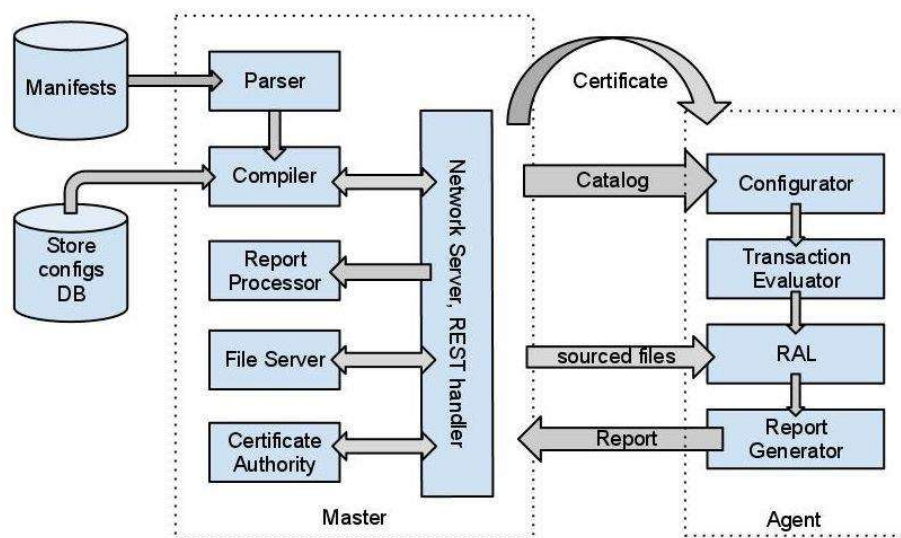


Experiment No:**Aim :** To provision a LAMP/MEAN Stack using Puppet Manifest.**Theory :**

LAMP stands for Linux, Apache, MySQL, and PHP. Together, they provide a proven set of software for delivering high-performance web applications. LAMP has a classic layered architecture, with Linux at the lowest level. The next layer is Apache and MySQL, followed by PHP. Although PHP is nominally at the top or presentation layer, the PHP component sits inside Apache.

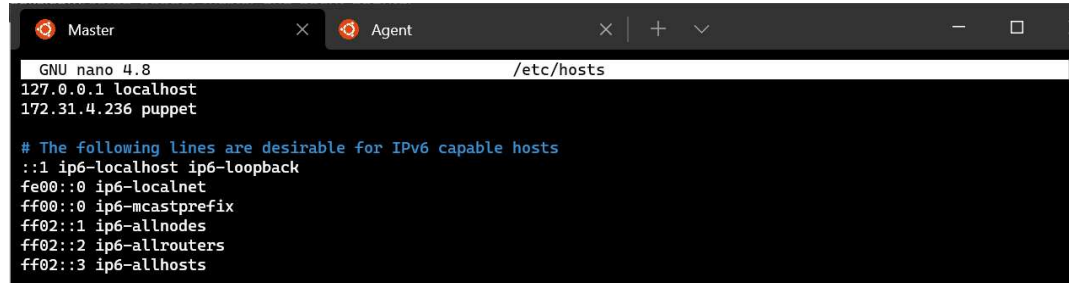


In Puppet, all the programs which are written using Ruby programming language and saved with an extension of .pp are called manifests. In general terms, all Puppet programs which are built with an intension of creating or managing any target host machine is called a manifest. All the programs written in Puppet follow Puppet coding style.

In Puppet, a module can be defined as a collection of resources, classes, files, definition, and templates. Puppet supports easy re-distribution of modules, which is very helpful in modularity of code as one can write a specified generic module and can use it multiple times with very few simple code changes. For example, this will enable default site configuration under /etc/puppet, with modules shipped by Puppet proper in /etc/share/puppet.

Procedure :**1) Add correct hostnames and IP addresses of puppet master in /etc/hosts file.**

```
sudo nano /etc/hosts
```



```

GNU nano 4.8 /etc/hosts
127.0.0.1 localhost
172.31.4.236 puppet

# The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
ff02::3 ip6-allhosts

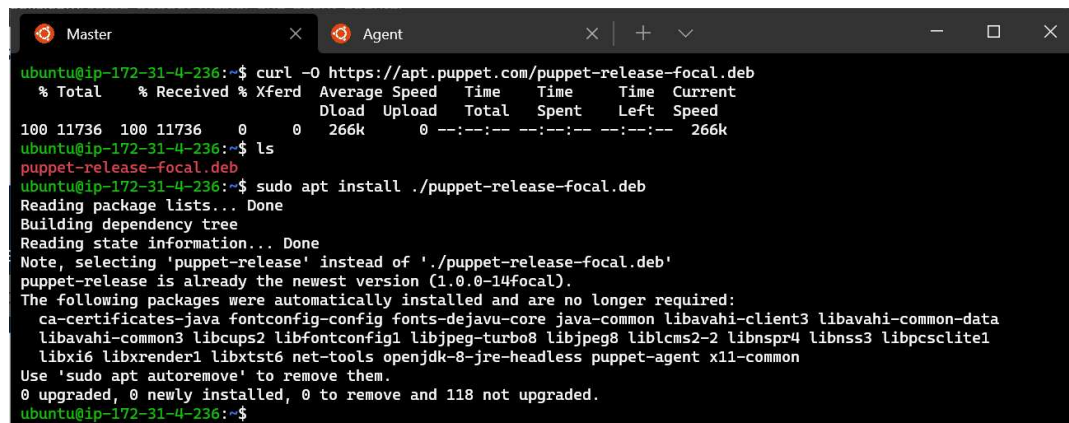
```

