



DELIVERABLE

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Revision History

Revision	Date	Author	Organisation	Description
0.1	14/02/2014	KochG	AIT	Draft
1.0	27/02/2014	BendaO, KochW, KochG	AIT	Version 1
2.0	03/03/2014	KochG	AIT	Version 2 Integrating comments from coordination; Adding guidelines to build KVM image as annex

Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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1. Introduction

The aim of task 3.1 of the LoCloud project is to establish a cloud-based collaborative testing environment for tools and services in order to develop and test a number of key cloud-based micro-services (SaaS¹) useful to smaller institutions in enriching their metadata and improving data quality for the benefit of Europeana² users.

The various cloud-based software services (geolocation services, vocabulary enrichment, metadata enrichment services etc.) should enable local heritage institutions to render their content both more discoverable and interoperable.

The predominant (technical) aims are the investigation of the potential of cloud computing for aggregation, enrichment and re-use, and the trial of a cloud based architecture as a scalable platform for Europeana metadata aggregation and harvesting with higher efficiency and reduced maintenance costs.

The operational SaaS test lab will provide the basis for a continuing process of participative testing and validation of each of the services and applications.

Cloud Computing

Cloud computing is a model for enabling ubiquitous, convenient, **on-demand network access** to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.³

The models marked in bold in the overview below are those that the LoCloud tests will focus on.

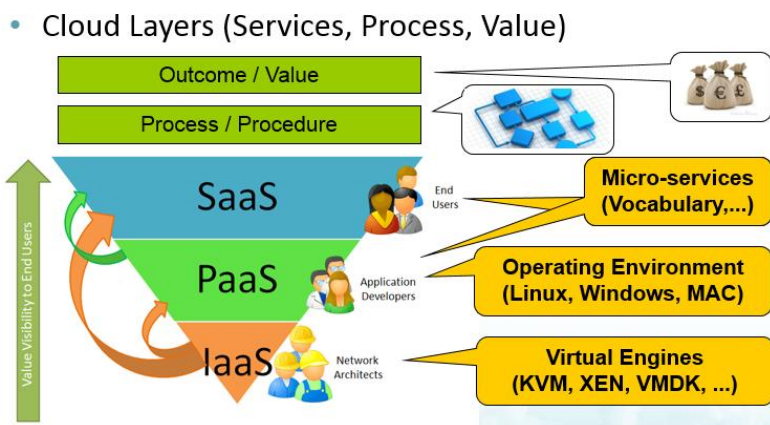


Figure 1 Cloud Layers

¹ Saas – Software as a Service http://en.wikipedia.org/wiki/Software_as_a_service , Feb 28, 2014.

² Europeana – <http://www.europeana.eu> , Feb 28, 2014.

³ The NIST (US National Institute of Standards and Technology, <http://www.nist.gov/>) Definition of Cloud Computing, Feb 28, 2014.

1. Main characteristics are:

- ☁ On demand self-service
- ☁ Broad network access ► available over a network for mobile devices, laptops, work stations etc.
- ☁ Resource pooling ► multi-tenancy, dynamic assignment of resources
- ☁ Rapid elasticity ► capabilities are provided elastically, “unlimited”
- ☁ Measured service ► monitoring

2. Frequent Service Models are:

- ☁ **Software as a Service**
- ☁ Platform as a Service
- ☁ **Infrastructure as a Service**

3. Common Deployment Models are:

- ☁ Private Cloud ► exclusive use by a single organization
- ☁ **Community Cloud** ► exclusive use by a community
- ☁ Public Cloud ► open use by the general public
- ☁ Hybrid Cloud ► composition of two or more cloud infrastructures (private, community, or public)

2. The LoCloud Testlab

The LoCloud test lab will provide access to the various micro services for test purposes.

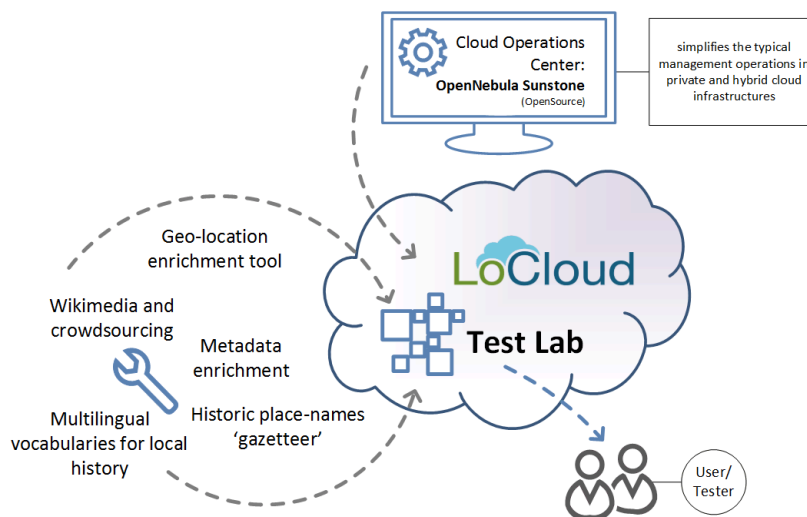


Figure 2 LoCloud Testlab

The OpenNebula Sunstone environment has been chosen as cloud operations center for the test lab. The operations centre simplifies the management operations in private and hybrid cloud infrastructures.

