

# Using Amazon EC2 Cloud Spot Instances as cheap compute resource for compute intensive scientific data analysis

Gergely Debreczeni

2014.05.26 - VDASC telecon

# About Amazon EC2

Amazon provides a wide range of various computing services.

<http://aws.amazon.com>

Almost any kind of configuration regarding, CPU, memory, storage and networking is possible.

Easy to register, video tutorial is helping you in the first steps.

Free trial account with 750 hour of free CPU usage / month during 1 year ! Just perfect for evaluation studies.

The screenshot shows the Amazon EC2 product page. At the top, there is the Amazon Web Services logo, a 'Sign Up' button, and links for 'My Account / Console' and 'English'. Below the logo is a navigation bar with 'AWS Products & Solutions', a search bar, and 'Developers' and 'Support' dropdown menus. The main content area is titled 'Amazon EC2' and features a 'Get Started for Free' button. The text describes Amazon EC2 as a web service for resizable compute capacity in the cloud, designed for developers. It highlights the ease of obtaining and configuring capacity, the ability to scale up and down, and the reduced time to boot new server instances. The page also mentions the AWS Free Tier, which includes 750 hours of Linux and Windows Micro Instances each month for one year. A link to 'View AWS Free Tier Details' is provided. On the left side, there is a navigation menu with links to 'Amazon EC2', 'Getting Started with EC2', 'Product Details', 'Instances', 'Pricing', 'Previous Generation Instances', 'Purchasing Options', 'Amazon EC2 Spot Instances', 'Amazon EC2 Reserved Instances', 'Amazon EC2 Dedicated Instances', 'Developer Resources', 'FAQs', and 'Amazon EC2 SLA'. Below the navigation menu, there are 'RELATED LINKS' for 'Windows Instances' and 'VM Import/Export'. At the bottom of the page, there is a video player titled 'Introduction to Amazon EC2 (4:01)'.

