Virtual Appliances User Guide

Activity 6: *Integration and Experimentation*

WP 6.1: *Integration*

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1 Introduction

This document includes the user guide for each of the OPTIMIS Virtual Appliances. The following sections describe how to use and configure the images to get the expected functionality.

1.1 Glossary of Acronyms

Table 1 - Acronyms table

Acronym	Definition
AC	Admission Control
CO	Cloud Optimizer
D	Deliverable
DM	Data Manager
DO	Deployment Optimizer
EE	Elasticity Engine
FTE	Fault Tolerance Engine
ICS	Image Creation Service
IDE	Integrated Development Environment
IDE	Integrated Development Environment
IP	Infrastructure Provider
MI	Monitoring Infrastructure
OVA	Open Virtual Appliance
PM	Programming Model
SD	Service Deployer
SDO	Service Deployment Optimizer
SM	Service Manager
SP	Service Provider
SSH	Secure Shell
VAPP	Virtual Appliance
VM	Virtual Machine
VMC	Virtual Machine Contextualizer
VMM	VM Manager
WP	Work Package
XML	Extensible Markup Language

2 Virtual Appliances User Guide

2.1 Release information

VAPP Name	OS	Hypervisor
Service Construction	Xubuntu 11.04 x86_64	Virtual Box
Service Provider	Centos 5.6 x86_64	Xen HVM / KVM [27]
Infrastructure Provider	Centos 5.6 x86_64	Xen HVM / KVM
Database	Centos 5.6 x86_64	Xen HVM / KVM
Data Manager	Ubuntu 12.0	Xen HVM / KVM
Data Node	Ubuntu 12.0	Xen HVM / KVM

Figure 1 - Release Information

2.2 Introduction

The Virtual Appliances released in Y3 will help the end-users visualize how the Optimis Toolkit components can operate together. These VMs contain an installation of the Y3 version of the Optimis Toolkit components.

The Service Construction virtual appliance provides an integrated development environment for implementing Optimis Services.

The Service Provider (SP) virtual appliance plays the role of an intermediary between end-users and the Infrastructure Providers.

The Infrastructure Provider (IP) virtual appliance contains tools to simplify and automates the management of the IP's infrastructure.

The Database virtual appliance includes a database where all the related OPTIMIS tools metrics are stored and also three VMs types are provided in order to build the Data Manager to create on-demand 'Data Analytics as a Service' clusters.

Figure 3. OPTIMIS Tools

2.3 Virtual Appliances

Next paragraphs describe how to use the Virtual Appliances.

2.3.1 Service Construction virtual appliance

The Virtual appliance for service construction contains the installation of the Y3 version of the OPTIMIS Programming Model (PM) and the Integrated Development Environment (IDE), which provide a graphical user interface for implementing OPTIMIS services.

2.3.1.1 Requirements

The Service Construction appliance require Virtual Box 4.1 or higher (to support .ova format)

2.3.1.2 Getting Started

To install the Service Construction Virtual Appliance you need to perform the following steps:

1. Download the Virtual Appliance file (*.ova*)

2. Open the VM VirtualBox [29] Administrator

3. Select the *Import virtualised service* option in the *File* menu and an import wizard will be open.

4. Click on *Select...* and choose the downloaded *.ova* file and click *Next*.

5. The following page will provide a default VM configuration for this appliance. In case some parameters are not suitable for your system change them. When finish, click *Import* to start the VM import process.

6. After a successful import process, a new VM will appear in the main window of the VM VirtualBox Administrator.

7. Select the newly created VM and click *Start*.

The Programming Model is installed in the folder */home/user/OPTIMIS/ProgrammingModel* and the PM runtime libraries are in */home/user/OPTIMIS/ProgrammingModel/runtime/integratedtoolkit*. The IDE is installed as an Eclipse plug-in.

Once the VM is running, you will see an Eclipse icon in the desktop. Click on it to launch the Eclipse platform and start using the OPTIMIS IDE plug-in. Details on how to use the IDE can be found in the Programming Model and IDE user guides. [1][2][3]

2.3.2 Service Provider virtual appliance

This Virtual Appliance plays a Service Provider role trough the following Optimis components:

- The Service Manifest offers an API that allows you to build Optimis Services in an xml manifest file following the OVF standards.

- The Service Manager that keeps track of all service runtime data.

- The SPTRustFramework provides trust from historical data and social networking.

- The Eco Efficiency Tool is in charge of assessing energy related aspects.

- The Broker components could be used to enable a multi-cloud deployment.

- Service Deployer (SD) / Deployment Optimizer (DO) manage the deployment of new services.

