

Loadays 2013
Brussels, Belgium, April 8th, 2013

OpenNebula Fundamentals

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OpenNebula Tutorial

Tomorrow at 09.30 Room 3

Bring VirtualBox or KVM or VMware if possible!!

What is OpenNebula?

Overview of the Project

- Started in 2008
- Core dedicated team of 7 engineers
- Contributions of code and documentation patches by users: RIM, Akamai, Logica, FermiLab, SARA, Terradue... (approx. 100 listed at <http://www.opennebula.org/about:contributors>)
- A lot of users (<http://opennebula.org/users:users>)
- 500 validated users at [dev.opennebula](http://dev.opennebula.org)
- Sunstone GUI being translated into 17 languages by the community

What is OpenNebula?

Public Cloud

Simple Web Interface
Infrastructure Resources
Elastic & “infinite”

Private Cloud

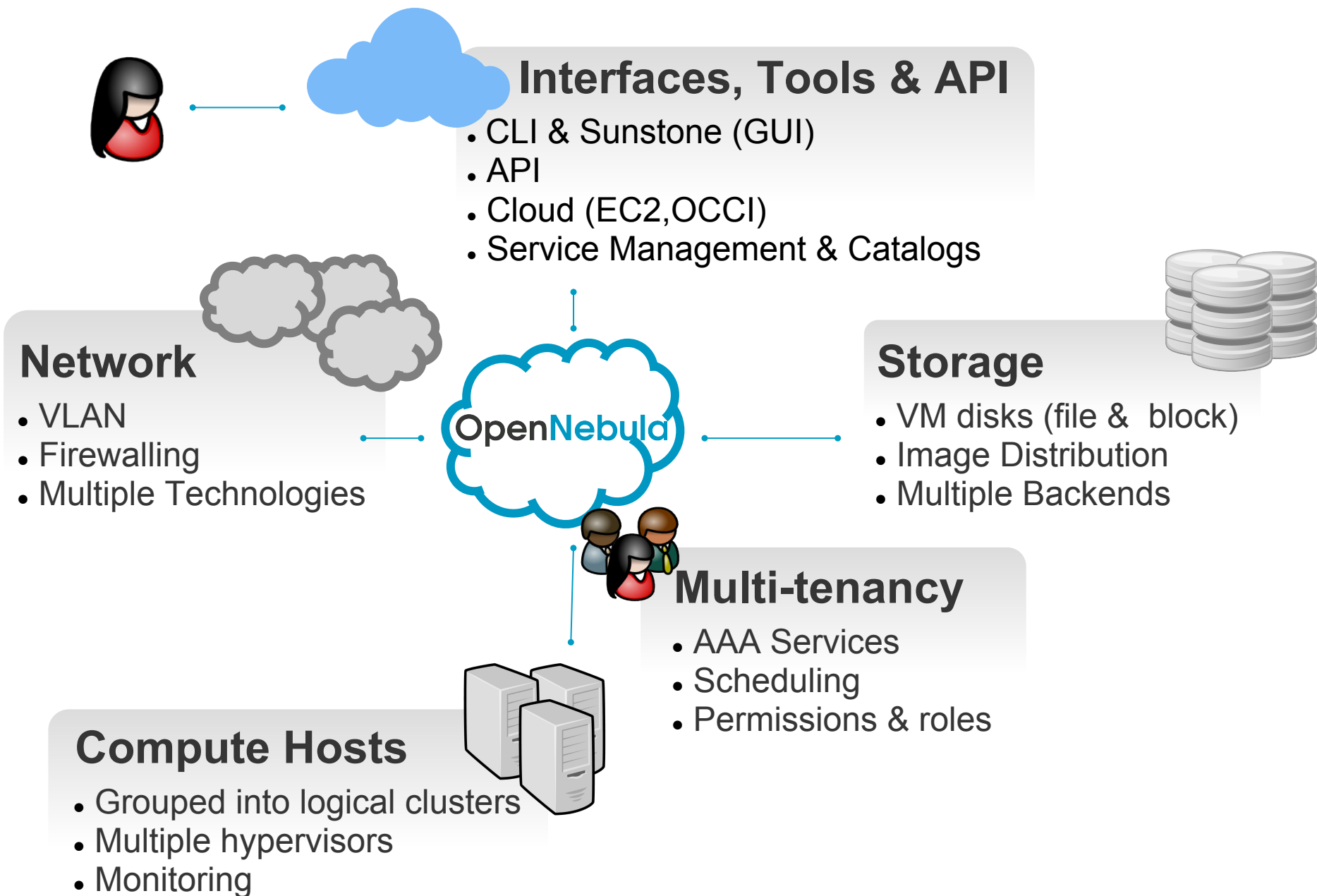
A Cloud behind a
firewall
Security Concerns
Improve Operations

OpenNebula

Hybrid Cloud / CloudBursting

Supplement Capacity
of the Private Cloud

What is OpenNebula?



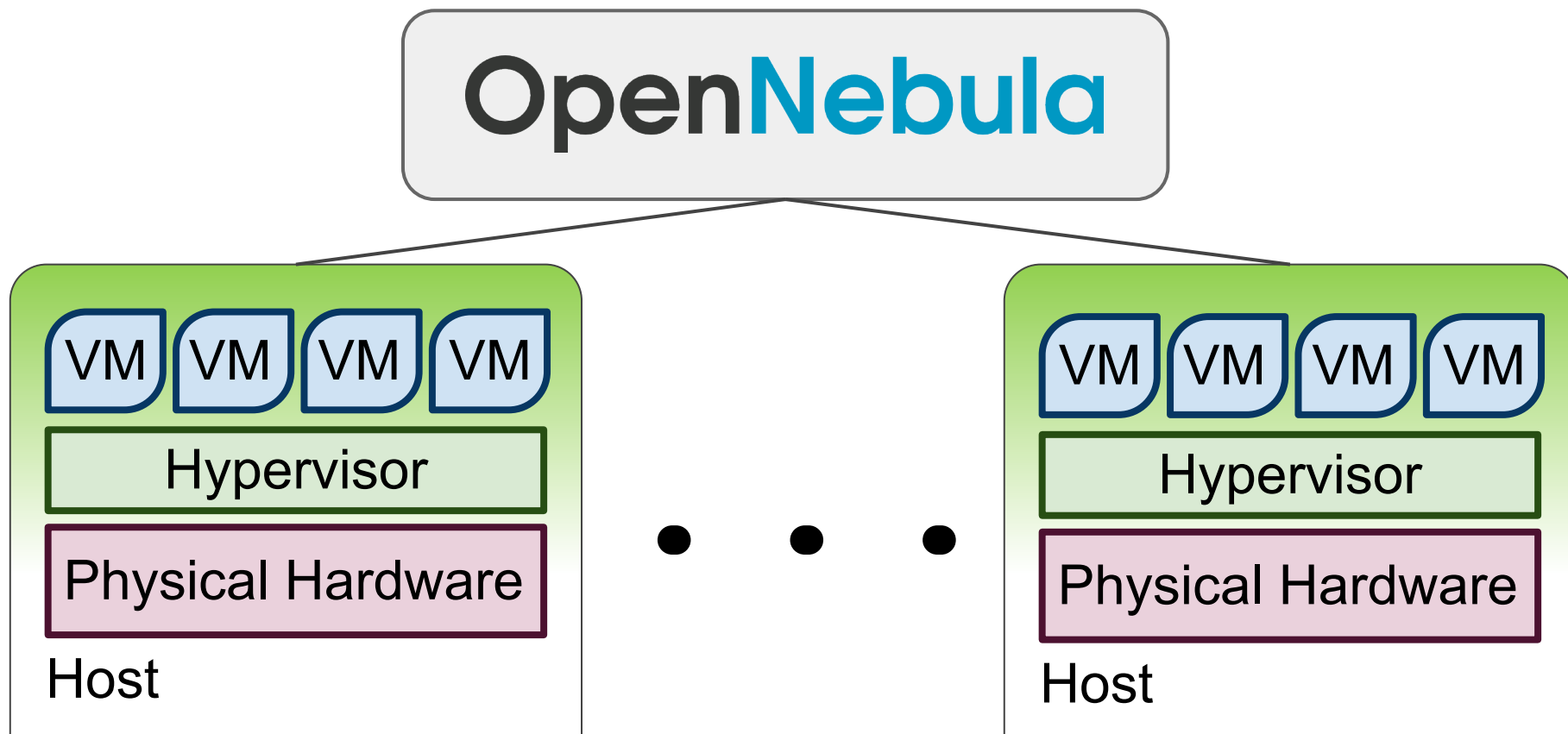
What is OpenNebula?

