│   ├── inventory
│   │   └── hosts
│   ├── output
│   │   └── SOUTH.cfg
│   ├── playbook.yml
│   └── roles
│       └── router
│           ├── tasks
│           │   └── main.yml
│           ├── templates
│           │   └── router_config.j2
│           └── vars
│               └── main.yml
│
```

ANSIBLE Introduction

Jinja2

- template engine for the Python programming language
- File extension `.j2`
- Support conditions, loops
- Variable declaration

ANSIBLE Introduction jinja2 sample

```
{% for interface in cisco_1921_interfaces %}
interface {{ interface }}
  {% if interface == 'GigabitEthernet0/0' %}
   description {{ item.int_descp }}
   ip address {{ item.ipv4_addp }} {{ item.ipv4_mus }}
  {% elif interface == 'GigabitEthernet0/1' %}
   description {{ item.int_descs }}
   ip address {{ item.ipv4_adds }} {{ item.ipv4_mus }}
  {% endif %}
   no shutdown
   exit
{% endfor %}

ip route {{ item.static_route1  }} {{ item.static_gw1 }}
ip route {{ item.static_route2  }} {{ item.static_gw1 }}
```

Ansible Language Basics

Ansible Language Basics

Variable

Ansible Language Basics : Variable

Introduction to ansible variable

- Variable names should be letters, numbers, and underscores.
- Variables should always start with a letter.
- `isp1, ISP1, isp_dc1, ispdc` is valid
- `1ISP_DC, 10, ISP DC` is not valid

Ansible Language Basics : Variable

Variable declaration and assignment

Variables

```
isp1_dc: 10.x.x.2
```

Lists

```
isp :
  - isp1_dc: 10.x.x.2
  - isp2_dc: 20.x.x.6
```

Dictionaries

```
isp :
  - isp_dc: 10.x.x.2
    subnet: 255.255.255.252
  - isp_dc: 20.x.x.6
    subnet: 255.255.255.248
```

Ansible Language Basics : Variable

Accessing Variable

Variables

```
{{ isp1_dc }}
```

Lists (looping)

```
{{  item }}
```

Dictionaries (looping)

```
{{ item.isp_dc }}
{{ item.subnet }}
```

Ansible Language Basics : Variable

host_vars and group_vars

```
├── apricot
│   ├── inventory
│   │   ├── group_vars
│   │   │   ├── all.yml
│   │   │   └── ipv4_router.yml
│   │   ├── host_vars
│   │   │   └── south_router.yml
│   │   └── hosts
│   ├── playbook.yml
│   └── roles
│
```

Ansible Language Basics : Variable

`host_vars`

Host-specefic variables

`host_vars/south_router.yml`

Variable to be used by `south_router` **host**

Ansible Language Basics : Variable

`group_vars`

Host group-specefic variables

`group_vars/ipv4_router.yml`

Variable to be used by any host in `ipv4_router` **group**

Ansible Language Basics

LOOPS

Ansible Language Basics : loops

Introduction to Loops

- A loop is an instruction that repeats until a specified condition is reached

- Used for doing the same thing for multiple times

Ansible Language Basics : loops

Types of Loops

- Standard
- Nested
- Do-Until
- for

Ansible Language Basics : loops

1

```
cat vars/main.yml

interface_address:
  - INTERFACE: “GigabitEthernet0/0”
    DESC: “ISP1”
    DC_IP: "10.X.X.1"
    MASK: “255.255.255.252”
  - INTERFACE: “GigabitEthernet0/1”
    DESC: “ISP2”
    DC_IP: "172.X.X.5”
    MASK: “255.255.255.252”
```

2

```
cat templates/interface.j2

{% for i in interface_address %}
   interface {{ i.INTERFACE }}
     description ->> {{ i.DESC }}
     ip address {{ i.DC_IP }} {{ i.MASK }}
     no shutdown
{% endfor %}
```

3

```
Output

interface GigabitEthernet0/0
  description ->> ISP1
  ip address 10.x.x.1 255.255.255.252

interface GigabitEthernet0/1
  description ->> ISP2
  ip address 172.x.x.5 255.255.255.252
```