2) Download PuppetLabs repository for Ubuntu and install Puppet master on the server.

```

sudo apt update
curl -O https://apt.puppet.com/puppet-release-focal.deb
sudo apt install ./puppet-release-focal.deb

```



```

ubuntu@ip-172-31-4-236:~$ curl -O https://apt.puppet.com/puppet-release-focal.deb
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left   Speed

100 11736 100 11736    0     0  266k      0 --:--:-- --:--:-- --:--:-- 266k
ubuntu@ip-172-31-4-236:~$ ls
puppet-release-focal.deb
ubuntu@ip-172-31-4-236:~$ sudo apt install ./puppet-release-focal.deb
Reading package lists... Done
Building dependency tree
Reading state information... Done
Note, selecting 'puppet-release' instead of './puppet-release-focal.deb'
puppet-release is already the newest version (1.0.0-14focal).
The following packages were automatically installed and are no longer required:
  ca-certificates-java fontconfig-config fonts-dejavu-core java-common libavahi-client3 libavahi-common-data
  libavahi-common3 libcups2 libfontconfig1 libjpeg-turbo8 libjpeg8 liblcms2-2 libnspr4 libnss3 libpcsclite1
  libxi6 libxrender1 libxtst6 net-tools openjdk-8-jre-headless puppet-agent x11-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 118 not upgraded.
ubuntu@ip-172-31-4-236:~$

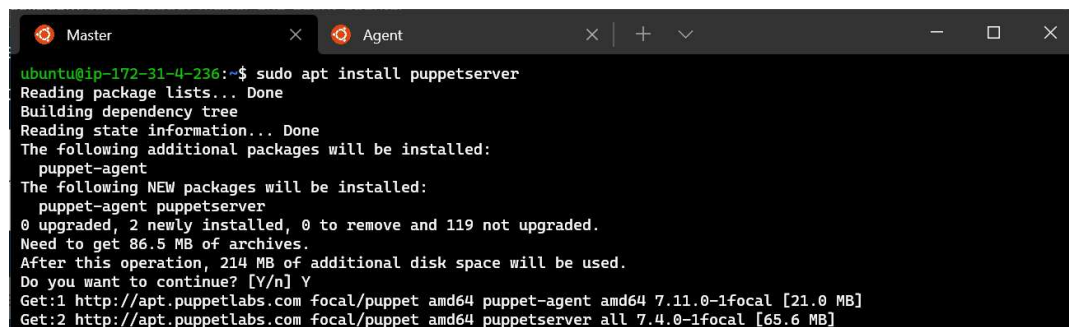
```

3) Update apt index and install puppet master

```

sudo apt update
sudo apt install puppetserver

```



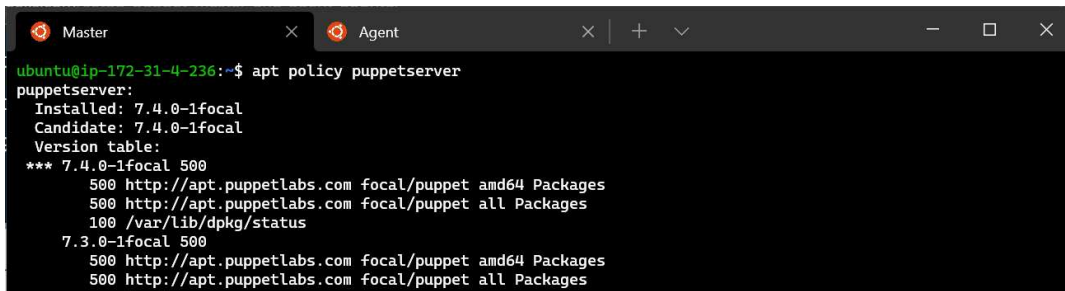
```

ubuntu@ip-172-31-4-236:~$ sudo apt install puppetserver
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  puppet-agent
The following NEW packages will be installed:
  puppet-agent puppetserver
0 upgraded, 2 newly installed, 0 to remove and 119 not upgraded.
Need to get 86.5 MB of archives.
After this operation, 214 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://apt.puppetlabs.com focal/puppet amd64 puppet-agent amd64 7.11.0-1focal [21.0 MB]
Get:2 http://apt.puppetlabs.com focal/puppet amd64 puppetserver all 7.4.0-1focal [65.6 MB]

```

4) Confirm the installed version of Puppet:

```
apt policy puppetserver
```

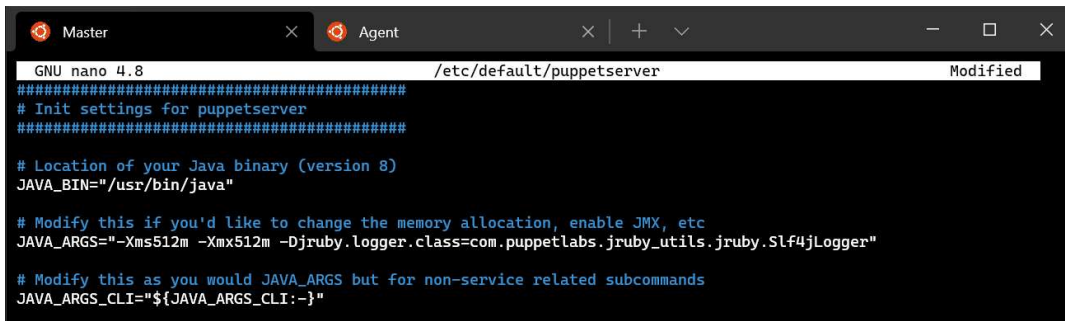


```
Master Agent
ubuntu@ip-172-31-4-236:~$ apt policy puppetserver
puppetserver:
  Installed: 7.4.0-1focal
  Candidate: 7.4.0-1focal
  Version table:
 *** 7.4.0-1focal 500
      500 http://apt.puppetlabs.com focal/puppet amd64 Packages
      500 http://apt.puppetlabs.com focal/puppet all Packages
      100 /var/lib/dpkg/status
 7.3.0-1focal 500
      500 http://apt.puppetlabs.com focal/puppet amd64 Packages
      500 http://apt.puppetlabs.com focal/puppet all Packages
```

