

Greek Research and Technology Network S.A. GRNET

~okeanos:
One Click Away from your Own
Virtual Machines, Network, and Storage

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Some History...

- 2007: Plans to deliver on-line storage service
- 2007 – 2009: Development of on-line storage service using GWT (front-end), JBoss (backend)
- 2009: Pithos released to the users.



Follow-up...

- In 2010, encouraged by the success of Pithos, we start planning an Infrastructure as a Service (IaaS) solution
- It would encompass a new version of Pithos, as well as computing (VMs) and networking resources.
- This would become ~okeanos.

The logo for okeanos, featuring a stylized blue wave icon to the left of the word "okeanos" in a lowercase, sans-serif font.

Goals

- **Production-quality** IaaS cloud similar to Amazon AWS
- **Scalability** to thousands users/nodes/VMs
- **Persistent** VMs
- **Commodity components** (No SAN, no exotic network infra)
- Everyone can use it – **super simple web UI**
- **No vendor lock-in**
- Low admin costs, **manageable by a small team**

Status at Start

- Reviewed open source ones
 - Eucalyptus
 - Cloudstack
 - Opennebula
 - Openstack
 - etc...
- **Still** evolving systems
- No turnkey solutions

Synnefo and ~okeanos



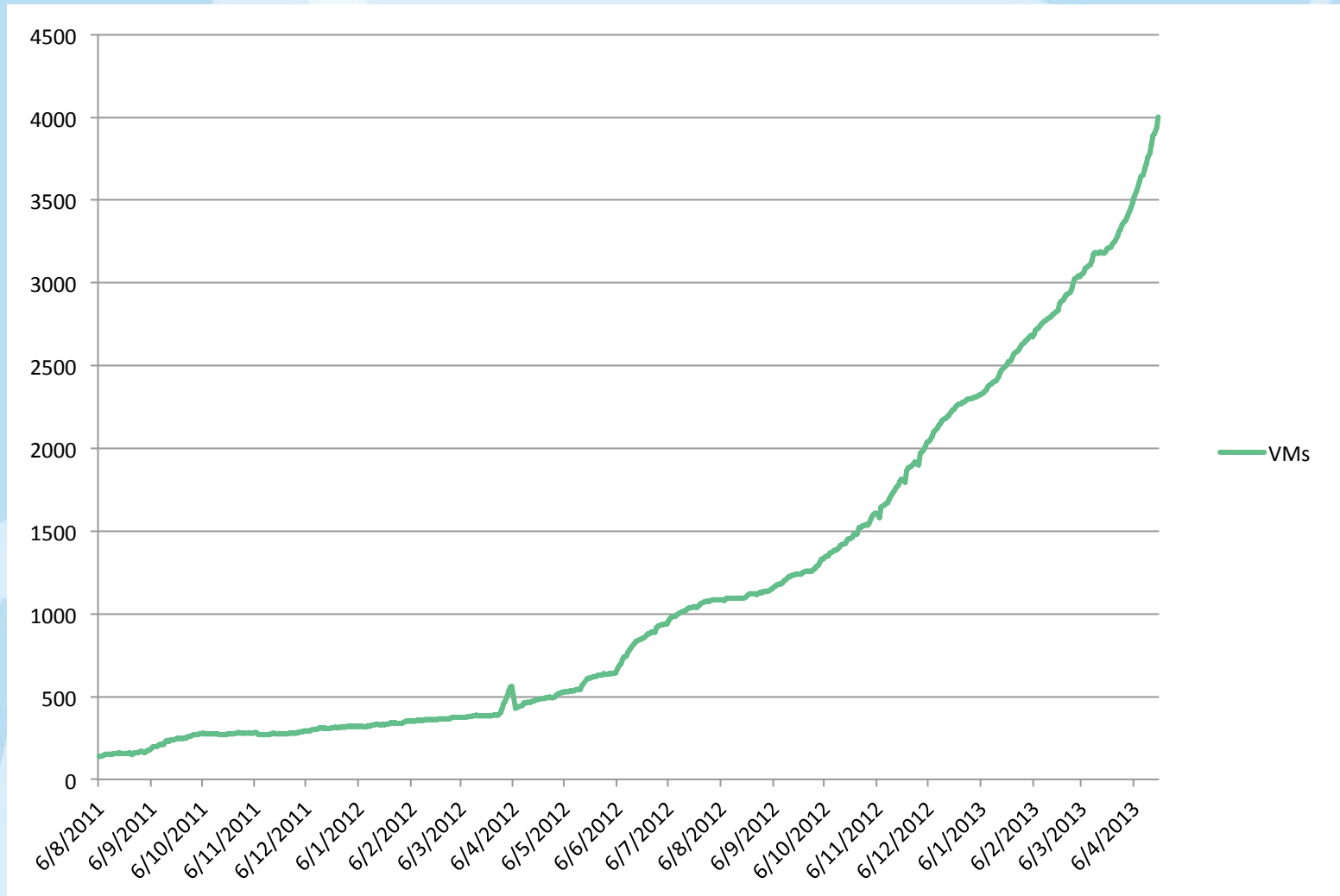
An open source cloud software written in Python and C

- Oct. 2010: implementation starts
- July 2011: v0.5.2.1 (powers ~okeanos alpha)
- 28.3.2012: v0.9
- 26.6.2013: v0.14.1
- 3.10.2013: v0.14.7
- 22.12.2013: v0.15rc1 (powers ~okeanos beta)
- 10.02.2014: v0.15rc5
- 14.02.2014: v0.15
- 11/2014: v0.16

