ConPaaS User Manual

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1 Introduction

ConPaaS is an open-source runtime environment for hosting applications in the cloud which aims at offering the full power of the cloud to application developers while shielding them from the associated complexity of the cloud.

ConPaaS is designed to host both high-performance scientific applications and online Web applications. It runs on a variety of public and private clouds, and is easily extensible. ConPaaS automates the entire life-cycle of an application, including collaborative development, deployment, performance monitoring, and automatic scaling. This allows developers to focus their attention on application-specific concerns rather than on cloud-specific details.

ConPaaS is organized as a collection of **services**, where each service acts as a replacement for a commonly used runtime environment. For example, to replace a MySQL database, ConPaaS provides a cloud-based MySQL service which acts as a high-level database abstraction. The service uses real MySQL databases internally, and therefore makes it easy to port an cloud application to ConPaaS. Unlike a regular centralized database, however, it is self-managed and fully elastic: one can dynamically increase or decrease its processing capacity by requesting it to reconfigure itself with a different number of virtual machines.

ConPaaS currently contains six services:

- **Two Web hosting services** respectively specialized for hosting PHP and JSP applications;
- **MySQL database** service;
- **Scalarix service** offering a scalable in-memory key-value store;
- **MapReduce service** providing thewell-known high-performance computation framework;
- **TaskFarming service** high-performance batch processing.

ConPaaS applications can be composed of any number of services. For example, a bio-informatics application may make use of a PHP and a MySQL service to host a Web-based frontend, and link this frontend to a MapReduce backend service for conducting high-performance genomic computations on demand.

2 ConPaaS usage overview

Most operations in ConPaaS can be done using the ConPaaS frontend, which gives a Web-based interface to the system. The front-end allows users to register, create services, upload code and data to the services, and configure each service.

- The Dashboard page displays the list of services currently active in the system. Beware: each active service uses credits, even if it is in "stopped" state. To stop using credits you must terminate the services completely.

- Each service comes with a separate page which allows one to configure it, upload code and data, and scale it up and down.

All the functionalities of the frontend are also available using a command-line interface. This allows one to script commands for ConPaaS. The command-line interface also features additional advanced functionalities, which are not available using the front-end.

3 The Front-end

The cloud front-end provides an intuitive web-based user interface that allows users to register new accounts in order to start using the Web Hosting Service. Registered users can create as well as terminate services. Additionally, the front-end provides a simplified interface through which a user can configure his services.

3.1 Register a user

Note: User registration can only be done through the cloud front-end.

1. Click on the "register" link.
2. Enter your user name and click on the "register" button.
3. You will be automatically logged in. Notice your user name and the "logout" link at the top right corner of the web page. You are now ready to experiment with the Web Hosting Service.

3.2 Create a Web Hosting Service

Node: Creating a new service can only be done through the cloud front-end.

1. Starting from the user home page, click on the "create service" button.
2. Select a type of web hosting service. For example "PHP Service".
3. Select a target cloud platform. For example "Amazon EC2".
4. Click on the "create service" button to start.

   What is happening now?

   The Web interface requested a new virtual machine from Amazon EC2 and is waiting for it to boot. This virtual machine will be the managing node of the new service. The web page will be automatically redirected and a list of all of the created services will be displayed. Note that, the service status is "Initializing". When the service is ready, its status will change to "created" and you can click on it to configure it further.

3.3 Rename the Service

Renaming a service can only be done through the cloud front-end.

1. Starting from the user home page, click on the service you intend to rename.
2. Click on the service name at the top left of the web page. A dialog box will appear where you can enter the new service name.

3.4 Terminate the service

Note: terminating the service can only be done through the cloud front-end.

1. Starting from the user home page, click on the service you intend to terminate.
2. Press on the "terminate" button at the top right of the page. Terminating the service will release the virtual machine hosting the manager and will delete all of the service's configuration and uploaded code.

4 Starting and Stopping the Service

4.1 Start the Service

4.1.1 Through the Front-end

1. Starting from the user home page, click on the service you intend to start.
2. Notice the message "No instances are running". This means that there is no web server running yet.
3. Click on the "start" button at the top right of the page to start a web server. Notice the progress message that appeared at the top of the page.

   What is happening now?

   The service requested a new virtual machine from the cloud provider. When the machine is ready, the manager will configure it to run a web server. When the web server is ready, the web page will display the running instances' information.

4. Notice the displayed instance information. It is tagged with "proxy", "web" and "php" which means that this virtual machine is running a proxy (load balancer) server, a web server and it supports executing PHP scripts.On the right end you will find the domain name of the virtual machine. You can use this to access the virtual machine directly.
5. Notice the link labeled "access active version". Click on it to access the newly created web server. The web servers start with a default welcome page.

4.1.2 Using the Command-line Client

```
$ ./cpsclient.web http://x-x-x-x/ startup
```

4.2 Stop the Service

4.2.1 Through the Front-end

1. Starting from the user home page, click on the service you intend to stop.
2. Press on the "stop" button at the top right of the web page.
3. Stopping the service would release the web servers but the service manager will remain active. If you want to permanently destroy the service, press on the terminate button after you stop the service.

4.2.2 Using the Command-line Client

```
$ ./cpsclient.web http://x-x-x-x/ shutdown
```

5 Code Management

The Web Hosting Service can manage and store multiple code archives. You can upload code archives to it and select which one should be active online. This section explains how to manage code archives.

5.1 Upload Code Version

5.1.1 Through the Front-end

1. Use the "choose file" button to upload a code archive. When creating an archive, you need to make sure it expands directly in the same directory. The upload file must be an archive of type '.zip', '.tar', '.tar.bz2' or '.tar.gz'. PHP applications should have a file named "index.php" which will be the default page. Java applications should have a file named index.jsp.
2. Notice that the "available code versions" list grew. A new code version appeared in the list but it is not active yet. Hover over the new code version with the mouse and two more links will appear; "set active" and "download".

