

Developer support in a federated Platform-as-a-Service environment

Master's Thesis

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Parallel and Distributed Computer Systems

June 14, 2012

What is this all about

How to make software developers life easier in the cloud.

Outline

- 1 Cloud Computing
- 2 What Developers Want
- 3 In practice

Cloud Computing: everyone talks about it

Business Market Plays Cloud Computing Catch-Up

Larry Ellison unveils Oracle Public Cloud, claims no one will be locked in

Oracle unveiled a broad cloud service this week, including both software ...



Cloud Cruiser announces availability of Cloud Cost Intelligence solution for HP CloudSystem

"\$70MM savings due to VMware Cloud." Watch the Revlon CIO video.

ADOBE & THE CREATIVE CLOUD™

Access all the CS6 tools and more. Store and share your work. Publish your apps and websites.

Create now.



Oracle takes the wraps off its public cloud entry



Ubuntu will power HP's new cloud.
HP's cloud service, launched recently in a private beta, will use Ubuntu as



Cloud Computing: what are we talking about?

Another stack CS students have to remember!

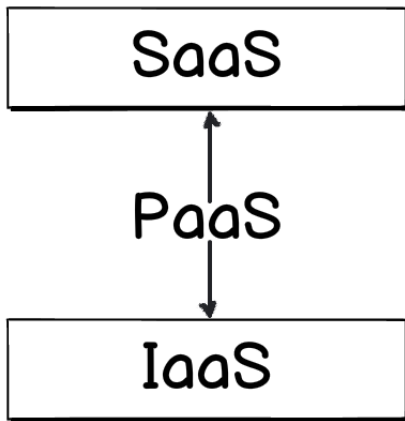
- Software as a Service
- Platform as a Service
- Infrastructure as a Service

Cloud Computing: what are we talking about?

Another stack CS students have to remember?

- Software as a Service → Software
- Platform as a Service → Middleware
- Infrastructure as a Service → Hardware

Cloud Computing: PaaS and developers



- PaaS: *The software platform where systems run on.*
- Developers **make** software that **runs** on some hardware!

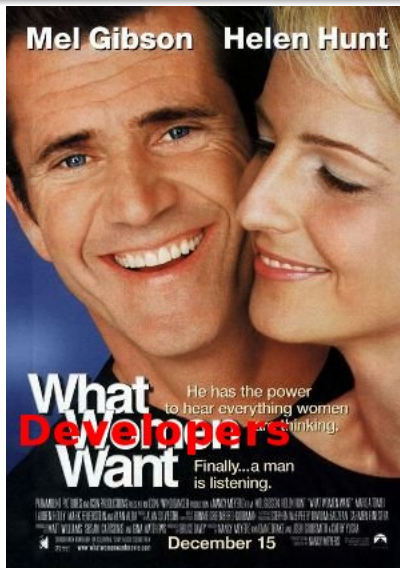
Cloud Computing: PaaS and developers

- Developers use the functionalities offered by PaaS systems to do their job.
- Certainly someone has studied how to make their life easier?

Cloud Computing: PaaS and developers

No, nobody has studied how to make devs life in the cloud easier.

What Developers Want



What Developers Want

- Developers are **users** of PaaS systems.
- Many efforts spent on User Experience.
- How about **Developer Experience**?

What Developers Want: support through the SD process

Activities of the Software development process:

- Requirements and Specifications
- Architecture and Design
- Implementation
- Testing
- Debugging
- Deployment

What Developers Want: support through the SD process

Activities of the Software development process:

- Requirements and Specifications
- Architecture and Design
- **Implementation**: supported programming languages
- **Testing**: availability of good testing tools
- **Debugging**: monitoring and administrative tools
- **Deployment**: intuitive, pain-free deployment options

Outline

- 1 Cloud Computing
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Analysis of PaaS offerings

- ① Programming languages
 - Every offering supports PHP and Java
 - Many support Python and Ruby
 - Lesser-known languages are also often available
- ② Testing tools
 - PaaS systems usually provide environments to test the applications locally
 - Unit and Functional testing are neglected!
- ③ Deployment options
 - Tarball based
 - VCS based

Improving the DX offered by ConPaaS

ConPaaS is a Platform as a Service system developed by the Vrije Universiteit Amsterdam, Zuse Institut Berlin and XLAB Ljubljana in the Contrail E.U. project.

It allows to deploy services such as webapps, databases, mapreduce and more on public and private clouds. Every service has a manager and one or more agents.

Improving the DX offered by ConPaaS

ConPaaS does well from the point of view of supported programming languages

- PHP and Java are supported
- Python is coming
- Adding new languages is easy

Improving the DX offered by ConPaaS

I have focused on the **deployment** and **testing** activities of the Software development process

- ➊ Adding support for GIT-based code deployments
- ➋ Integrating the Selenium functional testing framework

GIT-based code deployments

- Developers use version control systems such as GIT to keep track of code changes
- Many PaaS systems allow code deployments via GIT
- ConPaaS had to catch up!