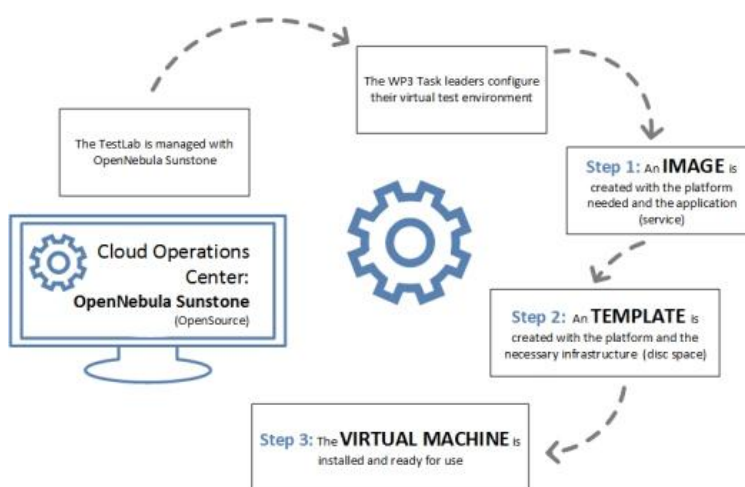


Figure 3 OpenNebula Operations Center



Figure 4 Enter the OpenNebula Operations Center

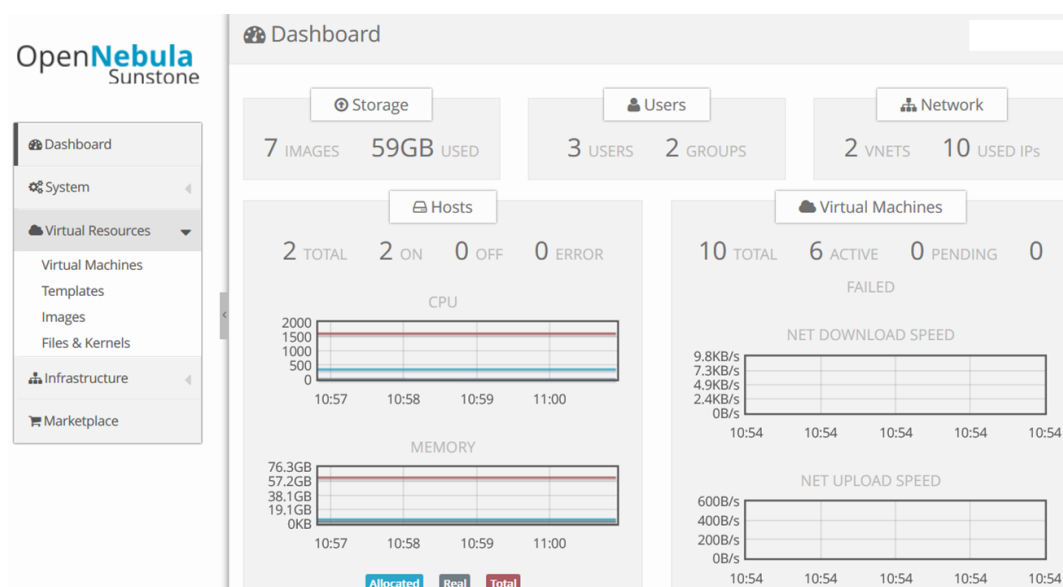


Figure 5 OpenNebula Dashboard

The OpenNebula resources are organized at three different levels:

1. **Images** are raw images of hard disks.
2. **Templates** are configuration profiles that specify the infrastructure resources and combine them with images into a bootable machine.
3. **Virtual Machines** are the running platforms and applications.

Step 1: An **IMAGE** is created with the platform needed and the application (service)

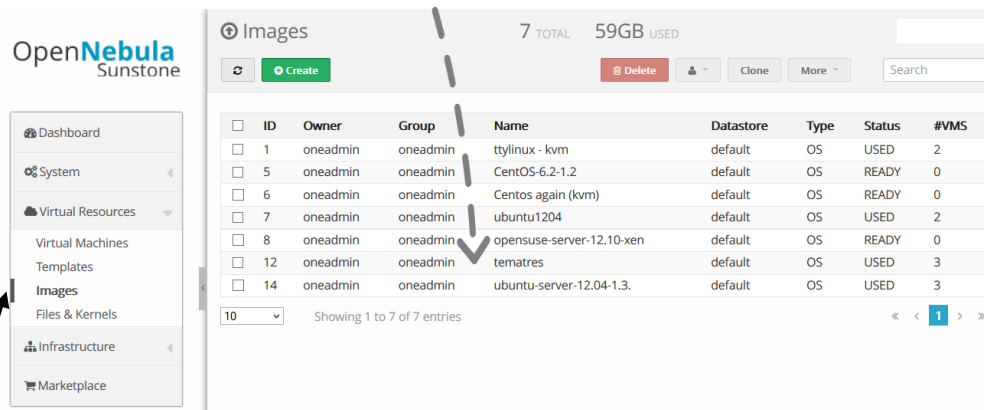


Figure 6 Using OpenNebula (Step 1a)

The **Images** tab contains a listing of all available hard disks that can be used for creating templates. These images can be in any format a hypervisor of the OpenNebula supports. The setup at locloud.ait.co.at prefers the KVM hypervisor. XEN is also possible. VMWare is not installed since OpenNebula did not work with the most recent free edition of ESX Server (5.1). Hence, the preferred image format is the thin provisioning qcow2 format. Preallocated raw images are also possible.

Permissions can be set on each image to restrict the access of users to certain images. Once an image is uploaded to OpenNebula it will not be changed but rather copied for each virtual machine.

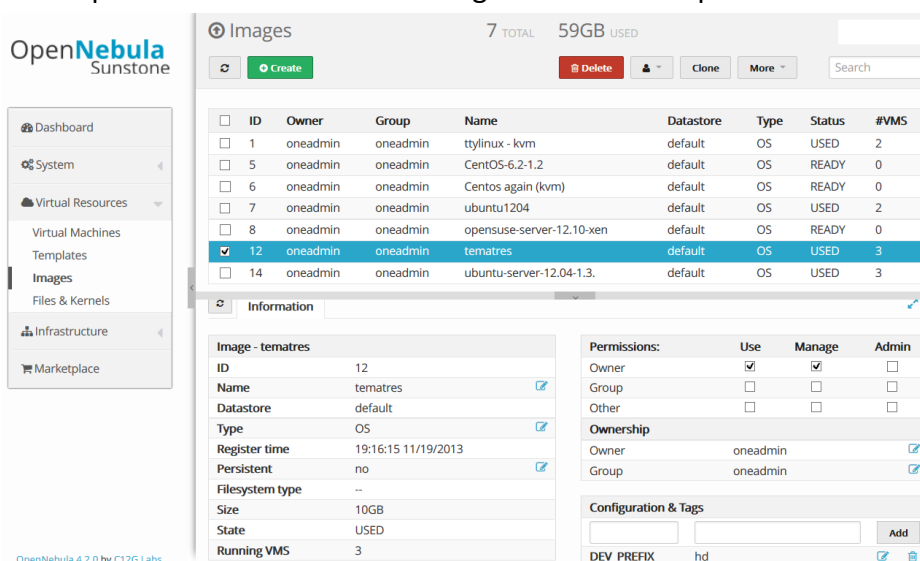


Figure 7 Using OpenNebula (Step 1b)