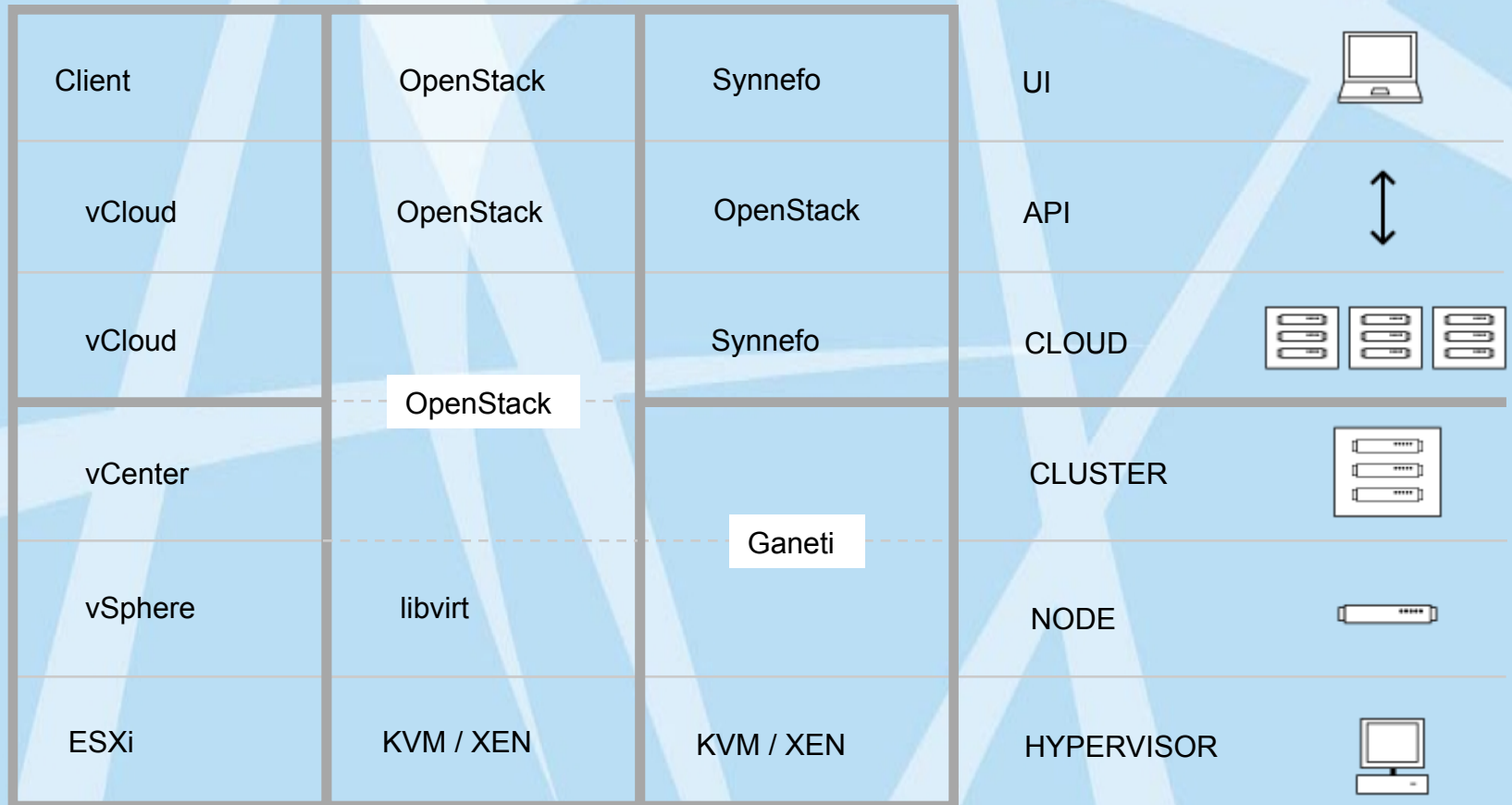
Some Numbers

- Users: > 8000
- VMs: > 7100 currently active
- ~428K VMs spawned so far (started/destroyed)
- More than 120K vLANs spawned so far (user owned VLANs)
- Typical VM flavor (more than 340 flavors available!):
4 cores (vCPUs), 80GB Hard Disk, 4 or 8GB RAM
- 13 Ganeti Clusters, spanning a whole DC
- 1PB of raw storage capacity

