Database Operations at Groupon using Ansible

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About me

- Worked as an Oracle DBA for 15+ years
- Branched out to MySQL since 2011
- Branched out to PostgreSQL since 2014
- Now - Managing Global Databases Services in Groupon

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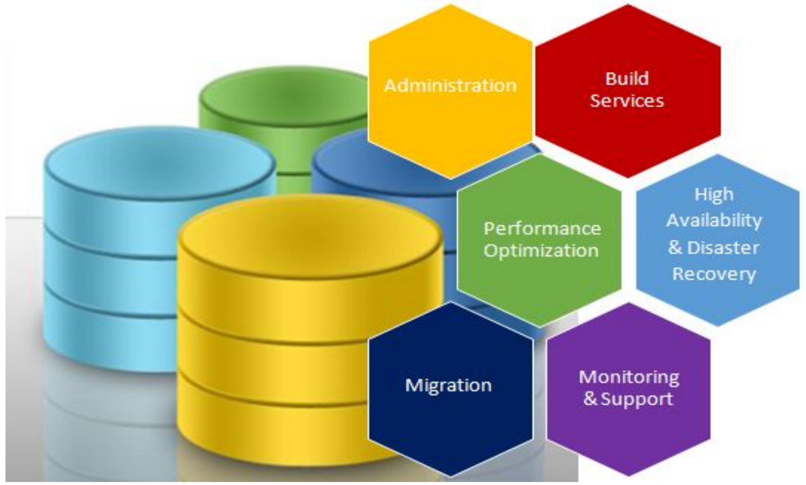
Global Database Services (GDS)

- Supports Production Operations
- Managing databases at scale both MySQL and PostgreSQL
- DaaS (Database as Service)
- Develop Tools and scripts for internal purpose
- Teams worldwide



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Purpose of the Presentation

- How to make DBA life easier
    - By saving time
    - Reducing errors
    - Automating the routing Tasks
    - Eventually speedup the operations

Agenda

- What is Ansible?
- Ansible components & Architecture
- Ansible Terms & layout
- Provisioning new PostgreSQL DB instances (Demo)
- Setting up Streaming replication (Demo)
- DB failover user Ansible (Demo)
- Destroy DB instances (Demo)
- Recover database using ZFS
- Future potential developments

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Environment

- FreeBSD Operating System
- ZFS FileSystem
- MySQL - Percona 5.6
- PostgreSQL - 9.4
- CARP - Common Address Redundancy Protocol
- Ansible 2.4
- Runit (init service)
- MHA for MySQL failover
- ZFS snapshots (FS level consistent backup)
- Xtrabackup (MySQL)
- Pg_basebackup(PostgreSQL)

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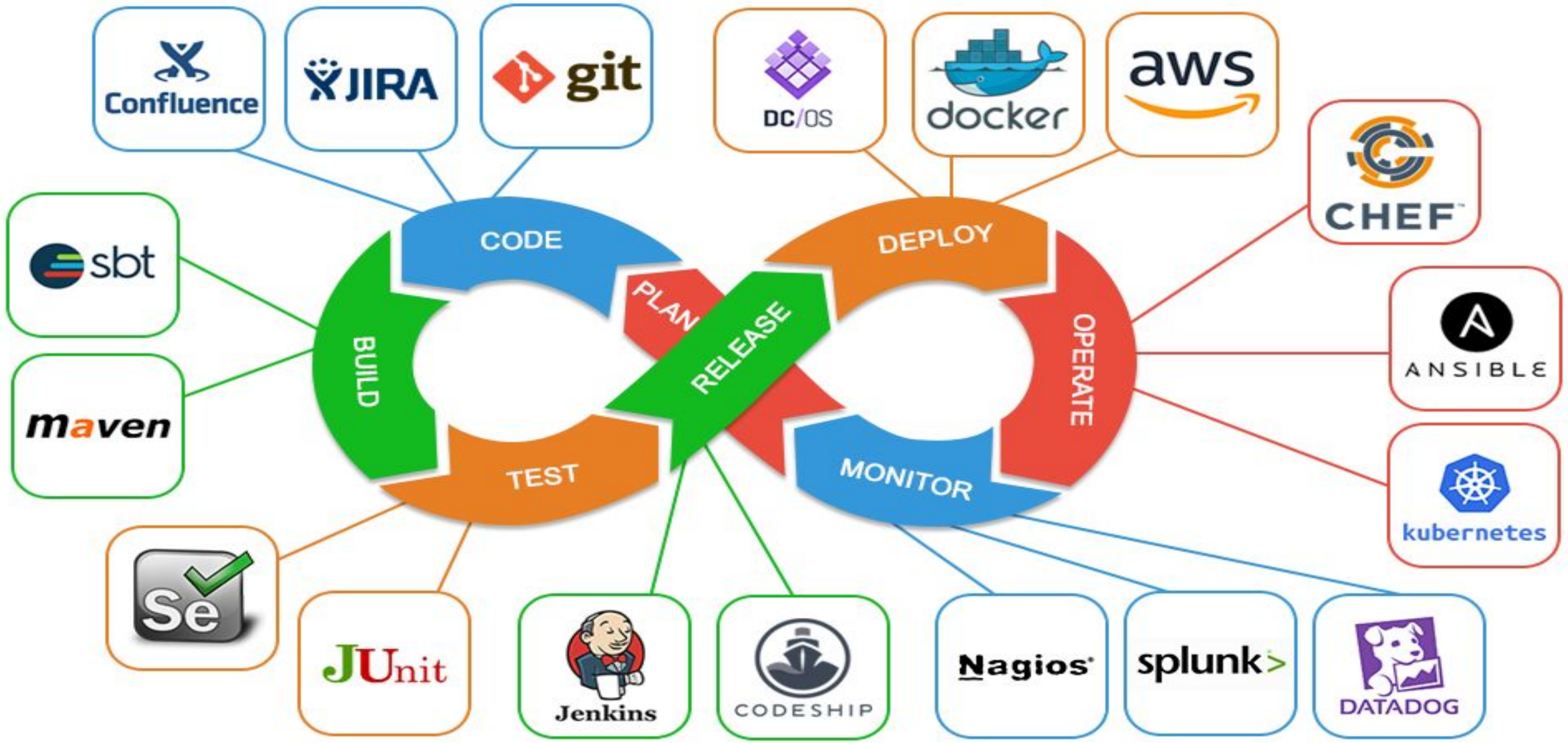
DevOps Tools