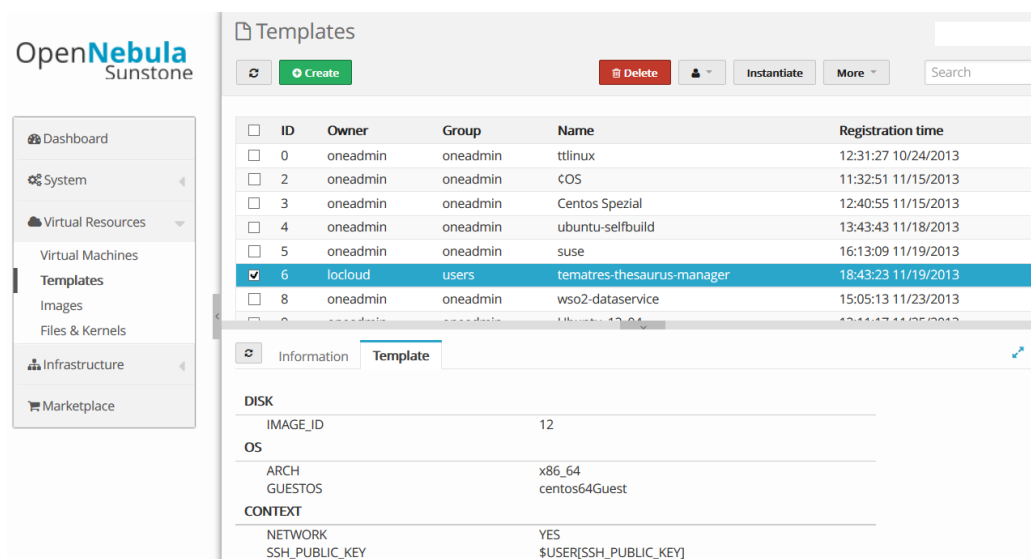
Templates are profiles that specify virtual hardware limits and initial hard disks for virtual machines. In order to start a virtual machine you first have to configure a template. An image alone cannot be booted.

The options that must be set in the template are:

- How much CPU and memory is allocated from the executing hypervisor. These resources are reserved once the machine is running.
- You can choose the image that will initially be copied when the machine is started.
- You can specify the network the machine is running on.

Permissions can be set on each template to restrict the access of users to certain templates.

Step 2: An **TEMPLATE** is created with the platform and the necessary infrastructure (disc space)



ID	Owner	Group	Name	Registration time
0	oneadmin	oneadmin	ttllinux	12:31:27 10/24/2013
2	oneadmin	oneadmin	COS	11:32:51 11/15/2013
3	oneadmin	oneadmin	Centos Spezial	12:40:55 11/15/2013
4	oneadmin	oneadmin	ubuntu-selfbuild	13:43:43 11/18/2013
5	oneadmin	oneadmin	suse	16:13:09 11/19/2013
6	locloud	users	tematres-thesaurus-manager	18:43:23 11/19/2013
8	oneadmin	oneadmin	wso2-dataservice	15:05:13 11/23/2013

Category	Value
DISK	
IMAGE_ID	12
OS	
ARCH	x86_64
GUESTOS	centos64Guest
CONTEXT	
NETWORK	YES
SSH_PUBLIC_KEY	\$USER[SSH_PUBLIC_KEY]

Figure 8 Using OpenNebula (Step 2)

The figure below shows the currently running cloud computers from the **Virtual machines** page. The machines can be paused/resumed/rebooted from this tab. The instances can be terminated and the hard disk can be reset to the original image's state. The VNC button allows users to see the console of machine.

Step 3: The **VIRTUAL MACHINE** is installed and ready for use

The screenshot shows the OpenNebula Sunstone interface. The 'Virtual Machines' tab is active, displaying a list of 10 machines. The machine 'Vocabulary Management (test)' with ID 39 is highlighted. Below the list, the 'Information' tab for this machine is open, showing details like ID, Name, State, LCM State, Host, and Start time. To the right, a permissions table is visible.

ID	Owner	Group	Name	Status	Host	IPs	VNC
<input type="checkbox"/>	oneadmin	oneadmin	test321	STOPPED	--	192.168.0.180	
<input type="checkbox"/>	oneadmin	oneadmin	test 332	STOPPED	--	192.168.0.181	
<input type="checkbox"/>	oneadmin	oneadmin	test501	STOPPED	--	192.168.0.183	
<input type="checkbox"/>	oneadmin	oneadmin	my-ubuntu-2	STOPPED	--	192.168.0.184	
<input type="checkbox"/>	oneadmin	oneadmin	tematres-development	RUNNING	192.168.0.171	192.168.0.189	
<input checked="" type="checkbox"/>	locloud	users	Vocabulary Management (test)	RUNNING	192.168.0.171	192.168.0.186	
<input type="checkbox"/>	oneadmin	oneadmin	tematres-dokumentation	RUNNING	192.168.0.171	192.168.0.190	
<input type="checkbox"/>	locloud	users	Greenstone (Digital Library)	RUNNING	192.168.0.171	192.168.0.182	
<input type="checkbox"/>	locloud	users	Koha (Integrated Library System)	RUNNING	192.168.0.171	192.168.0.187	
<input type="checkbox"/>	oneadmin	oneadmin	sakai-image	RUNNING	192.168.0.171	192.168.0.185	

Virtual Machine - Vocabulary Management (test)		Permissions:		
ID	39	Use	Manage	Admin
Name	Vocabulary Management (test)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
State	ACTIVE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LCM State	RUNNING	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Host	192.168.0.171	Ownership		
Start time	07:26:43 11/24/2013	Owner	locloud	
		Group	users	

Figure 9 Using OpenNebula (Step 3)

Make your own Virtual Machine

In order to start a virtual machine you have to press **Create** in the **Virtual Machines** tab. You have to give the machine a name and select a template from list. Depending on the size of the initial hard disk and the application that is running on the machine it will be ready within a minute or two.