# Instances - a few example

## Instance Types Matrix

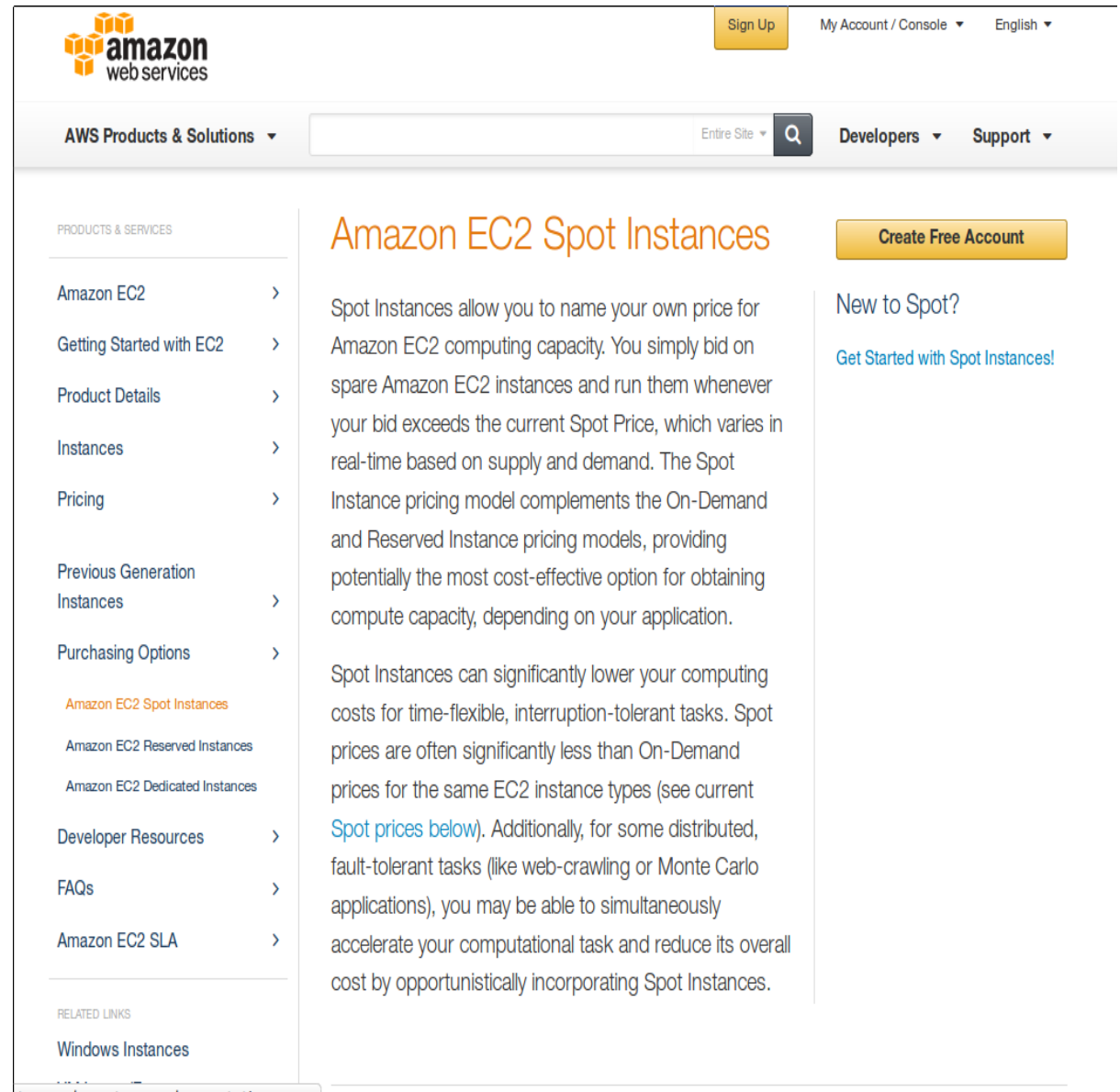
Instance Type	vCPU	Memory (GiB)	Storage (GB)	Networking Performance	Physical Processor	Clock Speed (GHz)	Intel® AES-NI	Intel® AVX†	Intel® Turbo	EBS OPT	Enhanced Networking
m3.medium	1	3.75	1 x 4 SSD	Moderate	Intel Xeon E5-2670*	2.6	Yes	Yes	Yes	-	-
m3.large	2	7.5	1 x 32 SSD	Moderate	Intel Xeon E5-2670	2.6	Yes	Yes	Yes	-	-
m3.xlarge	4	15	2 x 40 SSD	Moderate	Intel Xeon E5-2670	2.6	Yes	Yes	Yes	Yes	-
m3.2xlarge	8	30	2 x 80 SSD	High	Intel Xeon E5-2670	2.6	Yes	Yes	Yes	Yes	-
c3.large	2	3.75	2 x 16 SSD	Moderate	Intel Xeon E5-2670 v2	2.8	Yes	Yes	Yes	-	Yes
c3.xlarge	4	7.5	2 x 40 SSD	Moderate	Intel Xeon E5-2670 v2	2.8	Yes	Yes	Yes	Yes	Yes
c3.2xlarge	8	15	2 x 80 SSD	High	Intel Xeon E5-2670 v2	2.8	Yes	Yes	Yes	Yes	Yes
c3.4xlarge	16	30	2 x 160 SSD	High	Intel Xeon E5-2670 v2	2.8	Yes	Yes	Yes	Yes	Yes
c3.8xlarge	32	60	2 x 320 SSD	10 Gigabit	Intel Xeon E5-2670 v2	2.8	Yes	Yes	Yes	-	Yes

# About spot instances

Spot instances are Amazon's „screen saver” solutions to sell their not used spare resources on a strongly reduced prices.

This was Amazon cloud is almost full all the time and applications that do not need on-demand immediate compute resources but can wait until compute prices are become sufficiently low can make very good use of it.

Prices are changing all time, just like in the stock market, upper (and lower) limits can be set by the user when to allow his/her image to be executed.