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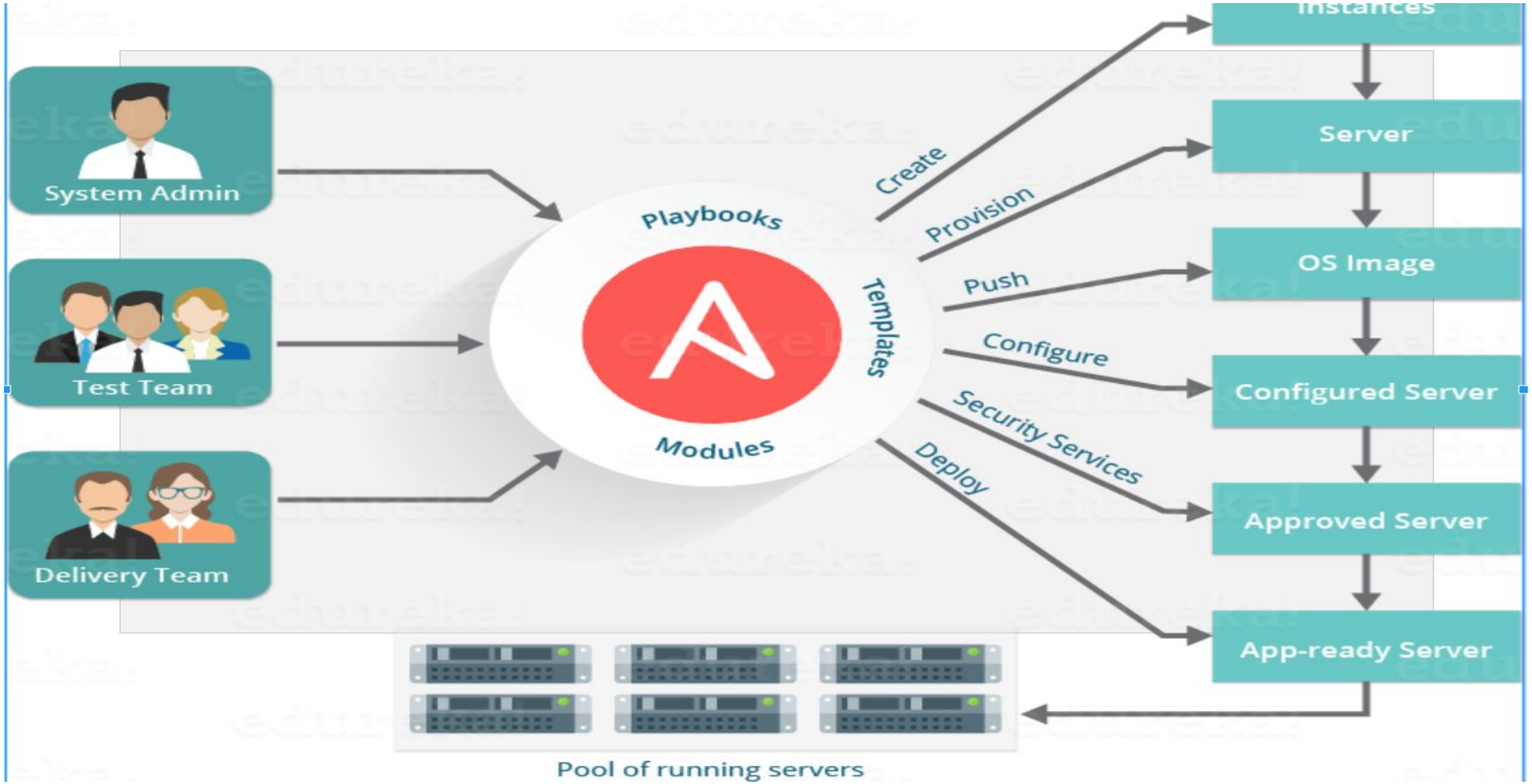
Ansible

- What is Ansible?
  - Radically simple IT automation engine
- Why Ansible in my opinion?
  - Automate tasks (sequence of tasks)
  - Save time and be more productive
  - Reduce mistakes or errors
- How does it work?
  - SSH Keys are your friends
  - No additional agents
  - Uses simple language (YAML in the form of Ansible playbooks)


Instances
Server
OS Image
Configured Server
Approved Server
App-ready Server
System Admin
Test Team
Delivery Team
Playbooks
Templates
Modules
Create
Provision
Push
Configure
Security Services
Deploy
Pool of running servers