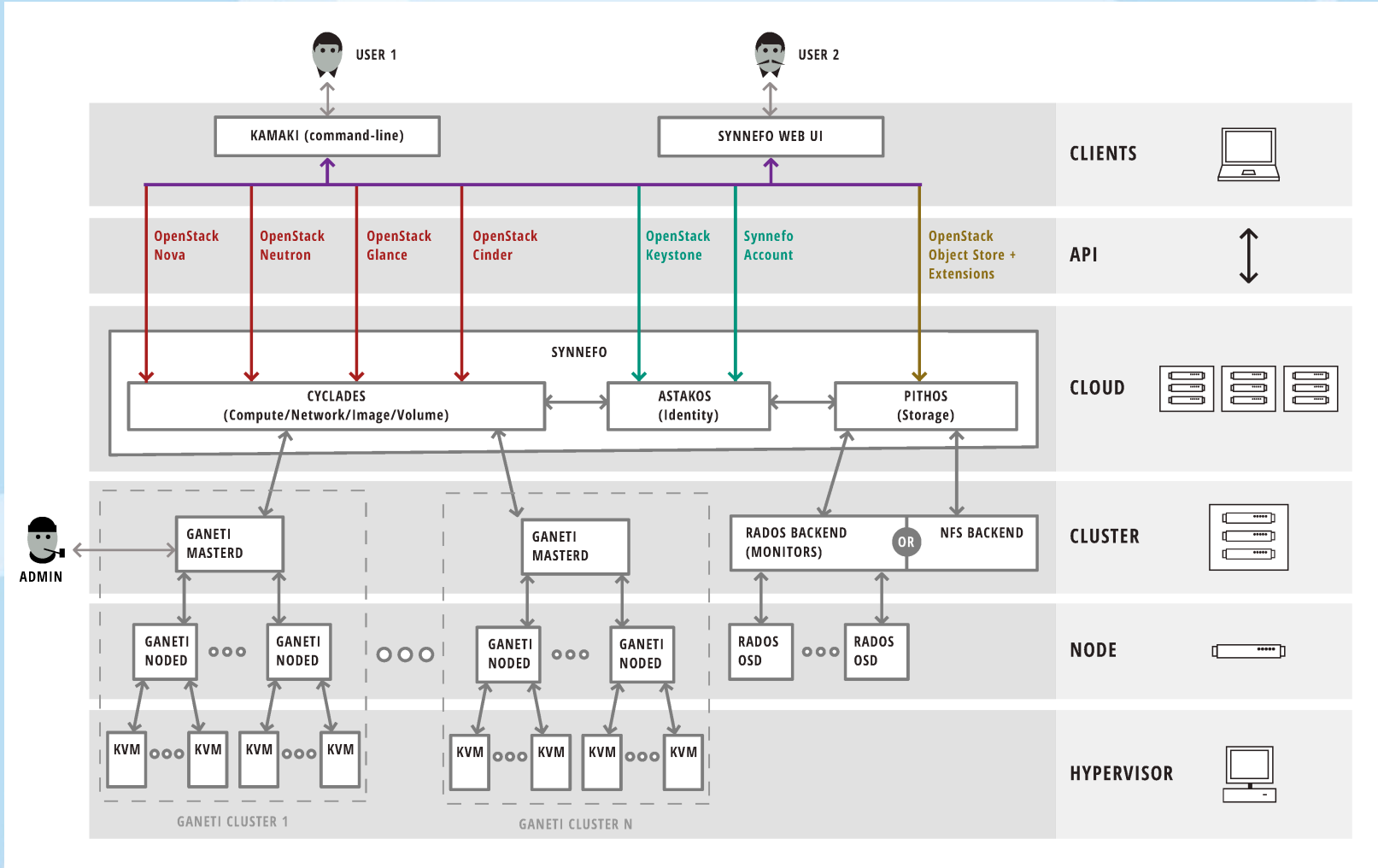
Evolution



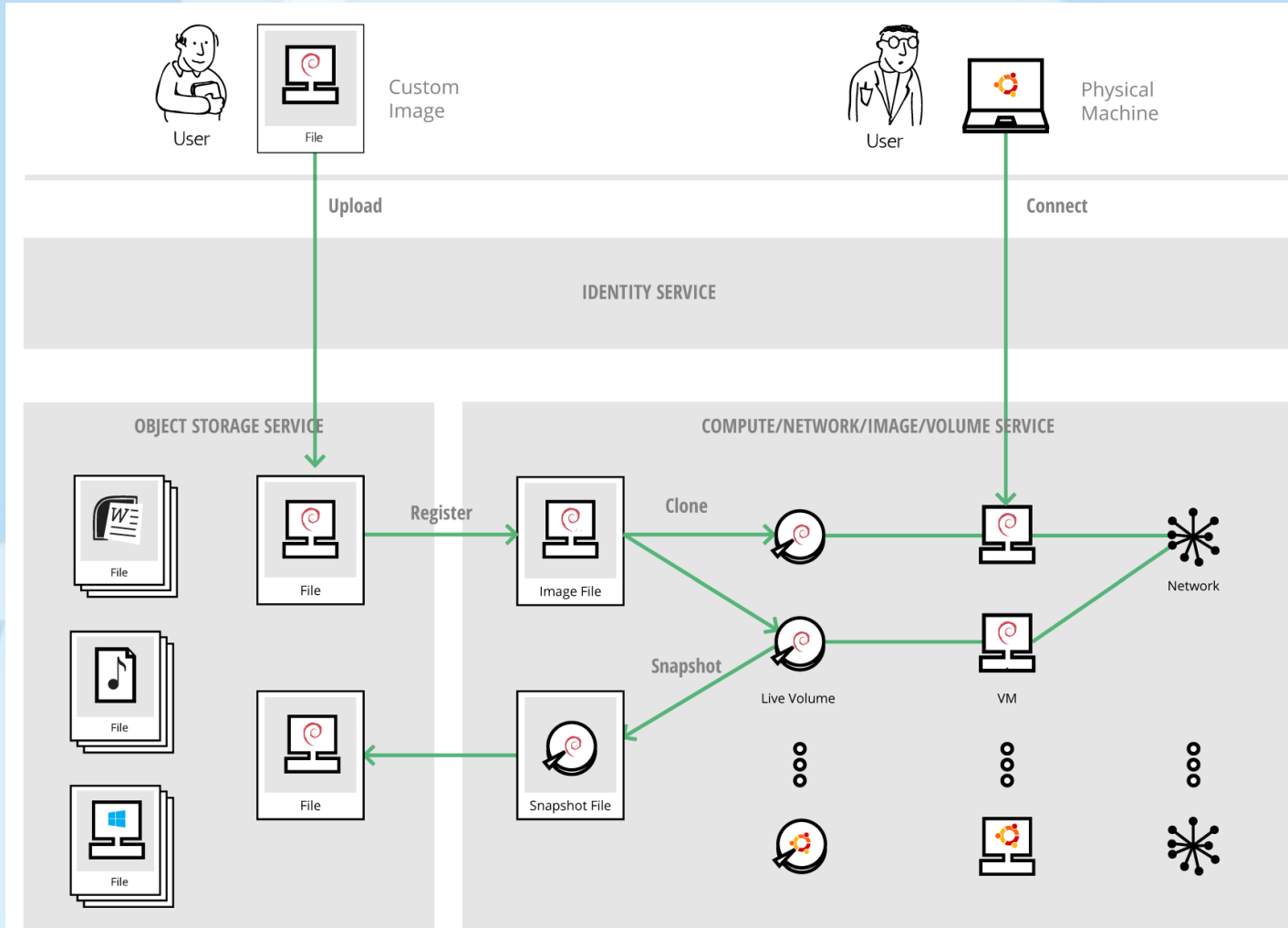
Design



Architecture



Services Overview



Identity Service (Astakos)

- Identity Management, Resource Accounting and SSO
 - Multiple authentication methods per user
 - LDAP, AD, Local username/password, Federated (Shibboleth)
 - Google, Twitter, LinkedIn
 - Fine-grained per-user, per-resource quota
 - Exposes the OpenStack APIs (Keystone) to users

Identity Service (Astakos)

- A single dashboard for users
 - View/modify profile information
 - Set/unset active authentication methods
 - Easy, integrated reporting of per-resource quotas
 - Project management: View/Join/Leave projects
 - Manage API access and retrieve authentication tokens

Compute/Network/Image/Volume Service (Cyclades)

- Layer over multiple Ganeti clusters
 - Python/Django implementation
 - Exposes the OpenStack APIs (Nova, Neutron, Glance, Cinder)
- A thin translation layer
 - From user (API) requests
 - To VM operations on multiple Ganeti clusters
- Ganeti clusters are distinct entities
 - May be geographically remote
 - Admin always has direct access for troubleshooting

Compute/Network/Image/Volume Service (Cyclades)

