



# OpenNebula

public and private cloud management

Martin Alfke

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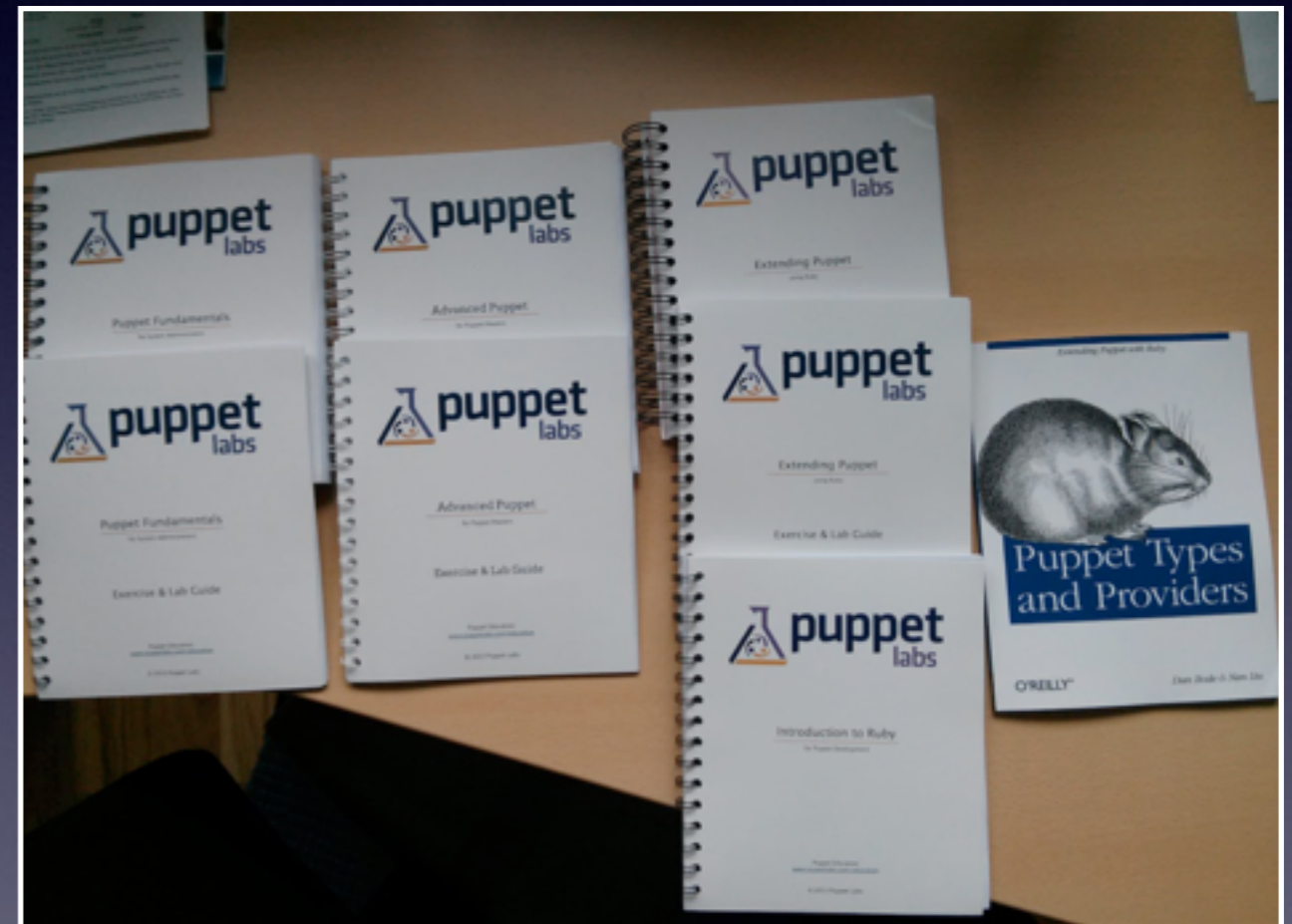
GUUG Hamburg

12.06.2014

# OpenNebula

## - Martin Alfke -

- Freelancer - Berlin/Germany
- Automation and Cfg Mgmt
- ePost Development GmbH
- Migration von HW auf VM
- Umzug Bonn → Berlin



Martin Alfke - at home

# OpenNebula

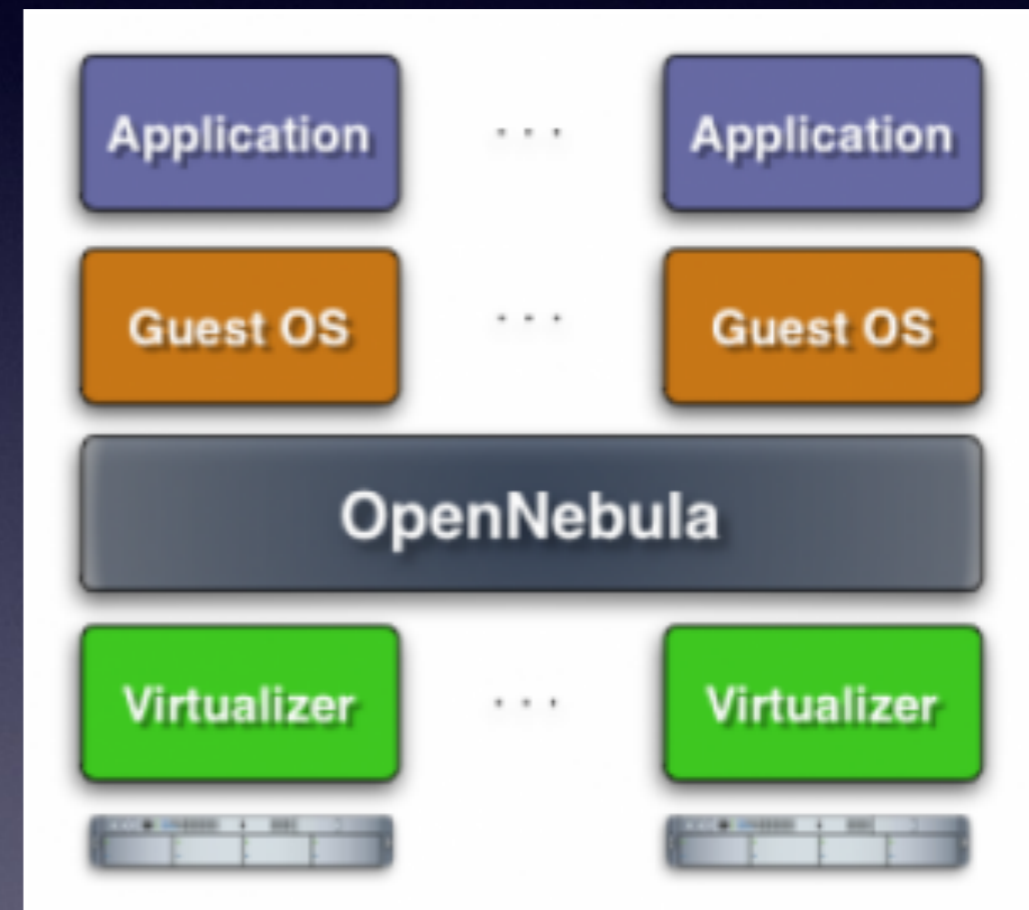
## - Agenda -

- Allgemein
- Backends
- Planung
- Komponenten
- Workflow
- Management (GUI/CLI)
- Live Demo