To access the machine from a remote location you have to look at the IP address it has assigned. We assign internal addresses in the form 192.168.NNN.XXX. The http ports 80 and 8080 are accessible though a proxy when using the name lcXXX.ait.co.at.

The ssh port is available at locloud.ait.co.at:23XX where XX are the last two digits of the IP 192.168.129.XX.

The following figures provide screenshots from the process of creating the machine.

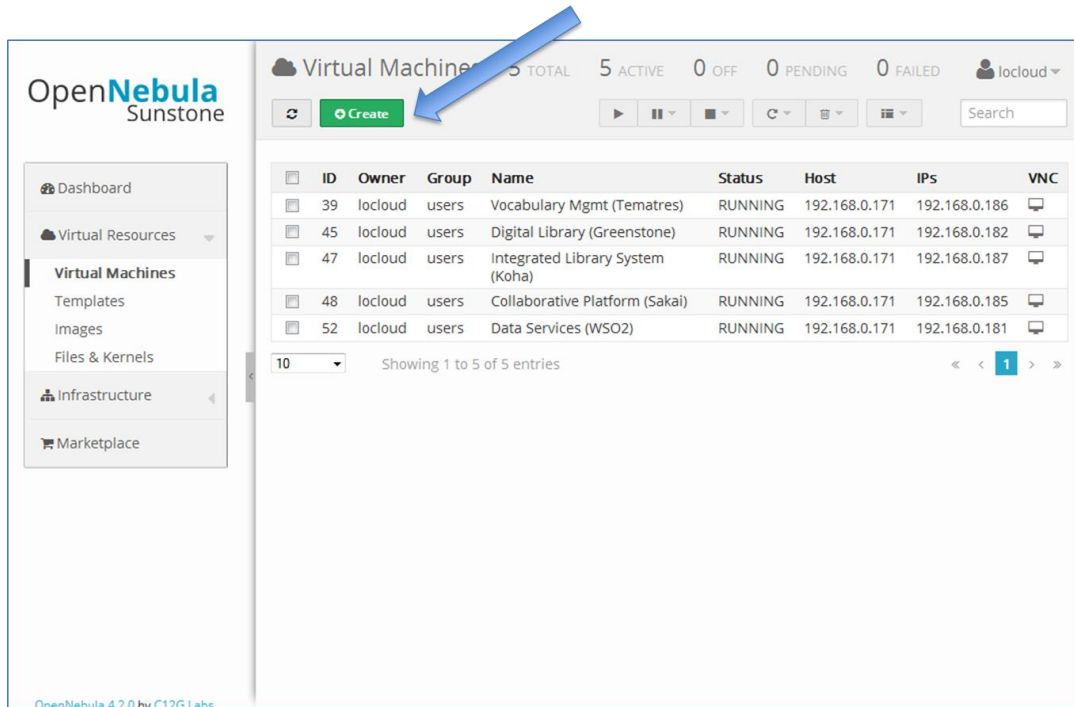


Figure 10 Create your own VM

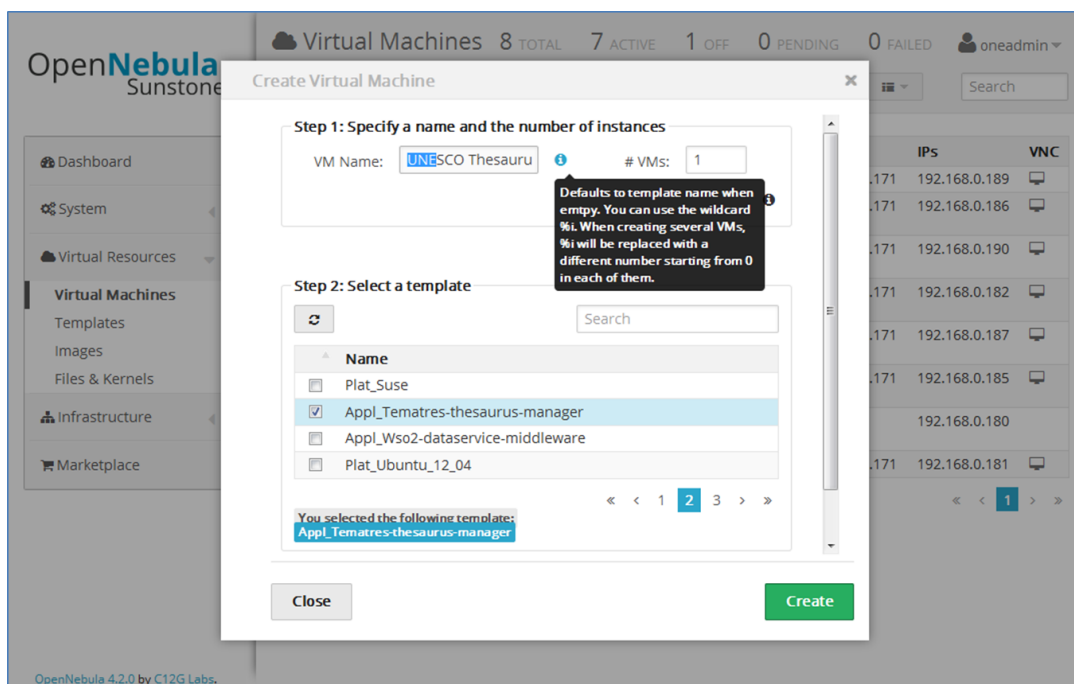


Figure 11 Create your own VM (Steps 1 and 2)

OpenNebula Sunstone

Virtual Machines 9 TOTAL 7 ACTIVE 1 OFF 1 PENDING 0 FAILED

ID	Owner	Group	Name	Status	Host	IPs	VNC
30	oneadmin	oneadmin	tematres-development	RUNNING	192.168.0.171	192.168.0.189	
39	locloud	users	Vocabulary Mgmt (Tematres)	RUNNING	192.168.0.171	192.168.0.186	
43	oneadmin	oneadmin	tematres-dokumentation	RUNNING	192.168.0.171	192.168.0.190	
45	locloud	users	Digital Library (Greenstone)	RUNNING	192.168.0.171	192.168.0.182	
47	locloud	users	Integrated Library System (Koha)	RUNNING	192.168.0.171	192.168.0.187	
48	locloud	users	Collaborative Platform (Sakai)	RUNNING	192.168.0.171	192.168.0.185	
51	oneadmin	oneadmin	Greenstone-Demo_BAD (IP=.182)	STOPPED	--	192.168.0.180	
52	locloud	users	Data Services (WSO2)	RUNNING	192.168.0.171	192.168.0.181	
54	oneadmin	oneadmin	UNESCO Thesaurus	PENDING	--	192.168.0.183	