```
roles
│
└── router
    ├── tasks
    │   └── main.yml
    ├── templates
    │   └── interface.j2
    └── vars
        └── main.yml
```

Ansible Language Basics

Comments

Ansible Language Basics : comments

Comments in ansible

#

{#   #}

Ansible Language Basics

Conditionals

Ansible Language Basics : conditionals

The `when` statement

Control execution flow in Ansible

Perform a particular step on a particular host

```
---
  - name: SET IP ADDRESS TO SOUTH ROUTER
    ios_config:
        provider: "{{ provider }}"
        authorize: yes
        parents: "interface FastEthernet0/1"
        lines:
          - description SOUTH-CUSTOMER
          - ip address 10.10.20.1 255.255.255.248
          - ipv6 address 2001:db8:2001::9/64
        after: "no shutdown"
    when: ansible_host == "2001:db8::20"
```

Ansible Language Basics

Filters

Ansible Language Basics : filters

Introduction to filters

Filters are from `jinja 2`

used for transforming data inside a template expression

Filters are separated from the variable by a pipe symbol (|)

Ansible Language Basics : filters

`jinja2` **filters**

```
{{ list1 | min }}

replace(s, old, new, count=None)
```

`{{ myvar | ipaddr }}`

http://docs.ansible.com/ansible/latest/playbooks_filters.html

Ansible Language Basics : filters

`ipaddr` filter for static routes

```
ip route {{ item.ISP_BR | ipaddr('network') }}
                          (Destination network)

         {{ item.ISP_BR | ipv4('netmask') }}
                          (Subnet mask)

         {{ item.ISP_DC | ipaddr('1') | ipaddr('address') }}
                                  (Gateway)
```

Ansible Language Basics

Facts

Ansible Language Basics : facts

Collecting facts

Is a module and called by playbook to gather useful information about remote host

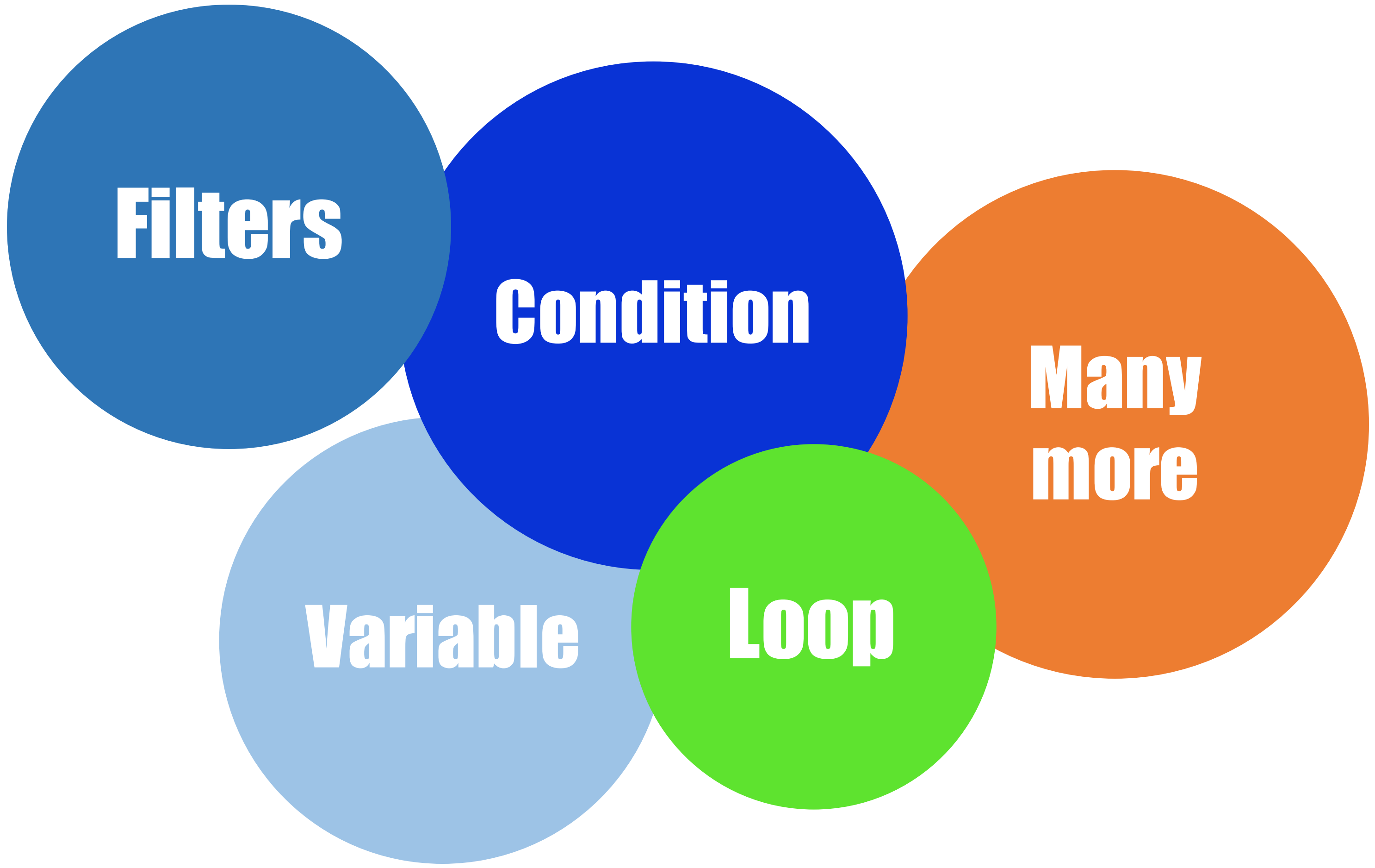
```
gather_facts: yes/no
```

Ansible Language Basics

Templating `(jinja2)`

Ansible Language Basics: `jinja2 templating`

What can be used?



Ansible Language Basics: jinja2