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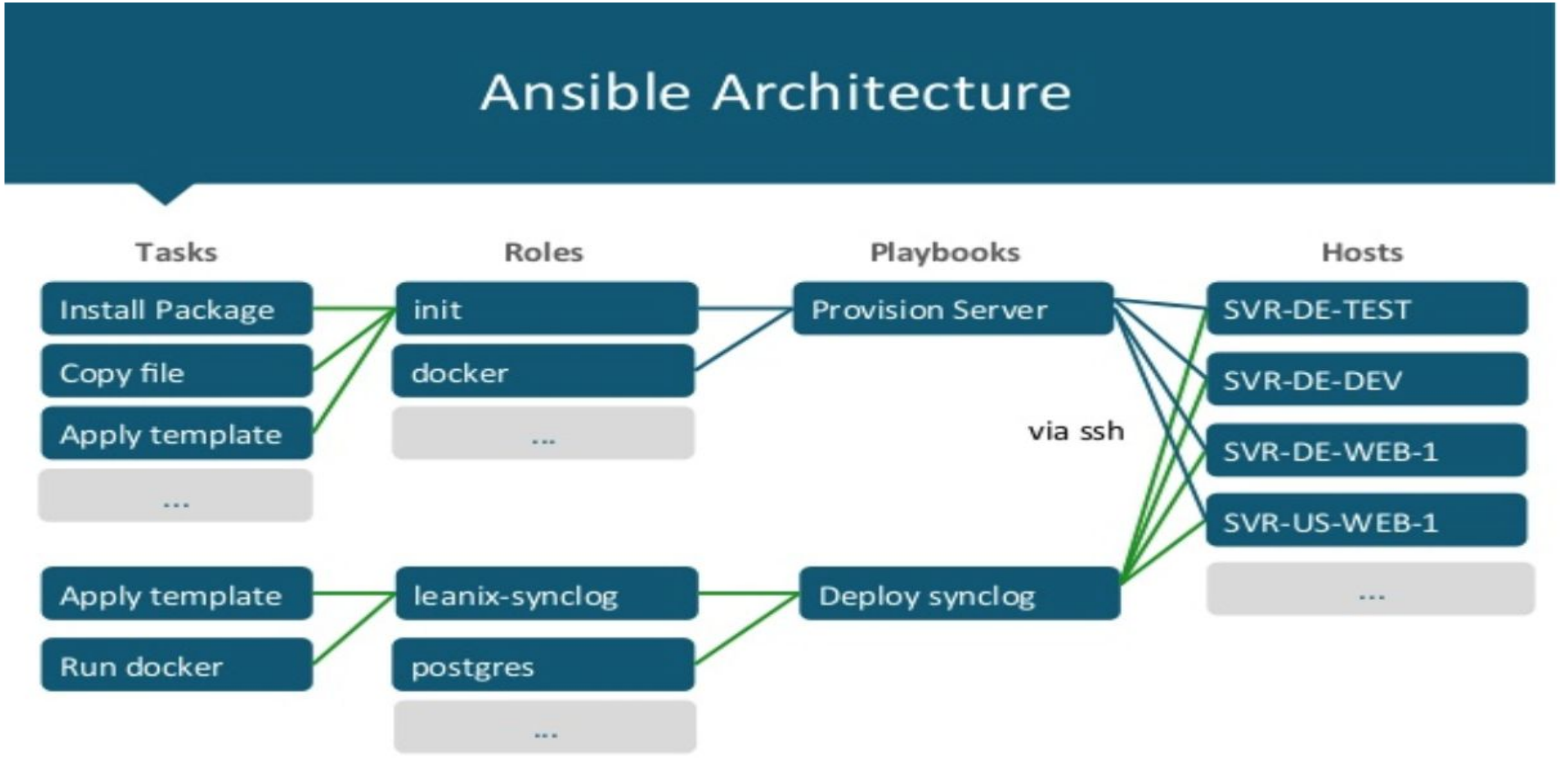

Ansible Architecture
Tasks
Roles
Playbooks
Hosts
Install Package
Copy file
Apply template
...
Apply template
Run docker
init
docker
...
leanix-synclog
postgres
...
Provision Server
Deploy synclog
via ssh
SVR-DE-TEST
SVR-DE-DEV
SVR-DE-WEB-1
SVR-US-WEB-1
...

Simple Ansible Terms

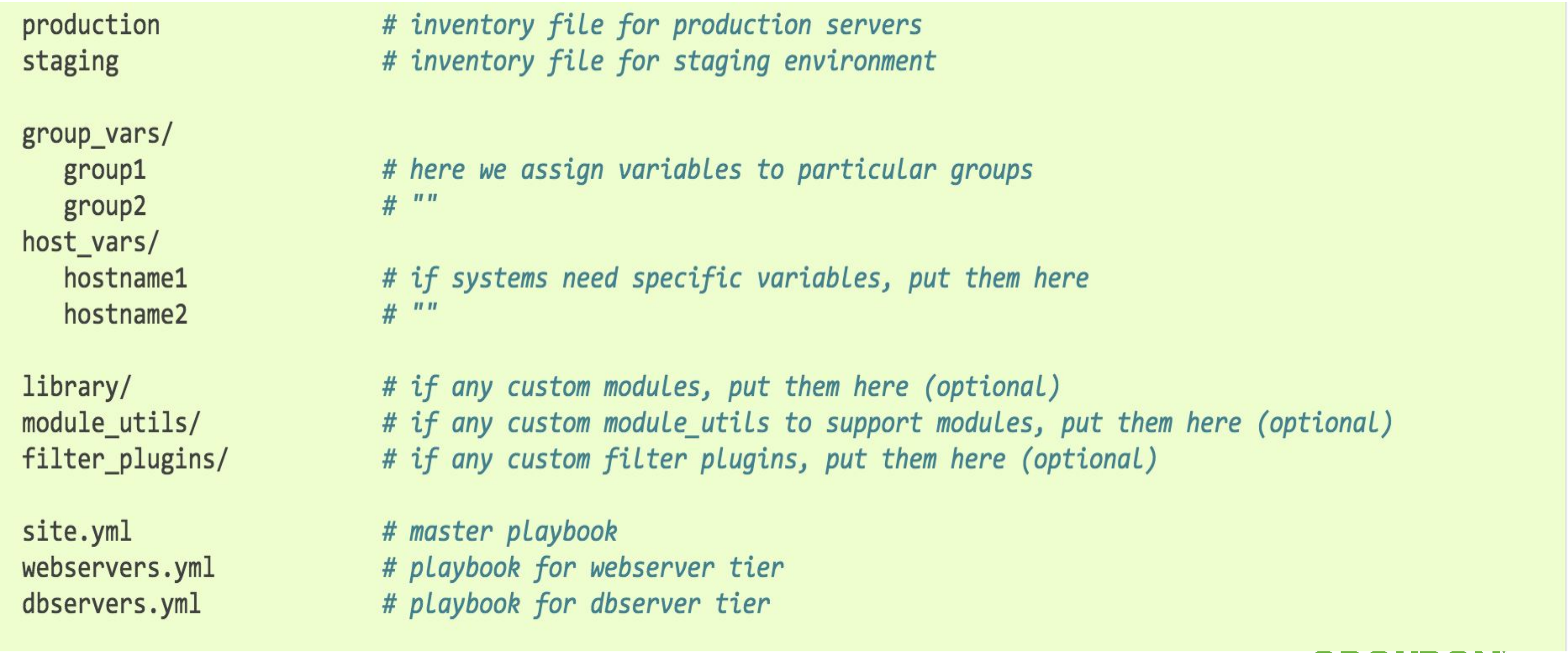
- Roles
  - Tasks
  - Handlers
  - Defaults
  - Vars
  - Files
  - Templates
  - Meta