Showing 1 to 9 of 9 entries

Figure 12 Create your own VM (pending)

OpenNebula Sunstone

Virtual Machines 9 TOTAL 8 ACTIVE 1 OFF 0 PENDING 0 FAILED

ID	Owner	Group	Name	Status	Host	IPs	VNC
30	oneadmin	oneadmin	tematres-development	RUNNING	192.168.0.171	192.168.0.189	
39	locloud	users	Vocabulary Mgmt (Tematres)	RUNNING	192.168.0.171	192.168.0.186	
43	oneadmin	oneadmin	tematres-dokumentation	RUNNING	192.168.0.171	192.168.0.190	
45	locloud	users	Digital Library (Greenstone)	RUNNING	192.168.0.171	192.168.0.182	
47	locloud	users	Integrated Library System (Koha)	RUNNING	192.168.0.171	192.168.0.187	
48	locloud	users	Collaborative Platform (Sakai)	RUNNING	192.168.0.171	192.168.0.185	
51	oneadmin	oneadmin	Greenstone-Demo_BAD (IP=.182)	STOPPED	--	192.168.0.180	
52	locloud	users	Data Services (WSO2)	RUNNING	192.168.0.171	192.168.0.181	
54	oneadmin	oneadmin	UNESCO Thesaurus	RUNNING	192.168.0.171	192.168.0.183	

Showing 1 to 9 of 9 entries

Figure 13 Your own VM machine is running

3. Access to the micro services

For coordinating the collaboration between technical partners within WP3 and in preparation to provide a common access point for all micro services during the test phase in the second project year, a platform was set up using the SAKAI⁴ environment.

This platform can be reached through the test lab address:

<http://lc004.ait.co.at:8080/portal/site/locloud>

To date access to the platform is restricted to the WP3 technical partners and the project manager.

The platform includes currently three work spaces:

- “My Workspace” > for personal data
- “LoCloud WP3” > visible and accessible just for WP3 partners
- “Micro services” > access point for all users and testers of the micro services

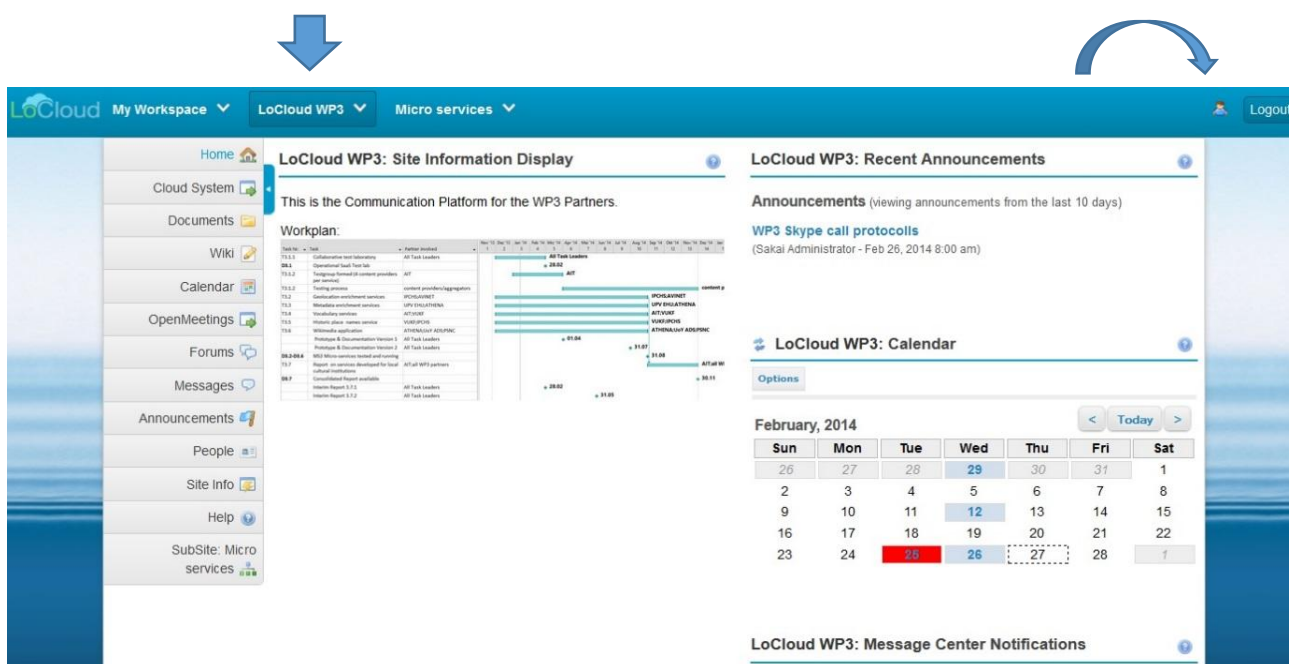


Figure 14 WP3 Collaborative platform

⁴ SAKAI Collaboration and Learning Environment (CLE) - http://en.wikipedia.org/wiki/Sakai_CLE Feb 28, 2014.