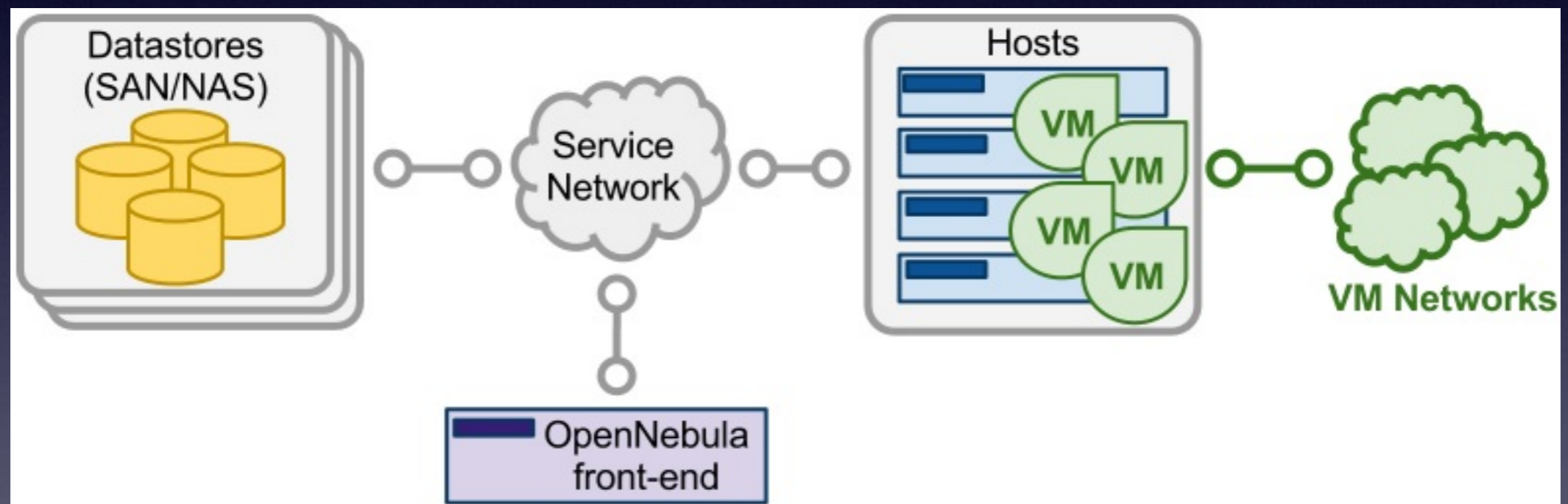
# OpenNebula

## - Allgemein -

- Management von Virtualisierern
- Management von Netzwerk Interfaces
- Management von VM's

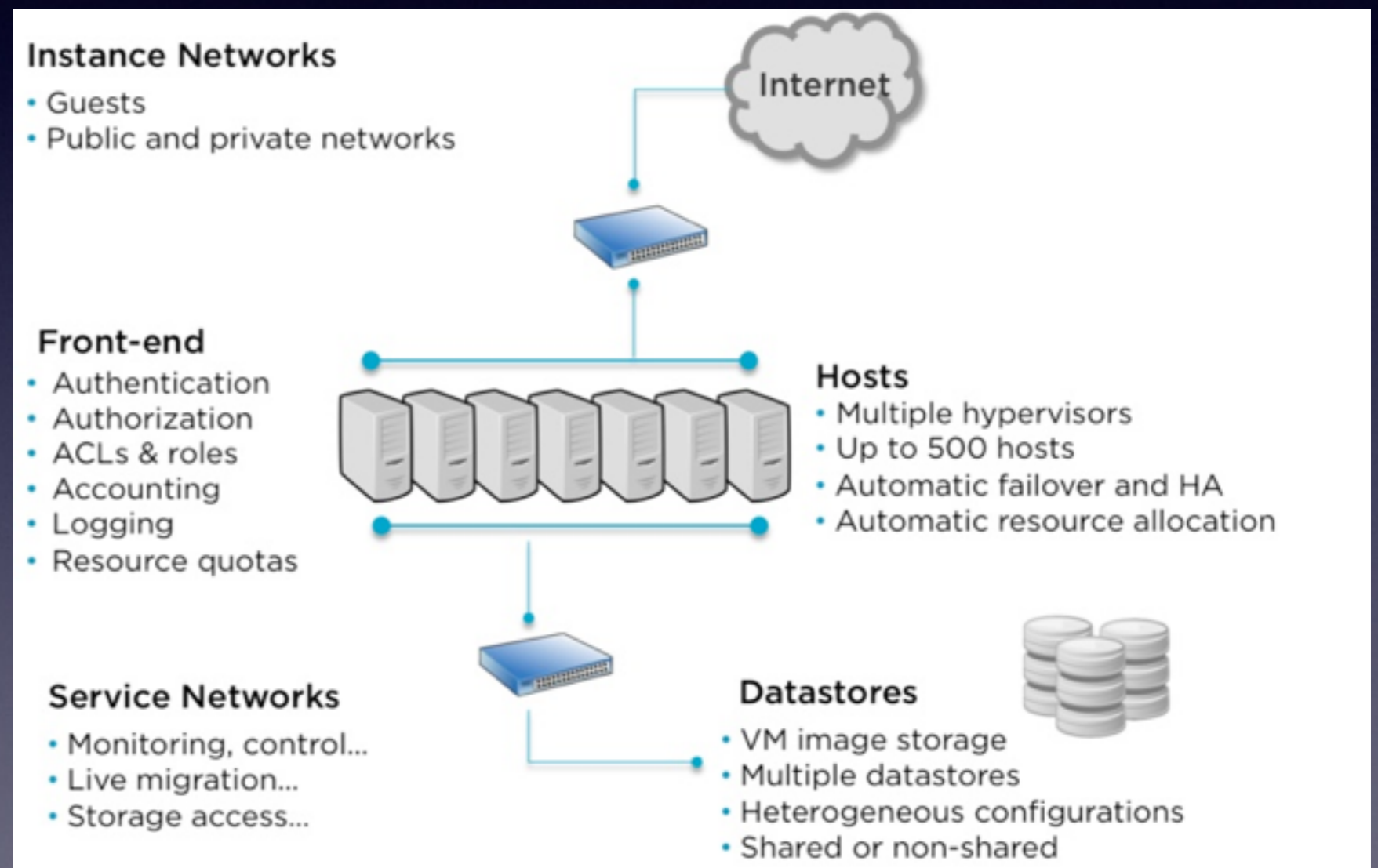


# OpenNebula - Allgemein -



# OpenNebula - Backends -

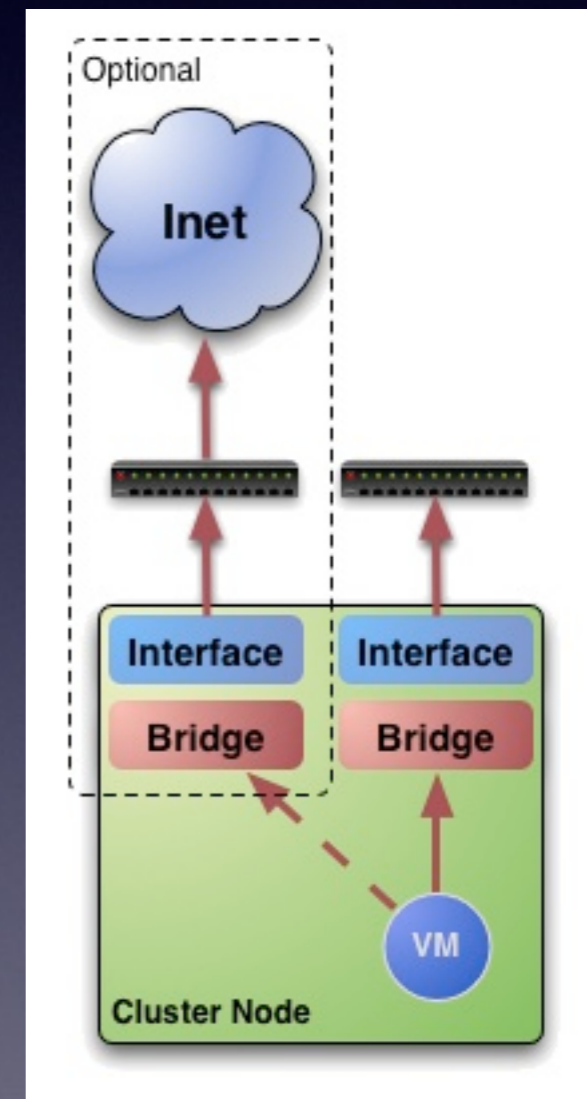
- Netzwerk
- Storage
- Virtualisierung
- Image