5) Change default memory usage as per your machine type. Puppet by default need 2gb ram. To make puppet master work properly, you have to allocate half memory of your machine.

```
sudo nano /etc/default/puppetserver
```

```
change to this in file -> JAVA_ARGS="-Xms512m -Xmx512m"
```



```
Master Agent
GNU nano 4.8 /etc/default/puppetserver Modified
#####
# Init settings for puppetserver
#####

# Location of your Java binary (version 8)
JAVA_BIN="/usr/bin/java"

# Modify this if you'd like to change the memory allocation, enable JMX, etc
JAVA_ARGS="-Xms512m -Xmx512m -Djruby.logger.class=com.puppetlabs.jruby_utils.jruby.Slf4jLogger"

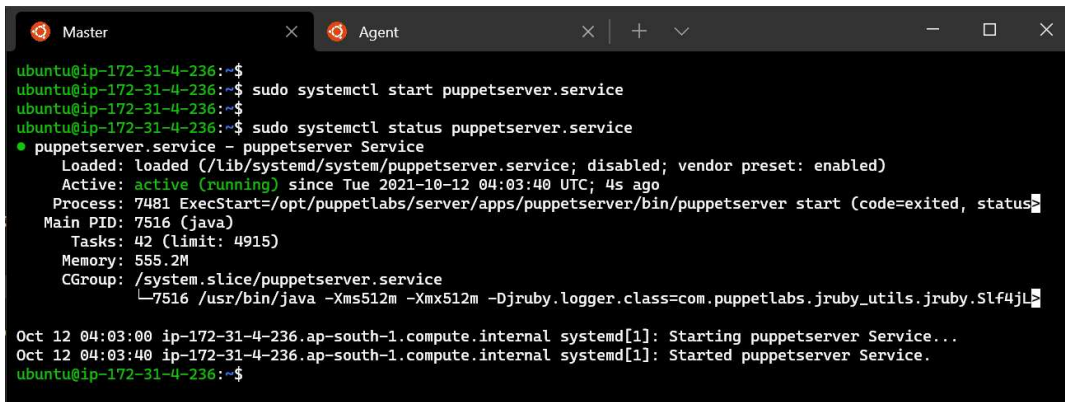
# Modify this as you would JAVA_ARGS but for non-service related subcommands
JAVA_ARGS_CLI="${JAVA_ARGS_CLI:-}"
```

6) Start and enable puppetserver service

```
sudo systemctl start puppetserver.service
```

```
sudo systemctl enable puppetserver.service
```

```
systemctl status puppetserver.service
```



```
Master Agent
ubuntu@ip-172-31-4-236:~$ sudo systemctl start puppetserver.service
ubuntu@ip-172-31-4-236:~$ sudo systemctl status puppetserver.service
● puppetserver.service - puppetserver Service
   Loaded: loaded (/lib/systemd/system/puppetserver.service; disabled; vendor preset: enabled)
   Active: active (running) since Tue 2021-10-12 04:03:40 UTC; 4s ago
     Process: 7481 ExecStart=/opt/puppetlabs/server/apps/puppetserver/bin/puppetserver start (code=exited, status=0)
    Main PID: 7516 (java)
      Tasks: 42 (limit: 4915)
     Memory: 555.2M
    CGroup: /system.slice/puppetserver.service
            └─7516 /usr/bin/java -Xms512m -Xmx512m -Djruby.logger.class=com.puppetlabs.jruby_utils.jruby.Slf4jLogger

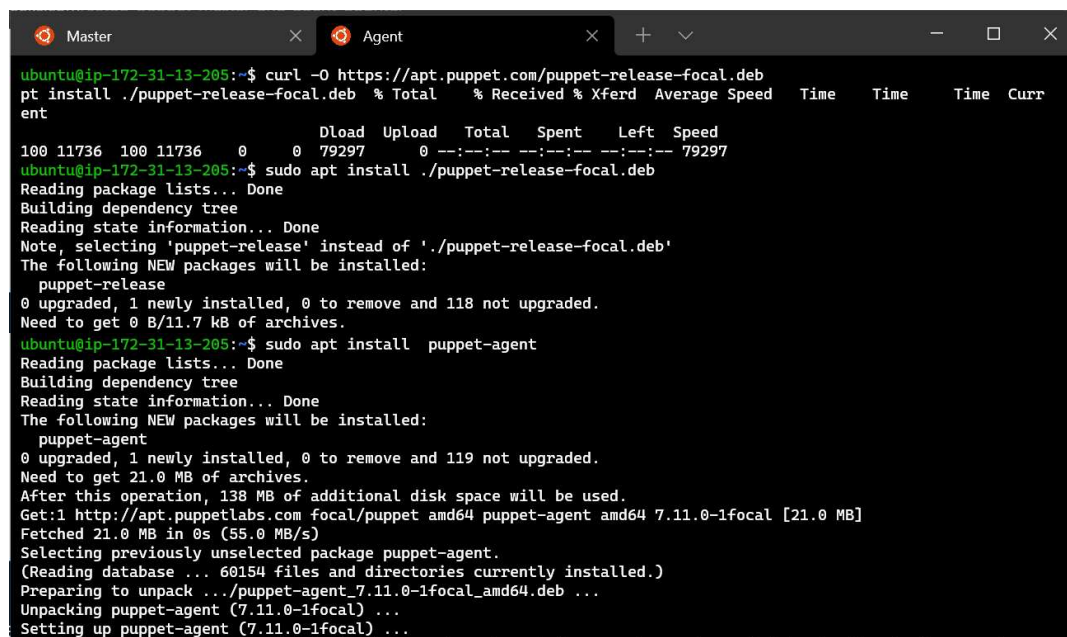
Oct 12 04:03:00 ip-172-31-4-236.ap-south-1.compute.internal systemd[1]: Starting puppetserver Service...
Oct 12 04:03:40 ip-172-31-4-236.ap-south-1.compute.internal systemd[1]: Started puppetserver Service.
ubuntu@ip-172-31-4-236:~$
```