- Image Handling
 - Spawning VMs from custom Images
 - Images treated as Files on Storage service
 - System and User Images, fine-grained sharing, custom ACLs
- Images for all major Operating Systems
 - Windows Server 2008, 2008 R2, 2012, 2012 R2
 - Debian, Ubuntu, RHEL, CentOS, Fedora, ArchLinux, openSUSE, Gentoo
 - NetBSD, FreeBSD, OpenBSD

Google Ganeti

- Mature, production-ready VM cluster management
 - developed by Google, for Google's corporate infra
 - as open source VMware alternative
 - scalable over commodity HW
 - in production inside Google since 2006
- Easy to integrate into existing infrastructure
 - Remote API over HTTP, pre/post hooks for every action

Storage Service (Pithos)

- A single location for user Files, VM Images, and Snapshots
- Exposes the OpenStack Object Storage API (Swift)
 - plus extensions, for sharing and syncing
- Rich sharing, with fine-grained Access Control Lists
- Hash-based (sha256) deduplication for individual blocks
- Partial file transfers, efficient syncing (Dropbox-like)
- Backed by Archipelago

Archipelago

- Storage Virtualization System
 - Powering storage in Synnefo
- 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

Unified View of Storage Resources



Files

- User files, with Dropbox-like syncing



Images

- Templates for VM creation



Volumes

- Live disks, as seen from VMs



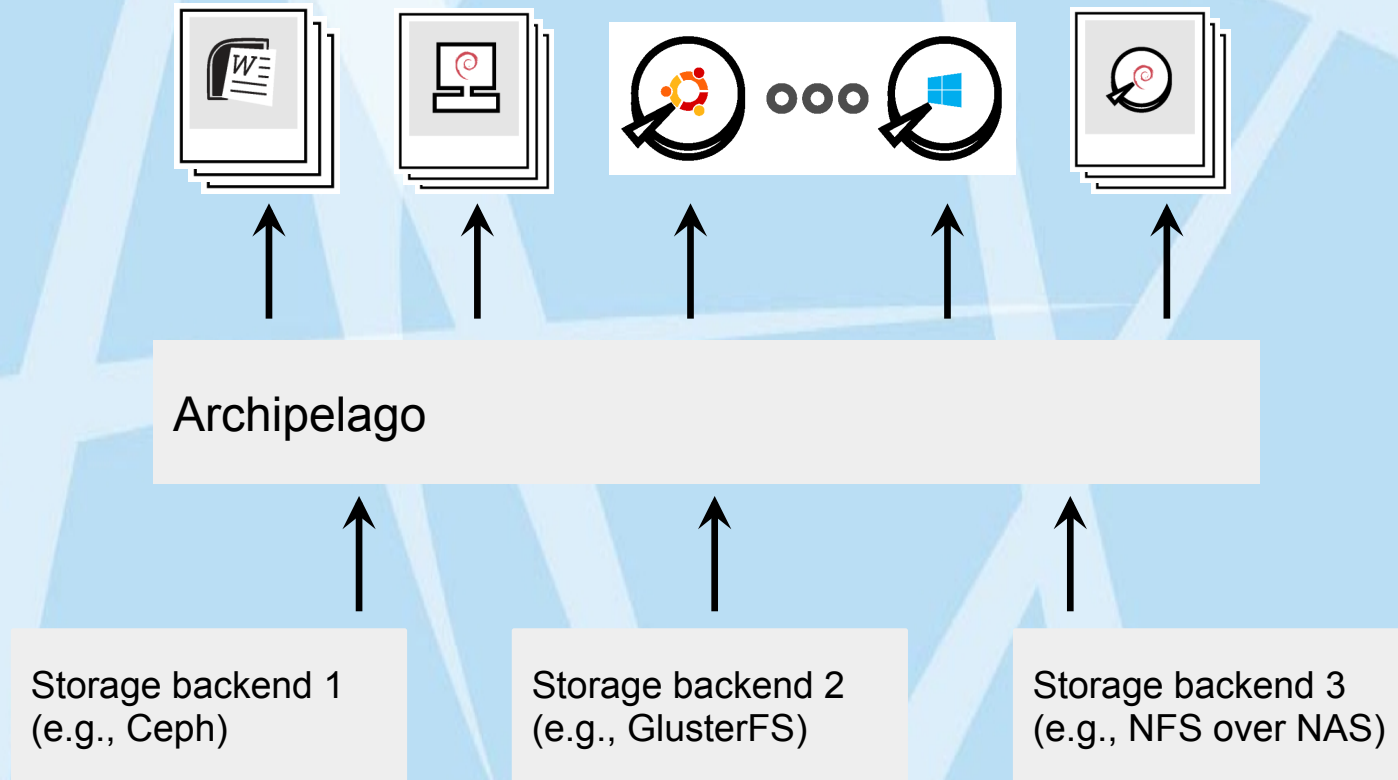
Snapshots

- Point-in-time snapshots of volumes

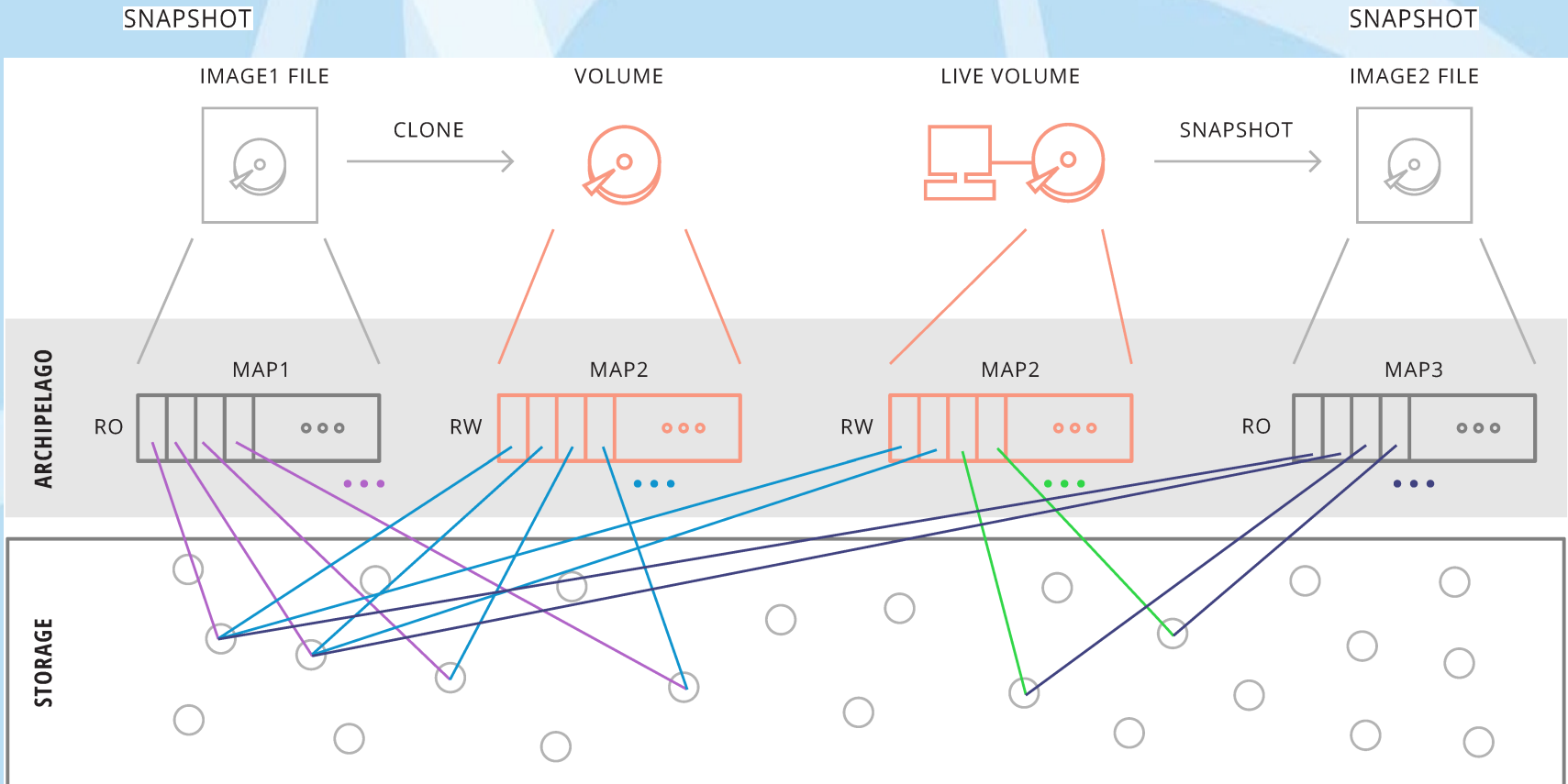
Interaction with Archipelago

- 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 (Pithos)
 - 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



Composing Resources with Archipelago



Next Steps

- Move from IaaS to PaaS
- PaaS for e-Science
- Leveraging computational and storage IaaS offered by Eucalyptus and Pithos
- Back-up as a Service
- Back-end improvements
- etc...

Requirements

- Interoperability with existing infrastructure (~okeanos, Pithos+)
- Web 2.0 Graphical User Interface
- Command-Line Interface
- Both GUI and CLI on top of single API, available to other 3rd party clients

Implementation

- Project already started (summer 2014)
- Completion time: summer 2015
- Development in rapid increments using Scrum
- All code open source, basic language is Python
- Adopting REST-based infrastructure with GUI on responsive framework (Ember.js) and asynchronous backend functionality

okeanos

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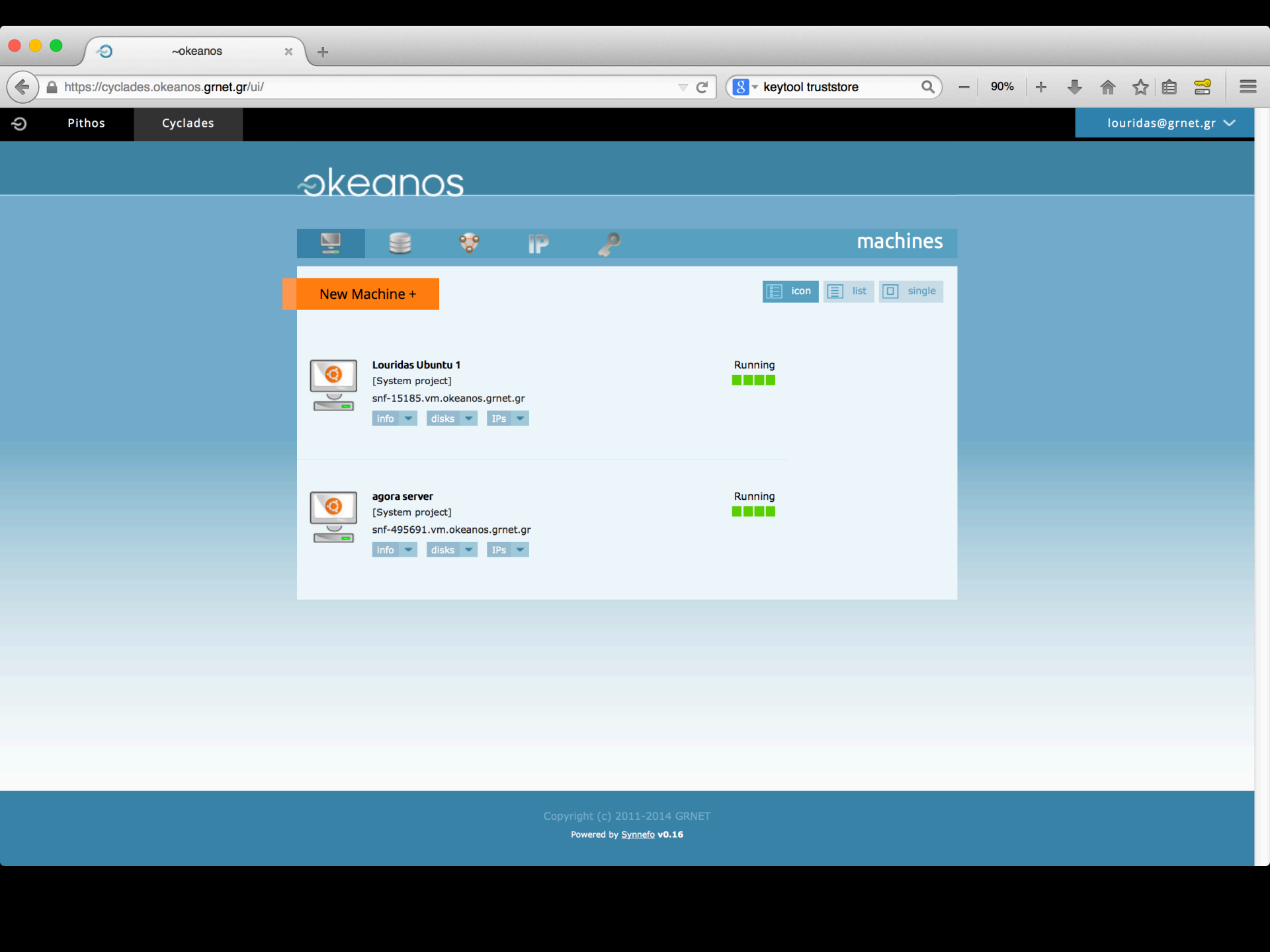
WELCOME TO OKEANOS!