# OpenNebula

## - Netzwerk Backends -

- Unterstütze Netzwerk Backends
  - 802.1q
  - ebtables / iptables
  - ovswitch
  - dummy (NAT)



# OpenNebula

## - Storage Backends -

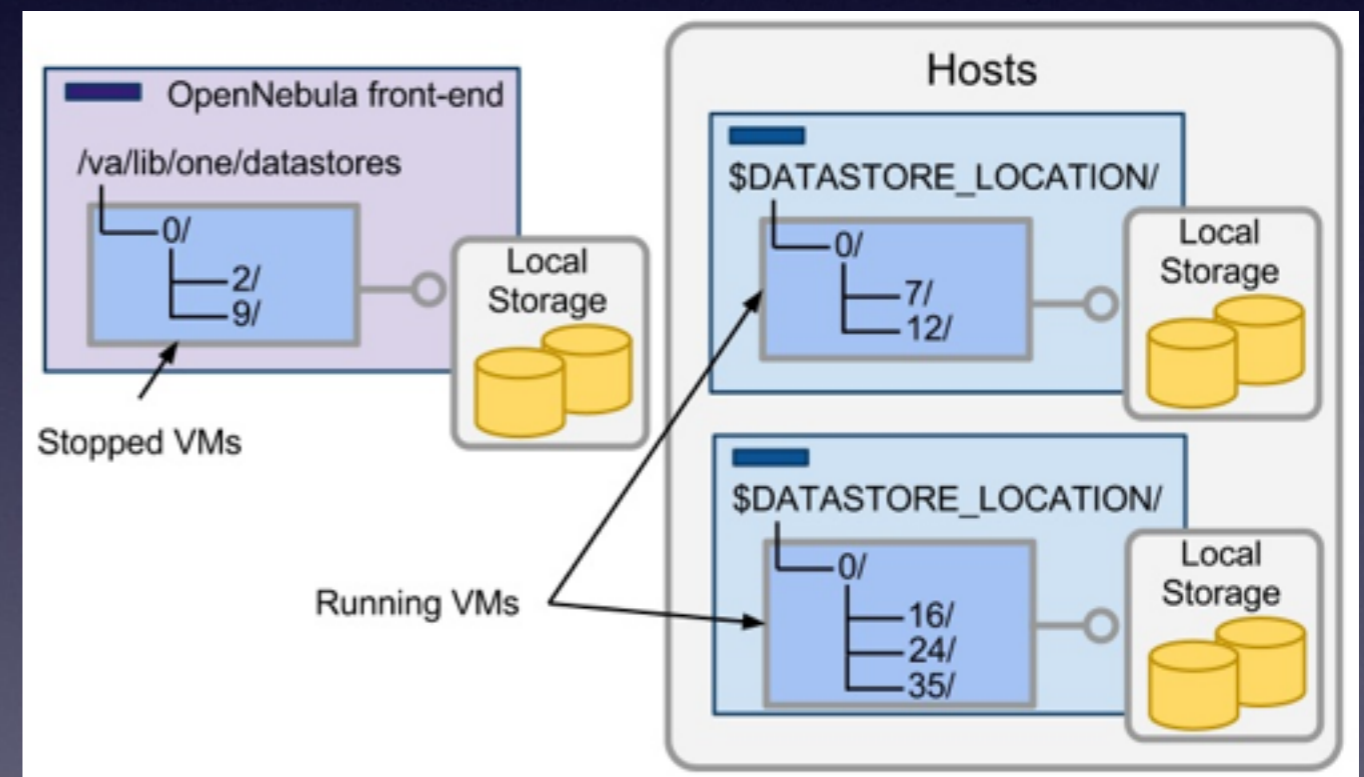
- Unterstütze Storage Backends
  - Lokale Storage
  - NFS
  - Ceph
  - Gluster
  - iSCSI (Community Plugin)



# OpenNebula

## - Storage Backends -

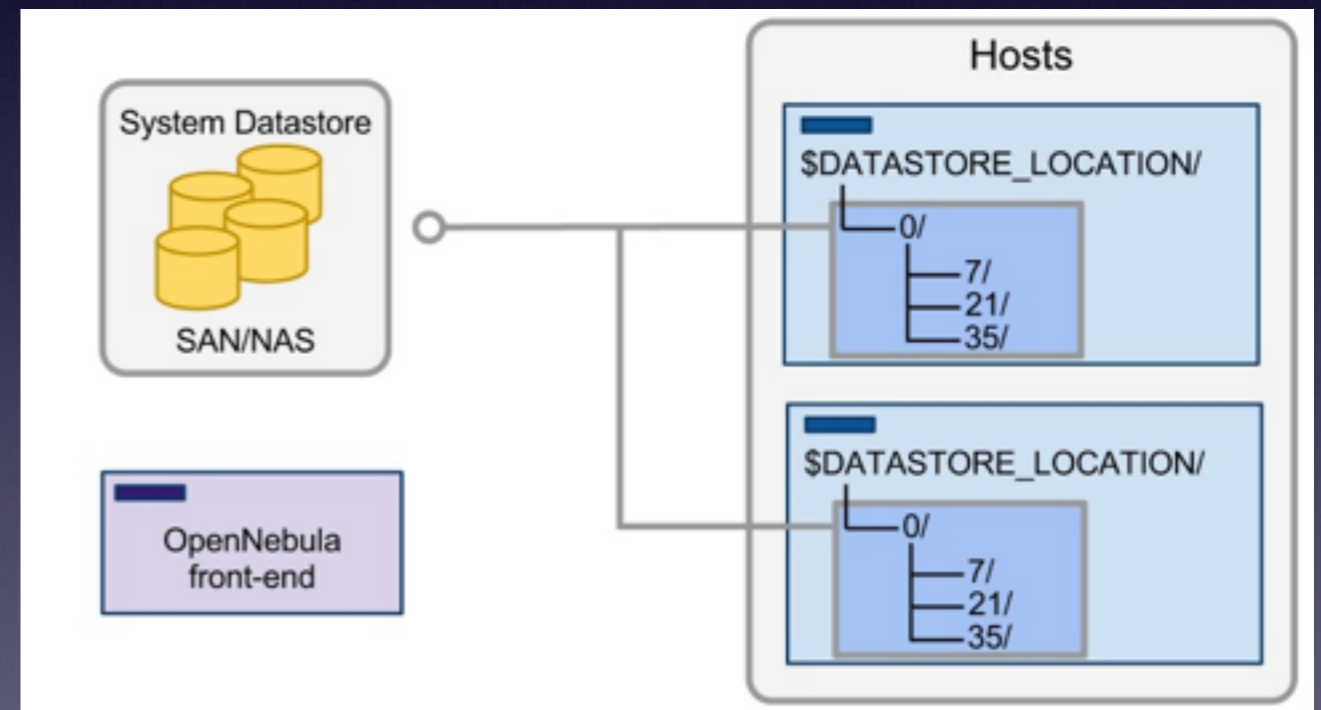
- ssh (Kopieren auf den Virtualisierer)