- The CloudBroker contains an IPregistry that allow SPs to register as many IPs as needed.

- The ServiceManager Web is a dashboard that centralizes the management of the Service Provider.

- The TREC Manager Web is a GUI where TREC related metrics are offered.

2.3.2.1 Requirements

Xen 3.3.2 [26] or higher is required. The hypervisor have to support hardware-assisted virtualization.

2.3.2.2 Getting Started

To configure the SP virtual appliance follows the steps below:

1. Download the Virtual Appliance file (*.img*)

2. Configure the network:

   An appropriate Internet Protocol address can be configured by decoding the MAC address. A VMC context-network script is provided inside the VMs. The MAC address is encoded so that the first group of two hexadecimal digits define if we will use a DHCP server or a static configuration. The last four groups of hexadecimal digits define the address on a Class A or B network address once converted to decimal format. Combining the two, the VM address configuration can be done by the contextualization scripts.

3. Access to the VM shh root@optimis-spvm

   User: root // Password: optimis

   Tomcat Manager: admin // optimis2012

4. Check that Tomcat [23] container is running, under $CATALINA_HOME you will find the components mentioned above.

5. In order to make the SP works the relation between hosts should looks like as follows:
   ```
   #Localhost
   127.0.0.1 localhost
   # Optimis Environment
   127.0.0.1 optimis-spvm
   x.x.x.x  optimis-ipvm
   x.x.x.x optimis-database
   x.x.x.x DataManager
   #Phisycal layer
   x.x.x.x optimis1
   ```

6. You will need to register the IPs, in this version only a provider called *'generic'* is configured. IPRegistry tool provided inside the Broker components is in charge of the IP registration. The IPRegistry information is stored in the file **IP-Store.xml** and the location of this file storage can be configured in the configuration file **BrokerServerProperties.**
   ($CATALINA_HOME/webapps/CloudBrokerREST/WEB-INF/classes/IP-Store.xml)

7. Once the provider targets are configured you can start the Service Deployment Optimizer component.
   ```
   visit sdo-config
   (Edit the configuration file: It is mandatory that the SM endpoint will be configured to be accessible from outside as it will be passed across the  OPTIMIS entities inside the manifest)
   visit ds
   ./runserver.sh
   ```

8. After a successful start of the SDO you are ready to deploy services. Use the Service Construction virtual appliance or the SDO GUI for performing deployments. The SDO GUI may be found on the following URL:

http://optimis-spvm:8087/

9. Additionally in Y3 Optimis provides a Service Provider Dashboard where the SP capabilities are centralized. Service Provider Dashboard may be found on the following URL:

http://optimis-spvm:8080/ServiceManagerWeb

Additional setup has to be made to configure the Data Manager, the required scripts to install and configure the shared mount point between the SP and the DM can be found under /opt/optimis/dm/.

The /conf folder contains the credentials of each of the DM instances that you want to connect.

Install the required packages with install-optimis-sp-datamanager.sh and use optimis-sp-mount/optimis-sp-umount to enable/disable the shared space.

Note that the components deployed on these virtual appliances are highly configurable; additional details about how to use a specific component can be found in the installation and user guides.[3][4][5][6][7][8]

2.3.3   Infrastructure Provider virtual appliance

The IP virtual appliance contains the tools to simplify and automate the management of the Infrastructure provider's infrastructure.

The components deployed on the virtual appliance covers different roles:

- The Admission Control decides when to admit services, the SLA Manager negotiates, create and monitor SLAs between SPs and IPs.

- The Monitoring Manager collects runtime metrics and propagates this information to the TREC framework analysis.

- The Fault Tolerance Engine recovers the service from failures restarting failing VMs.

- The Elasticity Engine proactively allocates and de-allocates resources based on the SLA metrics defined for the service.

- The VM Manager provides a mechanism to operate and allocate VMs across the infrastructure.

- The Cloud Optimizer component is a management entity that combines monitoring and assessment tools in the toolkit.

- The Virtual Machines Contextualizer enables the dynamic changing environment of an IP to be abstracted away from the application deployed.

- The IP Trust framework calculates the trust rating based on historical information and social networking offering this information at deployment and operation time.

- The Eco Efficiency Tool is in charge of assessing energy related aspects.

- The Economic Framework is responsible of cost and economic factors.

- The TREC Manager Web is a GUI where TREC related metrics are offered.

- The IPManagerWeb is a dashboard that centralizes the management of the Infrastructure Provider.

2.3.3.1 Requirements

Xen 3.3.2 or higher is required. The hypervisor have to support hardware-assisted virtualization.