```
├── router_config
│   ├── inventory
│   │   └── hosts
│   ├── output
│   │   └── SOUTH.cfg
│   ├── playbook.yml
│   └── roles
│       └── router
│           ├── tasks
│           │   └── main.yml
│           ├── templates
│           │   └── router_config.j2
│           └── vars
│               └── main.yml
```

Ansible Language Basics : jinja2

Jinja2 template

```
hostname {{ item.hostname }}

{# Physical interface #}
{% for interface in cisco_1921_int %}
   interface {{ interface }}
    description ->> {{ cisco_1921_int[interface].dess }}
    ip address {{ cisco_1921_int[interface].addrs }}
               {{ cisco_1921_int[interface].sub }}
    no shutdown
    exit
{% endfor %}
```

Ansible Language Basics

Roles setup

Ansible Language Basics : roles

Roles structure and files

tasks
`tasks/main.yml`

templates
`templates/router_config.j2`

vars
`vars/main.yml`

files
`files/myscript.sh`

```
├── router_config
│   ├── inventory
│   │   └── hosts
│   ├── output
│   │   └── SOUTH.cfg
│   ├── playbook.yml
│   └── roles
│       └── router
│           ├── tasks
│           │   └── main.yml
│           ├── templates
│           │   └── router_config.j2
│           └── vars
│               └── main.yml
```

Debugging

Ansible Language Basics : debugging

Ansible debugging

Verbose mode `ansible -v`

`error_on_undefined_vars` **in ansible.cfg**

`fail` **module with customize messges**

Ansible Language Basics

Ansible encryption decryption

ANSIBLE Security

Ansible Vault

- It keeps sensitive data such as password, keys, variable name in encrypted format
- Need a password while encrypting, decrypting and running
- `ansible-vault` is the keyword along with `encrypt, decrypt, view, etc.` parameter

ANSIBLE Security

Ansible Vault

```
---

---creds:
     username: "imtiaz"
     password: ”password"
     auth_pass: ”password”
```

