D3.6.1: Management Tools V1

<table>
<thead>
<tr>
<th>Project acronym:</th>
<th>NUBOMEDIA</th>
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<td>Project title:</td>
<td>NUBOMEDIA: an elastic Platform as a Service (PaaS) cloud for interactive social multimedia</td>
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<tr>
<td>Project duration:</td>
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<tr>
<td>Work package</td>
<td>WP3: NUBOMEDIA cloud platform</td>
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<tr>
<td>WP leader</td>
<td>Giuseppe Carella (TUB)</td>
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<tr>
<td>Deliverable nature:</td>
<td>Prototype</td>
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<tr>
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<td>Cristian Spoiala (USV)</td>
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## Version History

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<td>Cristian Spoia la</td>
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<td>API</td>
<td>Application Programming Interface</td>
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<tr>
<td>SLA</td>
<td>Service-level Agreement</td>
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<tr>
<td>WSGI</td>
<td>Web Server Gateway Interface</td>
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<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
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1 Analysis of monitoring tools

This section aims to give an overview of current open source monitoring tools that can be used for monitoring NUBOMEDIA instances.

1.1 OpenStack Horizon

Horizon is a web-based dashboard for OpenStack and provides a web user interface for services like Nova, Keystone, Telemetry, etc. Relevant to this section is the Resource Usage tab that can provide daily reports and stats.

1.1.1 Daily Report

Daily report tab generates reports for specific periods.

First select a period:

![Horizon Resource Usage Daily Report](image)

Figure 1 Horizon Resource Usage Daily Report

After selecting the period will be generated the report:
1.1.2 Stats

Stats tab is displaying data from telemetry API for various metrics. Can be selected a metric and will be show a list of resources utilization for that metric.

1.1.3 Conclusion

Horizon seems good at displaying basic information about instances load, but detailed information could not be gathered. Also it lacks advanced filtering on graphs, reports availability, alerting system.
1.2 Nagios

Nagios is an open source monitoring and alerting tool for systems, network devices and services.

It is distributed under a GPL v2 license.

Nagios monitors your entire infrastructure to ensure systems, applications, services, and business processes are functioning properly. In the event of a failure, Nagios can alert technical staff of the problem, allowing them to begin remediation processes before outages affect business processes, end-users, or customers. Also can generate SLA reports for billing purposes.

1.2.1 Features

- Capabilities to monitor applications, services, operating systems, network protocols, system metrics and infrastructure components with a single tool. Powerful script APIs allow easy monitoring of in-house and custom applications, services, and systems
- Centralized view of entire monitored IT infrastructure. Detailed status information available through web interface
- Fast detection of infrastructure outages. Alerts can be delivered to technical staff via email or SMS. Escalation capabilities ensure alert notifications reach the right people
- Alert acknowledgments provide communication on known issues and problem response. Event handlers allow automatic restart of failed applications and services
- Trending and capacity planning addons ensure you're aware of aging infrastructure. Scheduled downtime allows for alert suppression during infrastructure upgrades
- Availability reports ensure SLAs are being met. Historical reports provide record of alerts, notifications, outages, and alert response. Third-party addons extend reporting capabilities
- Multi-user access to web interface allows stakeholders to view infrastructure status. User-specific views ensure clients see only their infrastructure components
- Integration with in-house and third-party applications is easy with multiple APIs. Hundreds of community-developed addons extend core Nagios functionality
- Over 10 years of active development. Scales to monitor thousands of nodes. Failover capabilities ensure non-stop monitoring of critical IT infrastructure components.
1.2.2 Dashboard

Figure 4 Nagios Service Status

1.2.3 Architecture

Using built-in plugins or addons Nagios can monitor all infrastructure.
1.2.4 Conclusion

Nagios has some issues:
- Progress for open source version is slow compared to the fork Icinga
- No built-in graphing system. Needs external plugins like Graphite, PNP4Nagios
- Configuration is static in flat files

But Nagios is a good solution with many useful features.

1.3 Icinga

Icinga is an open source network and computer system monitoring application. Was originated as a fork of Nagios in 2009 but maintaining the compatibility with Nagios plugins. Goals over Nagios were to add a new modern user interface, multiple database connectors and a REST API for developers. Additionally of Nagios contains improvements to SLA accuracy.

Is distributed under GPL v2 license.

1.3.1 Dashboard
1.3.2 Architecture
Considering the improvements from Nagios, Icinga can be a better option than Nagios. Has the same shortcoming like Nagios for graphs but Icinga2 has a built-in connector for Graphite.

1.4 Graphite

Graphite is an open source project to store numeric time-series data and render graphs of this data. Graphite doesn’t collect the information, is only storing it. To send data to Graphite can be used Nagios, collectd, StasD.