2.3.3.2 Getting Started

In order to configure the IP virtual appliance follows the steps below:

1. Download the Virtual Appliance file (.img)

2. Configure the network:

   An appropriate Internet Protocol address can be configured by decoding the MAC address. A VMC context-network script is provided inside the VMs. The MAC address is encoded so that the first group of two hexadecimal digits define if we will use a DHCP server or a static configuration. The last four groups of hexadecimal digits define the address on a Class A or B network address once converted to decimal format. Combining the two, the VM address configuration can be done by the contextualization scripts.

3. Access to the VM shh root@optimis-ipvm

   User: root // Password: optimis

   Tomcat Manager: admin // optimis2012

4. Check that Tomcat container is running, under $CATALINA_HOME you will find the components mentioned above.

5. In order to make the IP works the relation between hosts should looks like as follows:
   #Localhost
   127.0.0.1 localhost
   # Optimis Environment
   x.x.x.x optimis-spvm
   127.0.0.1 optimis-ipvm
   x.x.x.x optimis-database
   x.x.x.x DataManager
   #Phisycal layer
   x.x.x.x optimis1

6. First of all you will need to start the container where the toolkit components are deployed
   ./opt/optimis/restartiptomcat.rb

7. After a successful start the VM is ready to deploy services.

8. Despite this other component are needed in order to fully support the operations offered by OPTIMIS.

   The Elasticity Engine server offers bursting recommendations to the IP based on the threshold metrics defined by the user, viritual, physical and even service level metrics are supported.

   cd /opt/optimis/ElasticityServer/ElasticityEngineServer/

nohup mvn jetty:run

The Service Monitoring tool allows us to capture server level metrics specifics to the application.

```
cd /opt/optimis/servicemonitoring
```

```
nohup ./run.sh
```

The SDO allows IPs to burst or federate among other providers if they cannot fulfill the service requirements.

```
visit sdo-config
(Edit the configuration file: It is mandatory that the SM endpoint will
be configured to be accessible from outside as it will be passed across
the  OPTIMIS entities inside the manifest)
visit ds
./runserver.sh
```

10. Additionally in Y3 Optimis provides an Infrastructure Provider Dashboard where the IP capabilities are centralized. Infrastructure Provider Dashboard may be found on the following URL:

<div align="center">

http://optimis-ipvm:8080/IPManagerWeb

</div>

GAMS version 23.6 or higher is required for solving the optimization problem that is formulated by the Admission Control component. Information about downloading and installing it can be found at the GAMS [28] site: http://www.gams.com . Please see the AC user guide for more information. [10]

Note that the components deployed on those virtual appliances are highly configurable; additional details about how to use a specific component can be found in the installation and user guides. [9][10][11][12][13][14][15][17][18][19][20][21]

2.3.4   Database virtual appliance

This virtual appliance includes the database used by the Monitoring infrastructure, other schemas are used to store the TREC related information.

The Monitoring Infrastructure (MI) software component provides its functionalities via two sub-components: Aggregator and Monitoring Manager. The MI is in charge of collecting all the service related metrics divided in virtual, physical and service level metrics.

Those metrics are stored in a database, they are used by the other decision making components such as Cloud Optimizer, VMM, when determining which actions to perform on the cloud.

2.3.4.1 Requirements

Xen 3.3.2 or higher is required. The hypervisor have to support hardware-assisted virtualization.

2.3.4.2 Getting Started

In order to configure the Database virtual appliance follows the steps below:

1. Download the Virtual Appliance file (*.img*)

2. Configure the network:

An appropriate Internet Protocol address can be configured by decoding the MAC address. A VMC context-network script is provided inside the VMs. The MAC address is encoded so that the first group of two hexadecimal digits define if we will use a DHCP server or a static configuration. The last four groups of hexadecimal digits define the address on a Class A or B network address once converted to decimal format. Combining the two, the VM address configuration can be done by the contextualization scripts.

3. Access to the VM shh root@optimis-database

   User: root // Password: database@optimis

   MySql: root // optimis

4. Check that the MySql server is running (/etc/init.d/mysqld status).

5. After a successful start you can visit the PhpMyadmin dashboard:

   http://optimis-database/phpmyadmin/

   Note that the components deployed on these virtual appliances are highly configurable; additional details about how to use a specific component can be found in the installation and user guides [18].

2.3.5   Data Manager virtual appliances

The Data Manager provides two virtual images. These images are the blue print for instantiating the OPTIMIS distributed file system. The description of each VM image is given below:

- **Data Manager VM**: This is the main virtual image where all services and API backend is supported. It is the central component for interacting with the Data Manager.

- **DataNode VM Template:** This is a template for building data nodes for hadoop [25] distributed file system. Instances created using this template have the role of data node and are storing the actual data (Blocks).