This is GRNET's cloud service, for the Greek Research and Academic Community. With -okeanos you are one click away from your own Virtual Machines, Networks and Storage.

STATISTICS

Spawned VMs	Active VMs	Spawned Networks
428,383	7,121	129,871





New Machine +

icon list single



Louridas Ubuntu 1
[System project]
snf-15185.vm.okeanos.grnet.gr

Running
■■■■

info disks IPs



agora server
[System project]
snf-495691.vm.okeanos.grnet.gr

Running
■■■■

info disks IPs







Create new machine close

1 Image Select an OS
Choose your preferred image **2** **3** **4** **5**

Images

- System
- My images
- Shared with me
- Public

Available images

 Windows Server 2008 R2 by system Windows Server 2008 R2 Datacenter details	13.36 GB
 Windows Server 2012 R2 by system Windows Server 2012 R2 Datacenter details	10.00 GB
 Windows Server 2012 by system Windows Server 2012 Datacenter details	15.31 GB
 Oracle Linux 6 by system Oracle Linux Server release 6.5 details	1.07 GB
 Kubuntu LTS (old) by system Kubuntu 12.04.5 LTS details	2.55 GB
 Kubuntu LTS by system Kubuntu 14.04.1 LTS details	3.29 GB

cancel **next**

Create new machine close

1 **2 Flavor** **3** **4** **5**

Select CPUs, RAM and Disk Size
Available options are filtered based on the selected image

agora.grnet.gr

Predefined

Small
Medium
Large

CPUs (2 left) Choose number of CPU cores

1 x 2 x 4 x 8 x

Memory size (4.00 GB left) Choose memory size

512 MB 1 GB 2 GB 4 GB 6 GB 8 GB

Disk size (5.00 GB left) Choose disk size

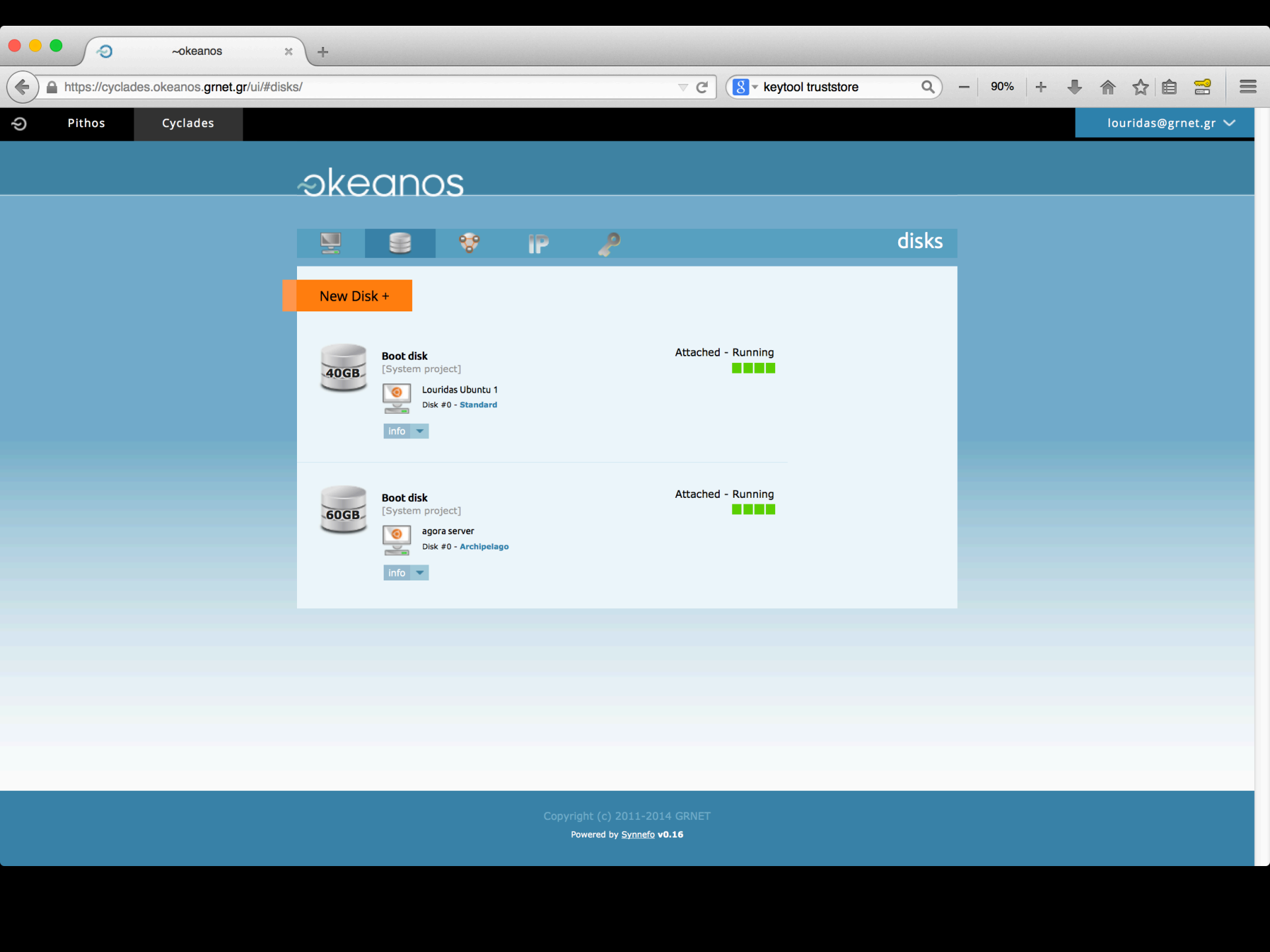
5 GB 10 GB 20 GB 40 GB 60 GB 80 GB 100 GB