# OpenNebula

## - Storage Backends -

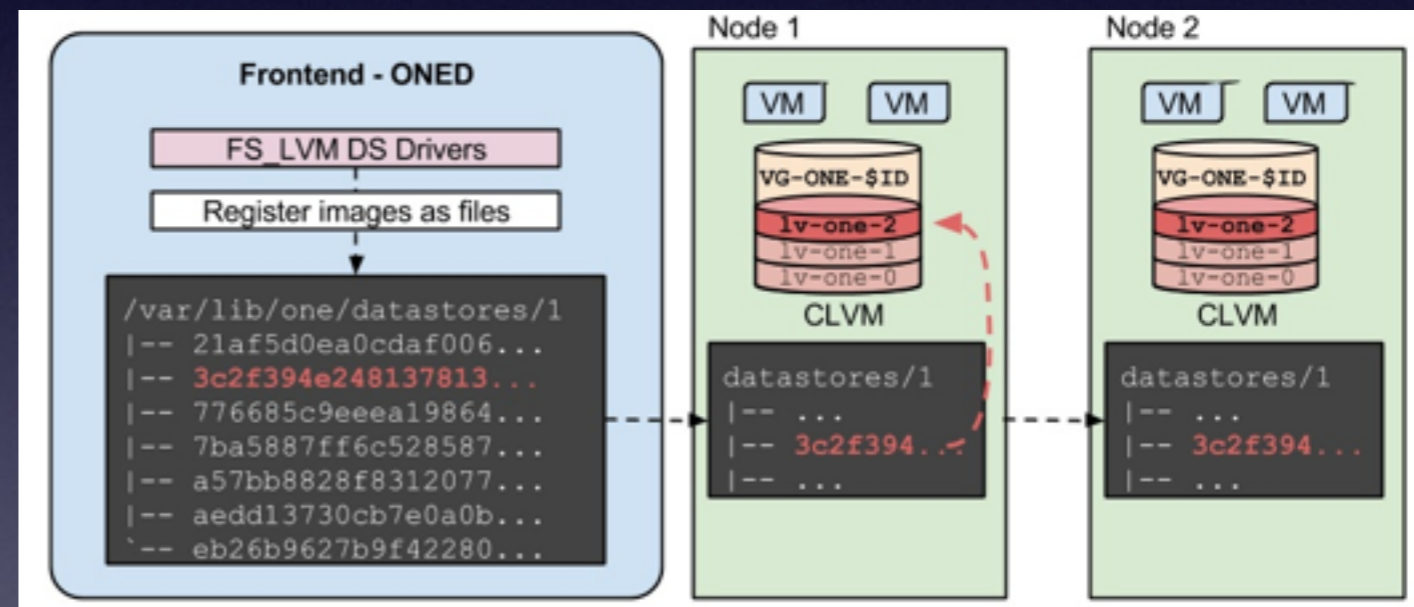
- ssh (Kopieren auf den Virtualisierer)
- shared (Kopieren von Shared Storage)



# OpenNebula

## - Storage Backends -

- ssh (Kopieren auf den Virtualisierer)
- shared (Kopieren von Shared Storage)
- lvm copy (LVM cluster FS)



# OpenNebula

## - Virtualisierung -

- Unterstütze Virtualisierer
  - KVM
  - VMware
  - Xen
  - Public Clouds (AWS/Rackspace/...)

# OpenNebula

## - Image Backends -

- Unterstütze Image Backends
  - LVM
  - qcow2
  - ceph blocks

# OpenNebula

## - Planung -

- Cluster
- Over Commitment
- Storage

# OpenNebula

## - Planung -

- Cluster
  - Trennung und Gruppierung von Virtualisierungen
  - Verteilung nach Kriterien:
    - Anzahl von VM's
    - Last
  - Individuelle User Berechtigungen

# OpenNebula - Planung -

Web Development



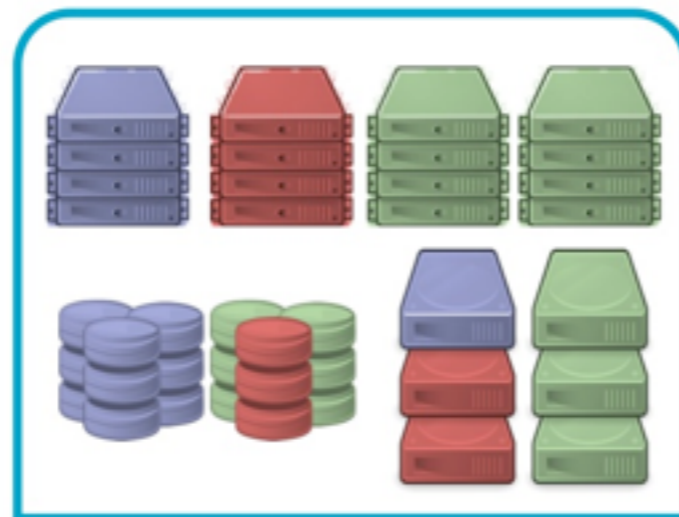
Human Resources



Big Data Analysis

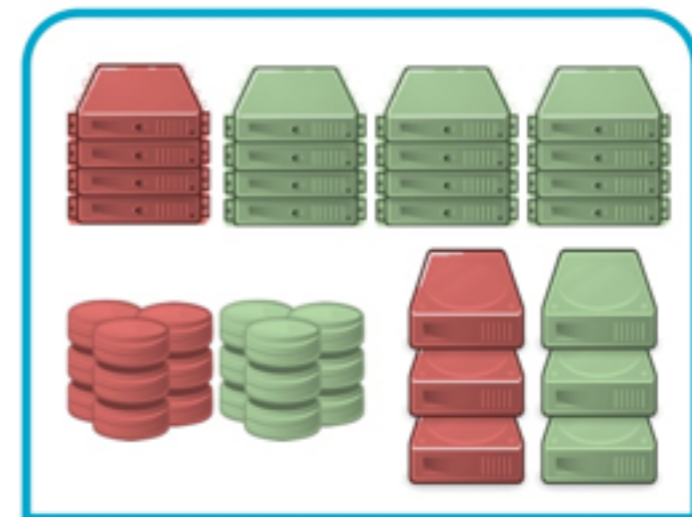


Public Clouds



DC West Coast

...



DC Europe



# OpenNebula

## - Planung -

- Over Commitment
  - RAM Over Commitment - benötigt KSM
  - Benötigt eine Code Änderung in OpenNebula (reserved RAM)
  - CPU Over Commitment - vCPU im Template

