Session 1
Introduction, Installation and Configuration

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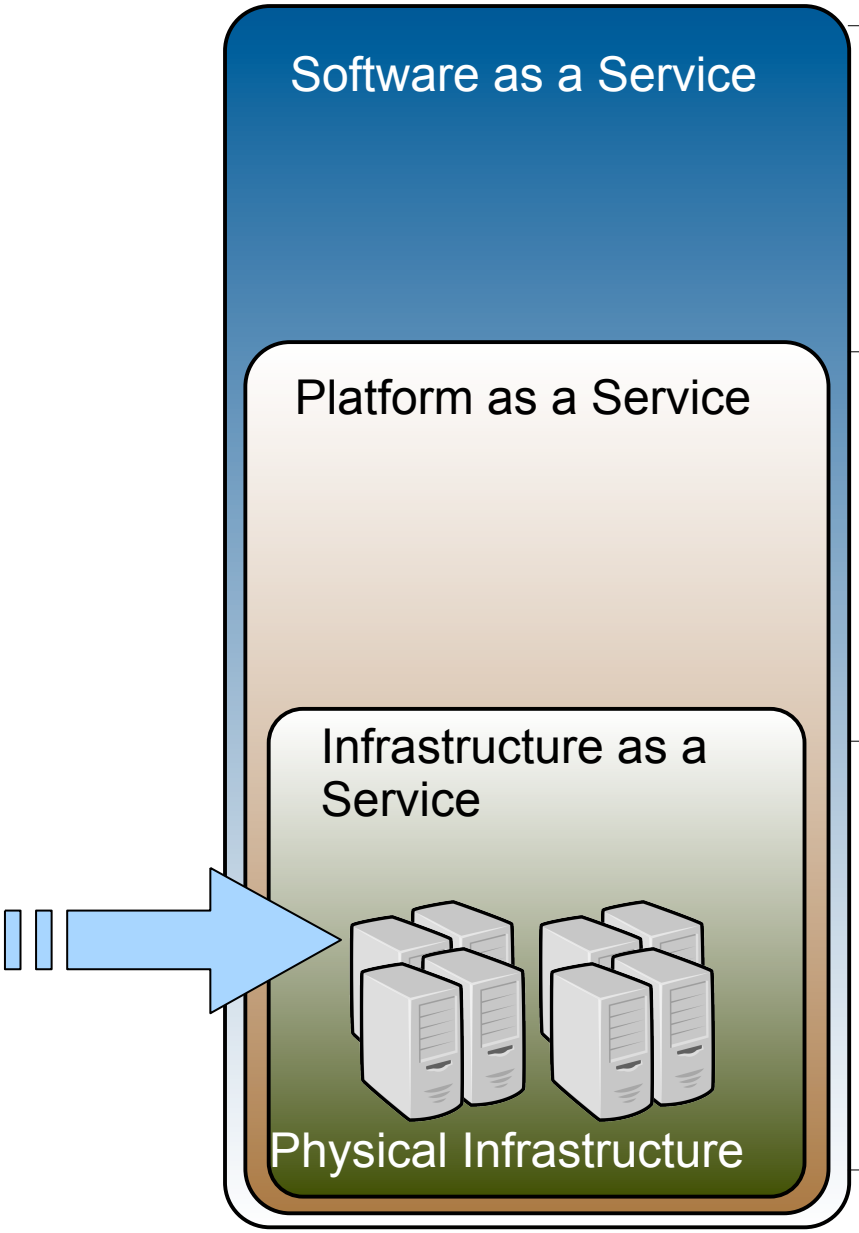
Cloud Computing in a Nutshell