Documentation : http://docs.ansible.com/ansible/latest/user_guide/

Roles Layout

```
ansible-foobar/
├── defaults
|   └── main.yml
├── files
├── handlers
|   └── main.yml
├── meta
|   └── main.yml
├── tasks
|   ├── check_vars.yml
|   ├── foobar.yml
|   └── main.yml
└── templates
    └── foobar.conf.j2
```

Directory Layout (1)



```
production                # inventory file for production servers
staging                   # inventory file for staging environment

group_vars/
   group1                 # here we assign variables to particular groups
   group2                 # ""
host_vars/
   hostname1              # if systems need specific variables, put them here
   hostname2              # ""

library/                  # if any custom modules, put them here (optional)
module_utils/             # if any custom module_utils to support modules, put them here (optional)
filter_plugins/           # if any custom filter plugins, put them here (optional)

site.yml                  # master playbook
webservers.yml            # playbook for webserver tier
dbservers.yml             # playbook for dbserver tier
```

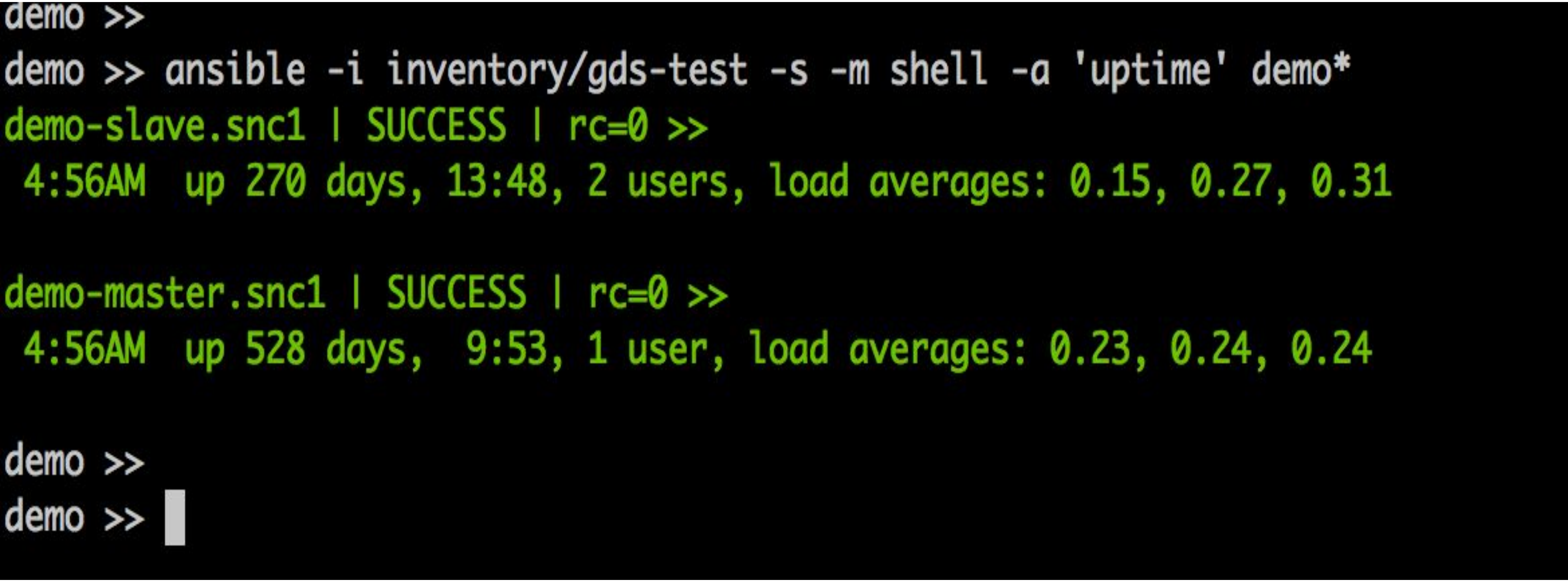
Directory Layout (2)

```
roles/
    common/               # this hierarchy represents a "role"
        tasks/            #
            main.yml      #  <-- tasks file can include smaller files if warranted
        handlers/         #
            main.yml      #  <-- handlers file
        templates/        #  <-- files for use with the template resource
            ntp.conf.j2   #  <------- templates end in .j2
        files/            #
            bar.txt       #  <-- files for use with the copy resource
            foo.sh        #  <-- script files for use with the script resource
        vars/             #
            main.yml      #  <-- variables associated with this role
        defaults/         #
            main.yml      #  <-- default lower priority variables for this role
        meta/             #
            main.yml      #  <-- role dependencies
        library/          # roles can also include custom modules
        module_utils/     # roles can also include custom module_utils
        lookup_plugins/   # or other types of plugins, like lookup in this case

    webtier/              # same kind of structure as "common" was above, done for the webtier role
    monitoring/           # ""
    fooapp/               # ""
```