Storage Select storage type

Standard Archipelago

Storage supporting fast, thin cloning and soon snapshots. Ideal for your elastic VMs, e.g.: desktop, experimental servers, short-lived compute-intensive servers.

previous next



New Disk +



Boot disk
[System project]

Attached - Running



Louridas Ubuntu 1
Disk #0 - Standard

info



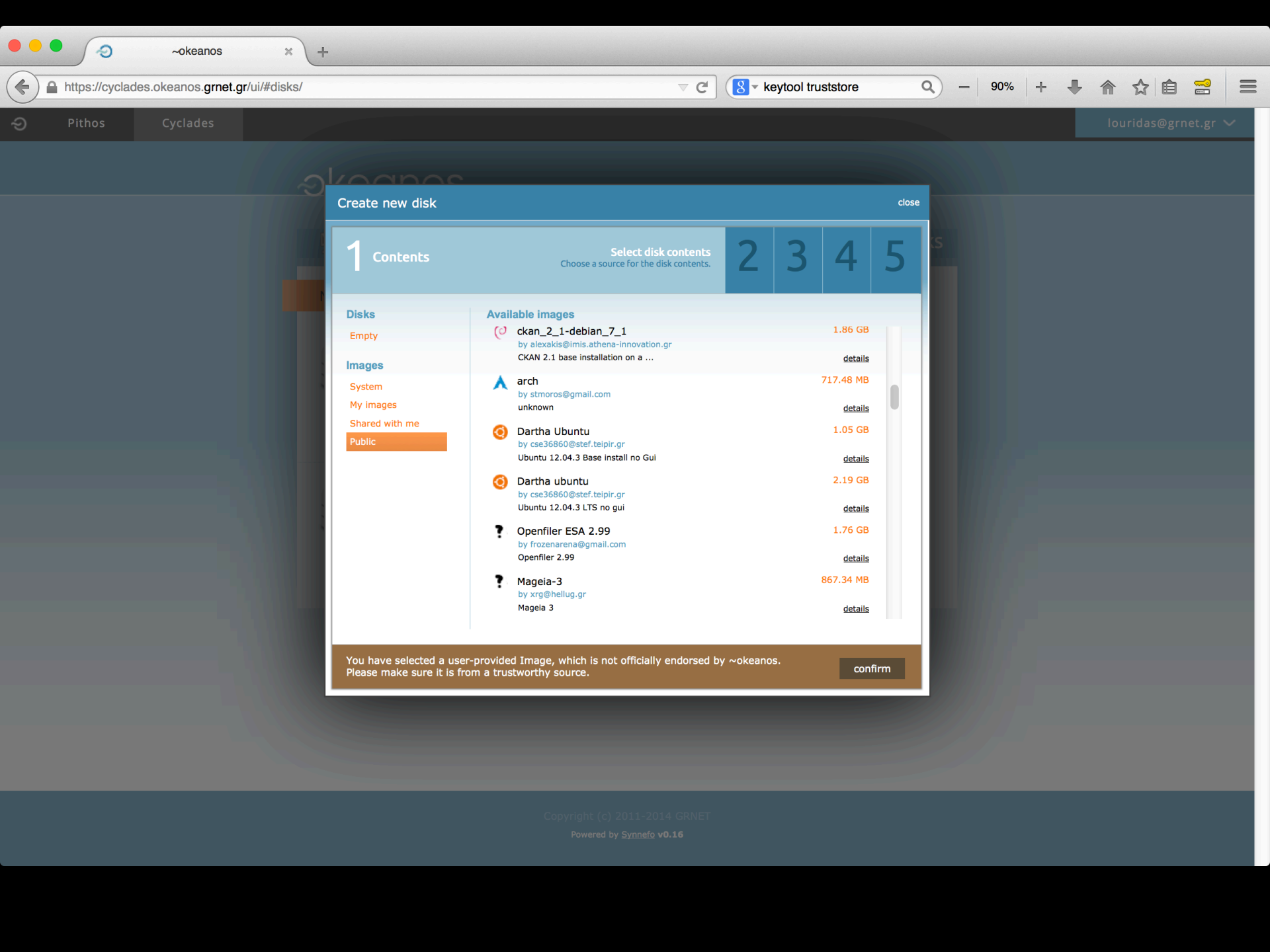
Boot disk
[System project]

Attached - Running



agora server
Disk #0 - Archipelago

info



Create new disk

close

1 Contents

Select disk contents
Choose a source for the disk contents.

2 3 4 5

Disks

Empty

Images

System

My images

Shared with me

Public

Available images

	ckan_2_1-debian_7_1 by alexakis@imis.athena-innovation.gr CKAN 2.1 base installation on a ...	1.86 GB	details
	arch by stmoros@gmail.com unknown	717.48 MB	details
	Dartha Ubuntu by cse36860@stef.teipir.gr Ubuntu 12.04.3 Base install no Gui	1.05 GB	details
	Dartha ubuntu by cse36860@stef.teipir.gr Ubuntu 12.04.3 LTS no gui	2.19 GB	details
	Openfiler ESA 2.99 by frozenarena@gmail.com Openfiler 2.99	1.76 GB	details
	Mageia-3 by xrg@hellug.gr Mageia 3	867.34 MB	details

You have selected a user-provided Image, which is not officially endorsed by ~okeanos. Please make sure it is from a trustworthy source.