```
ansible-vault encrypt secretfile.yml
```

```
$ANSIBLE_VAULT;1.1;AES256
643364643164623266393365366
561613566303362303933343662
30653866373635386261643432
```

Installing Ansible

Python 2.6 or above for the control machine
and python 2.X or later for managed node

yum, rpm, apt-get, emerge,
pkg, brew, github

http://docs.ansible.com/ansible/latest/intro_installation.html

How to run

- `ansible <inventory> -m`
- `ansible-playbook`
- `Ansible tower` **($$)**

Demo Time

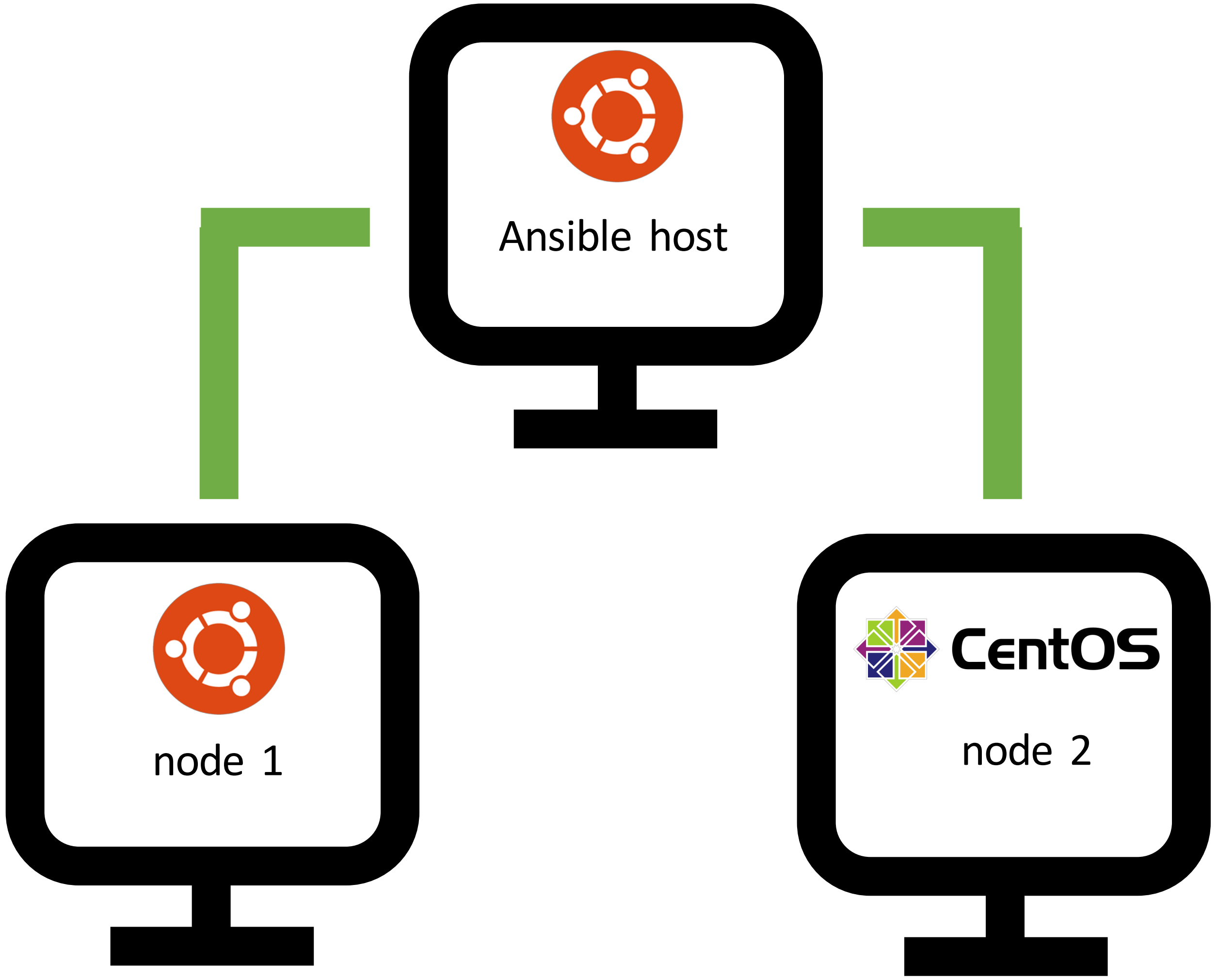
Demo configuration files

`https://git.io/fhsLB`

Demo 1

Introduction to Ad-Hoc commands