Ansible inventory file

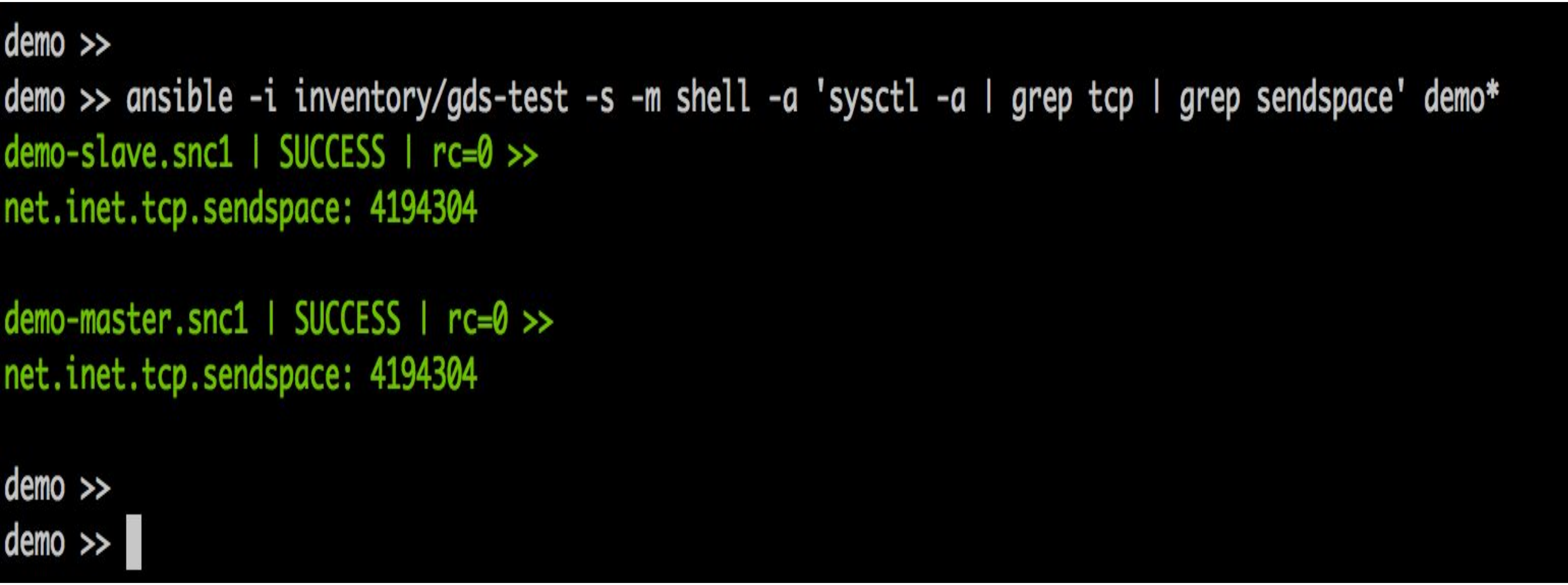
```
[demo]

demo-master.snc1

demo-slave.snc1

[sandbox]

sandbox-master.snc1

sandbox-slave.snc1

[testbox]

test-master.snc1

test-slave.snc1
```

Ansible usage - Example1



```
demo >>
demo >> ansible -i inventory/gds-test -s -m shell -a 'uptime' demo*
demo-slave.snc1 | SUCCESS | rc=0 >>
 4:56AM  up 270 days, 13:48, 2 users, load averages: 0.15, 0.27, 0.31

demo-master.snc1 | SUCCESS | rc=0 >>
 4:56AM  up 528 days,  9:53, 1 user, load averages: 0.23, 0.24, 0.24

demo >>
demo >> 
```

Ansible usage - Example2



```
demo >>
demo >> ansible -i inventory/gds-test -s -m shell -a 'sysctl -a | grep tcp | grep sendspace' demo*
demo-slave.snc1 | SUCCESS | rc=0 >>
net.inet.tcp.sendspace: 4194304

demo-master.snc1 | SUCCESS | rc=0 >>
net.inet.tcp.sendspace: 4194304

demo >>
demo >>
```