The screenshot shows the AWS website's page for Amazon EC2 Spot Instances. The page features a navigation bar with the AWS logo, a search bar, and links for 'Sign Up', 'My Account / Console', and 'English'. Below the navigation bar, there are dropdown menus for 'AWS Products & Solutions', 'Developers', and 'Support'. The main content area is titled 'Amazon EC2 Spot Instances' and includes a 'Create Free Account' button. The page is divided into three columns: a left sidebar with a 'PRODUCTS & SERVICES' menu, a central text area, and a right sidebar with a 'New to Spot?' section. The left sidebar menu includes items like 'Amazon EC2', 'Getting Started with EC2', 'Product Details', 'Instances', 'Pricing', 'Previous Generation Instances', 'Purchasing Options', 'Amazon EC2 Spot Instances' (highlighted), 'Amazon EC2 Reserved Instances', 'Amazon EC2 Dedicated Instances', 'Developer Resources', 'FAQs', and 'Amazon EC2 SLA'. The central text area contains two paragraphs explaining Spot Instances and their pricing model. The right sidebar contains a 'New to Spot?' section with a link to 'Get Started with Spot Instances!'.

amazon web services

Sign Up My Account / Console English

AWS Products & Solutions Entire Site Search Developers Support

PRODUCTS & SERVICES

- Amazon EC2
- Getting Started with EC2
- Product Details
- Instances
- Pricing
- Previous Generation Instances
- Purchasing Options
- Amazon EC2 Spot Instances**
- Amazon EC2 Reserved Instances
- Amazon EC2 Dedicated Instances
- Developer Resources
- FAQs
- Amazon EC2 SLA