This work space is used for collaborating within WP3. It provides the following features:

LoCloud WP3	
Home	Message board with recent announcements, calendar and notifications
Cloud System	Access to the OpenNebula Test laboratory
Documents	WP3 document library
Wiki	WP3 Wiki
Calendar	Deadlines and Meeting schedules for WP3
OpenMeetings	Conference Tool
Forums	Forum Tool
Announcements	View Announcements
People	Participants list for this work space
Site Info	General information about this site
Help	Access to help information
SubSite: Micro services	Link to the Micro services work space



Figure 15 Entry page for testing the micro services

The Micro services work space will be used as entry point to the various micro services. To date it has the following features:

Micro services	
Home	
1 Geolocation Tool	Access to the Geolocation Tool
2 Metadata Tool	Access to Metadata Tool
3 Vocabulary Tool	Access to Vocabulary Tool
4 Historic Placenames	Access to Historic Placenames
5 Wikimedia	Access to Wikimedia Application
Micro services Documenation Wiki	Access/Download here the guidelines to the various tools
Announcements	View Announcements
Messages	Post Messages here
Calendar	Calendar
Resources	Documents Repository
People	People having access to this work space
LoCloud Projectsite	Link to the LoCloud official project website
Site Info	General information about this site
Help	Access to help information

4. Conclusion

To date the various micro services are still under development and the prototype versions for testing shall be available and included in the test lab by end of March 2014.

However, some partners started to upload very first versions of their micro services' prototypes on virtual machines to the test lab: A first version of the metadata enrichment and the vocabulary micro services are already available at this stage.

In addition, the collaborative platform described in chapter 3 has been installed in the test lab.

Furthermore, a guideline was issued on how to build an image and integrate a virtual machine to the test lab. Annex 1 of this deliverable includes this document: LoCloud Image Builder guidelines

5. Glossary

TERM	EXPLANATION
Cloud Computing	<p>Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). The name cloud computing was inspired by the cloud symbol that's often used to represent the Internet in flowcharts and diagrams. A cloud service has three distinct characteristics that differentiate it from traditional hosting. It is sold on demand, typically by the minute or the hour; it is elastic -- a user can have as much or as little of a service as they want at any given time; and the service is fully managed by the provider (the consumer needs nothing but a personal computer and Internet access).</p> <p>http://searchcloudcomputing.techtarget.com/definition/cloud-computing http://en.wikipedia.org/wiki/Cloud_computing</p>
ESX Server	<p>VMware ESX is an enterprise-level computer virtualization product offered by VMware, Inc. ESX is a component of VMware's larger offering, VMware Infrastructure, which adds management and reliability services to the core server product. VMware is replacing the original ESX with ESXi.</p> <p>http://en.wikipedia.org/wiki/ESX_Server</p>
Hypervisor	<p>A hypervisor or virtual machine monitor (VMM) is a piece of computer software, firmware or hardware that creates and runs virtual machines.</p> <p>http://en.wikipedia.org/wiki/Hypervisor</p>
KVM	<p>KVM (Kernel-based Virtual Machine) is a virtualization infrastructure for the Linux kernel which turns it into a hypervisor. KVM requires a processor with hardware virtualization extension.</p> <p>http://en.wikipedia.org/wiki/Kernel-based_Virtual_Machine</p>
OpenNebula	<p>OpenNebula is a cloud computing toolkit for managing heterogeneous distributed data center infrastructures. The OpenNebula toolkit manages a data center's virtual infrastructure to build private, public and hybrid implementations of infrastructure as a service. OpenNebula is free and open-source software, subject to the requirements of the Apache License version 2.</p> <p>http://en.wikipedia.org/wiki/OpenNebula</p>
port	<p>In computer networking, a port is an application-specific or process-specific software construct serving as a communications endpoint in a</p>

TERM	EXPLANATION
	<p>computer's host operating system. A port is associated with an IP address of the host, as well as the type of protocol used for communication. The purpose of ports is to uniquely identify different applications or processes running on a single computer and thereby enable them to share a single physical connection to a packet-switched network like the Internet.</p> <p>https://en.wikipedia.org/wiki/Network_port</p>
proxy	<p>In computer networks, a proxy server is a server (a computer system or an application) that acts as an intermediary for requests from clients seeking resources from other servers. A client connects to the proxy server, requesting some service, such as a file, connection, web page, or other resource available from a different server and the proxy server evaluates the request as a way to simplify and control its complexity. Proxies were invented to add structure and encapsulation to distributed systems.</p> <p>https://en.wikipedia.org/wiki/Proxy_server</p>
qcow	<p>qcow is a file format for disk image files used by QEMU, a hosted virtual machine monitor. It stands for "QEMU Copy On Write" and uses a disk storage optimization strategy that delays allocation of storage until it is actually needed. Files in qcow format can contain a variety of disk images which are generally associated with specific guest operating systems. Two versions of the format exist: qcow, and qcow2, which use the .qcow and .qcow2 file extensions, respectively.</p> <p>http://en.wikipedia.org/wiki/Qcow2</p>
SAKAI Collaboration and Learning Environment (CLE)	<p>Sakai is a community of academic institutions, commercial organizations and individuals who work together to develop a common Collaboration and Learning Environment (CLE). The Sakai CLE is a free, community source, educational software platform distributed under the Educational Community License (a type of open source license). The Sakai CLE is used for teaching, research and collaboration.</p> <p>http://en.wikipedia.org/wiki/Sakai_CLE</p>
SSH	<p>Secure Shell (SSH) is a cryptographic network protocol for secure data communication, remote command-line login, remote command execution, and other secure network services between two networked computers that connects, via a secure channel over an insecure network, a server and a client (running SSH server and SSH client programs, respectively). The protocol specification distinguishes between two major versions that are referred to as SSH-1 and SSH-2.</p> <p>http://en.wikipedia.org/wiki/Secure_Shell</p>
VMware	<p>VMware, Inc. is an American software company that provides cloud and virtualization software and services, and was the first to successfully virtualize the x86 architecture.</p>

TERM	EXPLANATION
	http://en.wikipedia.org/wiki/VMware
VNC	In computing, Virtual Network Computing (VNC) is a graphical desktop sharing system that uses the Remote Frame Buffer protocol (RFB) to remotely control another computer. It transmits the keyboard and mouse events from one computer to another, relaying the graphical screen updates back in the other direction, over a network. http://en.wikipedia.org/wiki/VNC
XEN	Xen /'zɛn/ is a native (bare-metal) hypervisor providing services that allow multiple computer operating systems to execute on the same computer hardware concurrently. The University of Cambridge Computer Laboratory developed the first versions of Xen. The Xen community develops and maintains Xen as free and open-source software, subject to the requirements of the GNU General Public License (GPL), version 2. Xen is currently available for the IA-32, x86-64 and ARM instruction sets. http://en.wikipedia.org/wiki/Xen

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Annex 1

LoCloud Image Builder guidelines

Guideline

Project Acronym: LoCloud
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LoCloud Image Builder guidelines

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Authors:

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1. Building your image locally

In order to integrate your virtual machine into the LoCloud Test lab a KVM disk image is needed. You can use the „aqemu“ tool, included in a Linux package, to create such an image and run the machine.