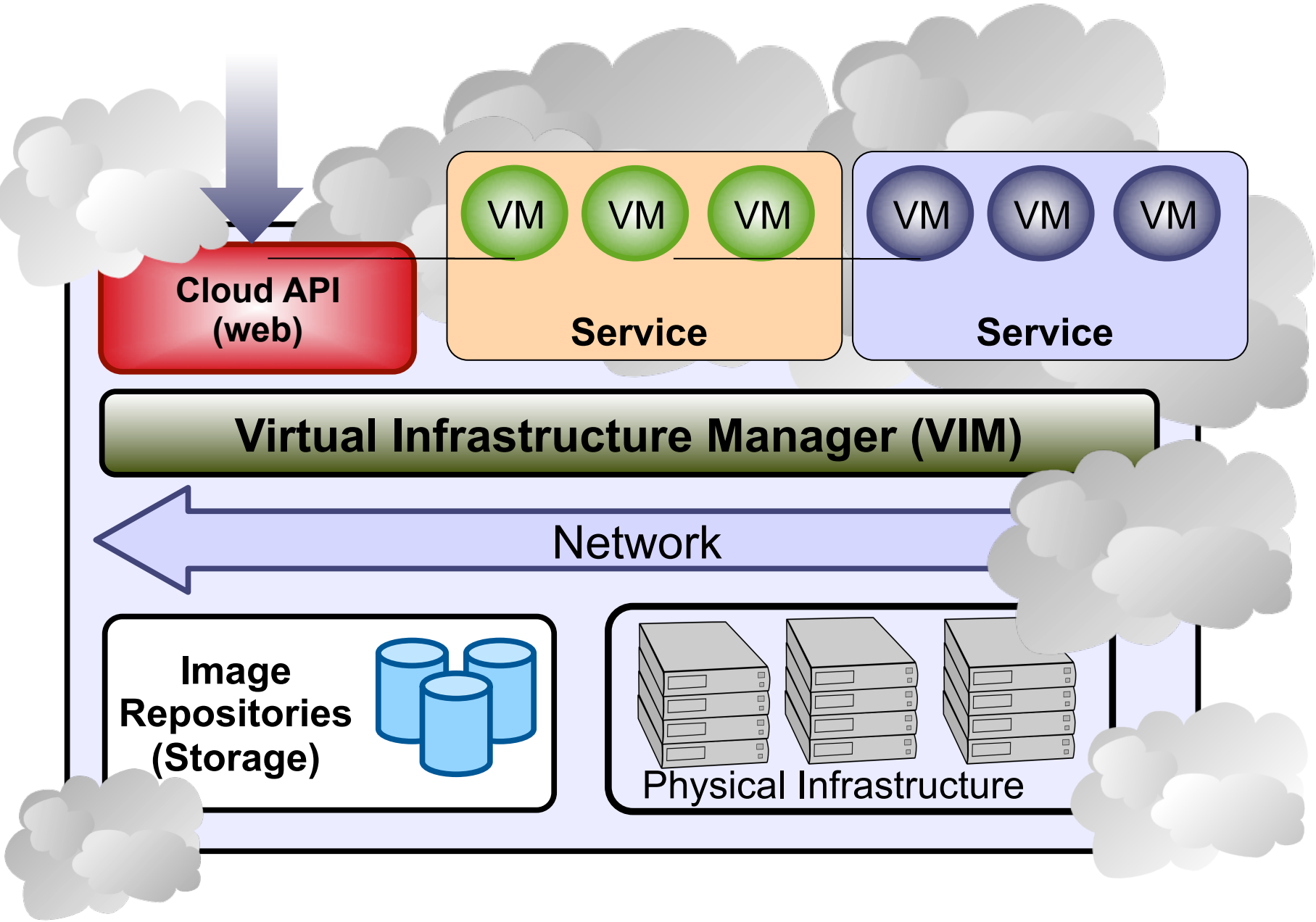


What	Who
On-demand access to any application	**End-user** (does not care about hw or sw)
Platform for building and delivering web applications	**Developer** (no managing of the underlying hw & swlayers)
Delivery of a *raw* computer infrastructure	**System Administrator** (complete management of the computer infrastructure)