RELATED LINKS

- Windows Instances

## Amazon EC2 Spot Instances

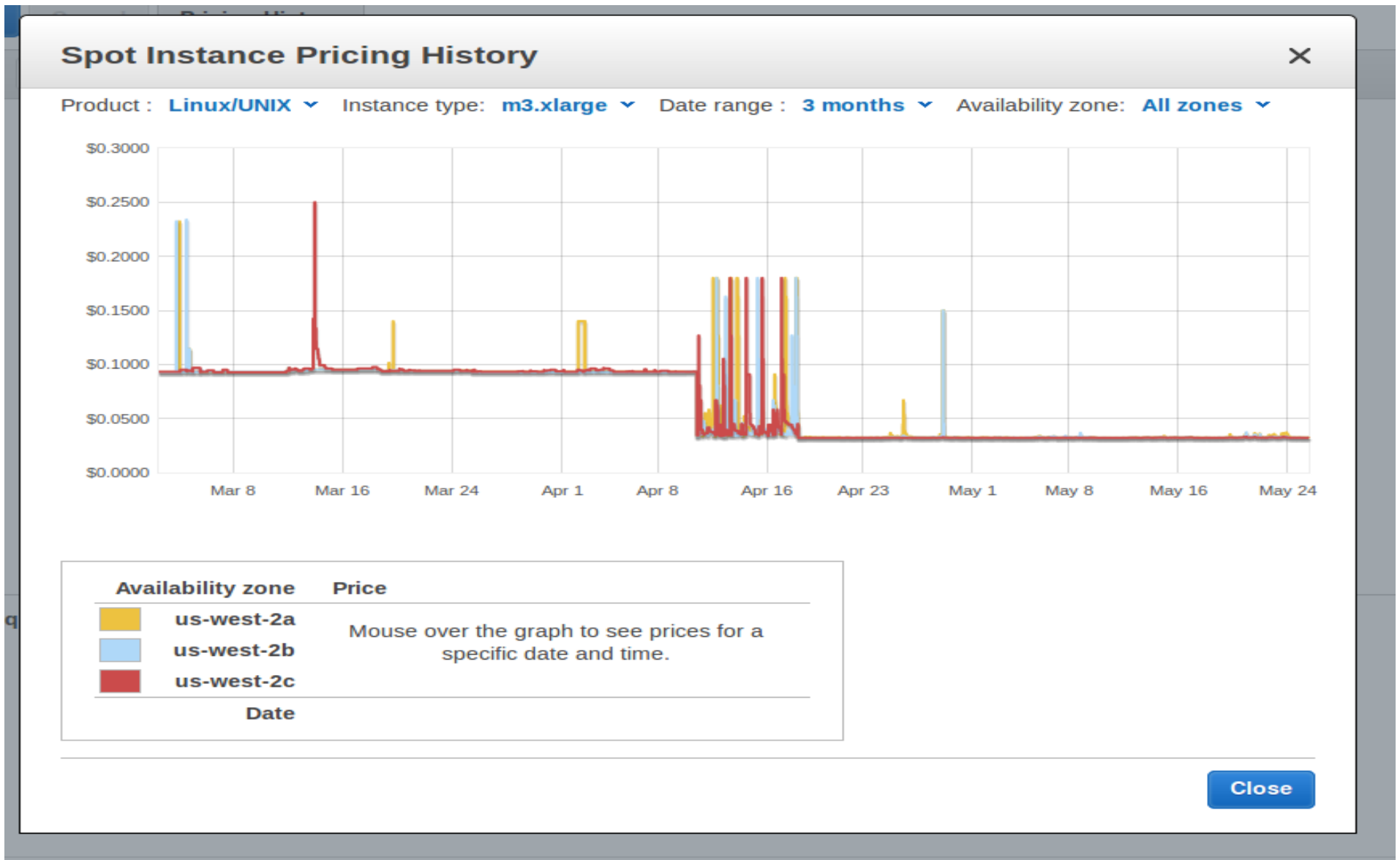
Create Free Account

New to Spot?  
[Get Started with Spot Instances!](#)

Spot Instances allow you to name your own price for Amazon EC2 computing capacity. You simply bid on spare Amazon EC2 instances and run them whenever your bid exceeds the current Spot Price, which varies in real-time based on supply and demand. The Spot Instance pricing model complements the On-Demand and Reserved Instance pricing models, providing potentially the most cost-effective option for obtaining compute capacity, depending on your application.

Spot Instances can significantly lower your computing costs for time-flexible, interruption-tolerant tasks. Spot prices are often significantly less than On-Demand prices for the same EC2 instance types (see current [Spot prices below](#)). Additionally, for some distributed, fault-tolerant tasks (like web-crawling or Monte Carlo applications), you may be able to simultaneously accelerate your computational task and reduce its overall cost by opportunistically incorporating Spot Instances.

# Pricing of spot instances



# Pricing of spot instances

In various configurations the price / core price more or less the same. An ideal configuration is m3.xlarge with 4 CPU and 15 GB memory:

$0.008 \text{ \$ / hour} = 0.192 \text{ \$ / day} = 0.0192 \text{ \$ / HS06.day} = \mathbf{0.014 \text{ Euro / HS06.day}}$

this is approximately the half what we pay for our dedicated resources !

Of course we have to benchmark it before claiming anything definit !

**Using Amazon EC2 Spot instances can save us 40-50 KEuro / year !**

# Management console

The screenshot displays the AWS Management Console interface. At the top, there is a navigation bar with 'Services' and 'Edit' menus, and user information for 'Debrecezeni Gergely' in the 'Oregon' region. The left sidebar contains a navigation menu with categories like 'EC2 Dashboard', 'INSTANCES', 'IMAGES', 'ELASTIC BLOCK STORE', 'NETWORK & SECURITY', and 'AUTO SCALING'. The main content area is divided into several sections: 'Resources' showing 0 Running Instances, 0 Elastic IPs, 0 Snapshots, 0 Volumes, 1 Key Pair, 0 Load Balancers, 0 Placement Groups, and 2 Security Groups; 'Account Attributes' showing supported platforms (VPC) and default VPC (vpc-cd52b9a8); 'Additional Information' with links to guides and documentation; 'AWS Marketplace' listing products like 'Wyatta Virtual Router/Firewall/VPN' and 'Alert Logic Threat Manager for AWS'; 'Service Health' for 'US West (Oregon)' showing normal status for all availability zones; and 'Scheduled Events' showing no events. A 'Launch Instance' button is prominently displayed in the 'Create Instance' section.

# Launching






- 1. Choose AMI
- 2. Choose Instance Type
- 3. Configure Instance
- 4. Add Storage
- 5. Tag Instance
- 6. Configure Security Group
- 7. Review

## Step 1: Choose an Amazon Machine Image (AMI)

Cancel and Exit

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.