5.1.2 Using the Command-line Client

```
$ ./cpsclient.web http://x-x-x-x/ upload_code_version -h
Usage: upload_code_version <filename>

Options:
  -h, --help  show this help message and exit

$ ./cpsclient.web http://x-x-x-x/ upload_code_version path/to/archive.zip
codeVersionId: code-XXXXX
```

5.2 Activate Code Version

5.2.1 Through the Front-end

1. Hover over a code version with the mouse and two links will appear; "set active" and "download".
2. Click on "set active" to activate this version online.
3. Notice that the selected code version is labeled with "active".
4. If the service is already running, click on "access active version" to validate that the new code version is running. Your web browser would normally cache web pages so you may need to refresh the page to view the latest updates.

5.2.2 Using the Command-line Client

```
$ ./cpsclient.web http://x-x-x-x/ update_java_configuration -h
Usage: update_java_configuration

Options:
  -h, --help            show this help message and exit
  -c CODEVERSIONID, --code=CODEVERSIONID

$ ./cpsclient.web http://x-x-x-x/ update_java_configuration -c code-XXXX
```

5.3 Download Code Version

5.3.1 Through the Front-end

1. Hover over a code version with the mouse and two links will appear; "set active" and "download".
2. Click the "download" link will download the file to your local computer.

6 Resource Management

One of the advantages of ConPaaS is elasticity. The Web Hosting Service can configure multiple servers and assign them different roles to scale. The deployment can grow and shrink transparently to the users without any service disruption.

6.1 Scaling Out/In

6.1.1 Through the Front-end

1. Notice the section labeled "add or remove instances to your deployment" in the web page were there are 3 boxes labeled "proxy", "web" and "php" with a 0 to the left of each one.

2. Click on the 0 of any box and a dialog will appear where you can specify the number of nodes you want to add/remove.

3. Let's add 1 web server, 1 proxy and 1 php. Then press on the "submit" button to their right.

4. A progress message will show up at the top of the page.

   What is happening now?

   Requesting new virtual machines will take some time. As soon as the new virtual machines become available, the manager will configure them and reconfigure the old nodes as well. If you want to monitor the progress of the new virtual machines more closely, click on the "raw log" link at the top of the page to view the log produced by the manager. You will need to refresh this page to view recent updates. Once the nodes are ready, they will be displayed on the web page.

5. Notice that the web page is now displaying the newly created nodes as well. Each node is tagged with its roles (proxy, web or php).

6.1.2 Using the Command-line Client

```
$ ./cpsclient.web http://x-x-x-x/ add_nodes -h
Usage: add_nodes

Options:
  -h, --help            show this help message and exit
  -p PROXY, --proxy=PROXY
  -w WEB, --web=WEB
  -b BACKEND, --backend=BACKEND

$ ./cpsclient.web http://x-x-x-x/ add_nodes -w 1 -b 1

$ ./cpsclient.web http://x-x-x-x/ remove_nodes -h
Usage: remove_nodes
```

```
Options:
  -h, --help            show this help message and exit
  -p PROXY, --proxy=PROXY
  -w WEB, --web=WEB
  -b BACKEND, --backend=BACKEND

$ ./cpsclient.web http://x-x-x-x/ remove_nodes -w 1 -b 1
```

7 Command-line Administration

You can perform all of the operations provided by the web interface by using a command-line tool. ***Prerequisites: python >= 2.6, python-pycurl and python-simplejson packages.*** Create a service, go to its web page and copy the URL provided by the "access manager" link at the top of the page. This URL points to the manager directly and you can use it with the command-line program "cpsclient.web" to issue commands.

7.1 Prepare Command-line Environment

- Download the source code file ConPaaSWeb.tar.gz.
- Unpack it and prepare your environment as follows:

```
$ tar -zxf ConPaaSWeb.tar.gz              # unpack the archive
$ export PYTHONPATH=‘pwd‘/ConPaaSWeb/src # Set PYTHONPATH
```

- The PYTHONPATH environment variable needs to be pointing to the location of the 'src' directory on your file system.
- Run ConPaaSWeb/bin/cpsclient.web to view a list of supported operations.

```
$ ./cpsclient.web
Usage: ./cpsclient.web URL ACTION options

Action could be one of:
 ACTION                    DESCRIPTION
 add_nodes                   Add more service nodes to a deployment
 getLog                      Get raw logging
 get_configuration           Get the configuration of a deployment
 get_node_info               Get information about a single service node
 get_service_history         Get the state change history of a deployment
 get_service_info            Get the state of a deployment
 get_service_performance     Get the average request rate and throughput
```

```
help                          Print the help menu
list_code_versions            List identifiers of all code versions stored by a deployment
list_nodes                    Get a list of service nodes
remove_nodes                  Remove some service nodes from a deployment
shutdown                      Shutdown a deployment
startup                       Startup a deployment
update_java_configuration     Update the configuration of a Java deployment
update_php_configuration      Update the configuration of a PHP deployment
upload_code_version           Upload a new code version
```

- Use the "access manager" URL as a first argument to cpsclient.web followed by one of the operation names to perform it. Use the '-h' option to check if an operation requires additional arguments.

```
$ ./cpsclient.web http://x-x-x-x/ get_node_info -h
Usage: get_node_info <nodeId>

Options:
  -h, --help  show this help message and exit

$ ./cpsclient.web http://x-x-x-x/ get_node_info i-23dffe4
Service Node         Address              Role(s)
i-23dffe4d           ec2-xxx-xx-xx-xxx.compute-x.amazonaws.com WEB
```