2.3.5.1 Requirements

Xen 3.3.2 or higher is required. The hypervisor have to support hardware-assisted virtualization.

2.3.5.2 Getting Started

To configure Data Manager virtual appliance follow the steps bellow:

1. Download the Virtual Appliance file (*.img*)

2. Configure the network:

   An appropriate Internet Protocol address can be configured by decoding the MAC address. A VMC context-network script is provided inside the VMs. The MAC address is encoded so that the first group of two hexadecimal digits define if we will use a DHCP server or a static configuration. The last four groups of hexadecimal digits define the address on a Class A or B network address once converted to decimal format. Combining the two, the VM address configuration can be done by the contextualization scripts.

3. Access to the VM shh root@optimis-database

   User: root // Password: database@optimis

4. Data Manager does not need any special configuration to run properly. There is only one file that needs to be installed to the DataManager. This xml file can be installed

easily using a Http POST method to a running Data Manager (http://datamanager-ip/DataManagerAPI/configure).

5. The configuration file is given below:

<xml>

<providername>generic</providername>

<ipdiscovery>the-ipaddress-of-the-ip-discovery-service</ipdiscovery>

<datamanager-host-path>/home/ntua</datamanager-host-path>

<hosts>

<node>   <ipaddress>192.12.10.1</ipaddress>   <password>DFDFDFDFF</password> </node>

<node> <ipaddress>192.12.10.2</ipaddress> <password>ASASASAS</password> </node>

</hosts>

</xml>

The hosts section is used to identify the host machines where the Data Manager deploys the DataNodes. DM is able to configure remotely the hosts in order to run the DataNodes created on demand by the DataManager. Data Manager is a crucial component for running OPTIMIS effectively. For this reason these hosts when the OPTIMIS toolkit is deployed in a real world scenario should be dedicated to Datamanager storage needs and not be used with other service VMs. This requirement is essential for achieving high quality of service.

The templates (Datanode) can be copied to all machines where the distributed file system guest VM machines will instantiated. The path is identified by the "datamanager-host-path".

Additional details about how to use Data Manager component can be found in the installation and user guide document. [9]

2.3.6   Physical Layer
Emotive Cloud 2.0

EMOTIVE Cloud 2.0 is a middleware to manage infrastructure resources in order to create private and public clouds. It consists of 4 components, each of them shipped as an independent war file. They are:

- The Virtualization Manager that allows managing the virtual resources of the host where it is installed.
- The Dynamic Resource Provisioning optimizes though a scheduler the placement of VM, and a Network Manager   that allows the creation of virtual networks.
- The Resource Manager is in charge of monitoring the status of the infrastructure resources.
- A Graphical User Interface to use Emotive functionalities from a web based dashboard.

Information about downloading and installing Emotive Cloud 2.0 can be found at the Emotive Cloud 2.0: Quick installation Guide and Startup [30].

Interoperability with other VM Managers
DRP OpenNebula:

We have implemented a plugin for OpenNebula (so-called DRP4ONE) that offers VMM the possibility of creating, removing and moving VM's around the OpenNebula cluster.

DRP4ONE is a web application, running on an application server, which provides its web services through a REST interface that follows the OCCI specification. DRP4ONE interacts with the XML-RPC API exposed by OpenNebula through the "Java OpenNebula Cloud API 3.8", a Java wrapper for the XML-RPC methods offered by OpenNebula.The main functionality of DRP4ONE is mapping the REST requests against its corresponding OpenNebula requests. DRP4ONE methods handle the client requests, extract from the requests all the necessary data and after that, generate the corresponding OpenNebula requests.

DRP OpenStack:

We have implemented a plugin for OpenStack (so-called DRP4OST) that offers VMM the possibility of creating, removing and moving VM's around the OpenStack cluster.

DRP4OST is a web application, running on an application server, which provides its web services through a REST interface that follows the OCCI specification. DRP4OST interacts with the OpenStack through its REST interface. DRP4OST generates the HTTP requests and analyze responses helped by HTTPComponents.

The main functionality of the web service is mapping the REST requests against its corresponding OpenStack requests. The methods that handle the client requests, extracts from the request received all the necessary data and after that, it generates the corresponding OpenStack requests. In the cases where nova client and glance client are used, the web application generates and executes command instead of generating a HTTP request.

Use the link bellow to find the most updated version of the DRP plugins:

https://emotivecloud.svn.sourceforge.net/svnroot/emotivecloud/branches/smendoza/Scheduler/

Image Creation Service (ICS)

The ICS need to be installed in the physical layer. More information about how to install and configure ICS component can be found in the Image Creation Service user and installation guides [16].