# OpenNebula

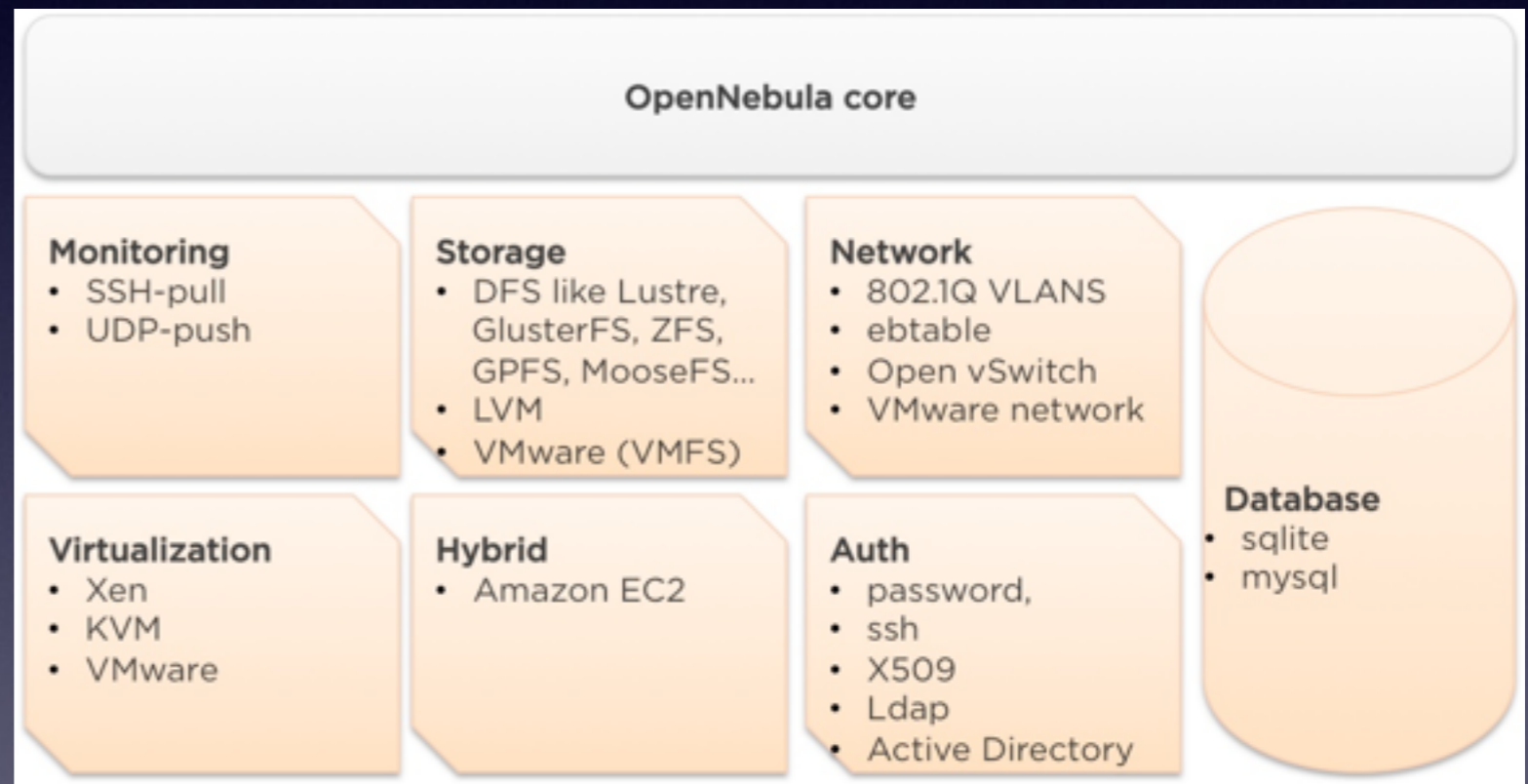
## - Planung -

- Storage
  - Lokale Storage - VM Images müssen via SSH kopiert werden
  - Shared Image Storage - VM Images werden lokal kopiert (cp)
  - Shared OpenNebula Installation - VM Images werden gelinkt (ln -s)

# OpenNebula

## - Komponenten -

- Management Node
- Virtualisierer



# OpenNebula

## - Komponenten -

- Management Node
  - Opennebula (notwendig)
  - Apache + Passenger (sunstone web gui - optional)
  - VNC Proxy (optional)
  - MySQL DB (notwendig - sqlite für Tests)
  - User: oneadmin + ssh key (notwendig)

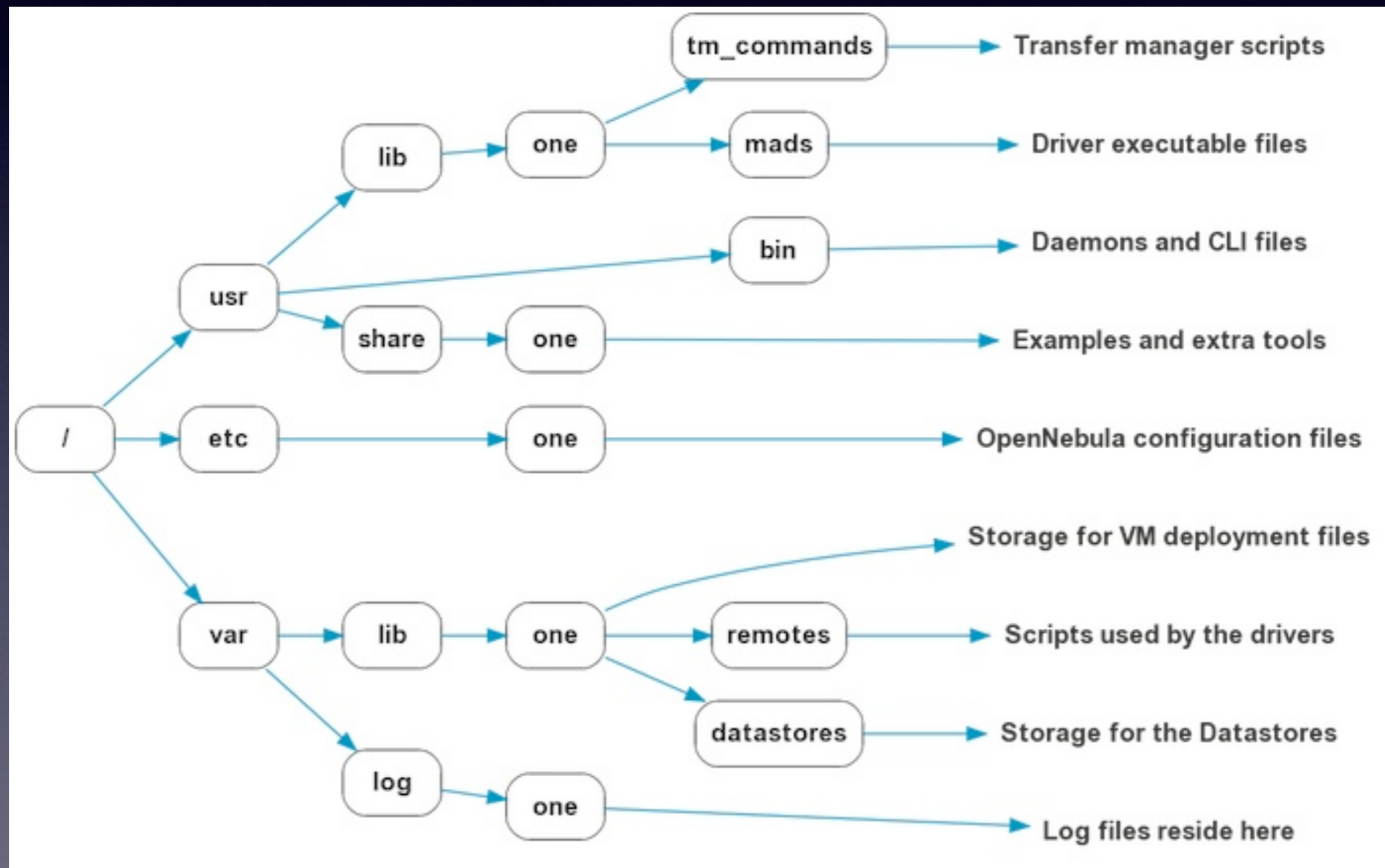
# OpenNebula

## - Komponenten -

- Virtualisierer (KVM)
  - libvirtd
  - User: oneadmin + authorized key file
  - sudoers (bridgetcl, ...)
  - policykit (RH) / User Berechtigungen für /dev/  
qemu (Debian)