The IaaS Clouds a Four Point Check List

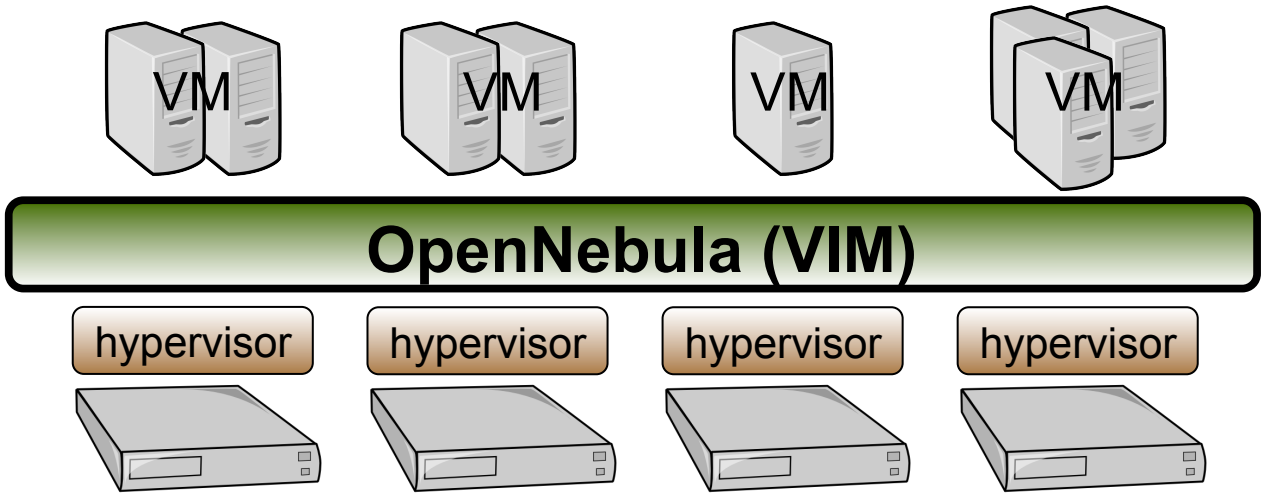
- Simple Interface
- Raw *Infrastructure* Resources
  - Total control of the resources
  - Capacity leased in the form of VMs
  - Complete Service-HW decoupling
- Pay-as-you-go
  - A single user can not get all the resources
- Elastic & "*infinite*" Capacity

The Anatomy of an IaaS Cloud



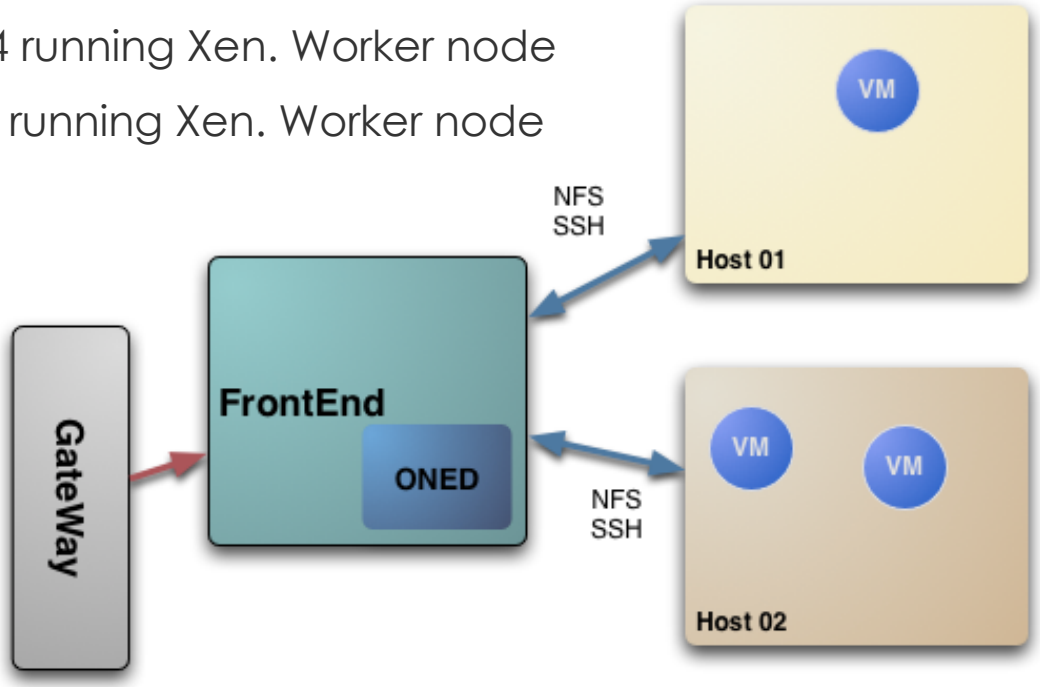
Why a Virtual Infrastructure Manager?