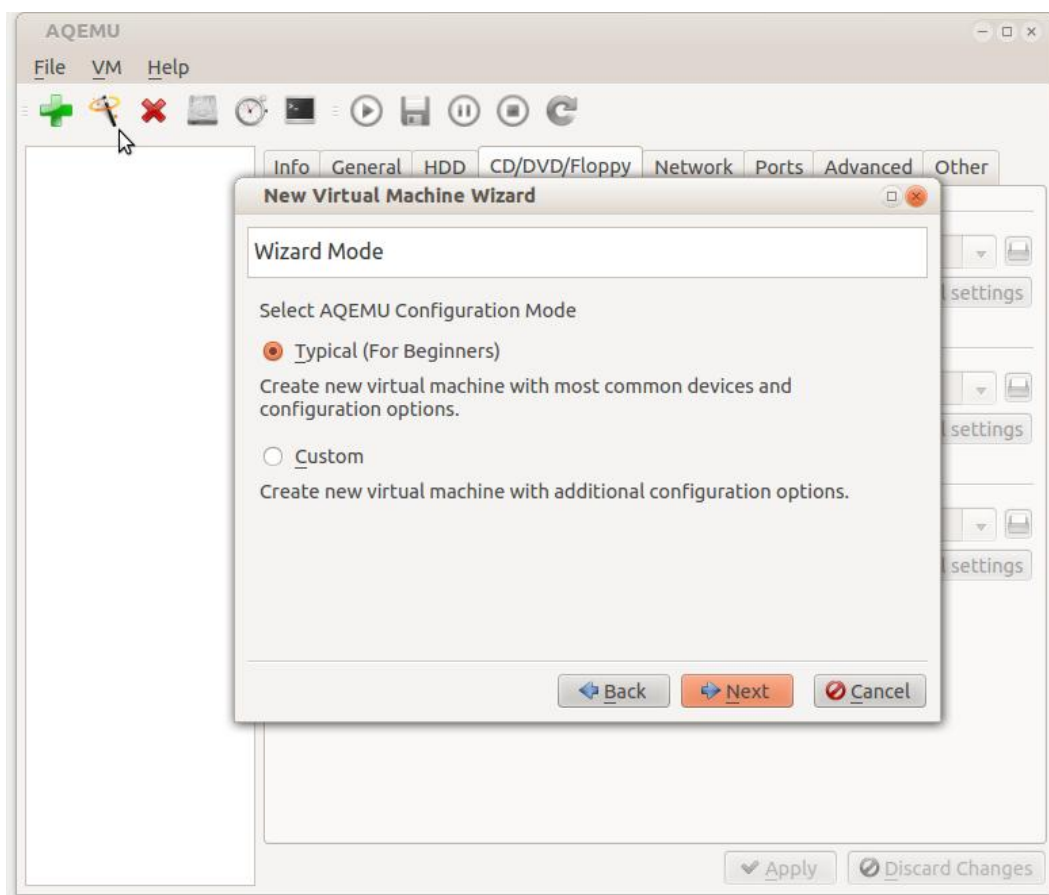
The desired disk image format is qcow2.

It is recommended that you use the defaults from the aqemu wizard.

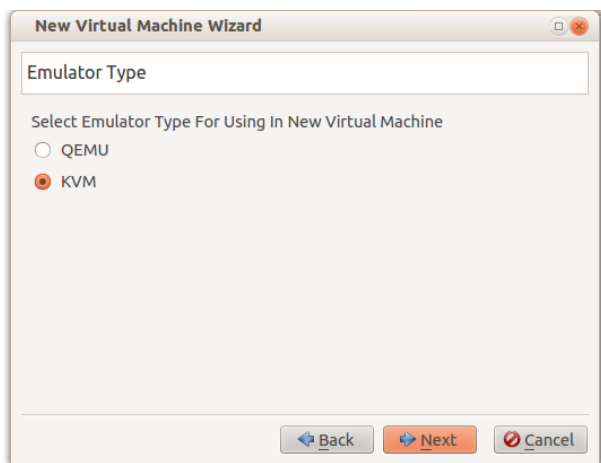
The disk image is stored in \$HOME/.aqemu/<MyService>_HDA.img

Please do not use non-standard network configuration. We need to be able to install the OpenNebula contextualization before running the image in the cloud.

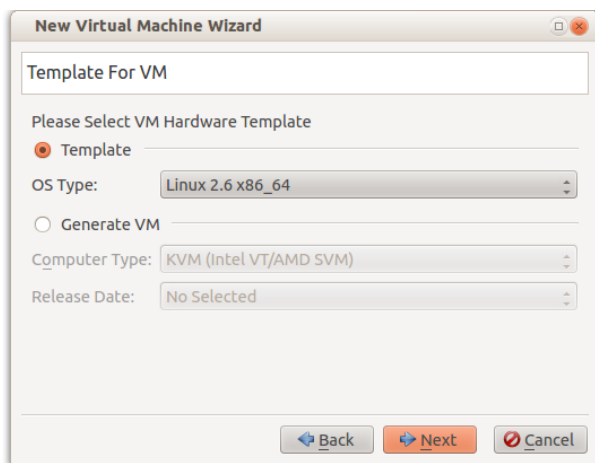
Contact us (AIT: Odo Benda bendao@ait.co.at, Walter Koch kochw@ait.co.at) once you are ready to upload the image.



