SYNNEFO: AN INTRODUCTION AND UPDATE
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PRINCIPAL CLOUD ENGINEER, GRNET
Synnefo cloud platform

An all-in-one cloud solution
  - Written from scratch in Python
  - Manages multiple Google Ganeti clusters of VMs
  - Uses Archipelago to unify all cloud storage resources
  - Exposes the OpenStack APIs to end users

Live since 2011
  - Came out of the ~okeanos public cloud service
Synnefo cloud platform

A complete cloud platform

- Identity Service (Keystone API)
- Object Storage Service (Swift API)
- Compute Service (Nova API)
- Network Service (Neutron API)
- Image Service (Glance API)
- Volume Service (Cinder API)
Unified view of storage resources

Files
- User files, with Dropbox-like syncing

Images
- Templates for VM creation

Volumes
- Live disks, as seen from VMs

Snapshots
- Point-in-time snapshots of Volumes
Services Overview
# Layered design

<table>
<thead>
<tr>
<th>Client</th>
<th>OpenStack</th>
<th>Synnefo</th>
<th>UI</th>
</tr>
</thead>
<tbody>
<tr>
<td>vCloud</td>
<td>OpenStack</td>
<td>OpenStack</td>
<td>API</td>
</tr>
<tr>
<td>vCloud</td>
<td>OpenStack</td>
<td>Synnefo</td>
<td>CLOUD</td>
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<tr>
<td>vCenter</td>
<td>OpenStack</td>
<td>Synnefo</td>
<td>CLUSTER</td>
</tr>
<tr>
<td>vSphere</td>
<td>libvirt</td>
<td>Ganeti</td>
<td>NODE</td>
</tr>
<tr>
<td>ESXi</td>
<td>KVM / XEN</td>
<td>KVM / XEN</td>
<td>HYPervisor</td>
</tr>
</tbody>
</table>
Architecture
Interaction with Ganeti

Support for all Ganeti storage templates including ExtStorage
OS Definition = snf-image
Networking = gnt-network +
  snf-network (KVM ifup scripts) +
  nfdhcpd (custom NFQUEUE-based DHCP server)

Asynchronous operation
- Effect path: Receive API requests from user, enqueue requests over RAPI to Ganeti
- Update path: Receive asynchronous notifications from Ganeti, update Synnefo DB, so the user can poll
Archipelago

Storage Virtualization System
Decouples storage resources from storage backends
  – Files / Images / Volumes / Snapshots
Unified way to provision, handle, and present resources
Decouples logic from actual physical storage
  – Software-Defined Storage
Interaction with Archipelago

A common storage substrate for Synnefo
Everything is a resource on Archipelago
The same resource is exposed as
  - A File through the API of the Storage Service
  - An Image through the API of the Image Service
  - A live disk / VM Volume through the API of the Volume Service
  - A Snapshot through the API of the Volume Service

All data remain in one place
No copying of data around
Cloud Storage with Archipelago

- Storage backend 1 (e.g., Ceph)
- Storage backend 2 (e.g., GlusterFS)
- Storage backend 3 (e.g., NFS over NAS)
Archipelago logic

Thin provisioning, with clones and snapshots
  - Independent from the underlying storage technology

Hash-based data deduplication

Pluggable architecture
  - Multiple endpoint (northbound) drivers
  - Multiple backend (southbound) drivers

Multiple storage backends
  - Unified management
  - with storage migrations
Archipelago interfaces
Running Archipelago

- **Physical Host**
  - VM
    - `/dev/vda1`
  - Kernel block driver
  - Archipelago
    - Storage driver
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  - Archipelago
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  - VM
    - `/dev/vda1`
  - Kernel block driver
  - Archipelago
    - Storage driver
- **Physical Host**
  - Web Server
    - HTTP gateway
  - Archipelago
    - Storage driver

**Storage**
- Rados, NFS, ...

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Comparison to OpenStack?

The best of both worlds

- Enterprise, persistent, stable VMs, live migrations (VMware-like)
  * Key technologies: Ganeti
- Over commodity hardware, no SAN needed
  * Key technologies: DRBD, Archipelago, Ceph
- at Cloud scale, accessible over Cloud APIs (OpenStack-like)
  * Key technologies: Synnefo

Storage virtualization with Archipelago

- Common storage pool for everything
  * User files, Images (VM templates), live VM volumes, Snapshots
  * Zero-copy thin cloning / snapshotting for super-fast provisioning
    * Over commodity hardware, no SAN needed
    * Less than 30 sec for a VM to be fully up and running
- Independent of the actual data store
- Pluggable storage: NFS/NAS, Ceph, Gluster, even SAN all at once
  * With inter-backend data moves
Why Synnefo? C: Easier to run at scale.