Design Principles

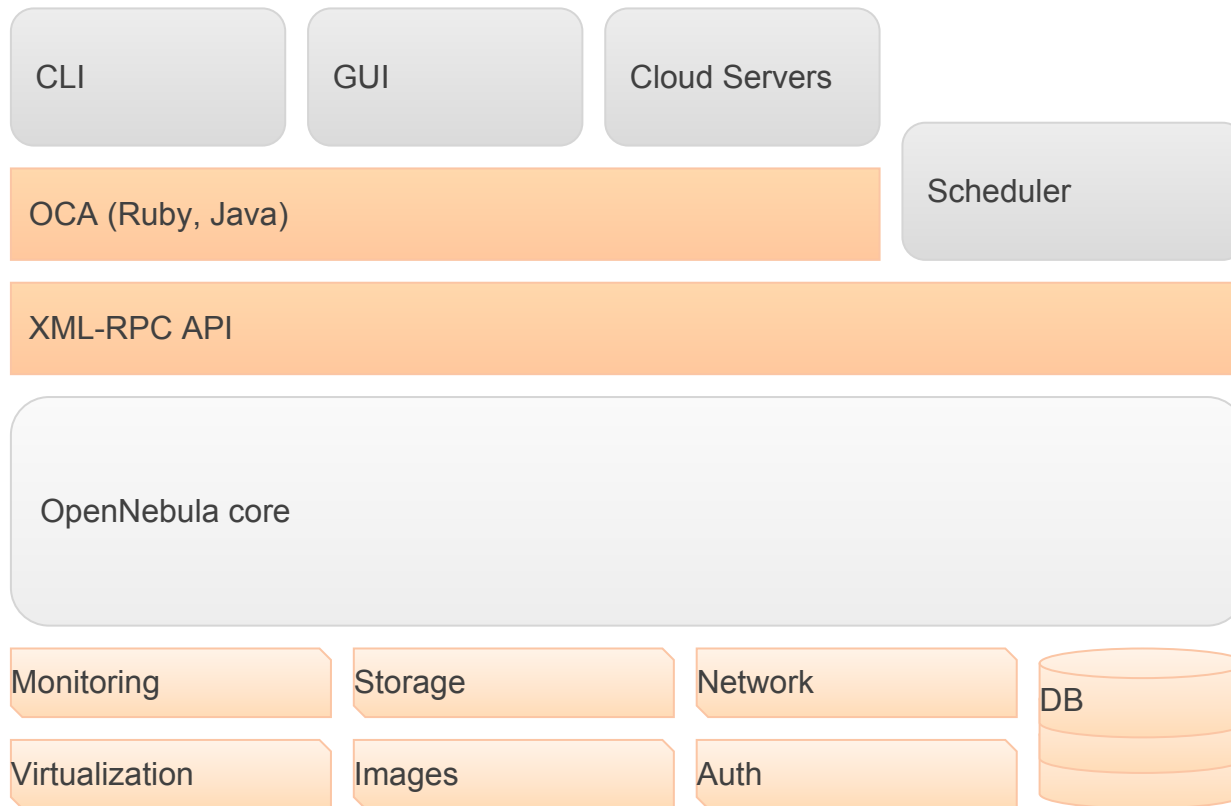
- **Flexible:** One solution can not fit all data-centers
- Provide basic components, but **easily hacked by others**
- **Simple:** just-what-you-need components & simple protocols
- **Scalable:** single instance & multi-tier architectures
- **Be interoperable!** rich set of API's & Interfaces
- **Open Source:** Apache License v2.0

What is OpenNebula?