- 7) If you have a firewall on your Ubuntu system, you need to open port 8140 which is used by the Puppet master service. Run the following commands to allow port on the firewall:

```
sudo ufw allow 8140/tcp
```

- 8) On the nodes to be automated with Puppet install puppet Agent:

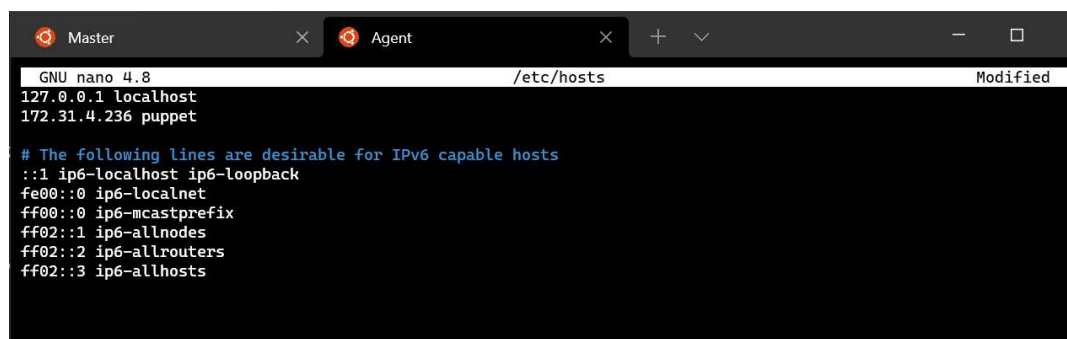
```
sudo apt update
curl -O https://apt.puppet.com/puppet-release-focal.deb
sudo apt install ./puppet-release-focal.deb
sudo apt update
sudo apt install puppet-agent
```



```
Master Agent
ubuntu@ip-172-31-13-205:~$ curl -O https://apt.puppet.com/puppet-release-focal.deb
pt install ./puppet-release-focal.deb % Total % Received % Xferd Average Speed Time Time Time Curr
ent
Dload Upload Total Spent Left Speed
100 11736 100 11736 0 0 79297 0 --:--:-- --:--:-- --:--:-- 79297
ubuntu@ip-172-31-13-205:~$ sudo apt install ./puppet-release-focal.deb
Reading package lists... Done
Building dependency tree
Reading state information... Done
Note, selecting 'puppet-release' instead of './puppet-release-focal.deb'
The following NEW packages will be installed:
  puppet-release
0 upgraded, 1 newly installed, 0 to remove and 118 not upgraded.
Need to get 0 B/11.7 kB of archives.
ubuntu@ip-172-31-13-205:~$ sudo apt install puppet-agent
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  puppet-agent
0 upgraded, 1 newly installed, 0 to remove and 119 not upgraded.
Need to get 21.0 MB of archives.
After this operation, 138 MB of additional disk space will be used.
Get:1 http://apt.puppetlabs.com focal/puppet amd64 puppet-agent amd64 7.11.0-1focal [21.0 MB]
Fetched 21.0 MB in 0s (55.0 MB/s)
Selecting previously unselected package puppet-agent.
(Reading database ... 60154 files and directories currently installed.)
Preparing to unpack .../puppet-agent_7.11.0-1focal_amd64.deb ...
Unpacking puppet-agent (7.11.0-1focal) ...
Setting up puppet-agent (7.11.0-1focal) ...
```

- 9) Open the /etc/hosts file and set name for the server

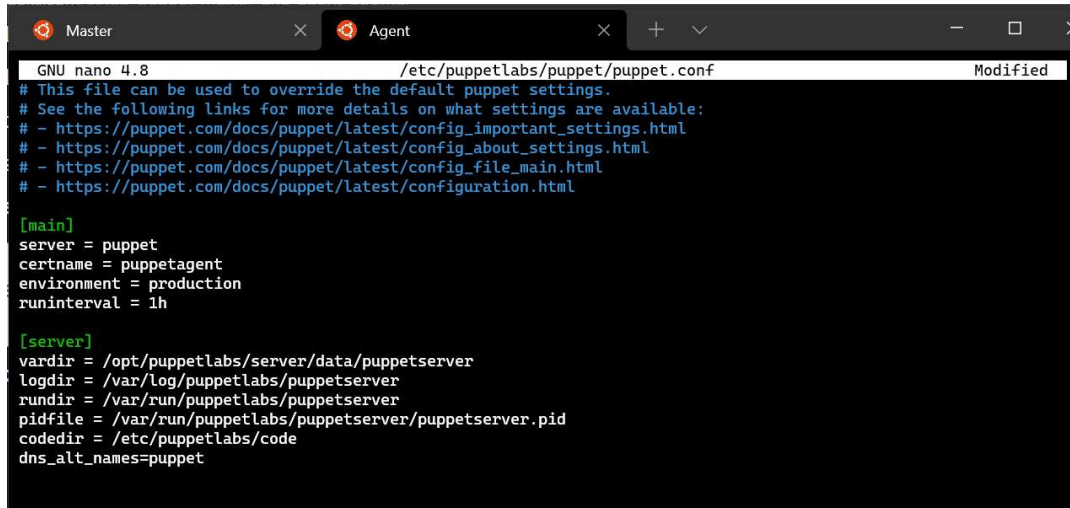
```
127.0.0.0 localhost
[master_ip] puppet
```



```
Master Agent
GNU nano 4.8 /etc/hosts Modified
127.0.0.1 localhost
172.31.4.236 puppet

# The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
ff02::3 ip6-allhosts
```