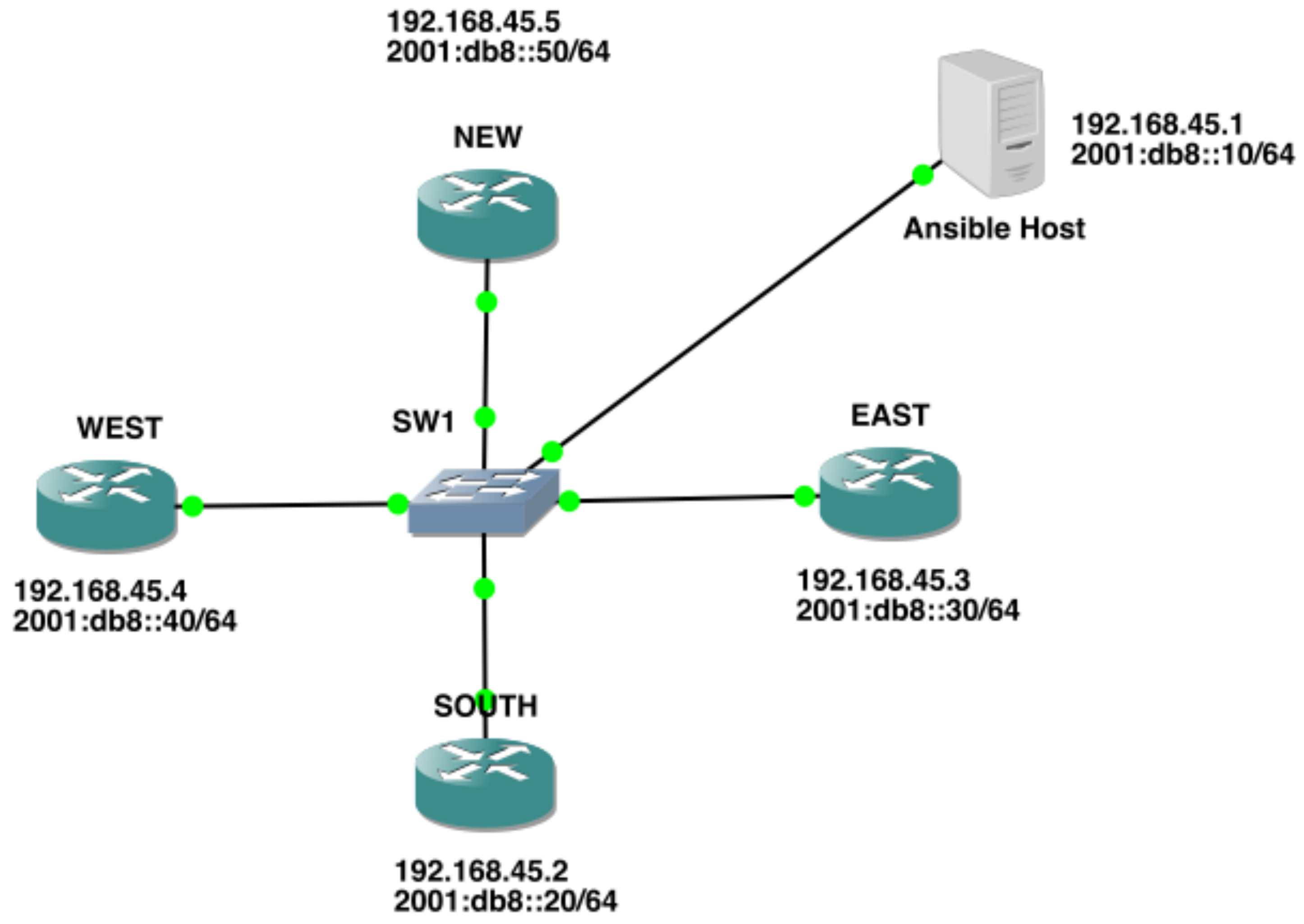
Demo topology



Demo 2

Introduction to Ansible playbook

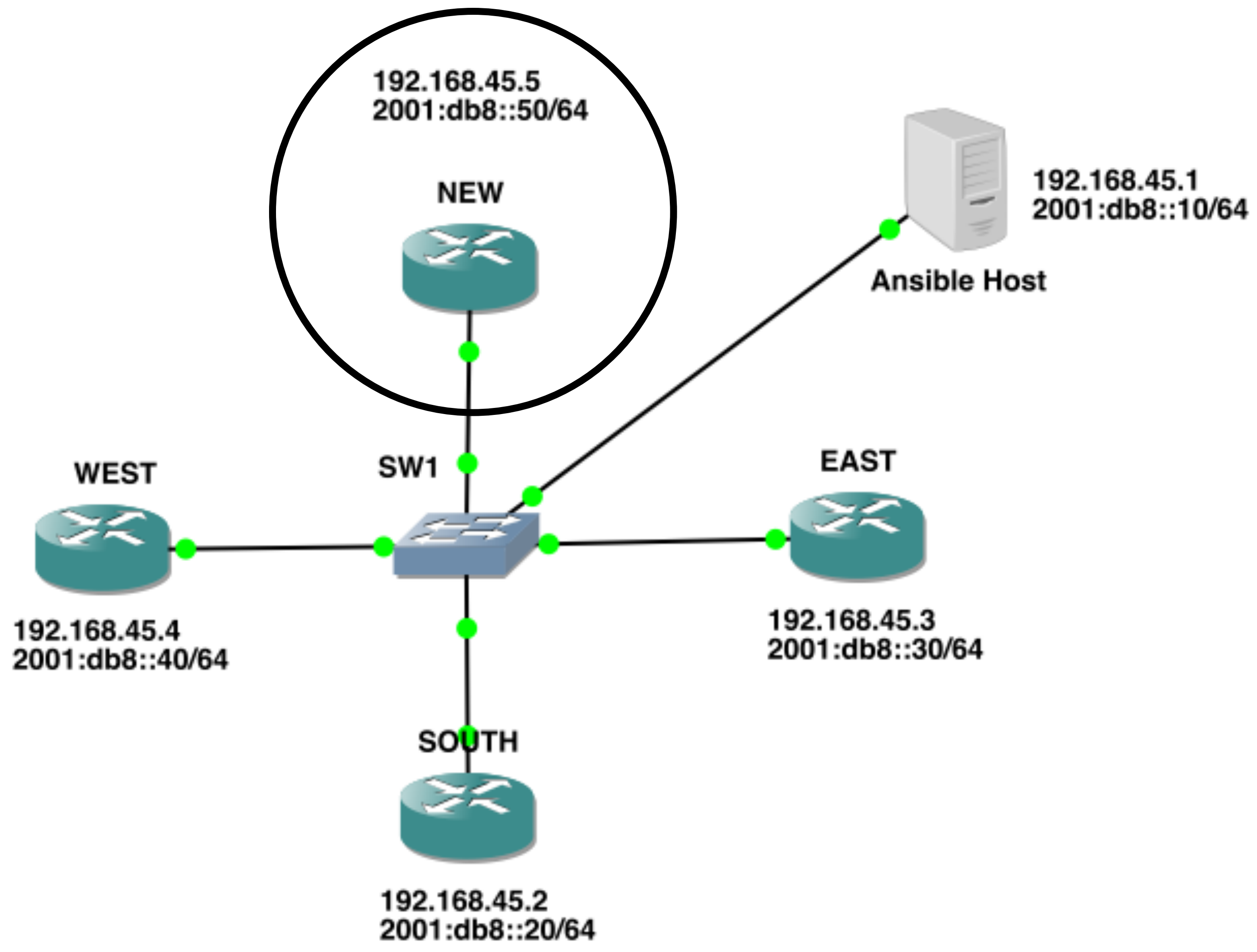
Demo topology

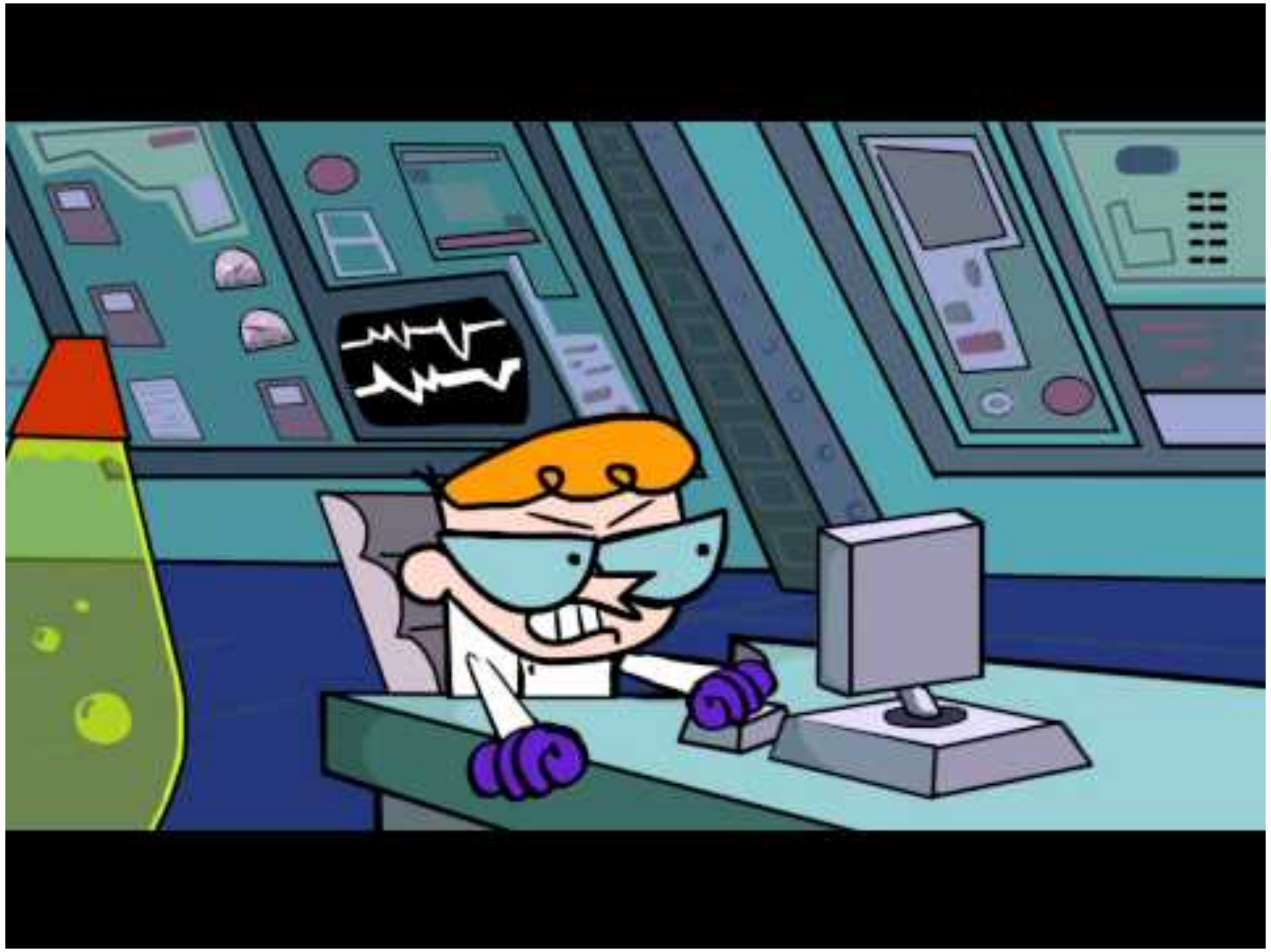


Demo 3

Introduction to Ansible role

Demo topology





Configuration & Hands on LAB (Session 2)

Configuration and hands on LAB

1. Preparing the environment (access the lab server and router)
2. Ansible installation
3. Playing with ad-hoc command
4. How to write ansible playbook
5. Ansible deep dive with roles, templates, variable and others
6. Ansible GALAXY

? ? ?

Thank You

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