Graphite is distributed under an Apache 2.0 License.

1.4.1 Architecture

Graphite is developed in Python and uses Django framework for Webapp.

1.4.1.1 Components:
- Whisper – time series database. Is an alternative to RRD
- Webapp – a Python/Django web application that renders graphs
- Carbon – Daemon that waits for the data
1.4.2 Conclusion

Graphite is a great graph rendering tool but needs to be integrated with other systems like Nagios, collectd, StatsD to be useful.

1.5 Zabbix

NUBOMEDIA: an elastic PaaS cloud for interactive social multimedia 15
Zabbix is an open source software for monitoring of networks, computer systems and services. Graphing is built-in. Can also monitor websites and web services.

Is distributed under a GPL v2 license.

1.5.1 Dashboard

![Zabbix Main Dashboard](image)

Figure 10 Zabbix Main Dashboard

1.5.2 Features

- Data gathering
- Flexible threshold definitions
- Highly configurable alerting
- Real-time graphing
- Web monitoring capabilities
- Extensive visualization options
- Historical data storage
- Easy configuration
- Use of templates
- Network discovery
- Fast web interface
- Zabbix API
- Permissions system
- Full featured and easily extensible agent
- Binary daemons
- Ready for complex environments

1.5.3 Architecture

Stores the configuration and monitoring data in a database. The following are supported:

- MySQL
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- PostgreSQL
- Oracle
- SQLite

### 1.5.3.1 Components

- Server
- Agents
- Frontend

Web frontend is developed in PHP, rest of the components are in C.

### 1.5.4 Conclusion

Zabbix is the most integrated solution with many features.

### 1.6 Ganglia

Ganglia is a scalable distributed monitoring system for high-performance computing systems such as clusters and Grids. It is based on a hierarchical design targeted at federations of clusters.

It leverages widely used technologies such as XML for data representation, XDR for compact, portable data transport, and RRDtool for data storage and visualization. It uses carefully engineered data structures and algorithms to achieve very low per-node overheads and high concurrency.

The implementation is robust, has been ported to an extensive set of operating systems and processor architectures, and is currently in use on thousands of clusters around the world. It has been used to link clusters across university campuses and around the world and can scale to handle clusters with 2000 nodes.

Ganglia is distributed under a BSD License.

### 1.6.1 Dashboard
1.6.2 Conclusion

Main task of Ganglia is monitor large distributed systems and alerting, reports are not included.

1.7 Zenoss

Zenoss is an open-source software that allows to monitor availability, inventory/configuration, performance, and events.

Is distributed under a GPL v2 License.

1.7.1 Dashboard

1.7.2 Features

- Monitoring availability of network devices using SNMP, SSH, WMI
- Monitoring of network services (HTTP, POP3, NNTP, SNMP, FTP)
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- Monitoring of host resources (processor, disk usage) on most network operating systems.
- Time-series performance monitoring of devices (based on RRDtool)
- Extended Microsoft Windows monitoring via Windows Management Instrumentation using SAMBA and Zenoss open source extensions
- Event management tools to annotate system alerts
- Automatically discovers network resources and changes in network configuration
- Alerting system provides notifications based on rule sets and on-call calendars
- Supports Nagios plug-in format

1.7.3 Architecture

Built with Python and Zope application server. Uses MySQL to store configuration.

1.8 Conclusion

For VM management we propose to use OpenStack management solution (Horizon). This will allow management of instances, networking configuration, virtual machines migration, disk management, images management and orchestration services.

For monitoring we propose to deploy and integrate Icinga in Horizon. Icinga will add following capabilities to the management console:

- Monitoring of host machines nodes and virtual machines instances
- Alerts
- Reports.

Data for alerts will be pushed to Icinga from Ceilometer when appropriate and Icinga agents.

For graphing system, Graphite will be integrated in Icinga with data provided by Ceilometer and Icinga agents.

2 NUBOMEDIA Management Console

For management console we choose to use OpenStack Dashboard. Horizon will be the core platform for further extensions with other open source tools to add more capabilities. Horizon is covering basic capabilities for managing virtual infrastructure but lacks advanced graphing system and web alerting tools. These capabilities are needed by a NUBOMEDIA instance provider to have a better understanding of the platform usage and early alerts of performance degradation or unavailability.

2.1 Why we choose Horizon

From our analysis of various monitoring tools, Horizon from OpenStack had already most of functionality that we needed in managing the virtual servers.
2.2 Architecture

Horizon is built on Python and Django Framework and provides access to OpenStack services.

On NUBOMEDIA is running on Apache with WSGI module. Currently is installed on the controller machine on both development and production instance.

Frontend is built with: Bootstrap, jQuery, AngularJS, LESS CSS.

