
# Where to get the needed computing

## Tuesday morning

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# Logistical reminder

- It is OK to ask questions
  - During the lecture
  - During the demos
  - During the exercises
  - During the breaks
- If I don't know the answer,
  I will find someone who likely does

# Introduction

- So, you have a problem that needs many CPUs to get solved in a reasonable amount of time
- **Where** do you get the needed resources?

# Available options

## You either:

- Buy CPUs

https://www.flickr.com/photos/15203028@N00/5692453121/

- Get a computing grant
- Use leftover CPU cycles
  - i.e. opportunistic use of other's resources


http://www.cattytown.com/

# Available options

## You either:

- Buy CPUs
  - Your own hardware (e.g. a cluster)
  - Contribute hardware to a common pool
  - Lease machines on monthly/yearly basis
  - Rent machines on a per hour basis
- Get a computing grant
- Use leftover CPU cycles
  - On friends' hardware
  - At your home institution
  - On a large-scale scientific infrastructure

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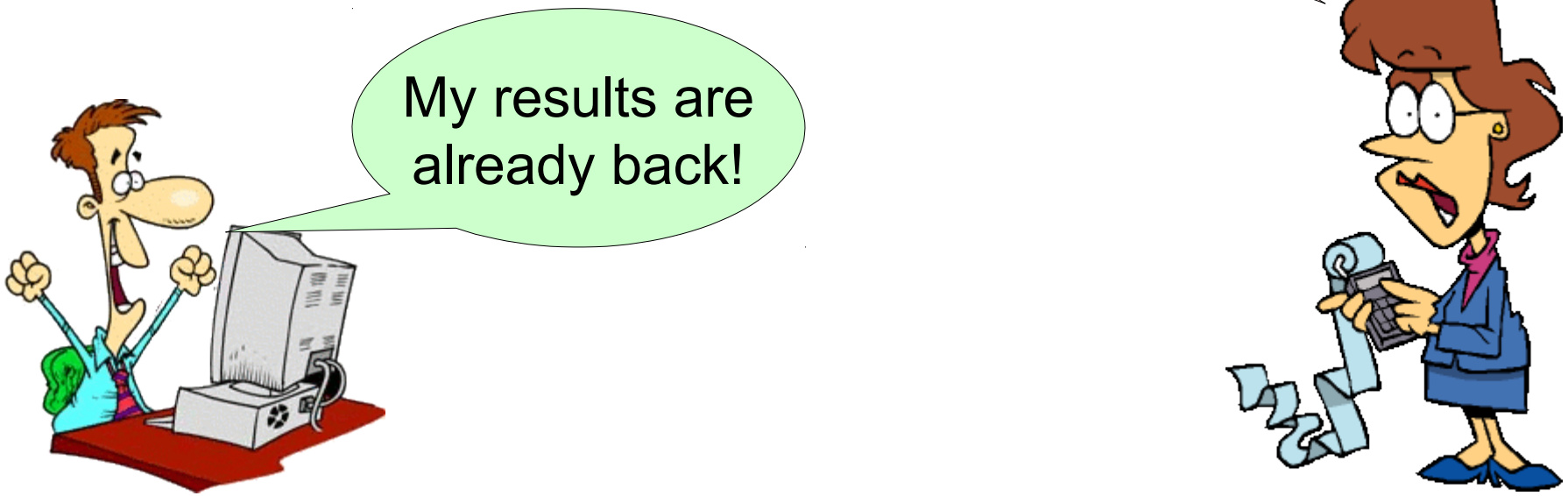
# Which way to go?

- Buying is **more reliable**
  - You can **plan** on how much computing you will be able to do
  - But not always an option
    - We all have a limited budget