- VMs are great!!...but something more is needed
  - Where did/do I put my VM? (***scheduling & monitoring***)
  - How do I provision a new cluster node? (***clone & context***)
  - What MAC addresses are available? (***networking***)
- Provides a ***uniform view*** of the resource pool
- ***Life-cycle management*** and monitoring of VM
- The VIM ***integrates*** Image, Network and Virtualization



Participants Guide

- Each **couple** has a cluster number ($CN) assigned (51-69)
- Each **cluster** is composed by three nodes:
  - **192.168.$CN.2 - FrontEnd**: Ubuntu Server 10.04 OpenNebula will be installed here.
  - **192.168.$CN.3 – Host 01**: CentOS 5.4 running Xen. Worker node
  - **192.168.$CN.4 – Host 02**: CentOS 5.4 running Xen. Worker node



Getting Started

1. Setup Wifi

Encryption: WPA2

SSID: **CLAID**

Password: **cl41d-2010**

2. Get private key

$ wget http://one-td:jul2010@gw.c12g.com:81/one-td.pem

3. Connect to gateway

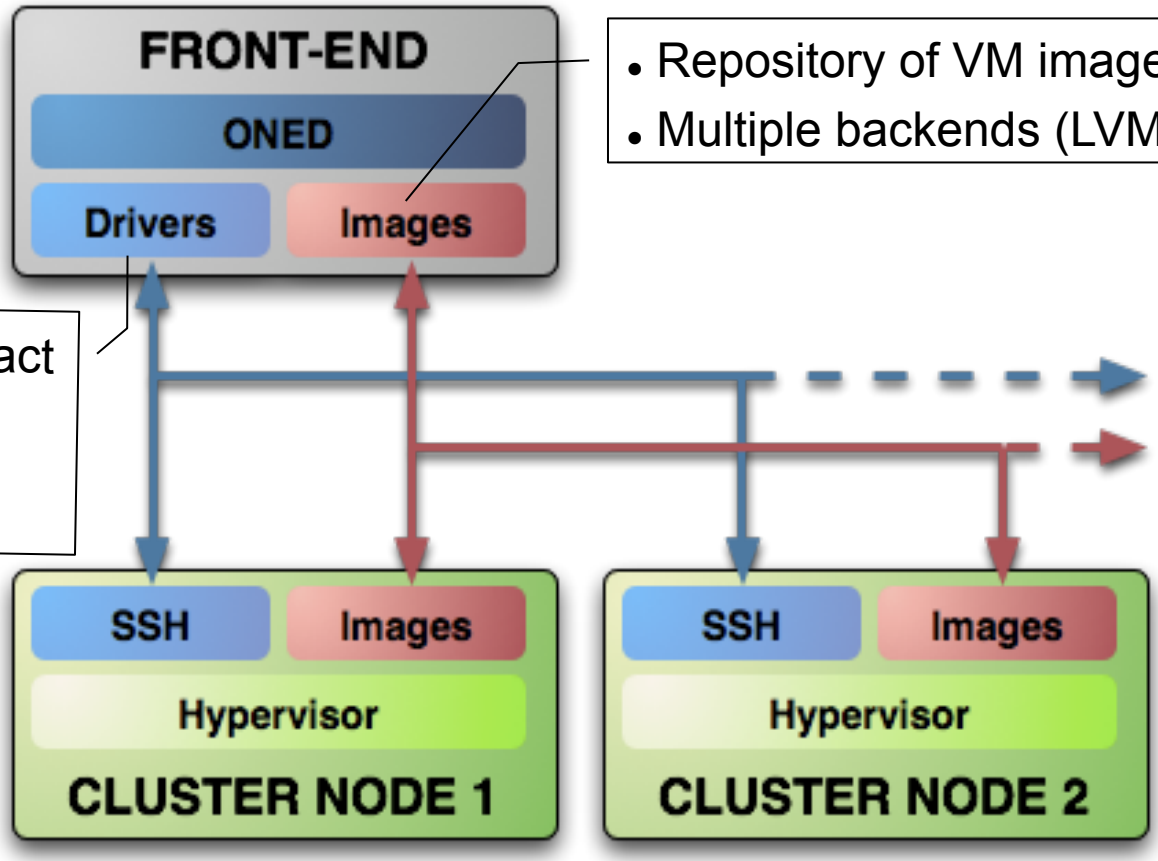
$ ssh -i one-td.pem oneadmin@gw.c12g.com