10) Edit Puppet Agent configuration file and add Master server DNS alternative names and also configure main section.



```

GNU nano 4.8 /etc/puppetlabs/puppet/puppet.conf Modified
# This file can be used to override the default puppet settings.
# See the following links for more details on what settings are available:
# - https://puppet.com/docs/puppet/latest/config_important_settings.html
# - https://puppet.com/docs/puppet/latest/config_about_settings.html
# - https://puppet.com/docs/puppet/latest/config_file_main.html
# - https://puppet.com/docs/puppet/latest/configuration.html

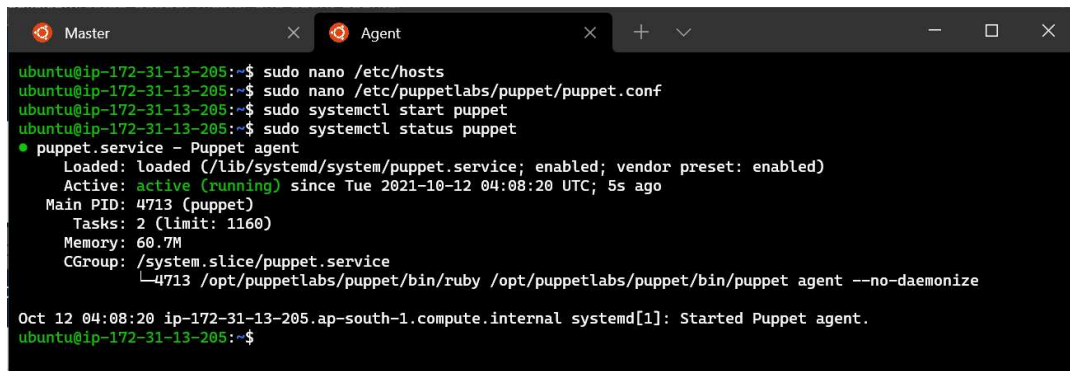
[main]
server = puppet
certname = puppetagent
environment = production
runinterval = 1h

[server]
vardir = /opt/puppetlabs/server/data/puppetserver
logdir = /var/log/puppetlabs/puppetserver
rundir = /var/run/puppetlabs/puppetserver
pidfile = /var/run/puppetlabs/puppetserver/puppetserver.pid
codedir = /etc/puppetlabs/code
dns_alt_names=puppet
  
```

11) Now start the Puppet service:

```

sudo systemctl start puppet
sudo systemctl enable puppet
sudo systemctl status puppet
  
```



```

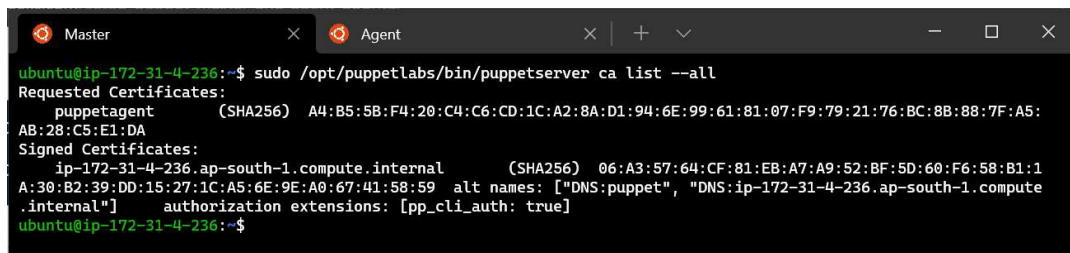
ubuntu@ip-172-31-13-205:~$ sudo nano /etc/hosts
ubuntu@ip-172-31-13-205:~$ sudo nano /etc/puppetlabs/puppet/puppet.conf
ubuntu@ip-172-31-13-205:~$ sudo systemctl start puppet
ubuntu@ip-172-31-13-205:~$ sudo systemctl status puppet
● puppet.service - Puppet agent
   Loaded: loaded (/lib/systemd/system/puppet.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2021-10-12 04:08:20 UTC; 5s ago
     Main PID: 4713 (puppet)
        Tasks: 2 (Limit: 1160)
      Memory: 60.7M
      CGroup: /system.slice/puppet.service
              └─4713 /opt/puppetlabs/puppet/bin/ruby /opt/puppetlabs/puppet/bin/puppet agent --no-daemonize

Oct 12 04:08:20 ip-172-31-13-205.ap-south-1.compute.internal systemd[1]: Started Puppet agent.
ubuntu@ip-172-31-13-205:~$
  
```

12) On the Puppet Master Node list all the available certificates:

```

sudo /opt/puppetlabs/bin/puppetserver ca list --all
  