Distinct management domains: Synnefo and Ganeti
- Management of self-contained Ganeti clusters
- Distinct Synnefo and Ganeti upgrade cycles
- Independent upgrades with no VM downtime

Limited access to DBs, decentralized VM state
- Only Synnefo workers need access to DBs
- No access from Ganeti nodes
  - Reduces impact of possible VM breakout
  - Boosts scalability to thousands of nodes
- Easier to firewall, easier to handle security-wise

Physical node management
- Dynamically add/remove/drain/set offline physical nodes
- Dynamically add/remove/drain/rebalance whole Ganeti clusters
- Evacuate failing nodes with live VM migrations, no VM downtime

Recovery from failure
- Built-in reconciliation mechanisms
- Able to recover from Synnefo/Ganeti downtime
  * Ensures in-sync state across components

Easier to contain failure
- Outages contained inside smaller domains
  * inside a node, or inside a Ganeti cluster
What’s new in upcoming Synnefo v0.16

Admin Dashboard
Implementation of Volumes + Cinder API
Add/Remove Volumes in running VMs (hotplug)
Revamped Projects
Snapshots
Archipelago becomes the Pithos backend

Coming in v0.17:
- Generic ACL mechanism for all Synnefo objects
- New settings mechanism
The ~okeanos use case @ GRNET

Live since July 2011

Numbers

− Users: > 10000
− VMs: > 10000 currently active
− More than 380k VMs spawned so far, more than 110k networks

Physical Infrastructure

− 13 Ganeti Clusters, spanning a whole DC
− 1PB of raw storage capacity
Try it out!

http://www.synnefo.org
Thank you!
Screenshots.
## Create new machine

### Image

<table>
<thead>
<tr>
<th>Image type</th>
<th>Available images</th>
<th>Size</th>
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<tbody>
<tr>
<td>System</td>
<td>NetBSD</td>
<td>4.75 GB</td>
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<tr>
<td></td>
<td>NetBSD 6.1.2 (GENERIC)</td>
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<tr>
<td></td>
<td>OpenBSD</td>
<td>4.75 GB</td>
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<tr>
<td></td>
<td>OpenBSD 5.4 (GENERIC)</td>
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<td></td>
<td>FreeBSD</td>
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<td></td>
<td>FreeBSD 9.2-RELEASE (GENERIC)</td>
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<td></td>
<td>OpenSUSE</td>
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<tr>
<td></td>
<td>openSUSE 13.1 (x86_64)</td>
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<td></td>
<td>Windows Server 2012</td>
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<tr>
<td></td>
<td>Windows Server 2012 Datacenter</td>
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<tr>
<td></td>
<td>Windows Server 2008R2</td>
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<tr>
<td></td>
<td>Windows Server 2008R2 Datacenter</td>
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<tr>
<td></td>
<td>CentOS</td>
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<td></td>
<td>CentOS release 6.5 (Final)</td>
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<td></td>
<td>Centos release 7.3 (Final)</td>
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- **cancel**
- **next**
<table>
<thead>
<tr>
<th>IP Address</th>
<th>Status</th>
<th>MAC Address</th>
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<tbody>
<tr>
<td>83.212.96.147</td>
<td>In use</td>
<td>aa:0e:ea:1e:c0:79</td>
</tr>
<tr>
<td>83.212.98.156</td>
<td>Available</td>
<td>MAC: aa:0e:ea:1e:c0:79</td>
</tr>
<tr>
<td>83.212.105.230</td>
<td>In use</td>
<td>MAC: aa:0e:ea:1e:c0:79</td>
</tr>
</tbody>
</table>
If you are a student, professor or researcher you can login using your academic account.

ACADEMIC LOGIN

vkoukis@grnet.gr

SUBMIT

Forgot your password?
<table>
<thead>
<tr>
<th>Resource</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Space</td>
<td>1%</td>
</tr>
<tr>
<td>System Disk</td>
<td>27%</td>
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<tr>
<td>CPUs</td>
<td>23%</td>
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<tr>
<td>RAM</td>
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<tr>
<td>Virtual Machines</td>
<td>17%</td>
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<td>Private Networks</td>
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<tr>
<td>Public IPs</td>
<td>33%</td>
</tr>
</tbody>
</table>
Integration with Synnefo

[Diagram of integration with Synnefo]

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