Get ready for the cloud!

A new paradigm in scientific computing

@jjmerelo
What is the cloud?
Cloud is where you run your programs
Virtualized resources on tap

Scaling out of the box
Infrastructure as code
Distributed, multi-vendor, computing
Reproducible configurations ⇢ Reproducible science
A new application development and deployment paradigm
.. designed around scaling
Why use the cloud in scientific computing?
✓ It's new!
✓ No sunk costs!
✓ It scales!
It changes the algorithmic paradigm
Let Nature be your guide.
Cloud is about reproducible infrastructure
Let's containerize
Describe infrastructure:

```json
{
    "name": "hiffeitor",
    "scripts": {
        "test": "mocha",
        "start": "./callback-ea-HIFF.js"
    },
    "dependencies": {
        "nodeo": "^0.2.1",
        "winston": "^2.2.0",
        "winston-logstash": "^0.2.11",
        "winston-papertrail": "^1.0.2"
    },
    "devDependencies": {
        "flightplan": "^0.6.14"
    }
}
```
Introducing **docker**

*Lightweight virtualization*

*Portable infrastructure*
Using docker

`docker pull jjmerelo/cloudy-ga`
FROM phusion/baseimage
MAINTAINER JJ Merelo "jjmerelo@gmail.com"
RUN echo "Building a docker environment for NodEO"
ENV DEBIAN_FRONTEND=noninteractive
RUN apt-get update && apt-get upgrade -y
RUN apt-get install apt-utils -y
[... more stuff ... ]
ADD https://github.com/JJ/cloudy-ga/raw/master/app/hiff.json app
WORKDIR /app
RUN npm i
RUN chmod +x callback-ea-HIFF.js

CMD npm start
Bring your own container
sudo docker build --no-cache -t jjmerelo/cloudy-ga:0.0.1
... and run it

```
sudo docker run -t jjmerelo/cloudy-ga:0.0.1
  -e "PAPERTRAIL_PORT=7777"
  -e "PAPERTRAIL_HOST=logs77.papertrailapp.com"
```
Logging matters
It's not programming as usual
Reactive programming
Algorithm + stream = application in the cloud
Decoupled processing and data structures
Running in the cloud
Infrastructure as a service
Create instance
Set up with Ansible

```yaml
- hosts: "{{target}}"
  tasks:
    - name: install prerequisites
      command: apt-get update -y && apt-get upgrade -y
    - name: install packages
      apt: pkg={{ item}}
      with_items:
        - git
        - npm
    - name: Create profile
      copy: content="export PAPERTRAIL_PORT={{PAPERTRAIL_PORT}}"
      dest=/home/cloudy/.profile
```
Run the *playbook*
PLAY [all] ******************************************************************************

GATHERING FACTS  ******************************************************************************
ok: [default]

TASK: [install prererequisites]  ******************************************************************************
changed: [default]

TASK: [install packages]  ******************************************************************************
changed: [default] => (item=language-pack-en,language-pack-es,git,curl,build-essential,libssl-dev,nodejs,npm)

PLAY RECAP  ******************************************************************************
default : ok=3    changed=2    unreachable=0    failed=0

==> default: Running provisioner: code (ansible)...
   default: Running ansible-playbook...

PLAY [all] ******************************************************************************

GATHERING FACTS  ******************************************************************************
ok: [default]

TASK: [clone repo]  ******************************************************************************
changed: [default]

PLAY RECAP  ******************************************************************************
default : ok=2    changed=1    unreachable=0    failed=0
Ready to run ✓
But there's something missing here
Deploying to the cloud
Let's use **FlightPlan**

```javascript
plan.target('azure', {
  host: 'cloudy-ga.cloudapp.net',
  username: 'azureuser',
  agent: process.env.SSH_AUTH_SOCK
});

// Local
plan.local(function(local) {
  local.echo('Plan local: push changes');
  local.exec('git push');
});
```
... And after setup

```javascript
plan.remote(function(remote) {
  remote.log('Pull');
  remote.with('cd cloudy-ga', function() {
    remote.exec('git pull');
    remote.exec('cd app;npm install .');
  });
  remote.with('cd /home/azureuser/cloudy-ga/app', function() {
    remote.exec('npm start');
  });
});
```
IaaS have free tiers

But it generally is pay-as-you-go

Great if you do small amounts of computation
Make do without a server
Platform as a service
There's *freemium* PaaS

Heroku, OpenShift, IBM's BlueMix and Google AppSpot
Available in domain jmerelo

objl
Node.js 0.10

Add Application...
Pool-based evolutionary algorithms: not so canonical any more
Detaching population from operations → Reactive programming.
Three good things about pool-based EAs
1. Self-organizing clients
2. Fully asynchronous
3. Persistent population
Island models can be used too.
Deploy server to PaaS ✓
Deploy clients to IaaS ✓
→ And do science!
Logs glue everything together

Oldest event reached.

Need to search events before Friday, Jul 8 at 4:03 AM? Download archives (or to retain logs longer, increase duration).
Vagrant.configure("2") do |config|
  config.vm.box = "ubuntu/xenial64"
  config.vm.provision "shell", inline: <<-SHELL
    apt-get update
    apt-get upgrade -y
  SHELL
  config.vm.provision "main", type: "ansible" do |ansible|
    ansible.extra_vars = { target: "all" }
    ansible.playbook = "playbook.yml"
  end
end
# and the rest...
All together

✓ Get servers ➔ PaaS, Loggers
✓ Create/provision boxes ➔ Vagrant + Ansible
✓ Deploy/run ➔ FlightPlan
Take this home

1. **Cloud** is the new (grid|cluster)
2. There is an (almost) **free** lunch
3. **Reactive** programming
4. We should ❤ **logs**
Questions?

Tweet out (or follow) @jjmerelo
Credits

- Running and clouds by Hernán Piñera
- Car assembly by Chrysler group
- Faucet on the sky by Kristin Nador
- Strip mall by Thomas Hawk
- Mobiles, Flickr image by Kai Hendry [flic.kr/p/5omH5r]
- People in room from Adriaan Bloem [flic.kr/p/8NDCRh]
- Shooting at clouds by Charles Prithvi Raj
- Sandbox, Flickr image by Gil Garcia [flic.kr/p/5Pa7ZJ]
- B&W sandbox, Flickr image by Stefani Woods [flic.kr/p/4QiGQV]
- HTTP codes, Image by Paul Downey [flic.kr/p/8yZyBF]
- Data center in cave, from Antony Antony [flic.kr/p/6K3ZAG]
- Nuns and pool, Flickr image by Lorianne diSabato @flic.kr/p/nXfbQ6
- 3 fingers, Flickr image by Mutiara Karina [https://flic.kr/p/a9SSm3]
- Freedom by Gonzalo Baeza