```

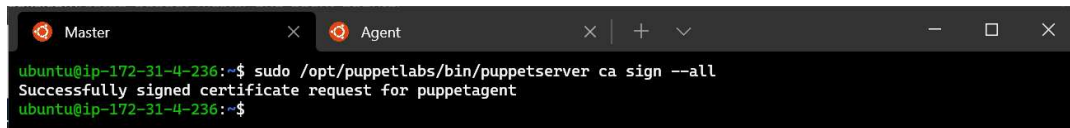


```

ubuntu@ip-172-31-4-236:~$ sudo /opt/puppetlabs/bin/puppetserver ca list --all
Requested Certificates:
  puppetagent (SHA256) A4:B5:5B:F4:20:C4:C6:CD:1C:A2:8A:D1:94:6E:99:61:81:07:F9:79:21:76:BC:8B:88:7F:A5:
AB:28:C5:E1:DA
Signed Certificates:
  ip-172-31-4-236.ap-south-1.compute.internal (SHA256) 06:A3:57:64:CF:81:EB:A7:A9:52:BF:5D:60:F6:58:B1:1
A:30:B2:39:DD:15:27:1C:A5:6E:9E:A0:67:41:58:59 alt names: ["DNS:puppet", "DNS:ip-172-31-4-236.ap-south-1.compute
.internal"] authorization extensions: [pp_cli_auth: true]
ubuntu@ip-172-31-4-236:~$
  
```


13) Sign any pending certificate:

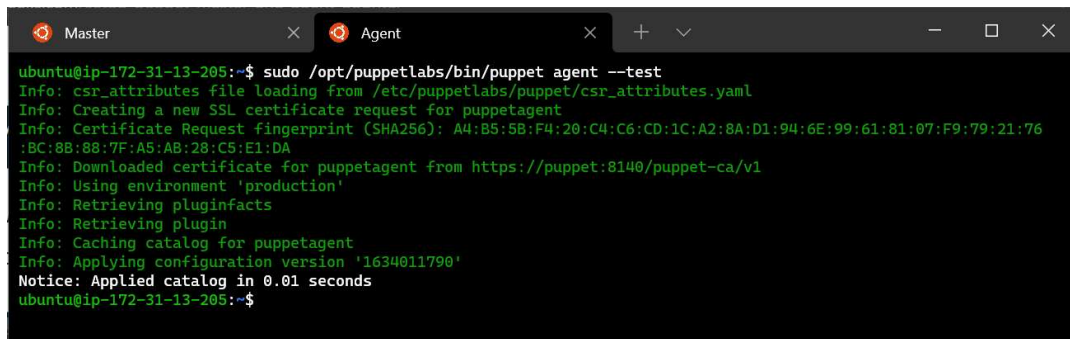
```
sudo /opt/puppetlabs/bin/puppetserver ca sign --all
```



```
Master
Agent
ubuntu@ip-172-31-4-236:~$ sudo /opt/puppetlabs/bin/puppetserver ca sign --all
Successfully signed certificate request for puppetagent
ubuntu@ip-172-31-4-236:~$
```

14) The Puppet Master should now be able to communicate with agent node and to control it. Confirm by running below command on the agent:

```
sudo /opt/puppetlabs/bin/puppet agent --test
```



```
Master
Agent
ubuntu@ip-172-31-13-205:~$ sudo /opt/puppetlabs/bin/puppet agent --test
Info: csr_attributes file loading from /etc/puppetlabs/puppet/csr_attributes.yaml
Info: Creating a new SSL certificate request for puppetagent
Info: Certificate Request fingerprint (SHA256): A4:B5:5B:F4:20:C4:C6:CD:1C:A2:8A:D1:94:6E:99:61:81:07:F9:79:21:76:BC:8B:88:7F:A5:AB:28:C5:E1:DA
Info: Downloaded certificate for puppetagent from https://puppet:8140/puppet-ca/v1
Info: Using environment 'production'
Info: Retrieving pluginfacts
Info: Retrieving plugin
Info: Caching catalog for puppetagent
Info: Applying configuration version '1634011790'
Notice: Applied catalog in 0.01 seconds
ubuntu@ip-172-31-13-205:~$
```

15) Now in Master create a module called nginx. In nginx module create a manifest called init.pp

```
sudo mkdir /etc/puppetlabs/code/environments/production/modules/nginx
sudo mkdir /etc/puppetlabs/code/environments/production/modules/nginx/manifests
sudo nano /etc/puppetlabs/code/environments/production/modules/nginx/manifests/init.pp
```

16) In init.pp, create a class called lamp and add following lines.

```
class lamp {
  # Execute 'apt-get update'
  exec {
    'apt-update':
      # exec resource named 'apt-update'
      command => '/usr/bin/apt-get update' # command this resource will run
  }
  # Install apache2 package
  package {
    'apache2':
      require => Exec['apt-update'], # require 'apt-update' before installing
      ensure => installed,
  }
  # Ensure apache2 service is running
  service {
    'apache2':
```

```

        ensure => running,
    }
    # Install mysql-server package
    package {
        'mysql-server':
            require => Exec['apt-update'],# require 'apt-update' before installing
            ensure => installed,
    }
    # Ensure mysql service is running
    service {
        'mysql':
            ensure => running,
    }
    # Install php7 package
    package {
        'php7.2-cli':
            require => Exec['apt-update'], # require 'apt-update' before installing
            ensure => installed,
    }
    # Ensure info.php file exists
    file {
        '/var/www/html/info.php':
            ensure => file,
            content => '<?php phpinfo(); ?>', # phpinfo code
            require => Package['apache2'], # require 'apache2' package
    }
}