2.3 Presentation

In the following will be presented current NUBOMEDIA management console.

2.3.1 Instance management

From instances are managed all states of a virtual machine. From the GUI is possible to create a server from an existing image or from scratch. Also is possible to edit the virtual machine by changing network and security settings. If a server is not needed anymore can be also deleted from the GUI.

![Figure 13 Horizon VM Management Dashboard](image-url)
2.3.2 Images management

From GUI of images can be managed an image. The following actions can be performed:

- Create an image
- Delete an image
- Launch a server from an image
- Edit name, description and security settings for an image
2.3.3 Security management

Security for each server can be configured from the Access & Security Tab. From the GUI, multiple ssh keys for the servers can be added or security rules for networking can be managed.

Networking rules can be grouped as Security Groups for easier management.
2.3.4 Monitoring

3 Installation
This section will cover the installation of OpenStack, NUBOMEDIA software.

3.1 Install OpenStack with RDO

For the v1 of the autonomous installer, the initial setup process is manual and will be configured automatically in v2 with a configuration management tool.

Deploying RDO is an easy process, setting up an OpenStack cloud takes approximately 15 minutes. It can be as short as 3 steps if you want to deploy it on a single server, but if you want to deploy it to add more nodes it can take more time.

RDO is maintained by RedHat, and it is more suitable for production environments.

The deployment script by RDO is licensed under the Creative Commons Attribution-ShareAlike 3.0 Unported license.

3.1.1 Software prerequisites:

For installing OpenStack RDO, you will need a RHEL-based Linux distribution, such as CentOS, Scientific Linux, or Fedora 20 or later.

3.1.2 Hardware prerequisites:

It is recommended a machine with at least 2GB of RAM, and hardware virtualization extension with at least 1 network adapter for single node deployment. For multi-node deployment, at least two network adapters are needed.

For multi-node deployment, you will also need a Layer 2 Switch that supports 802.11Q VLANs (VLAN tagging).
### 3.1.3 Operating system preparation

- You will first need to add RDO repositories:
  
  ```
  yum install -y http://rdo.fedorapeople.org/rdo-release.rpm
  ```

- You will need to update your current packages using:
  
  ```
  yum update -y
  ```

- Then you need to enable ssh key login:
  
  ```
  cd ~
  mkdir .ssh
  chmod 700 .ssh
  cd .ssh
  nano -w authorized_keys # here you should add your public key
  chmod 600 authorized_keys
  restorecon -R -v /root/.ssh
  ```

- Disable selinux or set it in permissive mode (if there is a reason not to have it in enforcing mode).
  
  In file: `/etc/selinux/config` edit:

  ```
  SELINUX=permissive
  ```

  After this if you do not want to reboot the system you should:
  
  ```
  setenforce 0
  ```

  If you have previously disabled SELinux, you will need to re-label the filesystem, since when SELinux is disabled, this does not happen for new files, and failing to relabel will likely cause many false positive issues. The easiest way to do that is to do the following as root:
  
  ```
  touch /.autorelabel
  reboot
  ```

- After this you should install NTP client on all servers because all servers should have date in sync with each other:
  
  ```
  yum install ntp -y
  chkconfig ntpd on
  ntpdate pool.ntp.org
  /etc/init.d/ntpd start
  ```

### 3.1.4 Install with Packstack

- You should first generate the configuration file for the deployment with the following command:
packstack -gen-answer-file=icehouse_deployment_vlan.cfg

- After this, you should configure the file accordingly with your hardware configuration and also configure the deployment location for every service, if you use multi-node deployment.

nano icehouse_deployment_vlan.cfg

- Next, you should run packstack to deploy OpenStack RDO to all instances configured:

    packstack -answer-file=icehouse_deployment_vlan.cfg

During this process, you will be required to type the root password for all node that you use in your deployment in order for OpenStack to be able to add its public key to each one of them.

Once the process is complete, you can log in to the OpenStack web interface "Horizon" by going to http://$YOURIP/dashboard. The username is "admin". The password can be found in the file keystonerc_admin in the /root/ directory of the control node.

### 3.2 Icinga Installation

Icinga was installed using a Chef recipe. Chef is a configuration management tool that helps for automatic installation and configuration of applications and servers.

Source code of Chef recipe can be found on NUBOMEDIA git repository:

- [http://git.nubomedia.eu/usv/chef-icinga](http://git.nubomedia.eu/usv/chef-icinga)

Figure 18 Icinga added to NUBOMEDIA Console

#### 3.2.1 How to install

- Install Chef

    curl -L https://www.opscode.com/chef/install.sh | bash
Download the chef icinga recipe
http://git.nubomedia.eu/usv/chef-icinga/repository/archive.tar.gz
Run installation
chef-solo -c solo.rb -j web.json

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