Simplicity



The Cloud Integrator Perspective

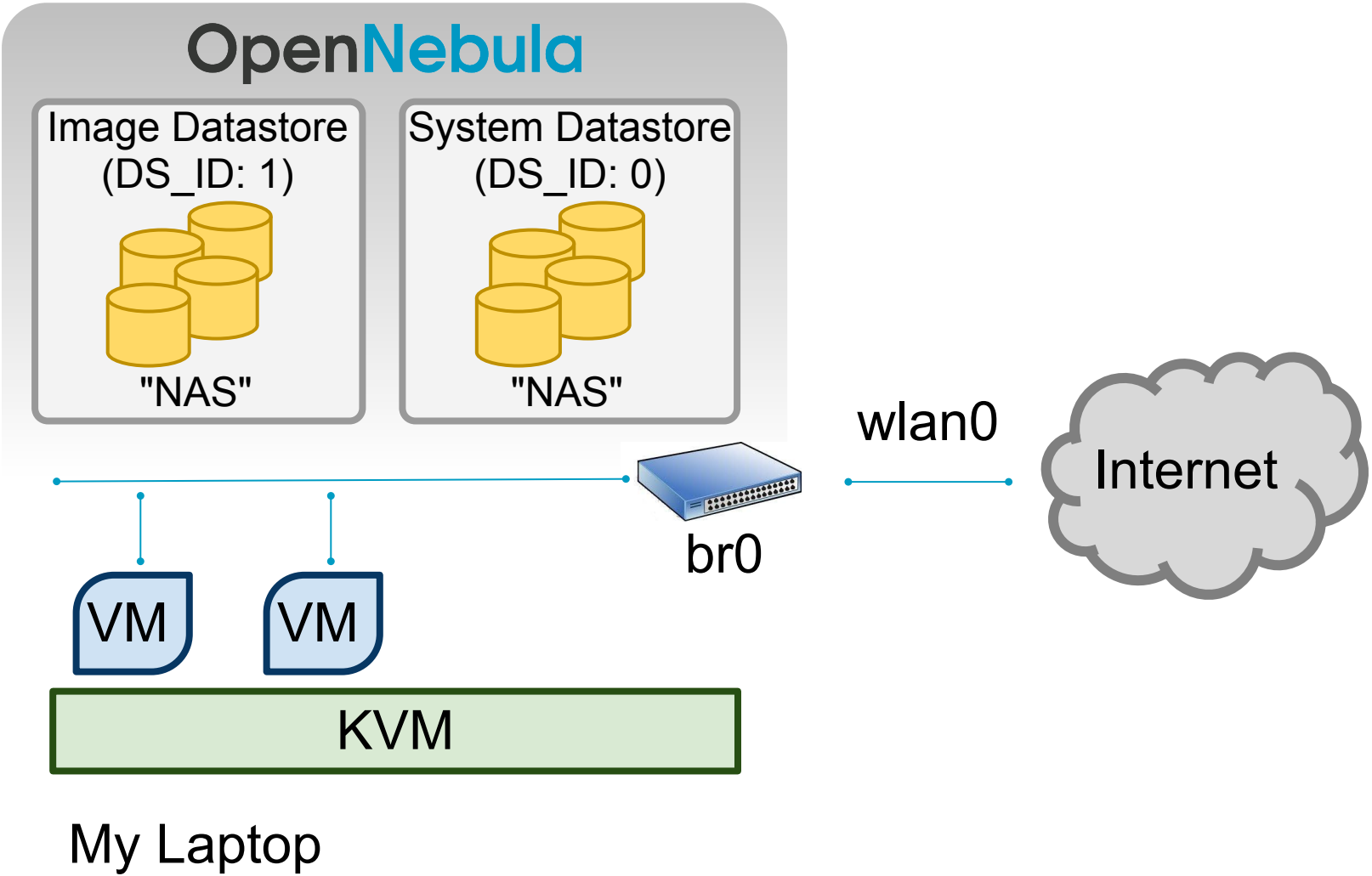


Languages

C++	39%
Ruby	23%
JavaScript	20%
shell script	5%
Other	13%



Demo environment



Host Management

- **Monitoring**
 - Simple - SSH probes
 - Ganglia
- **Cluster**
 - Logical set of:
 - Storage
 - Network
 - Hosts
 - Deal with heterogeneity

OpenNebula

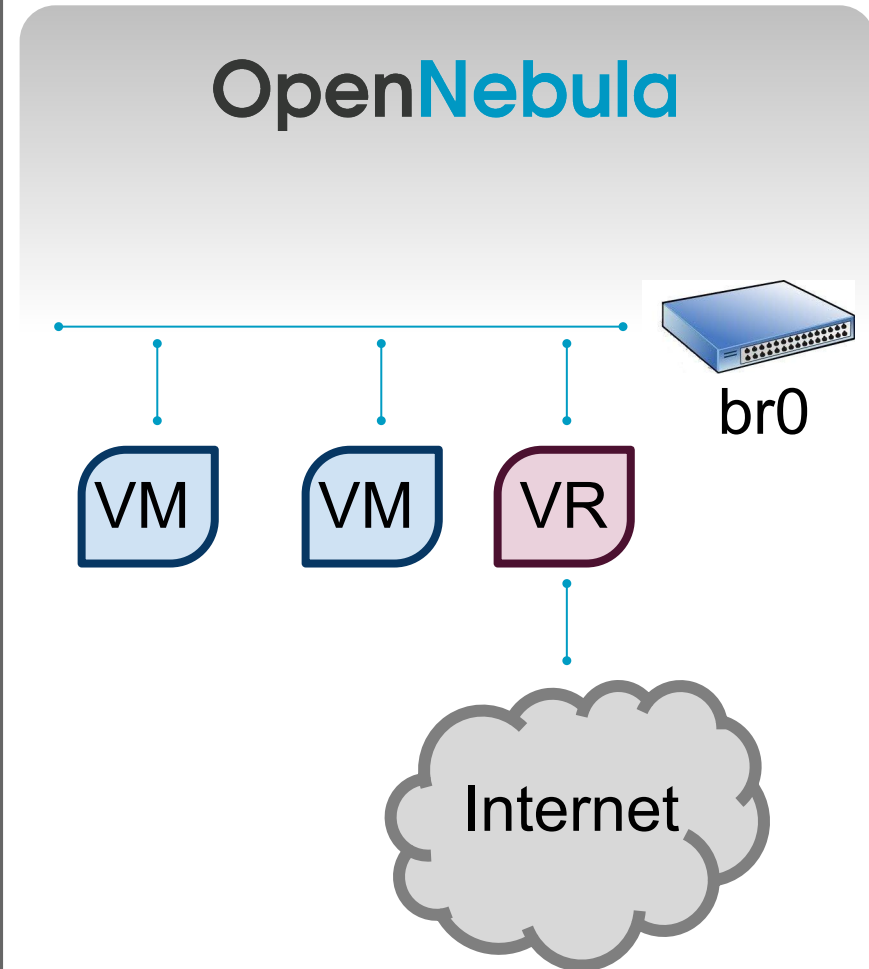
HOST

HOST

HOST

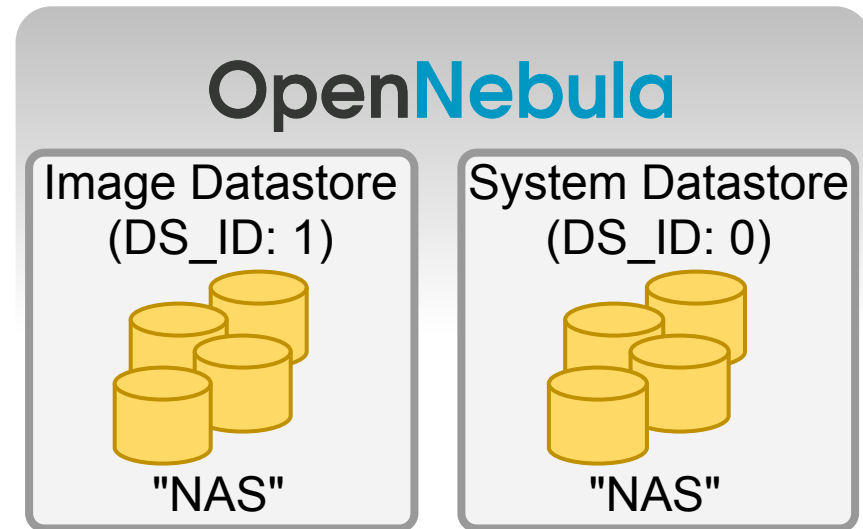
Networks

- Define a MAC-IP address space
- Layer 2 Isolation (drivers)
 - 802.1Q (Tagging)
 - OpenvSwitch
 - ebtables
 - Flat
- Layer 3 simple firewalling
 - TCP/UDP ports
 - ICMP's
- Virtual Router
- IPv6