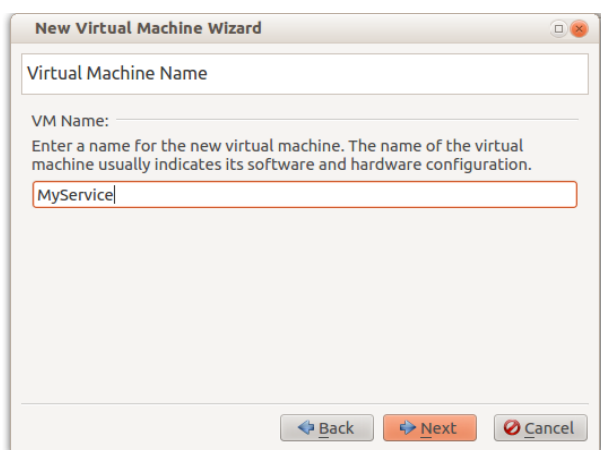
Step 1



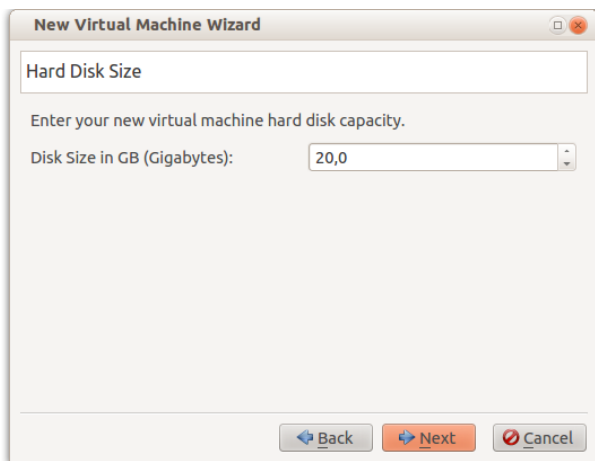
Step 2



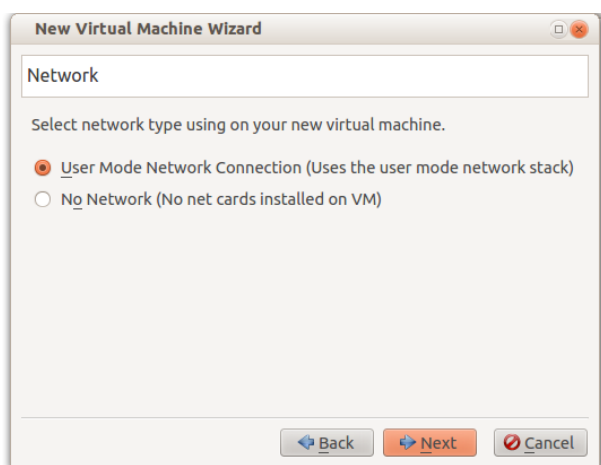
Step 3



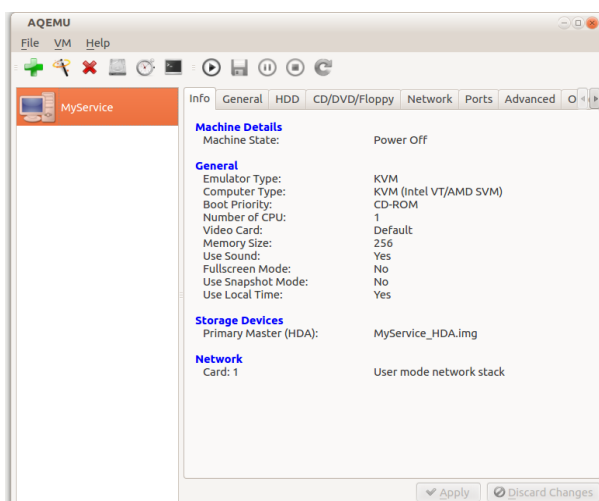
Step 4



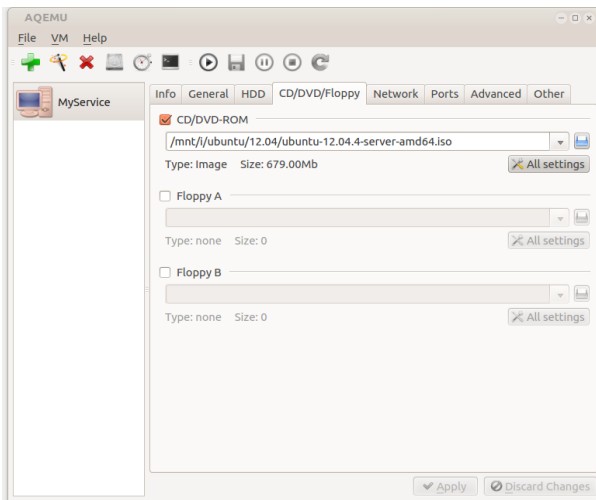
Step 5



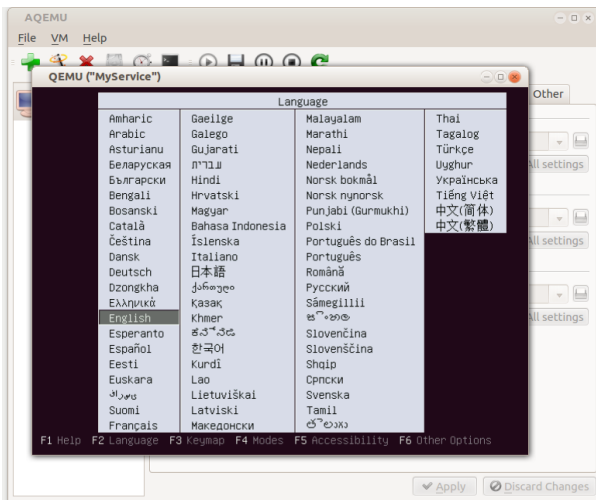
Step 6



Step 7



Step 8



Step 9

2. Building your image in the cloud

Go to <http://locloud.ait.co.at>.

Start your desired platform from the section from „Virtual Machines“. Select the desired platform from the „templates“.

The machine will be started and given an IP address within the range 192.168.129.1- 192.168.129.99

Please note that the virtual machine runs entirely in our private network.

The ports 80 and 8080 are exposed through a proxy. That is lc0XX.ait.co.at, where XX are last digits of the IP address. SSH access is available at locloud.ait.co.at port 23XX.

E.g. if the machine starts as 192.168.129.8 then you can access <http://lc008.ait.co.at> and <http://lc008.ait.co.at:8080> and <ssh://locloud.ait.co.at:2308>.