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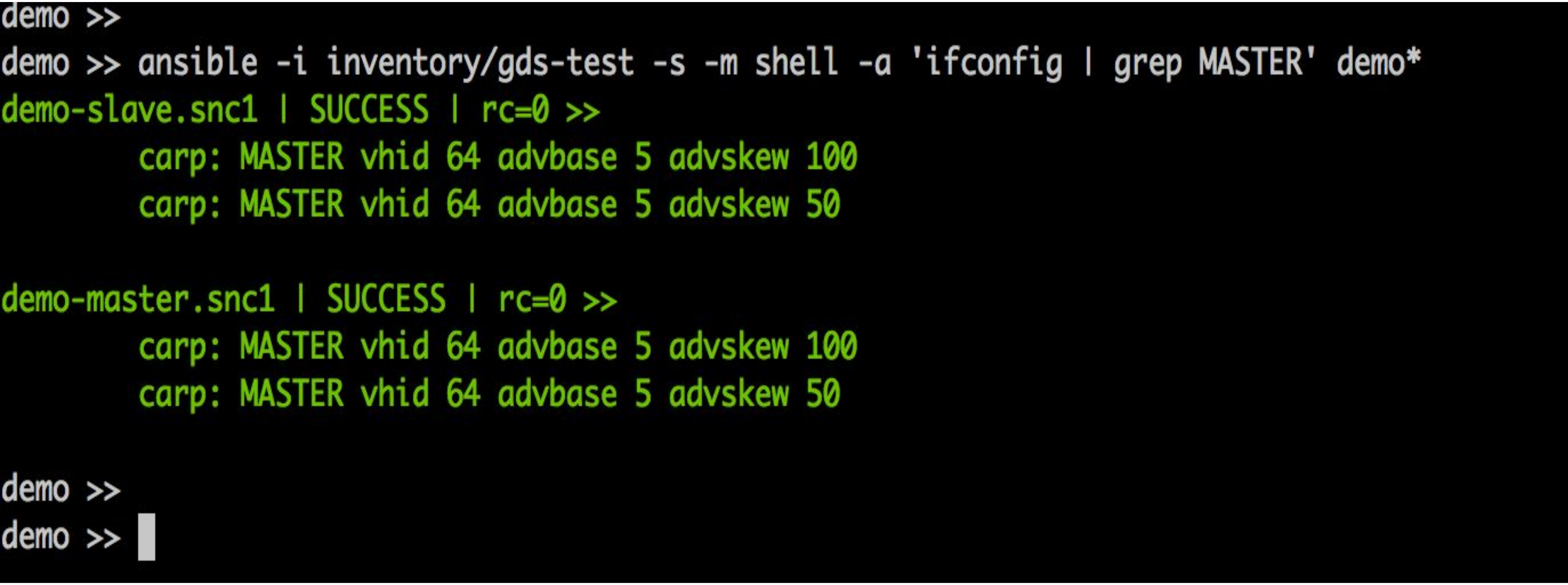
Ansible usage - Example3



```
demo >>
demo >> ansible -i inventory/gds-test -s -m shell -a 'ifconfig | grep MASTER' demo*
demo-slave.snc1 | SUCCESS | rc=0 >>
        carp: MASTER vhid 64 advbase 5 advskew 100
        carp: MASTER vhid 64 advbase 5 advskew 50

demo-master.snc1 | SUCCESS | rc=0 >>
        carp: MASTER vhid 64 advbase 5 advskew 100
        carp: MASTER vhid 64 advbase 5 advskew 50


demo >>
demo >>
```

Ansible usage - Example 4

```
ansible -s -m shell -a 'zpool list | grep tank ' demo*

ansible -m raw -a 'uptime' -i inventory/gds-test demo*

ansible -i inventory/gds-test -s -m shell -a 'zfs list -t snapshot | grep hourly'
demo*
```

DB Instances Provisioning

```
ansible-playbook -i inventory/gds-test plays/pg_instances.yml --limit
demo-master.snc1 -e "inst_type=master"
```

<<DEMO>>

```
ansible-playbook -i inventory/gds-test plays/pg_instances.yml --limit
demo-slave.snc1 -e "inst_type=slave"
```

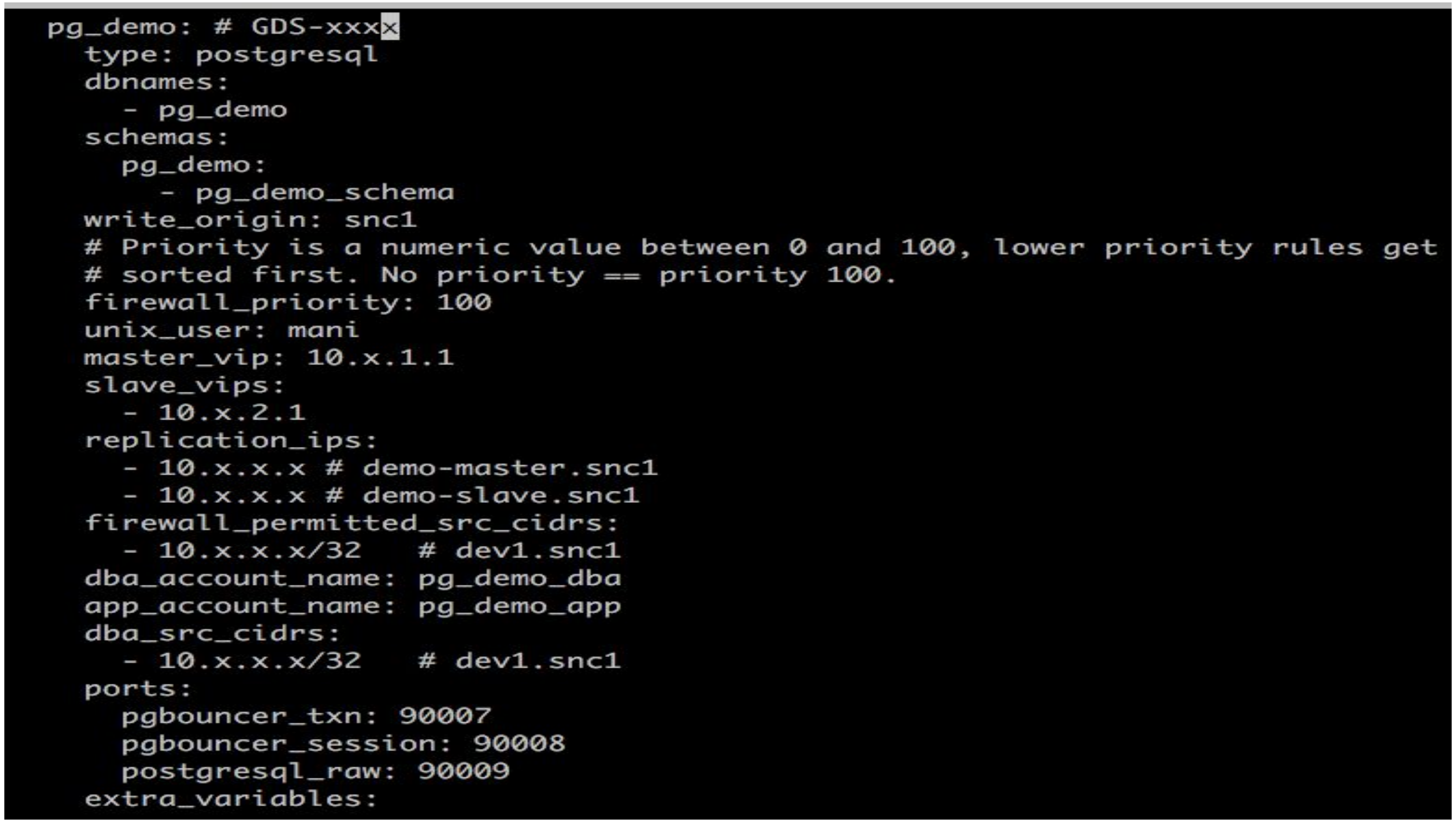
<<DEMO>>

```
ansible-playbook -i inventory/gds-test
plays/postgres/pg_install_initial_users.yml -e "master_server=demo-master.snc1
instance=pg_demo dba_password=DBAdemo911 app_password=APPdemo911"
```