4. Connect to your cluster's frontend

$ ssh 192.168.$CN.2

Planning the Installation: System Overview

- Executes the OpenNebula Services
- *Usually* acts as a classical cluster front-end



- Repository of VM images
- Multiple backends (LVM, iSCSI..)

- Modular components to interact with the cluster services
- *Types:* storage, monitoring, virtualization and network

- Provides physical resources to VMs
- *Must have* a hypervisor installed

The same host can be can be a the front-end and a node

Planning the Installation: Working in the Front-End ...

- Choose your installation mode
  - system wide (/usr, /etc...)
  - *self-contained* (under $ONE_LOCATION)

- Install software dependencies.
  - Check the documentation for platform specific notes installation nodes

  http://opennebula.org/documentation:rel1.4:notes

- Dependencies already installed in the Front-End and the Nodes

Planning the Installation: Working in the Front-End ...

- The Users of the private cloud:
  - oneadmin: Account to run the daemons, manage the system and do all the low-level operations (e.g. start VMs, move images...).
  - Users: create and manage their own VMs and networks. *Need to be defined in OpenNebula*
- Installation layout
  - We will use the /srv/cloud directory to place the OpenNebula software
  - /srv/cloud/one will hold the OpenNebula installation

```
# tree /srv
/srv/
`-- cloud
    |-- images
    `-- one
        |-- SRC
```

The oneadmin account must be created system wide (i.e. front-end and all the nodes) you can use NIS, or a local account with the same ID's in all the hosts. Users do not need a UNIX account in the nodes, nor in the front-end.

Planning the Installation: Working in the Front-End ...

- Hands on...

```
# groupadd -g 9000 oneadmin

# mkdir /srv/cloud
# chmod g+ws oneadmin /srv/cloud
# mkdir /srv/cloud/images

# useradd -d /srv/cloud/one -g oneadmin-u 9000 -s /bin/bash -m oneadmin
```

Create the file-system hierarchy with the oneadmin account

```
$ id
Uid=9000(oneadmin) gid=9000(oneadmin) grupos=9000(oneadmin)

$ mkdir /srv/cloud/images
$ mkdir SRC

We will place the OpenNebula source code in SRC
```