confirm



New Network +

Public IPv4 Network Public Public

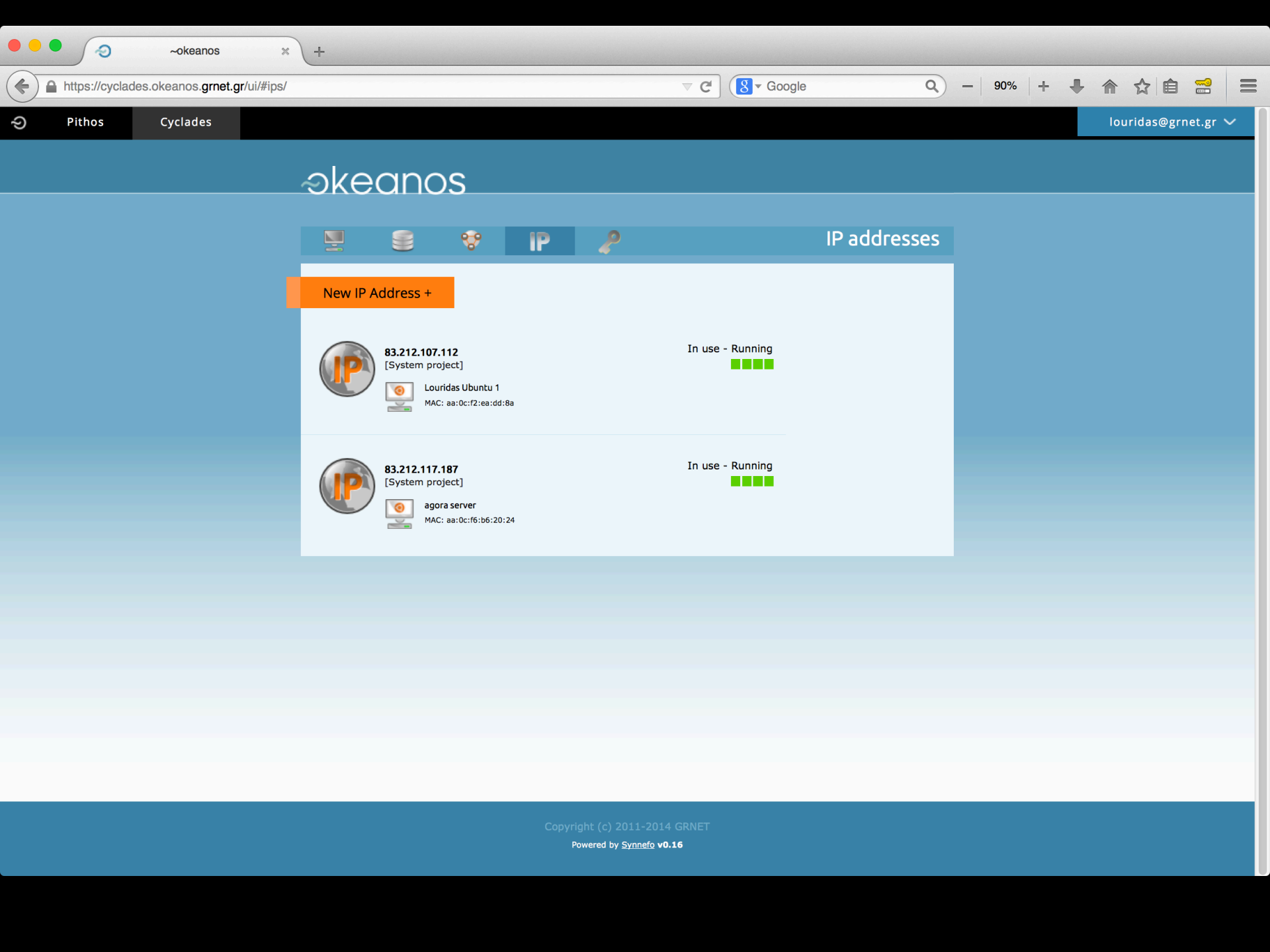
Connections (2)

- Louridas Ubuntu 1**
IPv4 83.212.107.112
Firewall (Off)
- agora server**
IPv4 83.212.117.187
Firewall (Off)

Public IPv6 Network Public Public

Connections (2)

- Louridas Ubuntu 1**
IPv6 2001:648:2ffc:1225:a800:2ff:fe88:8757
Firewall (Off)
- agora server**
IPv6 2001:648:2ffc:1225:a800:6ff:fe1a:92bf
Firewall (Off)



New IP Address +

	83.212.107.112 [System project]	In use - Running 
	Louridas Ubuntu 1 MAC: aa:0c:f2:ea:dd:8a	
	83.212.117.187 [System project]	In use - Running 
	agora server MAC: aa:0c:f6:b6:20:24	



Upload

New folder Share folder Refresh More... 8 Files

- My Files
 - pithos
 - mp3
 - photos_public
 - pics
 - presentations-public
 - ThunderBird FileLink
 - trash

Used: 901.5MB of 100GB (1%)
 - Shared with me
 - Shared by me
 - Groups

Name	Size	Last Modified
00201_lakejipe_1920x1200.jpg (view)	198.6 KB	12/11/2012 11:07 AM
00388_fallintennessee_1920x1200.jpg (view)	402.7 KB	12/11/2012 11:07 AM
00423_polynesian_1920x1200.jpg (view)	610.4 KB	12/11/2012 11:07 AM
00649_almostnightfall_1920x1200.jpg (view)	488.3 KB	12/11/2012 11:07 AM
00785_bodegagulch_1920x1200.jpg (view)	405.9 KB	12/11/2012 11:07 AM
01392_dreambeach_1920x1200.jpg (view)	1008.8 KB	12/11/2012 11:08 AM
01407_harboursunset_1920x1200.jpg (view)	814.3 KB	12/11/2012 11:08 AM
1537_grassysunset_1920x1200.jpg (view)	1.6 MB	12/11/2012 11:08 AM

okeanos dashboard



LOGIN

[Sign up](#)

If you are a student, professor or researcher you can login using your academic account.

ACADEMIC LOGIN

Classic login (username/password)

vkoukis@grnet.gr

.....

SUBMIT

[Forgot your password?](#)

RESOURCE USAGE



Storage Space

901.48 MB out of 100.00 GB Storage Space

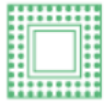
1%



System Disk

80.00 GB out of 300.00 GB System Disk

27%



CPUs

5 out of 22 CPUs

23%



RAM

5.00 GB out of 26.00 GB RAM

19%



Virtual Machines

2 out of 12 Virtual Machines

17%



Private Networks

0 out of 15 Private Networks

0%



Public IPs

3 out of 9 Public IPs

33%

Thanks

- Try it live at:
<http://okeanos-global.grnet.gr>
- Homepage:
<http://okeanos.grnet.gr>
- Software lives at:
<http://www.synnefo.org>
- Repository:
<https://github.com/grnet/synnefo>

okeanos GLOBAL

okeanos

synnefo

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