Ansible-playbook options

-e	Set additional variables as key=value
-i	Inventory host path
-l	Further limit selected hosts
-v	verbose -vvv for more, -vvvv enable connection debug
- start-at-task	start the playbook at the task matching this name
--step	one-step-at-a-time, confirm each task before running

groupvar YAML for Provisioning



```
pg_demo: # GDS-xxxx
  type: postgresql
  dbnames:
    - pg_demo
  schemas:
    pg_demo:
      - pg_demo_schema
  write_origin: snc1
  # Priority is a numeric value between 0 and 100, lower priority rules get
  # sorted first. No priority == priority 100.
  firewall_priority: 100
  unix_user: mani
  master_vip: 10.x.1.1
  slave_vips:
    - 10.x.2.1
  replication_ips:
    - 10.x.x.x # demo-master.snc1
    - 10.x.x.x # demo-slave.snc1
  firewall_permitted_src_cidrs:
    - 10.x.x.x/32   # dev1.snc1
  dba_account_name: pg_demo_dba
  app_account_name: pg_demo_app
  dba_src_cidrs:
    - 10.x.x.x/32   # dev1.snc1
  ports:
    pgbouncer_txn: 90007
    pgbouncer_session: 90008
    postgresql_raw: 90009
  extra_variables:
```

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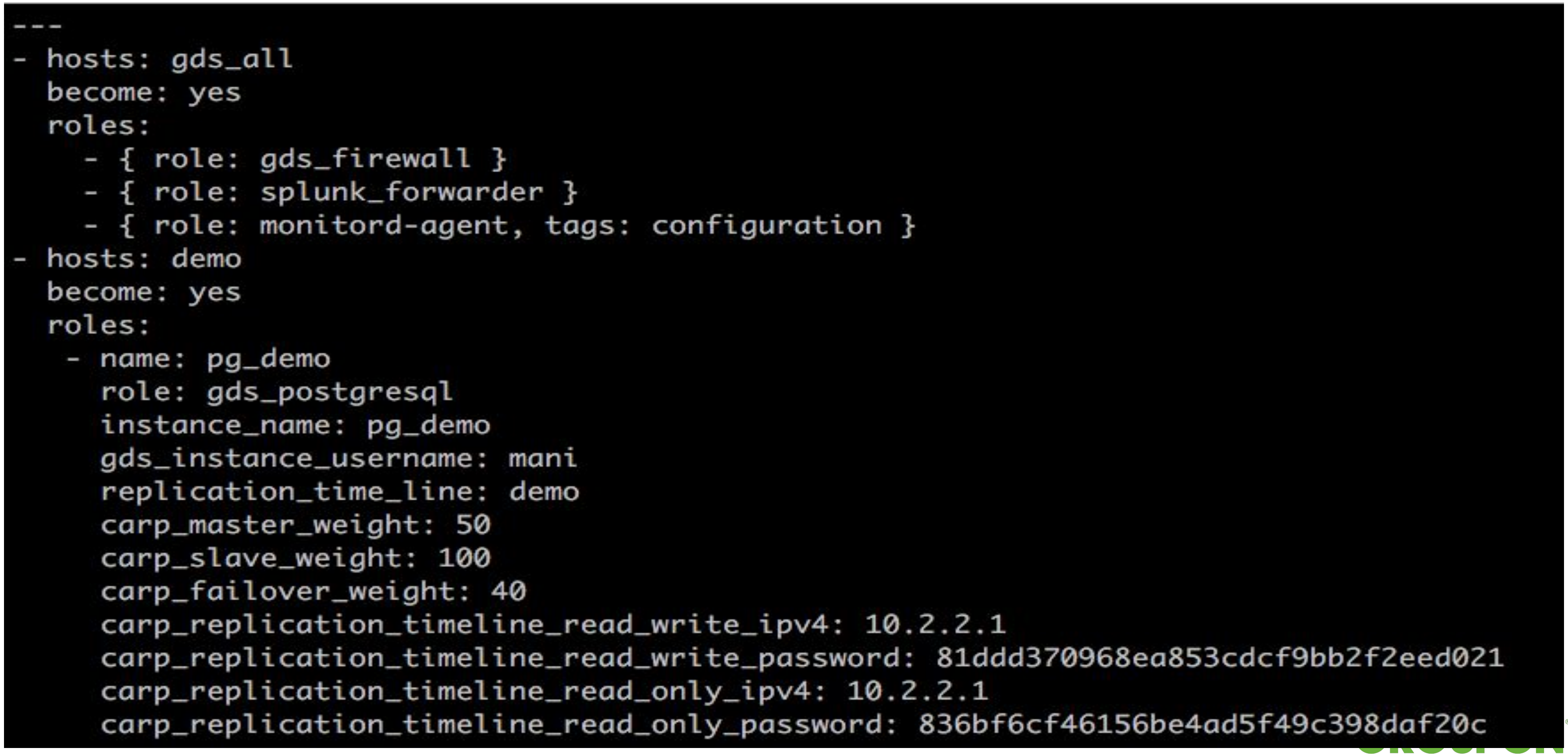
plays/pg_instances.yml



```
---
- hosts: gds_all
  become: yes
  roles:
    - { role: gds_firewall }
    - { role: splunk_forwarder }
    - { role: monitord-agent, tags: configuration }
- hosts: demo
  become: yes
  roles:
   - name: pg_demo
     role: gds_postgresql
     instance_name: pg_demo
     gds_instance_username: mani
     replication_time_line: demo
     carp_master_weight: 50
     carp_slave_weight: 100
     carp_failover_weight: 40
     carp_replication_timeline_read_write_ipv4: 10.2.2.1
     carp_replication_timeline_read_write_password: 81ddd370968ea853cdcf9bb2f2eed021
     carp_replication_timeline_read_only_ipv4: 10.2.2.1
     carp_replication_timeline_read_only_password: 836bf6cf46156be4ad5f49c398daf20c
```