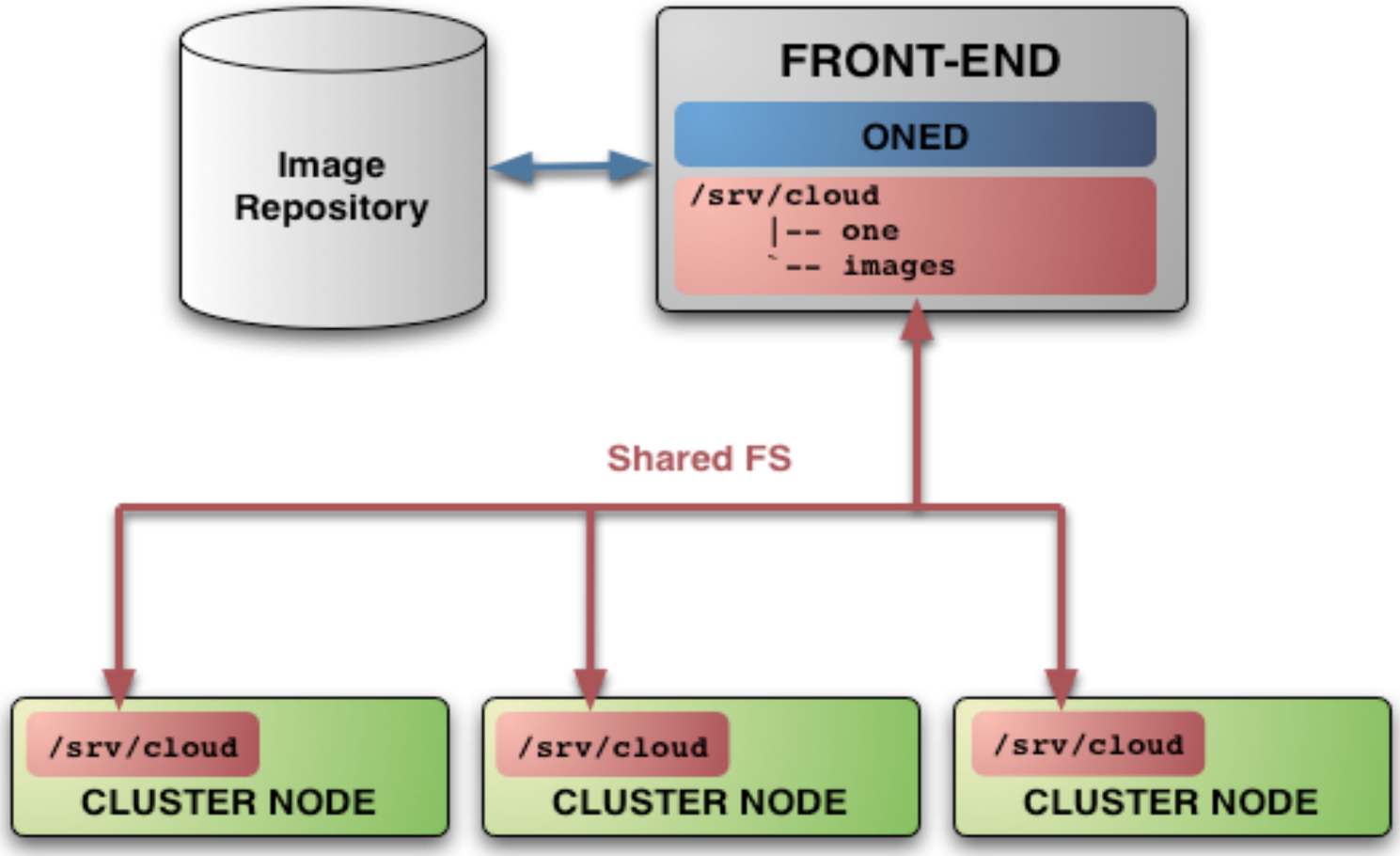
Planning the Installation: Working in the Front-End ...

- Preparing the storage for the private cloud...
  - ***Image Repository:*** Any storage medium for the VM images (usually a high performing SAN)
    - OpenNebula supports multiple back-ends (e.g. LVM for fast cloning)
    - The front-end must have access to the repository
  - ***VM Directory:*** The home of the VM in the cluster node
    - Stores checkpoints, description files and VM disks
    - Actual operations over the VM directory depends on the storage medium
    - Should be shared for live-migrations
    - You can go on without a shared FS and use the SSH back-end
    - Defaults to $ONE_LOCATION/var/$VM_ID

Dimensioning the Storage... Example: A 64 core cluster will typically run around 80VMs, each VM will require an average of 10GB of disk space. So you will need ~800GB for /srv/cloud/one, you will also want to store 10-15 master images so ~200GB for /srv/cloud/images. A 1TB /srv/cloud will be enough for this example setup.