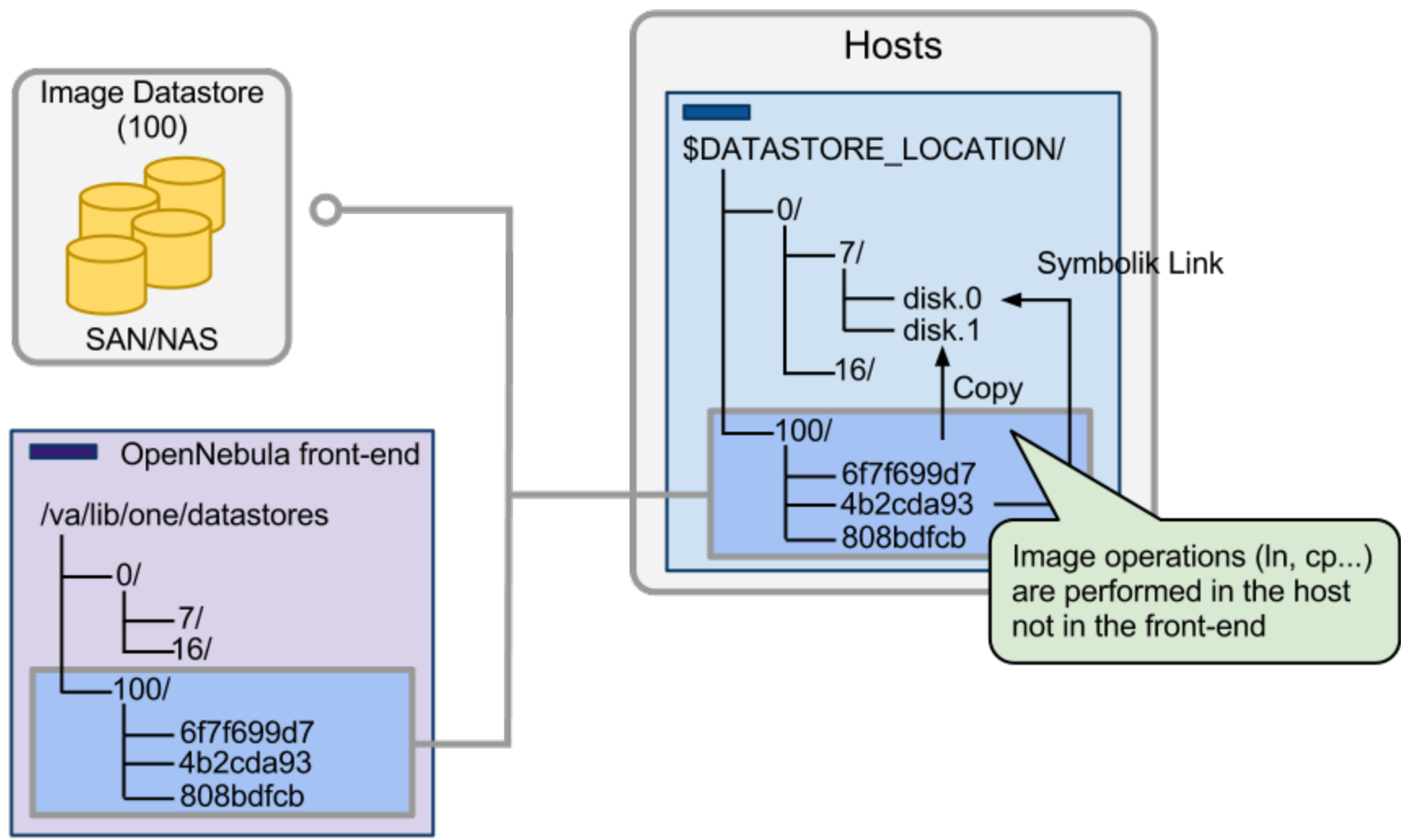
Storage

- **Datastore**
 - Image store
 - Balance I/O
 - Policies
 - File, iSCSI, LVM, VMFS
- **Image distribution**
 - System Datastore
 - Shared/Distributed FS
 - SSH
 - iSCSI
 - LVM
 - Ceph



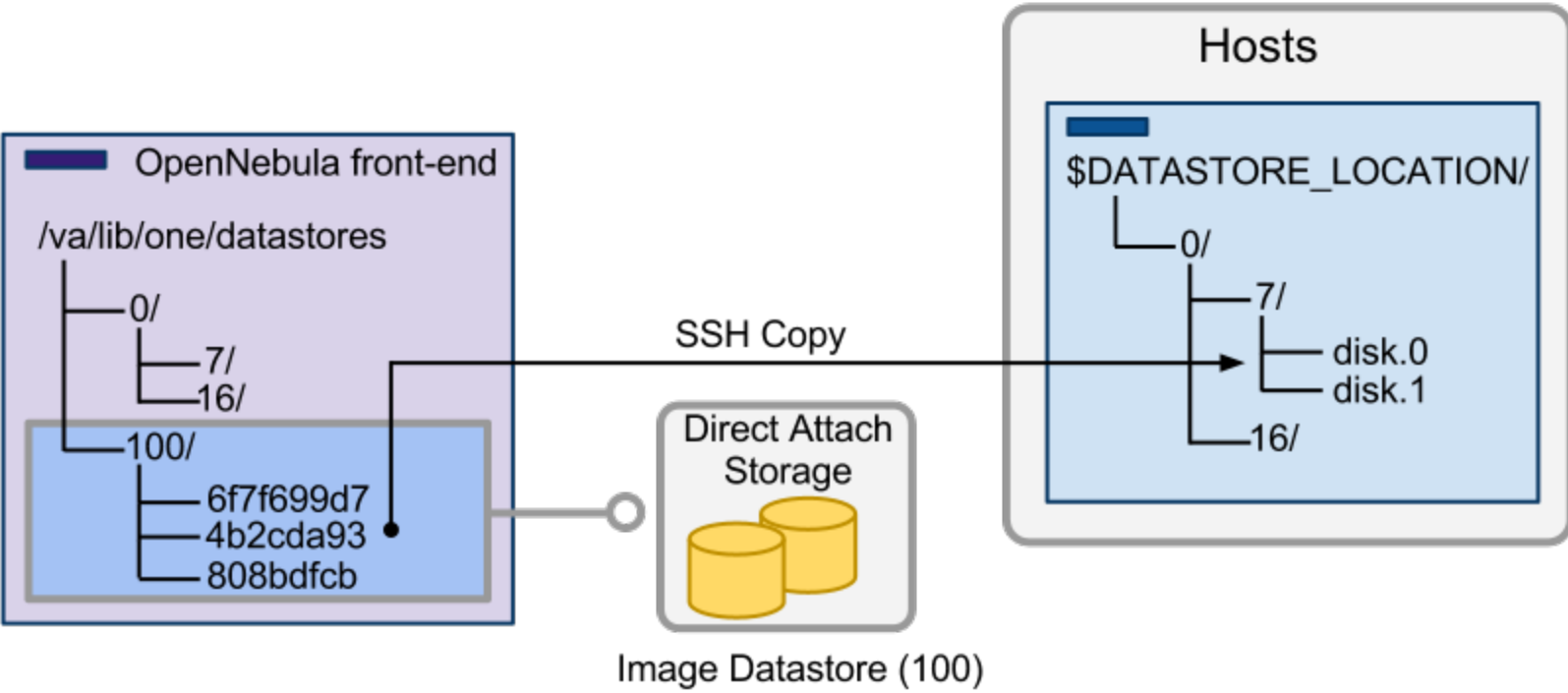
Building an IaaS Cloud: Storage (Datastores)

Shared Datastore



Building an IaaS Cloud: Storage (Datastores)

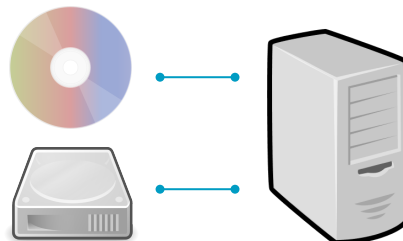
SSH Datastore



Images

- Files vs Block devices
 - Performance
 - Management
- Types
 - Golden Images
 - Persistent
 - Volatile
- Context

CD-ROM with
custom data
Disk images



OpenNebula

Image Datastore
(DS_ID: 1)



"NAS"