```

```

GNU nano 4.8 /etc/puppetlabs/code/environments/production/modules/init.pp Modified
class lamp {
    # Execute 'apt-get update'
    exec {
        'apt-update':
            command => '/usr/bin/apt-get update' # exec resource named 'apt-update'
            # command this resource will run
    }

    # Install apache2 package
    package {
        'apache2':
            require => Exec['apt-update'], # require 'apt-update' before installing
            ensure => installed,
    }

    # Ensure apache2 service is running
    service {
        'apache2':
            ensure => running,
    }

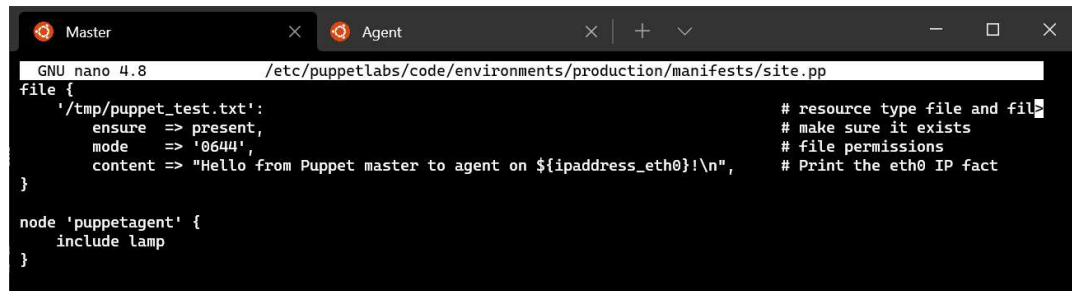
    # Install mysql-server package
    package {
        'mysql-server':
            require => Exec['apt-update'], # require 'apt-update' before installing
            ensure => installed,
    }

    # Ensure mysql service is running
    service {
        'mysql':
    }
}

```

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^G Cur Pos M-U Undo
 ^X Exit ^R Read File ^\ Replace ^U Paste Text ^T To Spell ^_ Go To Line M-E Redo

- 17) In Puppet master main manifest i.e., in site.pp, include lamp module for agent node.



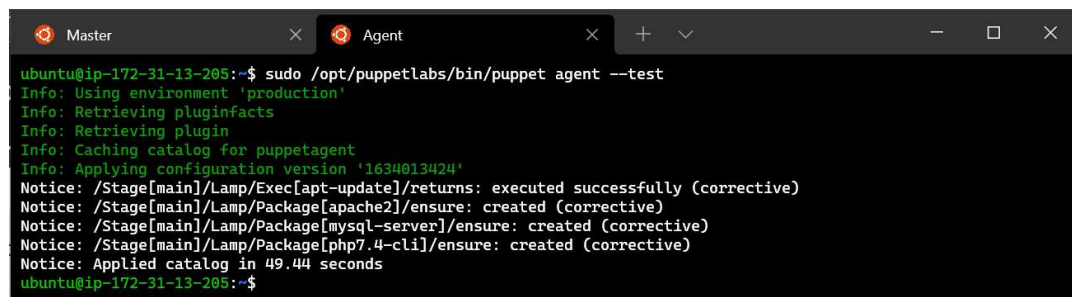
```

GNU nano 4.8 /etc/puppetlabs/code/environments/production/manifests/site.pp
file {
  '/tmp/puppet_test.txt':
    ensure => present,           # resource type file and file
    mode   => '0644',           # make sure it exists
    content => "Hello from Puppet master to agent on ${ipaddress_eth0}!\n", # file permissions
                                           # Print the eth0 IP fact
}

node 'puppetagent' {
  include lamp
}

```

- 18) In Puppet Agent, pull the new manifest from master

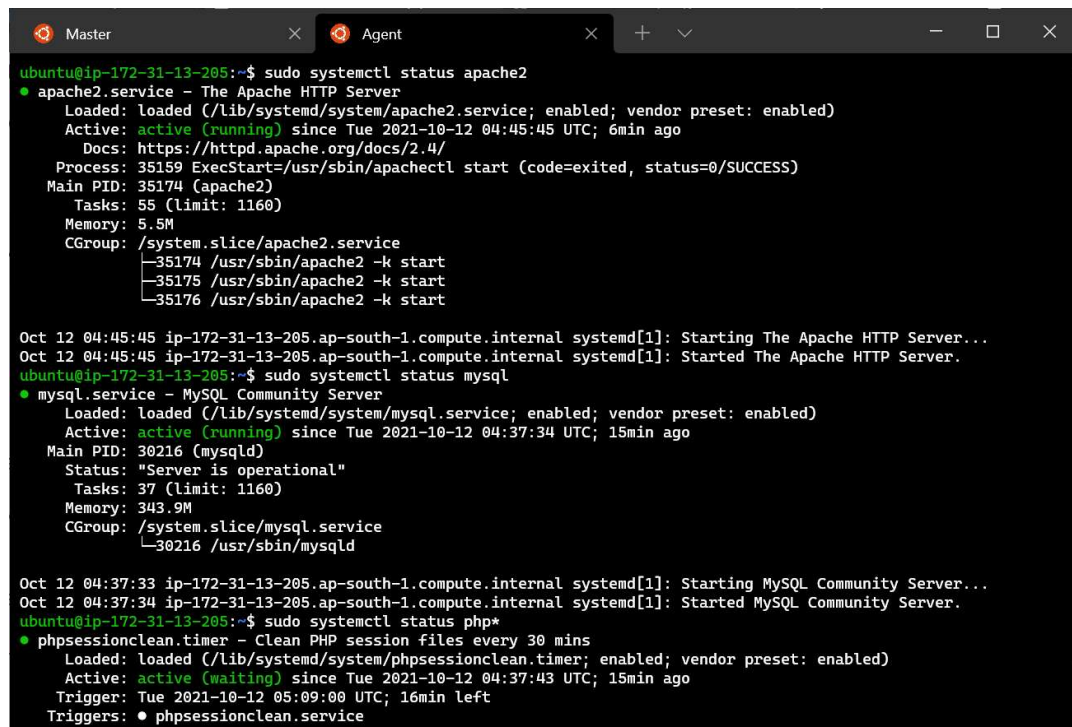


```

ubuntu@ip-172-31-13-205:~$ sudo /opt/puppetlabs/bin/puppet agent --test
Info: Using environment 'production'
Info: Retrieving pluginfacts
Info: Retrieving plugin
Info: Caching catalog for puppetagent
Info: Applying configuration version '1634013424'
Notice: /Stage[main]/Lamp/Exec[apt-update]/returns: executed successfully (corrective)
Notice: /Stage[main]/Lamp/Package[apache2]/ensure: created (corrective)
Notice: /Stage[main]/Lamp/Package[mysql-server]/ensure: created (corrective)
Notice: /Stage[main]/Lamp/Package[php7.4-cli]/ensure: created (corrective)
Notice: Applied catalog in 49.44 seconds
ubuntu@ip-172-31-13-205:~$