GIT-based code deployments

- Developers upload their SSH public keys
- Application code can be updated via **git push**
- Multiple public keys are accepted. Collaborative development

[back to Dashboard](#)

 **New Php Service** [start](#) [terminate](#) [manager log](#)

 initialized · init a few moments ago

1 instance running on Amazon EC2

 **Instance i-3a820043** [manager](#) ec2-107-22-96-29.compute-1.amazonaws.com
running

Code management

you may update the stage by

☐ uploading archive

or by

☒ checking out repository

Use the following command to upload your SSH public key:

cpclient.web http://107.22.96.29 upload_authorized_key ~/.ssh/id_rsa.pub

And then check out your GIT repository

git clone git@107.22.96.29:code

available code versions

code-default [code-default.tar](#) · [active](#) · [download](#) a few moments ago

Settings

Software Version [5.3](#)Maximum script execution time [30 seconds](#)

terminal

ConPaaS - management interf...

ec2-23-22-39-6.compute-1.amazonaws.com/service.php?sid=1

DuckDuckGo (SSL)

ema 969 help logout

ema@saturn - byobu

```
ema@saturn:~/dev/conpaas/conpaas-services$ python bin/cpsclient.web http://107.22.96.29 upload_authorized_key ~/.ssh/id_rsa.pub
1 keys added to authorized_keys
ema@saturn:~/dev/conpaas/conpaas-services$ git clone git@107.22.96.29:code
Cloning into code...
warning: You appear to have cloned an empty repository.
ema@saturn:~/dev/conpaas/conpaas-services$
```

1 instance running

Instance running

Code manager

you may upload or by

uploading

checking

available code

code-default

Settings

Maximum session time: 1h10m

ema@saturn 80.112.142.228 Menu:<F9>

Ubuntu 11.10

263kbps 627kbps 1h10m 1.01 2x2.0GHz 3.9GB,27% 2012-06-12 14:21:59

```
ema@saturn - byobu
ema@saturn:~/dev/conpaas/conpaas-services/code$ echo "<h1>Hello from ConPaaS\!</h1>" > index.php
ema@saturn:~/dev/conpaas/conpaas-services/code$ git add index.php
ema@saturn:~/dev/conpaas/conpaas-services/code$ git commit -am "First code version uploaded via GIT"
[master (root-commit) 4b6562a] First code version uploaded via GIT
 1 files changed, 1 insertions(+), 0 deletions(-)
 create mode 100644 index.php
ema@saturn:~/dev/conpaas/conpaas-services/code$ git push origin master
Counting objects: 3, done.
Writing objects: 100% (3/3), 259 bytes, done.
Total 3 (delta 0), reused 0 (delta 0)
remote: Code version 4b6562a successfully uploaded
To git@107.22.96.29:code
 * [new branch]      master -> master
ema@saturn:~/dev/conpaas/conpaas-services/code$
```



[back to Dashboard](#)

 **New Php Service** stop

running · started a few moments ago

[access application](#) · [manager log](#)

2 instances running on Amazon EC2

 Instance i-3a820043 manager	ec2-107-22-96-29.compute-1.amazonaws.com
running	
 Instance i-baa92bc3 proxy web php	23.22.149.192
running	

add or remove instances to your deployment

0 proxy 0 web 0 php submit

Code management

[access application](#)

you may update the stage by

☒ uploading archive Browse...

example: .zip, .tar of your source tree

or by

☐ checking out repository

available code versions

4b6562a 4b6562a · set active · download	a few moments ago
code-default code-default.tar · active · download	a few moments ago

javascript: void(0);



[back to Dashboard](#)

 **New Php Service** stop

[access application](#) → · [manager log](#) →

 running · started a few moments ago

2 instances running on Amazon EC2

 Instance i-3a820043 manager running	ec2-107-22-96-29.compute-1.amazonaws.com
 Instance i-baa92bc3 proxy web php running	23.22.149.192