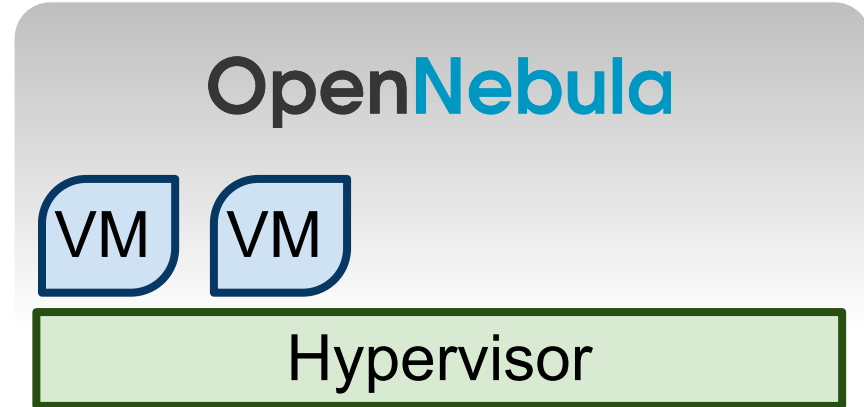
System Datastore
(DS_ID: 0)



"NAS"

Virtualization

- Virtual Machine Templates
 - Capacity
 - Disks, NICs, etc...
 - Other (VNC, OS,...)
- Support VM operations
 - Suspend/Power Off
 - Stop/Undeploy
 - Reboot/Destroy
 - Shutdown
 - Resume
 - Migration (live)
 - Attach/Detach - NIC/Disk
 - Snapshotting
- Hypervisor
 - Agnostic
 - Xen, KVM and VMware



AuthZ, AuthN & Acct.

- Multi-tenancy
 - Groups
 - Permissions & ACLs
- Authentication
 - X509
 - SSH Keys
 - LDAP
 - Internal
- Authorization
 - Quotas
- Accounting (Billing)

OpenNebula

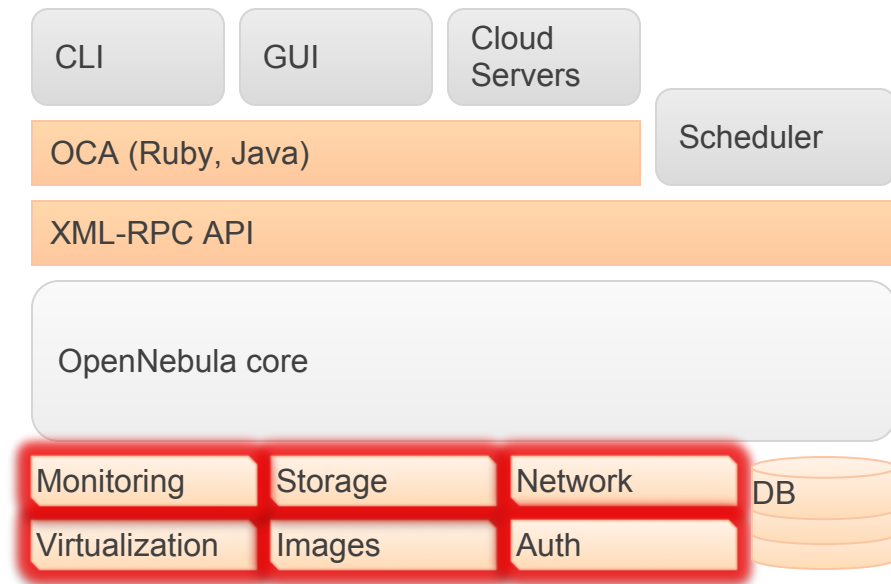
Core & Scheduler

- OpenNebula core daemon
 - Orchestration
 - Driver based
 - Fast & Robust (C++)
- Scheduler
 - Matchmaking
 - Programmable

Operations

The Cloud Integrator Perspective

How to Develop Drivers



Drivers

- Small scripts for each action
- Any language (shell, Ruby, Python,...)
- Different drivers can co-exist in heterogeneous environments

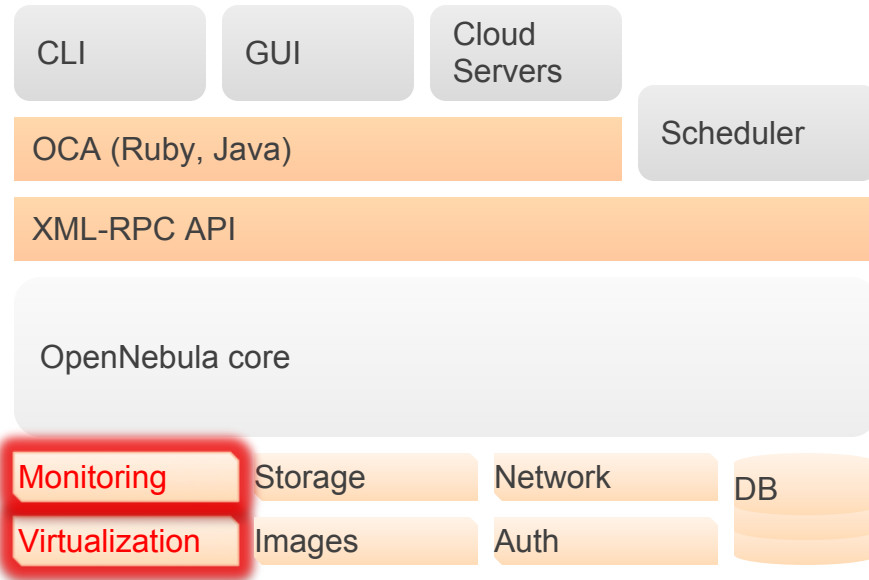
Easy to adapt

Easy to create new ones

Easy to maintain

The Cloud Integrator Perspective

How to Develop Drivers



Virtualization Drivers

- Translate the OpenNebula VM life-cycle management into specific hypervisor operations