# OpenNebula

## - Komponenten -



# OpenNebula - Workflow -

- Netzwerk
- Image
- Kontextualisierung
- Template
- VM
- Hooks

# OpenNebula - Workflow -

- Netzwerk
- Image
- Kontextualisierung
- Template
- VM
- Hooks
- 802.1q
- ebtables
- open vswitch
- dummy (nat)



# OpenNebula - Workflow -

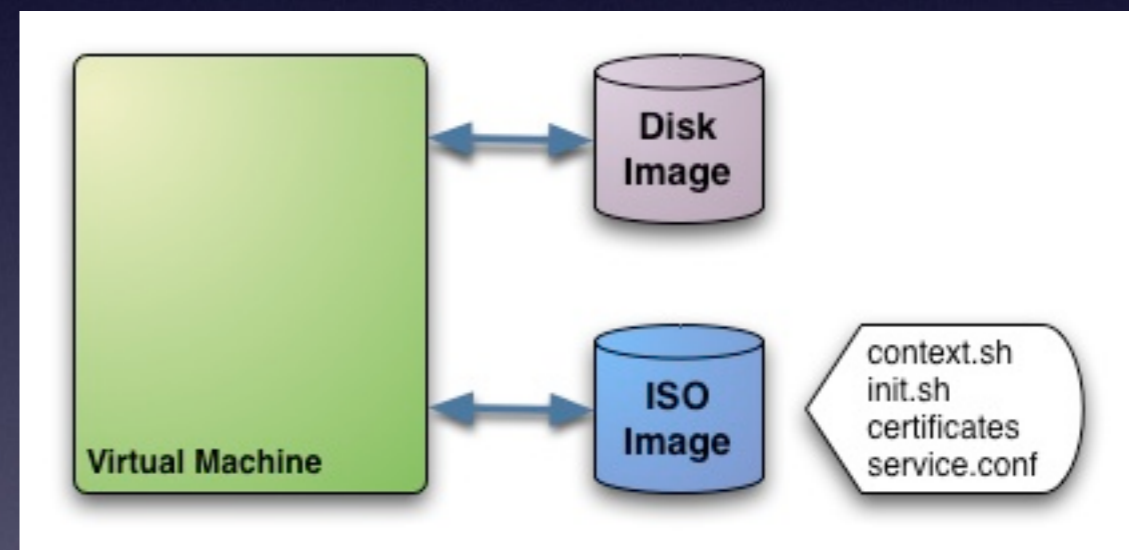
- Netzwerk
- Image
- Kontextualisierung
- Template
- VM
- Hooks
- Muss vorab angefertigt werden
- Braucht one-context Package oder cloud-init (v0.7.3 oder neuer)
- Hinweis: Image erst auf Management Node kopieren

# OpenNebula - Workflow -

- Netzwerk
- Image
- Kontextualisierung
- Template
- VM
- Hooks
- Anpassungen des Images (hostname, Netzwerk Konfiguration, ssh pub key, ...)
- Kann durch eigene Skripte erweitert werden
- VM erhält ein CD-ROM mit den Kontext Informationen

# OpenNebula - Workflow -

- Netzwerk
- Image
- Kontextualisierung
- Template
- VM
- Hooks



# OpenNebula

## - Workflow -

- Netzwerk
- Image
- Kontextualisierung
- Template
- VM
- Hooks
- Zusammenfassung von Netzwerk, CPU, RAM und Image
- Hardware Spezifika (z.B. ACPI)
- Dient als Vorlage für VM

# OpenNebula

## - Workflow -

- Netzwerk
- Image
- Kontextualisierung
- VM wird auf Basis eines Templates initialisiert
- Template
- VM
- Hooks

# OpenNebula - Workflow -

- Netzwerk
- Image
- Kontextualisierung
- Template
- VM
- Hooks
- Hooks werden bei bestimmten VM Stati ausgeführt
- DNS (nsupdate), Puppet Zertifikatsmanagement, PuppetDB remove
- Anmelden einer VM an einem Dritt-System

# OpenNebula

## - Workflow -

- Netzwerk
  - Image
  - Kontextualisierung
  - Template
  - VM
  - Hooks
- ```
#!/bin/bash
set -e
NAME=`onevm show $1 | \
    grep HOSTNAME | cut -d '"' -f2`

DOMAIN=`echo $NAME | cut -d '.' -f2-`

curl -k -X DELETE -H "Accept: pson" https://
puppet.$DOMAIN:8140/production/
certificate_status/$NAME
```

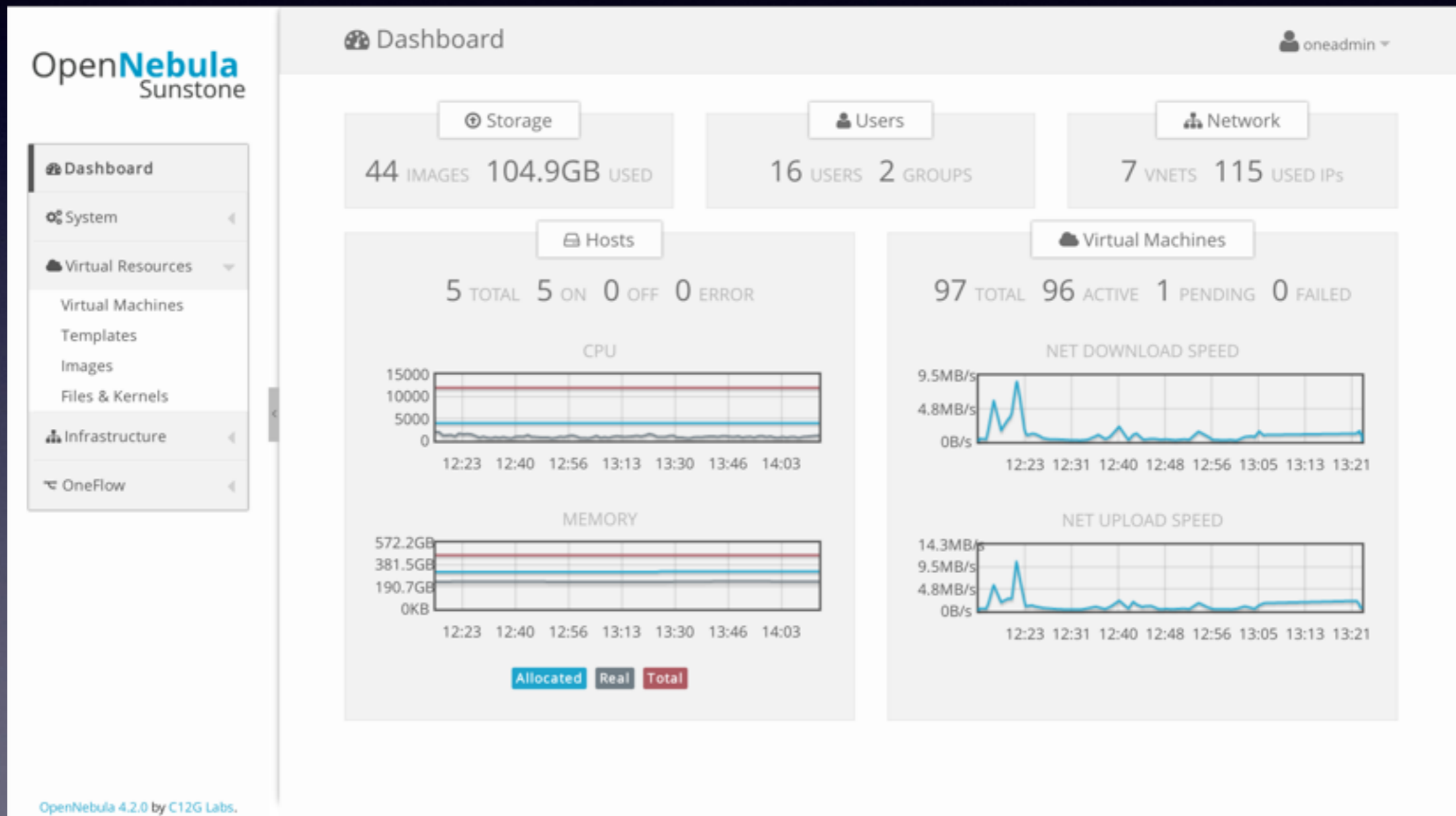
# OpenNebula

## - GUI / CLI -

- CLI
  - User braucht eine Token Datei `~/.one_auth.conf`
  - Verschiedene Kommandos (`one*`)
- GUI
  - Sunstone Web Interface
  - Anbindung an LDAP möglich
  - Verwendet ebenfalls eine Token Datei