add or remove instances to your deployment

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Code management

[access application](#) →

you may update the stage by

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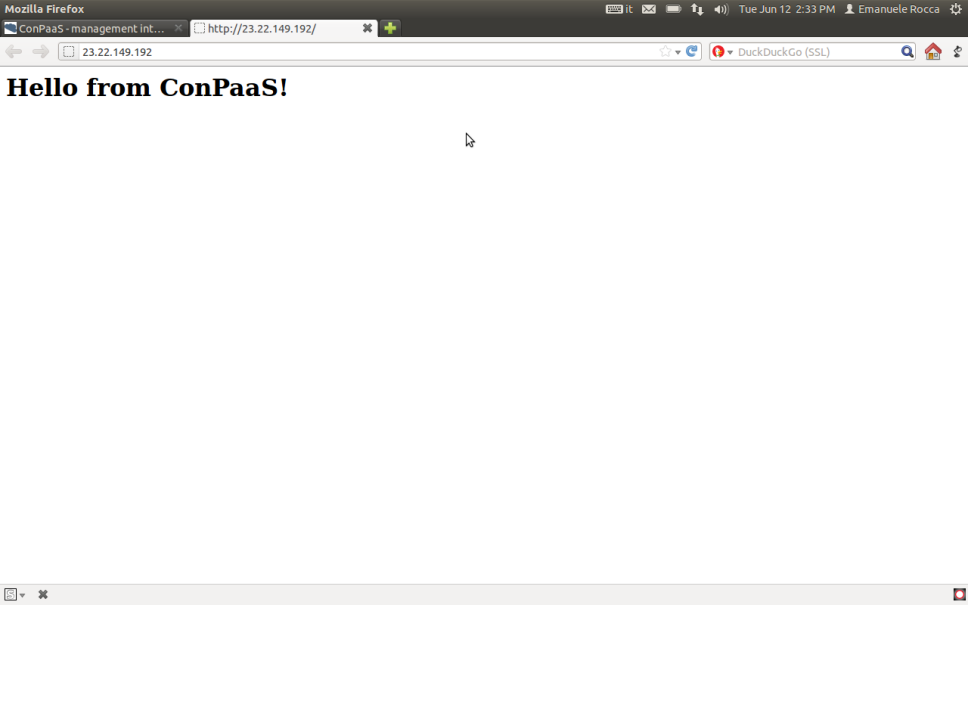
example: .zip, .tar of your source tree

☐ checking out repository

available code versions

4b6562a → 4b6562a · active · download	a few moments ago
code-default code-default.tar	a few moments ago

<http://23.22.149.192/>



Hello from ConPaaS!

GIT-based code deployments

A specific code version can be activated from the command line.

Automation is possible.

Functional testing of web applications

- Current Platform as a Service offerings neglect the Testing activity of the software development process
- Opportunity for ConPaaS!

Functional testing of web applications: Selenium

- Selenium offers a way to remotely control web browsers
- Complex, modern web applications can be tested from the **functional** point of view
- eg: if we open `www.conpaas.eu` and click on "Features", do we get a page with "ConPaaS - Features" in the title?

Functional testing of web applications: an example

```
require "selenium-webdriver"

driver = Selenium::WebDriver.for(
  :remote,
  :desired_capabilities => :firefox,
  :url => "http://23.20.4.21:4444/wd/hub"
)

base_url = "http://www.conpaas.eu/"

driver.get(base_url + "/")
driver.find_element(:link, "Features").click

puts "ConPaaS - Features" == driver.title
~
~
```

1,1

All

Functional testing of web applications in ConPaaS

- Selenium can function in **Grid** mode: a single server, called *hub* works as the point of contact for the tests
- Requests are proxied to a number of Selenium servers, called *nodes*
- On ConPaaS the service starts up with one agent functioning both as a hub and as a node. Users can run tests also with only one agent
- The service is elastic: more nodes can be added, they will register themselves with the hub

[back to Dashboard](#)

New Selenium Service

stop

running · created a few moments ago

[manager log](#) · [hub](#)

4 instances running on Amazon EC2

	Instance i-fa089f83 manager running	ec2-107-22-12-216.compute-1.amazonaws.com
	Instance i-2433a45d hub running	23.20.4.21
	Instance i-7a3daa03 node running	23.22.174.139
	Instance i-7c3daa05 running	23.22.191.6

add or remove instances to your deployment

0 Selenium Nodes

submit

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<http://23.20.4.21:4444/grid/console>

Grid Hub 2.21.0

DefaultRemoteProxy

listening on http://23.20.4.21:3306

test session time out after 300 sec.

Supports up to 6 concurrent tests from:



DefaultRemoteProxy

listening on http://23.22.174.139:3306

test session time out after 300 sec.

Supports up to 6 concurrent tests from:



DefaultRemoteProxy

listening on http://23.22.191.6:3306

test session time out after 300 sec.

Supports up to 6 concurrent tests from:



[view config](#)

Functional testing of web applications: scalability

- When the number of tests grows it might take a long time to get the results
- We need quick feedback!
- Unlimited horizontal scalability on ConPaaS: simply add new agents

Conclusions

Developer Experience should be considered as a key aspect by Platform as a Service vendors

ConPaaS is a nice system with many interesting features and properties. It is now more appealing to developers, but we can do even better!