Quick Start 1 to 18 of 18 AMIs

My AMIs	 <b>Amazon Linux AMI 2014.03.1</b> - ami-043a5034 (64-bit) / ami-1e3a502e (32-bit) <b>Free tier eligible</b> The Amazon Linux AMI is an EBS-backed image. It includes Linux 3.10, AWS tools, Java 7, Ruby 2, and repository access to multiple versions of Apache, MySQL, PostgreSQL, Python, Ruby and Tomcat. Root device type: ebs Virtualization type: paravirtual	Select <input checked="" type="radio"/> 64-bit <input type="radio"/> 32-bit
AWS Marketplace	 <b>Red Hat Enterprise Linux 6.5 (PV)</b> - ami-aa8bfe9a (64-bit) / ami-dc8ffaec (32-bit) <b>Free tier eligible</b> Red Hat Enterprise Linux version 6.5 (PV), EBS-backed Root device type: ebs Virtualization type: paravirtual	Select <input checked="" type="radio"/> 64-bit <input type="radio"/> 32-bit
Community AMIs	 <b>SuSE Linux Enterprise Server 11 sp3 (PV)</b> - ami-d8b429e8 (64-bit) / ami-9eb429ae (32-bit) <b>Free tier eligible</b> SuSE Linux Enterprise Server 11 Service Pack 3 (PV), EBS-backed with Amazon EC2 AMI Tools preinstalled; Apache 2.2, MySQL 5.5, PHP 5.3, and Ruby 1.8.7 available Root device type: ebs Virtualization type: paravirtual	Select <input checked="" type="radio"/> 64-bit <input type="radio"/> 32-bit
<input checked="" type="checkbox"/> Free tier only ⓘ	 <b>Ubuntu Server 14.04 LTS (PV)</b> - ami-6ac2a85a (64-bit) / ami-68c2a858 (32-bit) <b>Free tier eligible</b> Ubuntu Server 14.04 LTS (PV), EBS-backed with support available from Canonical ( <a href="http://www.ubuntu.com/cloud/services">http://www.ubuntu.com/cloud/services</a> ). Root device type: ebs Virtualization type: paravirtual	Select <input checked="" type="radio"/> 64-bit <input type="radio"/> 32-bit
	 <b>Microsoft Windows Server 2012 Base</b> - ami-23e79113 <b>Free tier eligible</b> Microsoft Windows 2012 Standard edition with 64-bit architecture. [English] Root device type: ebs Virtualization type: hvm	Select 64-bit



# Launching



## Launch Status

### ✓ Your instances are now launching

The following instance launches have been initiated: [i-8b20e280](#), [i-8a20e281](#), [i-8920e282](#), [i-8820e283](#), [i-8f20e284](#), [i-8e20e285](#), [i-8d20e286](#), [i-8c20e287](#), [i-ff20e2f4](#), [i-fe20e2f5](#), [i-fd20e2f6](#), [i-fc20e2f7](#), [i-f320e2f8](#), [i-f220e2f9](#), [i-f120e2fa](#), [i-f020e2fb](#), [i-f720e2fc](#), [i-f620e2fd](#), [i-f520e2fe](#), [i-f420e2ff](#) [View launch log](#)

### ⋮ Get notified of estimated charges

[Create billing alerts](#) to get an email notification when estimated charges on your AWS bill exceed \$0.0 (in other words, when you have exceeded the free usage tier).

## How to connect to your instances

Your instances are launching, and it may take a few minutes until they are in the **running** state, when they will be ready for you to use. Usage hours on your new instances will start immediately and continue to accrue until you stop or terminate your instances.

Click **View Instances** to monitor your instances' status. Once your instances are in the **running** state, you can **connect** to them from the Instances screen. [Find out](#) how to connect to your instances.

### ▼ Here are some helpful resources to get you started

- [How to connect to your Linux instance](#)
- [Learn about AWS Free Usage Tier](#)
- [Amazon EC2: User Guide](#)
- [Amazon EC2: Discussion Forum](#)

While your instances are launching you can also

[Create status check alarms](#) to be notified when these instances fail status checks. (Additional charges may apply)

[Create and attach additional EBS volumes](#) (Additional charges may apply)

[Manage security groups](#)

[View Instances](#)

# Status

Services ▾ Edit ▾ Debrecezi Gergely ▾ Oregon ▾ Help ▾

EC2 Dashboard  
Events  
Tags  
Reports

INSTANCES  
Instances  
Spot Requests  
Reserved Instances

IMAGES  
AMIs  
Bundle Tasks

ELASTIC BLOCK STORE  
Volumes  
Snapshots

NETWORK & SECURITY  
Security Groups  
Elastic IPs  
Placement Groups  
Load Balancers  
Key Pairs  
Network Interfaces