```

- 19) Check if the Apache, MySQL and PHP is running in Puppet Agent.



```

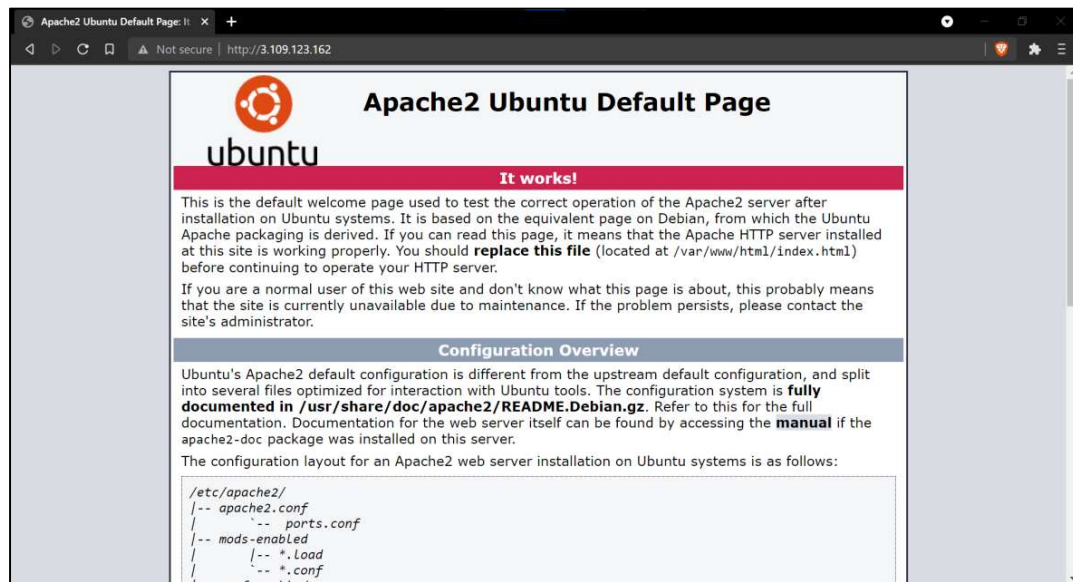
ubuntu@ip-172-31-13-205:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2021-10-12 04:45:45 UTC; 6min ago
     Docs: https://httpd.apache.org/docs/2.4/
   Process: 35159 ExecStart=/usr/sbin/apachectl start (code=exited, status=0/SUCCESS)
   Main PID: 35174 (apache2)
    Tasks: 55 (limit: 1160)
   Memory: 5.5M
   CGroup: /system.slice/apache2.service
           └─35174 /usr/sbin/apache2 -k start
             └─35175 /usr/sbin/apache2 -k start
               └─35176 /usr/sbin/apache2 -k start

Oct 12 04:45:45 ip-172-31-13-205.ap-south-1.compute.internal systemd[1]: Starting The Apache HTTP Server...
Oct 12 04:45:45 ip-172-31-13-205.ap-south-1.compute.internal systemd[1]: Started The Apache HTTP Server.
ubuntu@ip-172-31-13-205:~$ sudo systemctl status mysql
● mysql.service - MySQL Community Server
   Loaded: loaded (/lib/systemd/system/mysql.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2021-10-12 04:37:34 UTC; 15min ago
     Main PID: 30216 (mysqld)
    Status: "Server is operational"
     Tasks: 37 (limit: 1160)
   Memory: 343.9M
   CGroup: /system.slice/mysql.service
           └─30216 /usr/sbin/mysqld

Oct 12 04:37:33 ip-172-31-13-205.ap-south-1.compute.internal systemd[1]: Starting MySQL Community Server...
Oct 12 04:37:34 ip-172-31-13-205.ap-south-1.compute.internal systemd[1]: Started MySQL Community Server.
ubuntu@ip-172-31-13-205:~$ sudo systemctl status php*
● phpsessionclean.timer - Clean PHP session files every 30 mins
   Loaded: loaded (/lib/systemd/system/phpsessionclean.timer; enabled; vendor preset: enabled)
   Active: active (waiting) since Tue 2021-10-12 04:37:43 UTC; 15min ago
     Trigger: Tue 2021-10-12 05:09:00 UTC; 16min left
    Triggers: ● phpsessionclean.service

```


20) Now go to browser and go to `http://<ip_addr_of_agent>/`



Conclusion :

Puppet does more than automate system administration. It changes the human workflow, and enables developers and system administrators to work together. Programmers can write, test, and launch applications without waiting on Ops staff to deliver the resources needed. Thus, we have successfully provisioned a LAMP Stack using Puppet Manifest.