# OpenNebula - GUI / CLI -



# OpenNebula - GUI / CLI -

**OpenNebula Sunstone**

Hosts 5 TOTAL 5 ON 0 OFF 0 ERROR oneadmin

| ID                                  | Name | Cluster            | RVMs         | Allocated CPU | Allocated MEM     | Status               |        |
|-------------------------------------|------|--------------------|--------------|---------------|-------------------|----------------------|--------|
| <input type="checkbox"/>            | 0    | srv-211.██████████ | BISS-Cluster | 14            | 1400 / 2400 (58%) | 76GB / 70.8GB (107%) | ON     |
| <input type="checkbox"/>            | 2    | srv-212.██████████ | BISS-Cluster | 26            | 700 / 2400 (29%)  | 60GB / 70.8GB (85%)  | ON     |
| <input checked="" type="checkbox"/> | 14   | srv-213.██████████ | BISS-Cluster | 13            | 325 / 2400 (14%)  | 42GB / 70.8GB (59%)  | ON     |
| <input type="checkbox"/>            | 17   | srv-220.██████████ | BISS-Cluster | 25            | 700 / 2400 (29%)  | 82.5GB / 126GB (65%) | UPDATE |
| <input type="checkbox"/>            | 21   | srv-219.██████████ | BISS-Cluster | 13            | 600 / 2400 (25%)  | 46GB / 126GB (37%)   | ON     |

Showing 1 to 5 of 5 entries

Information **Graphs**

**CPU**

3000  
2000  
1000  
0

13:33 16:20 19:06 21:53 00:40 03:26 06:13 09:00

Allocated  Real  Total

**MEMORY**

95.4GB  
71.5GB  
47.7GB  
23.8GB  
0KB

13:33 16:20 19:06 21:53 00:40 03:26 06:13 09:00

Allocated  Real  Total

OpenNebula 4.2.0 by C12G Labs.

# OpenNebula - GUI / CLI -

The screenshot displays the OpenNebula Sunstone web interface. On the left is a navigation sidebar with categories like Dashboard, System, Virtual Resources, Infrastructure, Clusters, and OneFlow. The main content area is titled 'Clusters' and shows a table of cluster information. Below this, a 'Hosts' tab is active, displaying a detailed table of host resources including CPU and memory usage.

**OpenNebula Sunstone**

**Clusters**

| ID  | Name         | Hosts | VNets | Datastores |
|-----|--------------|-------|-------|------------|
| 100 | BISS-Cluster | 5     | 4     | 3          |
| 101 | umg22        | 0     | 0     | 0          |
| 102 | DEV-Cluster  | 0     | 0     | 0          |

Showing 1 to 3 of 3 entries

**Hosts**

| ID | Name               | Cluster      | RVMS | Allocated CPU     | Allocated MEM        | Status |
|----|--------------------|--------------|------|-------------------|----------------------|--------|
| 0  | srv-211.██████████ | BISS-Cluster | 14   | 1400 / 2400 (58%) | 76GB / 70.8GB (107%) | ON     |
| 2  | srv-212.██████████ | BISS-Cluster | 26   | 700 / 2400 (29%)  | 60GB / 70.8GB (85%)  | ON     |
| 14 | srv-213.██████████ | BISS-Cluster | 13   | 325 / 2400 (14%)  | 42GB / 70.8GB (59%)  | ON     |
| 17 | srv-220.██████████ | BISS-Cluster | 25   | 700 / 2400 (29%)  | 82.5GB / 126GB (65%) | UPDATE |
| 21 | srv-219.██████████ | BISS-Cluster | 13   | 600 / 2400 (25%)  | 46GB / 126GB (37%)   | ON     |

Showing 1 to 5 of 5 entries

OpenNebula 4.2.0 by C12G Labs.

# OpenNebula - GUI / CLI -

OpenNebula Sunstone

Files & Kernels 7 TOTAL 7MB SIZE oneadmin

Create Delete More Search

| ID  | Owner    | Group    | Name                  | Datastore | Type    | Status |
|-----|----------|----------|-----------------------|-----------|---------|--------|
| 0   | oneadmin | oneadmin | init.sh               | files     | CONTEXT | READY  |
| 87  | oneadmin | oneadmin | SetupComplete.cmd     | files     | CONTEXT | READY  |
| 91  | oneadmin | oneadmin | startup.vbs           | files     | CONTEXT | READY  |
| 103 | oneadmin | oneadmin | one-context.ps1       | files     | CONTEXT | READY  |
| 124 | oneadmin | oneadmin | SetupCompleteWin8.cmd | files     | CONTEXT | READY  |
| 126 | oneadmin | oneadmin | startupWin8.vbs       | files     | CONTEXT | READY  |
| 127 | oneadmin | oneadmin | one-contextWin8.ps1   | files     | CONTEXT | READY  |

Showing 1 to 7 of 7 entries

Information

| File - init.sh  |                     |
|-----------------|---------------------|
| ID              | 0                   |
| Name            | init.sh             |
| Datastore       | files               |
| Type            | CONTEXT             |
| Register time   | 15:07:57 08/14/2013 |
| Filesystem type | --                  |
| Size            | 1MB                 |
| State           | 1                   |
| Running VMS     | 0                   |

| Permissions: | Use                                 | Manage                              | Admin                    |
|--------------|-------------------------------------|-------------------------------------|--------------------------|
| Owner        | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Group        | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> |
| Other        | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |

| Ownership |          |
|-----------|----------|
| Owner     | oneadmin |
| Group     | oneadmin |

Configuration & Tags

Add

OpenNebula 4.2.0 by C12G Labs.

# OpenNebula - GUI / CLI -

The screenshot displays the OpenNebula Sunstone web interface. On the left is a navigation sidebar with categories like System, Virtual Resources, Infrastructure, and OneFlow. The main content area is titled 'Images' and shows a summary of 41 total images with 88.2GB used. Below this is a table listing various images, with one selected. A modal window is open, showing detailed information for the selected image, including its metadata, permissions, ownership, and configuration tags.