Monitoring Drivers

- Gather information about the physical host and hypervisor status

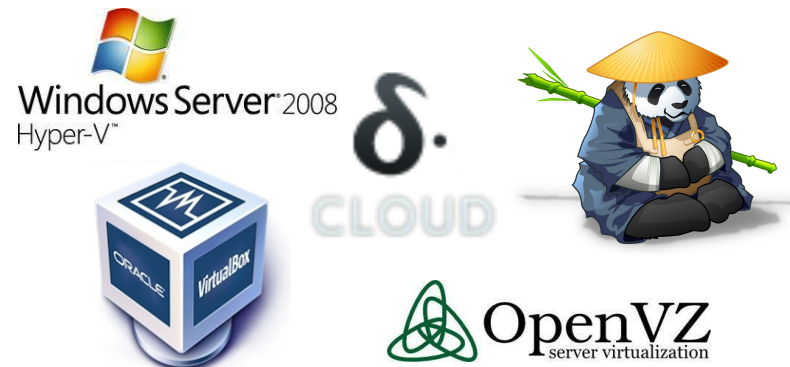
Hybrid Cloud Drivers

- Interact with an external provider instead of a hypervisor

OpenNebula distribution



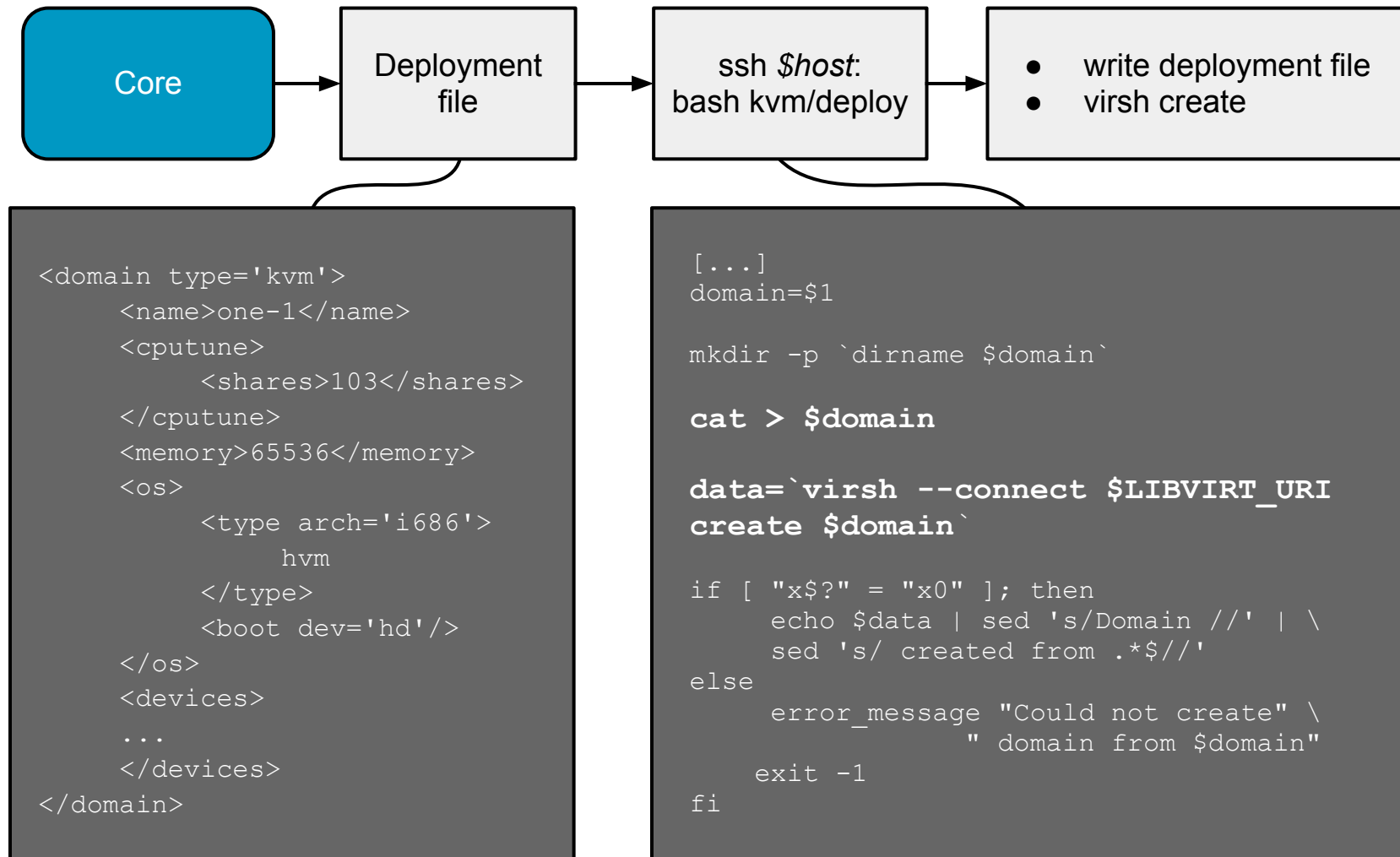
Community contributions



The Cloud Integrator Perspective

Virtual Machine Manager Drivers

Deployment flow for KVM



The Cloud Integrator Perspective

Virtual Machine Manager Drivers

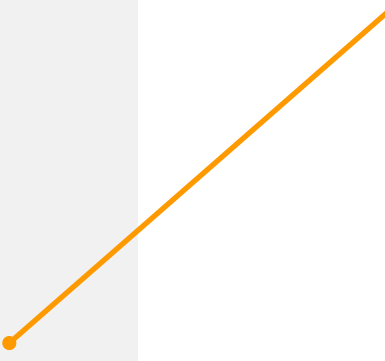
Virtualization Driver Example:

Hypervisor: Xen

Action: migrate

Description: live-migrates a running VM to the specified Host

```
├── xen
│   ├── save
│   ├── shutdown
│   ├── restore
│   ├── reboot
│   ├── xenrc
│   ├── deploy
│   ├── poll
│   ├── cancel
│   ├── migrate
│   └── poll_ganglia
```



```
1 |#!/bin/bash
2
3  source $(dirname $0)/xenrc
4  source $(dirname $0)/../../scripts_common.sh
5
6  deploy_id=$1
7  dest_host=$2
8
9  exec_and_log "$XM_MIGRATE $deploy_id $dest_host" \
10     "Could not migrate $deploy_id to $dest_host"
11
```

The Cloud Integrator Perspective

How to Develop Drivers

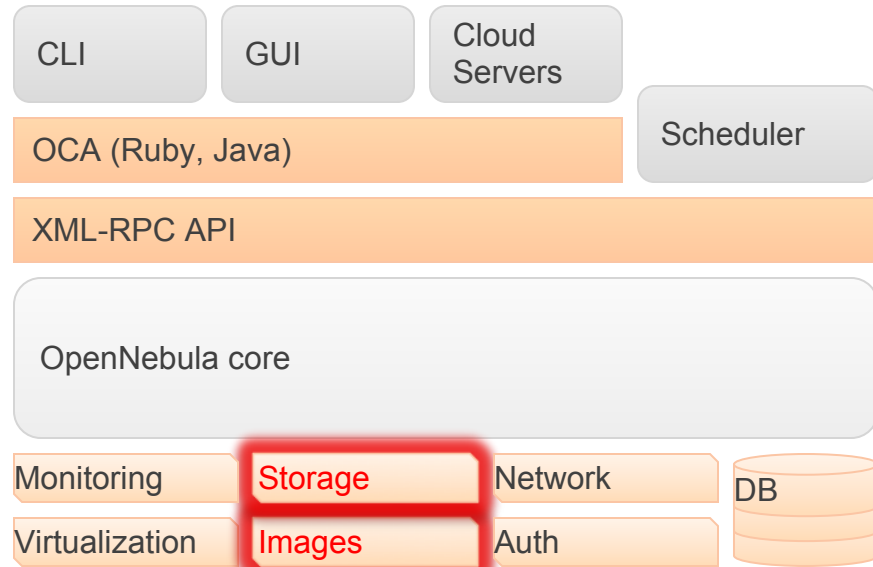


Image & Storage Drivers

- Create or Import new Images into the Image Repository
- File management between the Image Repository and the physical hosts