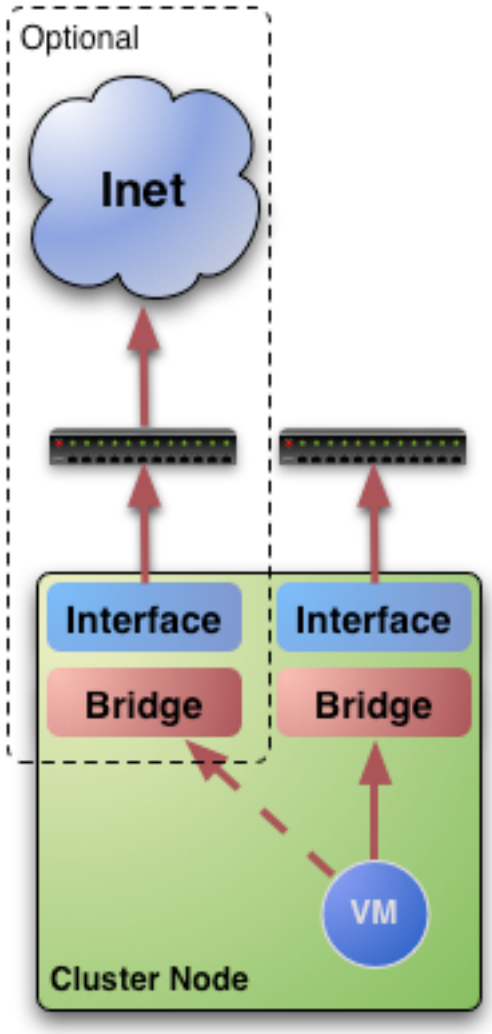
Planning the Installation: Working in the Front-End ...

- In this course we will use NFS to share the VM directories
- The Image Repository is /srv/cloud/images



Planning the Installation: Working in the Front-End ...

- Networking for the private cloud
  - OpenNebula management operations uses a ssh connections, it does not require a performing NIC
  - ***Image traffic,*** may require the movement of heavy files (VM images, checkpoints). Dedicated storage links may be a good idea
  - ***VM demands,*** consider the typical requirements of your VMs. Several NICs to support the VM traffic may be a good idea
  - OpenNebula relies on bridge networking for the VMs



Planning the Installation: Working in the Front-End ...

- Prepare NFS

```
Export /srv/cloud to your nodes
  - only need /srv/cloud/one/var
  - we also export $HOME of oneadmin for easy SSH key configuration
  - No really need to export /srv/cloud/images

# vi more /etc/exports
/srv/cloud 84.21.XX.YY(rw,async,no_subtree_check,no_root_squash)

# /etc/init.d/nfs-kernel-server stop
# /etc/init.d/nfs-kernel-server start
```

Planning the Installation: Working in the Nodes ...

- Install software dependencies
  - We need SSH daemon running in the cluster nodes (check it!)
  - Runtime dependencies:
    - Ruby 1.8.x
- Users
  - Create the oneadmin account (**use same UID and GID**)

```
# groupadd -g 9000 oneadmin
# useradd -d /srv/cloud/one -g oneadmin -u 9000 -s /bin/bash oneadmin
```

- Storage
  - Recreate the installation layout and configure NFS to mount the VM dirs

```
# mkdir /srv/cloud
# chmod g+ws cloud /srv/cloud

# vi /etc/fstab
x.y.z.w:/srv/cloud /srv/cloud nfs soft,intr,rsize=32768,wsize=32768,rw 0 0
```