Replication Setup

```
ansible-playbook -i inventory/gds-test
plays/postgres/database-postgres-clone-slave.yml -e
"master_server=demo-master.snc1" -e "slave_server=demo-slave.snc1" -e
"instance=pg_demo"
```

<<< DEMO >>>

- Stop the slave service
- Wipes slave datadir
- Pg_basebackup to pull data
- Change ownership of data dir
- Set timeline on recovery.conf
- Start postgres service

Destroying DB instances - Part 1

```
ansible-playbook plays/postgres/pre-destroy-instance.yml -e
"node=demo-slave.snc1 instance=pg_demo"
ansible-playbook plays/postgres/pre-destroy-instance.yml -e
"node=demo-master.snc1 instance=pg_demo"
```

<<< DEMO >>>

It does

- Checks for connections
- Removes monitoring
- Stops the service

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Destroying DB instances (part 2)

```
ansible-playbook plays/postgres/destroy-instance.yml -e
"node=demo-slave.snc1 instance=pg_demo"
ansible-playbook plays/postgres/destroy-instance.yml -e
"node=demo-master.snc1 instance=pg_demo"
```

<<< DEMO >>>

It does

- Deletes instances
- Removes snapshots
- Removes ZFS filesystem

Failover PostgreSQL database

```
ansible-playbook -i inventory/gds-staging plays/postgres/postgres-failover.yml --extra-vars
"current_master=demo-master.snc1 current_slave=demo-slave.snc1 instance=pg_demo"
```

<<< DEMO >>>

- Checkpoint on master
- Don’t allow anymore connections
- Kill all sessions
- Shutdown the master
- Checkpoint on slave
- Extract last checkpoint location
- Promote the slave
- etc....

ZFS Snapshots

It is a life saver in multiple scenarios like

- When User drops tables/wipes data mistakenly
- Rollback faster on any planned data changes
- Repeated load test on same data set is possibles
- Shipping ZFS filesystem to different box/data center for Research/Recovery purposes

<< Demo >>

Recover DB using Snapshots

```
-- Create objects

create table demo_table (c1 int, c2 varchar(10));

insert into demo_table values (generate_series(1,1000),'Demo');

select * from demo_table limit 5;
```

Recover DB using Snapshots cont.

```
-- Take snapshots

zfs snapshot -r tank/var/groupon/postgresql/data94/demo-pg_demo@pgconf19

-- changes to the db

drop table demo_table;

select * from demo_table limit 5;

-- Need to rollback & Check if you have needed snapshots

zfs list -t snapshot | grep pgconf19

zfs list -t snapshot | grep pgconf19 | awk '{print $1}' | xargs -n1 echo zfs rollback -r
```

Recover DB using Snapshots cont.

-- If all snapshots are available then stop the service

```
sv stat /var/groupon/service/postgresql-demo-pg_demo/

sv stop /var/groupon/service/postgresql-demo-pg_demo/

sv stat /var/groupon/service/gds_sandbox_demo-mysql/
```

-- Rollback to the right snapshots

```
zfs list -t snapshot | grep pgconf19 | awk '{print $1}' | xargs -n1 echo zfs rollback -r

sv up /var/groupon/service/postgresql-demo-pg_demo/

show databases;
```

Yaml file to schedule backup

```
sandbox-ro-vip.snc1-J1:
  host: sandbox-ro-vip.snc1
  instance_name:
  - sandbox_demo
  pool: us
  retention: 31d-1m-2y
  target: mysql
  template: daas_mysql_v2
  zfs_fs: snc1.prod.sandbox
```

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Scheduling backups

Run the key generation play:

```
ansible-playbook -i inventory/percona-demo plays/test-gen-ssh-keys.yml
```

Run the key installation play:

```
ansible-playbook -i inventory/percona-demo plays/test-install-keys.yml
```

Installing Backup Jobs:

```
ansible-playbook -i inventory/percona-demo plays/test-install-jobs.yml
```

Monitoring

- Ansible play creates instance and also pushes monitoring scripts to the hosts.
- Check-Mk agent executes to collect data for monitoring alerts
- More details http://mathias-kettner.com/check_mk.html

Future potential development

- Backfill and bulk DML using ansible
- Operations using CMDB
- Self service on DB instance provisioning and whitelisting app servers
- Schema change using ansible

Thank you

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