**OpenNebula Sunstone**

41 TOTAL 88.2GB USED

oneadmin

Refresh Create Delete Clone More Search

| ID | Owner    | Group    | Name                                 | Datastore | Type      | Status   | #VMS |
|----|----------|----------|--------------------------------------|-----------|-----------|----------|------|
| 2  | oneadmin | oneadmin | centos_base                          | default   | OS        | USED     | 9    |
| 8  | oneadmin | oneadmin | centos_base_with_2nd_device          | default   | OS        | DISABLED | 0    |
| 9  | oneadmin | oneadmin | 40gb_data                            | default   | DATABLOCK | DISABLED | 0    |
| 10 | oneadmin | oneadmin | centos_base_with_2nd device_virtio   | default   | OS        | USED     | 19   |
| 11 | oneadmin | oneadmin | 40gb_data_virtio                     | default   | DATABLOCK | USED     | 20   |
| 16 | oneadmin | oneadmin | jenkins-build-debian_squeeze_x64_15G | default   | OS        | USED     | 3    |
| 40 | oneadmin | oneadmin | jenkins-centos_59_x64_15G            | default   | OS        | USED     | 3    |
| 45 | oneadmin | oneadmin | centos_59_x64_15G                    | default   | OS        | READY    | 0    |

Information

| Image - centos_base_with_2nd device_virtio |                                    |
|--------------------------------------------|------------------------------------|
| ID                                         | 10                                 |
| Name                                       | centos_base_with_2nd device_virtio |
| Datastore                                  | default                            |
| Type                                       | OS                                 |
| Register time                              | 12:41:54 08/16/2013                |
| Persistent                                 | no                                 |
| Filesystem type                            | --                                 |
| Size                                       | 1.1GB                              |
| State                                      | USED                               |
| Running VMS                                | 19                                 |

| Permissions: | Use                                 | Manage                              | Admin                    |
|--------------|-------------------------------------|-------------------------------------|--------------------------|
| Owner        | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Group        | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> |
| Other        | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |

Ownership

|       |          |                          |
|-------|----------|--------------------------|
| Owner | oneadmin | <input type="checkbox"/> |
| Group | oneadmin | <input type="checkbox"/> |

Configuration & Tags

|            |       |                          |                          |
|------------|-------|--------------------------|--------------------------|
| DRIVER     | qcow2 | <input type="checkbox"/> | <input type="checkbox"/> |
| DEV_PREFIX | hd    | <input type="checkbox"/> | <input type="checkbox"/> |

OpenNebula 4.2.0 by C12G Labs.

# OpenNebula

## - GUI / CLI -

OpenNebula Sunstone

Templates

oneadmin

Create Delete Instantiate More Search

| ID | Owner    | Group    | Name                                             | Registration time   |
|----|----------|----------|--------------------------------------------------|---------------------|
| 0  | oneadmin | oneadmin | centos-6x-2core-4gb_VLAN4001-2nd_40G_virtio      | 15:11:50 08/14/2013 |
| 1  | oneadmin | oneadmin | 1core2gb_VLAN4001                                | 15:14:00 08/14/2013 |
| 2  | oneadmin | oneadmin | 0.5core1gb_VLAN4001                              | 15:54:19 08/14/2013 |
| 6  | oneadmin | oneadmin | 4core4gb_VLAN4001                                | 16:45:32 08/19/2013 |
| 11 | oneadmin | oneadmin | jenkins-build-squeeze-15GB_HDD_12GB_RAM_VLAN4001 | 18:07:25 08/20/2013 |
| 13 | oneadmin | oneadmin | debian-squeeze-15GB_HDD_4GB_RAM_2Cores           | 18:33:54 08/20/2013 |
| 14 | oneadmin | oneadmin | centos-59x64-15GB_HDD_4GB_RAM_2Cores             | 16:39:59 08/21/2013 |
| 16 | oneadmin | oneadmin | jenkins-build-centos59-15GB_HDD_8GB_RAM          | 00:03:52 08/22/2013 |

Information Template

CONTEXT

SSH\_PUBLIC\_KEY ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQCeIcC0WV5owf2+NM3rQEke/d6SZYZCLE68TsNBKh/P/5NoGPrGV6z/eko4x8yMwXGkZxLFZYdHU53p2jUCmW69VyGgWdtWmEswW+NYjBWIvwux4NyQpUB9cZQgqF8wdVgVMCEvW/mABK0aIP5D5nrX54G3FEc3QOzc1glupo1kRPWA/s1eTTChCgc7QY1Pj77R3XrF9Nr6go9GHUKZRUXj/vm95IkiODYSz4QH5omjRFE87uFeHxK64Gi0QMhy4evhvbfdqqilsbyQIPvtBsPOobRM18JRGR8qXzrU6KST0kNu6B4pe7yGct3Dyp1y54Tz9qYNSnb64Eht1Y0PIDr vmroot@teamcity-slave

NETWORK YES

HOSTNAME \$name

FILES\_DS \$FILE[IMAGE\_ID=0]

VCPU 4

NIC

NETWORK\_ID 0

MODEL virtio

OpenNebula 4.2.0 by C12G Labs.

# OpenNebula - GUI / CLI -

The screenshot displays the OpenNebula Sunstone web interface. On the left is a navigation sidebar with categories like Dashboard, System, Virtual Resources, Infrastructure, and OneFlow. The main area shows a 'Virtual Machines' overview with a summary of 94 total machines (91 active, 0 off, 1 pending, 0 failed) and a 'Create' button. Below this is a table listing several VMs, with the first one (ID 24) selected. A detailed view of this VM is shown below the table, including its information, permissions, ownership, and tags.

**Virtual Machines Overview**

| ID | Owner    | Group    | Name                        | Status  | Host               | IPs          | VNC |
|----|----------|----------|-----------------------------|---------|--------------------|--------------|-----|
| 24 | malfke   | users    | martin.██████████           | RUNNING | srv-219.██████████ | 10.175.24.8  |     |
| 47 | oneadmin | oneadmin | jenkins-build-01.██████████ | RUNNING | srv-211.██████████ | 10.175.24.21 |     |
| 48 | oneadmin | oneadmin | jenkins-build-02.██████████ | RUNNING | srv-211.██████████ | 10.175.24.22 |     |
| 49 | oneadmin | oneadmin | jenkins-build-03.██████████ | RUNNING | srv-211.██████████ | 10.175.24.23 |     |
| 50 | oneadmin | oneadmin | dashboard-01.██████████     | RUNNING | srv-220.██████████ | 10.175.24.24 |     |

**Virtual Machine - martin.██████████**

|            |                     |
|------------|---------------------|
| ID         | 24                  |
| Name       | martin.██████████   |
| State      | ACTIVE              |
| LCM State  | RUNNING             |
| Host       | srv-219.██████████  |
| Start time | 16:30:02 08/16/2013 |
| Deploy ID  | one-24              |
| Reschedule | no                  |

**Permissions:**

|       | Use                                 | Manage                              | Admin                               |
|-------|-------------------------------------|-------------------------------------|-------------------------------------|
| Owner | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| Group | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Other | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |

**Ownership**

|       |        |
|-------|--------|
| Owner | malfke |
| Group | users  |

**Tags**

|        |                                           |
|--------|-------------------------------------------|
| FOOBAR | test                                      |
| ERROR  | Tue Oct 1 23:10:25 2013 : Error deploying |

# OpenNebula

## - Kontextualisierung -

```
# Context variables generated by OpenNebula
DISK_ID='1'
ETH0_DNS='10.175.4.11'
ETH0_GATEWAY='10.175.16.1'
ETH0_IP='10.175.24.1'
ETH0_MASK='255.255.240.0'
ETH0_NETWORK='10.175.16.0'
FILES_DS='/var/lib/one/datastores/2/
ef48a35be2d8723ef7788175be6087eb:"init.sh"'
HOSTNAME='martin.xxxxxxxxxx'
NETWORK='YES'
TARGET='hdb'
```



# OpenNebula

## - XML RPC API -

```
#!/usr/bin/python
# based on script of Chris Usher June 2009
# import xmlrpclib re hashlib

server = 'http://<opennebula>:2633/RPC2'
user = "oneadmin"
password = "<password>"
one_auth = '{0}:{1}'.format(user, password)

def getVMInfo(id):
    response = xmlrpclib.ServerProxy(server).one.vm.info(one_auth,id)
    return response[1]

print getVMInfo(24)
```

# OpenNebula

- Demo

**OpenNebula.org**  
The Open Source Toolkit for Cloud Computing

# OpenNebula

Danke schön.  
Fragen?