AUTO SCALING  
Launch Configurations  
Auto Scaling Groups

**Launch Instance** **Connect** **Actions ▾**

Filter: All instances ▾ All instance types ▾  1 to 20 of 20 Instances

<input type="checkbox"/>	Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS	Public
<input type="checkbox"/>		i-8820e283	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-37-0.us-we...	54.206
<input type="checkbox"/>		i-8920e282	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-88-175.us-...	54.200
<input type="checkbox"/>		i-8a20e281	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-55-193.us-...	54.200
<input type="checkbox"/>		i-8b20e280	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-113-137.us-...	54.200
<input type="checkbox"/>		i-8c20e287	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-108-222.us-...	54.200
<input type="checkbox"/>		i-8d20e286	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-45-14.us-w...	54.200
<input type="checkbox"/>		i-8e20e285	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-14-167.us-...	54.200
<input type="checkbox"/>		i-8f20e284	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-187-254-27.us-...	54.187
<input type="checkbox"/>		i-f020e2fb	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-149-129.us-...	54.200
<input type="checkbox"/>		i-f120e2fa	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-196-127.us-...	54.200
<input type="checkbox"/>		i-f220e2f9	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-187-240-109.us-...	54.187
<input type="checkbox"/>		i-f320e2f8	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-187-109-74.us-...	54.187
<input type="checkbox"/>		i-f420e2ff	t1.micro	us-west-2b	● running	⌛ Initializing	None	ec2-54-200-163-116.us-...	54.200

Select an instance above

# Login

```
gdebrecz@stan:/home/gdebrecz/Arbeits/Virgo/presentation/2014.05.26-VDASC-Amazon$
gdebrecz@stan:/home/gdebrecz/Arbeits/Virgo/presentation/2014.05.26-VDASC-Amazon$
gdebrecz@stan:/home/gdebrecz/Arbeits/Virgo/presentation/2014.05.26-VDASC-Amazon$ ssh -i /home/gdebrecz/.ssh/AmazonTestingKey.p
em 54.200.37.0 -l root
Please login as the user "ec2-user" rather than the user "root".

Connection to 54.200.37.0 closed.
gdebrecz@stan:/home/gdebrecz/Arbeits/Virgo/presentation/2014.05.26-VDASC-Amazon$ ssh -i /home/gdebrecz/.ssh/AmazonTestingKey.p
em 54.200.37.0 -l ec2-user
Last login: Sun May 25 09:37:02 2014 from 79.172.200.249
[ec2-user@ip-172-31-45-255 ~]$ sudo su
[root@ip-172-31-45-255 ec2-user]# cat /proc/cpuinfo
processor           : 0
vendor_id          : GenuineIntel
cpu family         : 6
model              : 45
model name         : Intel(R) Xeon(R) CPU E5-2650 0 @ 2.00GHz
stepping           : 7
cpu MHz            : 1795.672
cache size         : 20480 KB
fpu                : yes
fpu_exception      : yes
cpuid level        : 13
wp                 : yes
flags              : fpu de tsc msr pae cx8 sep cmov pat clflush mmx fxsr sse sse2 ss ht syscall nx lm up rep_good unfair_spinloc
k pni pclmulqdq ssse3 cx16 pcid sse4_1 sse4_2 x2apic popcnt tsc_deadline_timer aes hypervisor lahf_lm
bogomips           : 3591.34
clflush size       : 64
cache_alignment    : 64
address sizes      : 46 bits physical, 48 bits virtual
power management:

[root@ip-172-31-45-255 ec2-user]# exit
exit
[ec2-user@ip-172-31-45-255 ~]$ exit
logout
Connection to 54.200.37.0 closed.
gdebrecz@stan:/home/gdebrecz/Arbeits/Virgo/presentation/2014.05.26-VDASC-Amazon$ scrot -s login.png
```

# Conclusion

Evaluation studies has to be done. But we cannot ignore this possibility.

- Benchmarking (To be done)
- Condor client joining the Pegasus pool (Done)
- Scalability (To be done)
- Input / Output transfer testing (To be done)