MI Physical Collectors

MI can collect monitoring parameters and store them in a monitoring database for TREC purpose. It uses pull and push process to collect parameters. By executing pull or push process MI works only with a specifically defined xml format, in which the collected monitoring data are wrapped.

MI uses Nagios [24] to collect physical level monitoring parameter. Because the monitoring parameters from Nagios should be wrapped in a specific XML format, we have developed script files, which are seen as collector scripts, to achieve this.

The following steps are needed to enable collect (physical) monitoring parameters

1. Install optimis_db database (section 2.3.4.2)
2. Install Nagios.
3. Add new records into the table monitoring_information_collector in Optimis database. (Currently the collector scripts could be found under /opt/optimis/MonitoringInfrastructure/scripts on optimis-ipvm host)
4. Start monitoring by calling the command:
   curl -d "" http://{HOST:PORT}/Aggregator/Aggregator/startmonitoring

<u>Mounting Distributed Virtual Image Repository</u>

Data Manager provides a distributed image repository. There are two image repositories which are used for storing virtual images. The first image repository is used for storing VM images for each service. These images can be in XEN or HVM (qcow2) or VDI format. SDO uses the DM client API in order to perform the actual uploading. Emotive can have access to this repository using a mounting point. The mounting point is created using the optimis-mount and optimis-umount scripts. These scripts are called by optimis-datamanager init.d service script and their operation is automatic.

These scripts have to be installed to all machines where the emotive is installed and where VM images are instantiated. The installation is straightforward:

- Download optimis-dm-mount-vmimages-current.zip

- unzip optimis-dm-mount-vmimages-current.zip
- chmod +x install-optimis-datamanager.sh
- ./install-optimis-datamanager.sh <ip-provider>

The ip-provider has the same file name as configuration file located inside the conf folder of optimis-dm-mount-vmimages-current.zip. The 'conf' folder has for each IP a configuration file. This configuration file has the IP address and an ssh key for accessing the repository.

The second image repository provided by DM is the Service Provider Image Repository. This repository is used by the Contextualization as a temporary storage facility while generating images. The functionality is provided through mounting scripts the same way we mount the storage for the IP.

The installation script is optimis-dm-mount-spimages-current.zip. The procedure is given below:

- yum -i zip wget zip

- Download optimis-dm-mount-spimages-current.zip

- unzip optimis-dm-mount-spimages-current.zip

- chmod +x install-optimis-sp-datamanager.sh

- ./install-optimis-sp-datamanager.sh

The mounting point is located at /opt/optimis-ics.

Additional details about how to use Data Manager component can be found in the installation and user guide document. [9]

2.4 Known limitations

This set of VMs is not supported in 32-bit environments; in addition hypervisors where the VMs will be deployed need to support Hardware-Virtualization.

2.5 Other information

2.5.1 Repository Information
<u>User and Installation Guides Repository</u>

http://ww.optimis-project.eu/

<u>Artifactory Repository</u>

http://optimis-artifactory.atosorigin.es/artifactory/

2.5.2 Contributors

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3   References

[1] Integrated Development Environment user and installation guide
[2] Programming model user and installation guide
[3] Service Manifest API user and installation guide
[4] Deployment Optimizer user and installation guide
[5] Risk Assessment Tools user and installation guide
[6] Service Manager user and installation guide
[7] Service Deployer user and installation guide
[8] Trust Framework user and installation guide
[9] Data Manager user and installation guide
[10] Admission Control user and installation guide
[11] Cloud Optimizer user and installation guide
[12] Eco Efficiency Tool user and installation guide
[13] Economic Framework user and installation guide
[14] Elasticity Engine user and installation guide
[15] Fault Tolerance Engine user and installation guide
[16] Image Creation Service user and installation guide
[17] Inter-Cloud Security user and installation guide
[18] Monitoring Infrastructure user and installation guide
[19] SLA Manager (QoS) user and installation guide
[20] Virtual Machine Contextualizer user and installation guide
[21] Virtual Machine Manager user and installation guide
[22] Optimis Y2 Whitepaper
[23] Tomcat [http://tomcat.apache.org/]
[24] Nagios [http://www.nagios.org/]
[25] Hadoop [http://hadoop.apache.org/]
[26] Xen [http://www.xen.org/]
[27] KVM [http://www.linux-kvm.org]
[28] GAMS [http://www.gams.com]
[29] Virtual Box [https://www.virtualbox.org]
[30] Emotive Cloud 2.0: Quick installation Guide and Startup
     [http://surfnet.dl.sourceforge.net/project/emotivecloud/EMOTIVEManual.pdf]