Planning the Installation: SSH Configuration

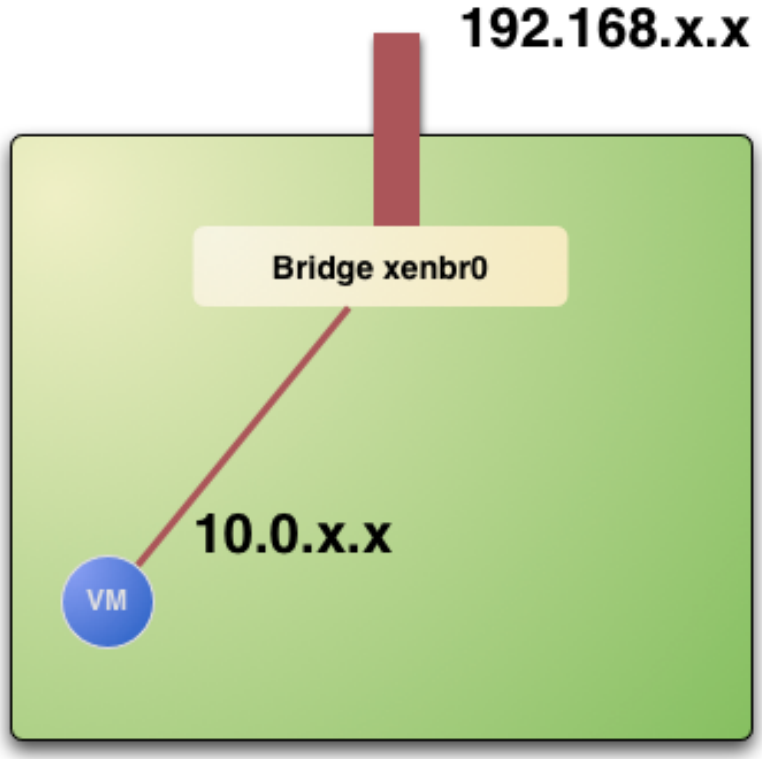
- Enable password-less SSH access to cluster nodes for the oneadmin account:

```
DO NOT PROTECT PRIVATE KEY WITH A PASSWORD
$ ssh-keygen
Generating public/private rsa key pair.
...
Enter passphrase (empty for no passphrase):
Enter same passphrase again:

$ cp ~/.ssh/id_rsa.pub ~/.ssh/authorized_keys

Tell ssh client not to ask to add hosts to known_hosts (optional)

$ cat /srv/cloud/one/.ssh/config
Host *
    StrictHostKeyChecking no

TEST!
$ ssh localhost
$ ssh 84.21.xx.yy
```

You may need to exchange keys with the nodes (not here as we share /srv/cloud/one the oneadmin home, and so the ~/.ssh directory

Planning the Installation: The Hypervisor ...

- Installing the Hypervisor
  - OpenNebula supports KVM, Xen and Vmware *(even simultaneously)*. This course applies to KVM and Xen
  - Refer to the hypervisor documentation for additional (and better information) on setting up them.
  - In this course, we will use XEN.



Planning the Installation: The Hypervisor ...

- The software bridge is essential for having different VMs in the same host with connectivity
- Let's check the bridge in the hosts

```
$ brctl show
Bridge name     bridge id               STP enabled     interfaces
virbr0          8000.000000000000       yes
xenbr0          8000.feffffffffff       no              peth0
                                                        vif0.0
```

Planning the Installation: The Hypervisor ...

- Test the installation for the oneadmin account

```
$ sudo xm list
Name      ID Mem(MiB) VCPUs State   Time(s)
Domain-0  0      256     1 r-----      8.2
```

- This ensures that oneadmin is capable of running VMs

Planning the Installation: Checklist

Software Requirements	
ACTION	**DONE/COMMENTS**
Installation type: self-contained, system-wide	self-contained
Installation directory	/srv/cloud/one
OpenNebula software downloaded to /srv/cloud/one/SRC	
sqlite, g++, scons, ruby and software requirements installed	
User Accounts	
ACTION	**DONE/COMMENTS**
oneadmin account and cloud group ready in the nodes and front-end	
Storage Checklist	
ACTION	**DONE/COMMENTS**
/srv/cloud structure created in the front-end	
/srv/cloud exported and accessible from the cluster nodes	
mount point of /srv/cloud in the nodes if different	VMDIR=<mount_point>/var/
Cluster nodes Checklist	
ACTION	**DONE/COMMENTS**
hostnames of cluster nodes	
ruby, sshd installed in the nodes	
oneadmin can ssh the nodes paswordless	