OpenNebula distribution

- Shared FS (nfs, gluster, lustre, ...)
- LVM
- iSCSI (tgt)
- SSH
- HTTP
- Ceph



Community contributions



The Cloud Integrator Perspective

Image & Storage Drivers

Datastore

- cp
- stat
- mkfs
- clone
- rm

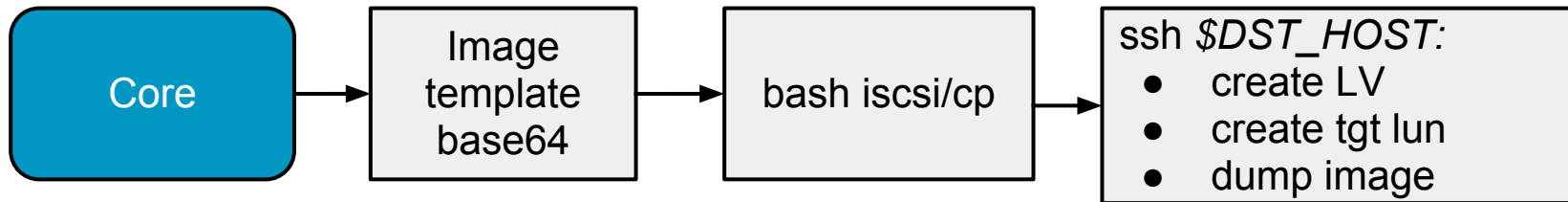
Transfer Manager

- clone
- ln
- mkimage
- mkswap
- mv
- mvds
- context
- delete
- postmigrate
- premigrate

The Cloud Integrator Perspective

Image & Storage Drivers

Datastore iscsi / cp



```
# Create LV and Setup tgt LUN
REGISTER_CMD=$(cat <<EOF
    set -e
    $SUDO $LVCREATE -L${SIZE}M ${VG_NAME} -n ${LV_NAME}

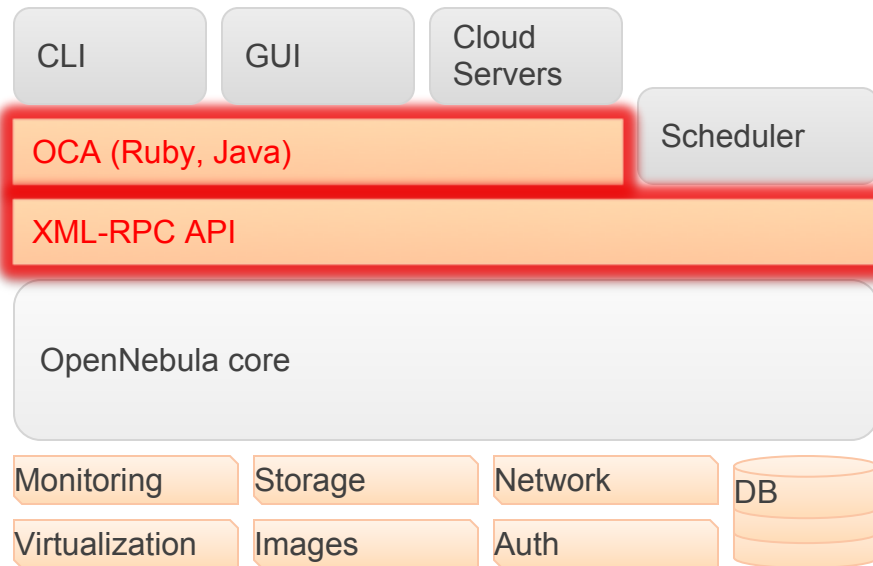
    $SUDO $(tgt_setup_lun "$IQN" "$DEV")
    $SUDO $(tgt_admin_dump_config "$TARGET_CONF")
EOF
)

ssh_exec_and_log "$DST_HOST" "$REGISTER_CMD"

# Dump
exec_and_log "eval $DUMP | \
    $SSH $DST_HOST $SUDO $DD of=$DEV bs=2M"
```


The Cloud Integrator Perspective

How to Interact with OpenNebula



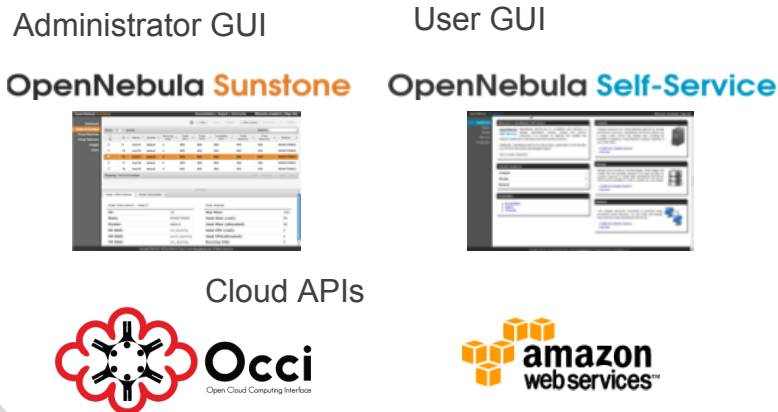
XML-RPC

- Simple, fast
- Works in any language

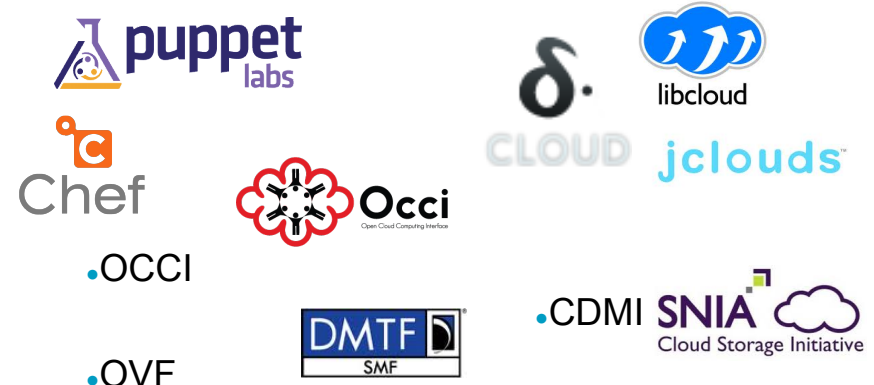
OCA (OpenNebula Cloud API)

- High level bindings
- Complete functionality
- Ruby, Java, Python

OpenNebula distribution



Community Contributions



The Cloud Integrator Perspective

How to Interact with OpenNebula

OCA Ruby Example:

Shutdown all my Virtual Machines

```
1  #!/usr/bin/env ruby
2
3  require 'OpenNebula'
4
5  CREDENTIALS = "oneuser:onepass"
6  ENDPOINT    = "http://localhost:2633/RPC2"
7
8  client = OpenNebula::Client.new(CREDENTIALS, ENDPOINT)
9
10 vm_pool = VirtualMachinePool.new(client, OpenNebula::Pool::INFO_MINE)
11
12 rc = vm_pool.info
13 if OpenNebula.is_error?(rc)
14   puts rc.message
15   exit -1
16 end
17
18 vm_pool.each do |vm|
19   rc = vm.shutdown
20   if OpenNebula.is_error?(rc)
21     puts "Virtual Machine #{vm.id}: #{rc.message}"
22   else
23     puts "Virtual Machine #{vm.id}: Shutting down"
24   end
25 end
26
27 exit 0
```

Tools for Users and Administrators

OpenNebulaApps



**App
Flow**

Manage services



**App
Stage**

Automatic installation of
software stacks



**App
Market**

Host your own
marketplace

Service Example

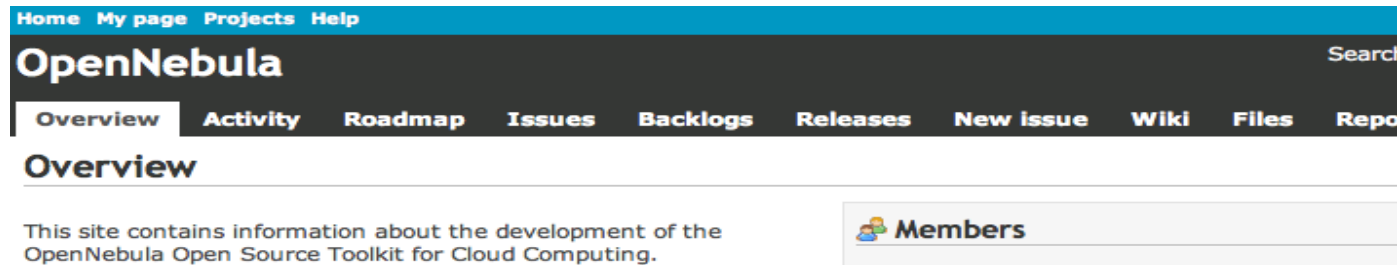
```
{
  "name": "my_service",
  "deployment": "straight",
  "roles": [
    {
      "name": "frontend",
      "vm_template": 0
    },
    {
      "name": "db_master",
      "parents": [
        "frontend"
      ],
      "vm_template": 1
    }
  ]
}
```

App Example

```
{
  "name": "wordpress",
  "run_list": [
    "recipe[mysql::server]",
    "recipe[wordpress]"
  ],
  "wordpress": {
    "db": {
      "database": "${WP_DB_NAME}",
      "user": "${WP_DB_USER}",
      "password": "${WP_DB_PASSWORD}"
    },
    "mysql": {
      "server_root_password": "${DB_PASSWORD}"
    }
  }
}
```

Join our growing community!

I Like OpenNebula, what can I do?



Help us make OpenNebula even better by...

- Use OpenNebula! give us feedback
- Join our mailing list
- Report bugs or features at [development at dev.opennebula.org](#)
- Translate OpenNebula
- Share your Virtual Appliances
- Use 'master'
- Write howto's
- Share your use cases
- Submit patches
- Maintain OpenNebula in your distro of choice

Community Activity

- Contributions by users: RIM, Akamai, Logica, FermiLab, SARA, Terradue...
- > 100 in [opennebula.org/about:contributors](#)
- ~ 500 in [dev.opennebula.org](#)
- Sunstone in 17 languages
- Components in the ecosystem by RIM, China Mobile...

IRC Channel

- **#opennebula** on **irc.freenode.net**

Try OpenNebula

Cloud Sandbox - Virtual Appliance

A real cloud in your laptop under 5 minutes by downloading a pre-configured automated installation of OpenNebula.

opennnebula.org/cloud:tryout

Available Platforms

- Amazon
- VirtualBox
- VMWare
- KVM

OpenNebula Tutorial

Tomorrow at 09.30 Room 3

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Questions?

We Will Be Happy to Answer any Question

TL; DR: OpenNebula is awesome, go check it out!

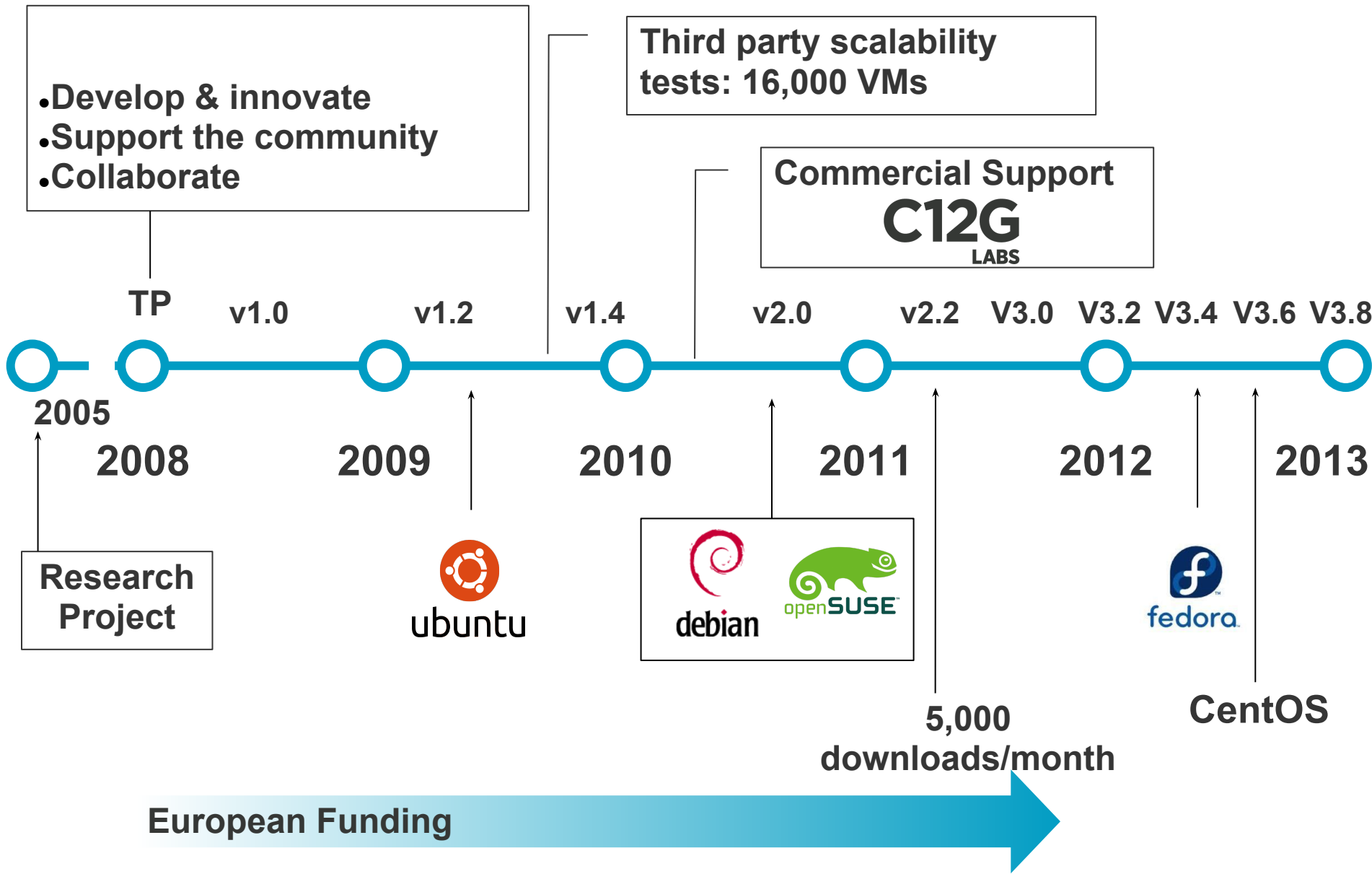


@opennebula



History of the Project

A Project Aimed at Building the Industry Standard Open Cloud Management Tool



Differentiating Factors in the Market

- Focus on enterprise **data center virtualization**
- **Rich functionality for private clouds**: on-demand provision of virtual data centers, self-service portal and catalog, clustering, fault tolerance...
- **Wide integration capabilities** with data center services: monitoring, computing, storage, networking, chargeback, authentication...
- **Service management** with automatic installation and configuration of software stacks, multi-tier service catalog and provision...
- External cloud connectors for **hybrid cloud computing**
- Delivered as a production-proven, packaged product with **single installing and upgrade process**
- **Direct support** from developers