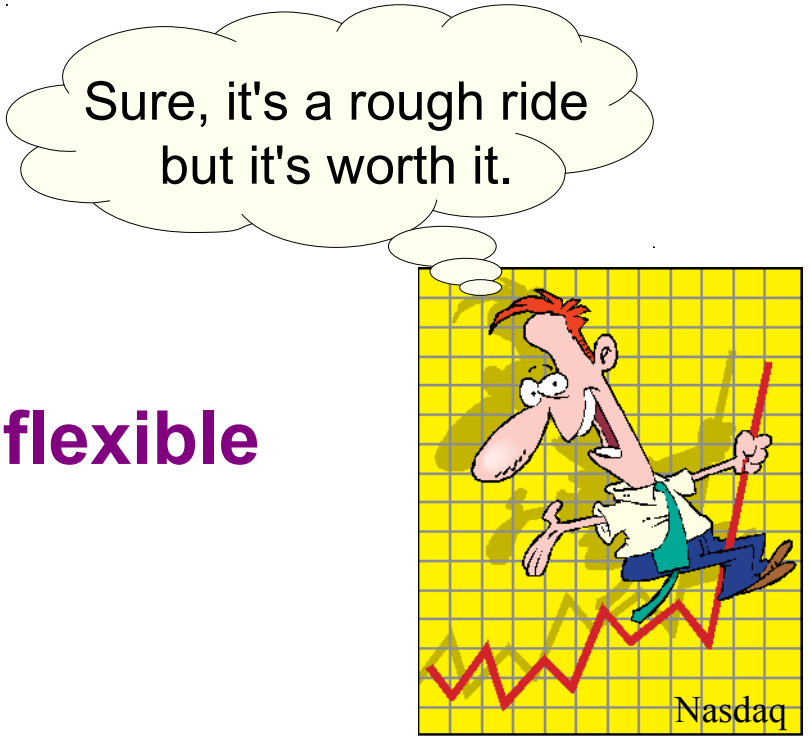


# Which way to go?

- Buying is **more reliable**
  - You can plan on how much computing you will be able to do
  - But not always an option
    (We all have a limited budget)
- Grants are **similar in nature**
  - But may be harder to get than money!

# Which way to go?

- Buying is more reliable
- Grants are similar in nature
- Opportunistic use **can** give you **vastly more**
  - But there is **no guarantee** you will get what you hope for
  - And you will have to be **flexible**



# Don't assume flat usage

- Most people have spiky compute needs, e.g.
  - You come up with a great idea...
    need a gazillion CPUs **now** to verify it!
    Then nothing for a month or more
    while you look for the next great one.
  - Everybody wants to run a last computing pass just before that important conference

If you think you are the rare exception,
please bear with me anyhow.

# Impact on planning

- You **likely cannot afford** to buy enough dedicated resources to **cover the peaks**
- You should always plan on using opportunistic resources
  - At least for part of the year
  - But owning something still a good idea
- Make sure you choose tools that allow you to do DHTC

# Buying dedicated hardware

- Buying your own hardware is the most straightforward approach
- But you must also budget for
  - Floor space
  - Electricity
  - Cooling
  - Personnel costs

Often more than the HW itself

- And install your own HTC system
  - Which requires significant expertise

# Server hosting

- You can lease hardware from commercial entities
  - Typically 3-12 months leases
  - Popular vendor: Rackspace

- Great for shorter projects
  - Likely gives you lower Total Cost of Ownership
    - May cost less than buying the HW itself
    - And you save on the infrastructure costs
  - But still requires you to operate an HTC system

# Cloud computing

- Similar to server hosting
  - But you **pay by the hour**
- Most famous is Amazon EC2
  (but not the only one)
- Great for spike leveling
  - Can get a lot of resources on short notice, if you have the needed money
  - But **can be quite expensive** if used over an extended period of time

# Cloud computing

- Similar to se[illegible]

You may hear talking about “Scientific Clouds”.

That's really just another name for VM-based HTC systems

(so **not** what I call Cloud here)

# Contributing to a common pool

- If you have an existing HTC system at your institution/campus, it is **likely cheaper** to contribute to it
  - Economies of scale
  - Better expertise

- You will likely not get all of “your” resources on moment's notice
  - But getting them within 24h very realistic

# Contributing to a common pool

- If you h… ystem at v… l…

The HTC system
may also be located
at a different location,
if they allow remote access.

See Condor-G and BOSCO talks later today

# Computing Grants

- Some of the US large-scale computing infrastructures are grant based
  - e.g. XSEDE
- You make a proposal, and if you make a good case, you can get a substantial CPU allocation on their HTC/HPC system
- Initial effort comparable to buying HW
  - A lot of paperwork needed
  - And long lead times

# Going for opportunistic resources

- All the methods described so far give you dedicated resources
  - i.e. you can count on them being there when you need them
    (at least, after the initial setup period)
  - But that may not be enough for your needs
    - And you cannot afford more
- Opportunistic resources may came to the rescue

  - Just remember there are **no guarantees** here

# Opportunistic resources

- The opportunistic resources are essentially machines that are **currently** not needed by the owner
  - e.g. owners are in the low part of a curve
- Reasons why they may allow you to use them (instead of turning them off)
  - Connections – e.g. Friend's desktop
  - Politics – e.g. Funding agency requirement
  - Money – e.g. Amazon's spot instances

# Free HTC resources

- You should first look close by
  - The HTC system at your home institution may frequently have spare capacity
  - They are likely happy to share
- Once that is not enough, remote HTC clusters may provide substantial additional free resources as well
  - e.g. Sites on OSG

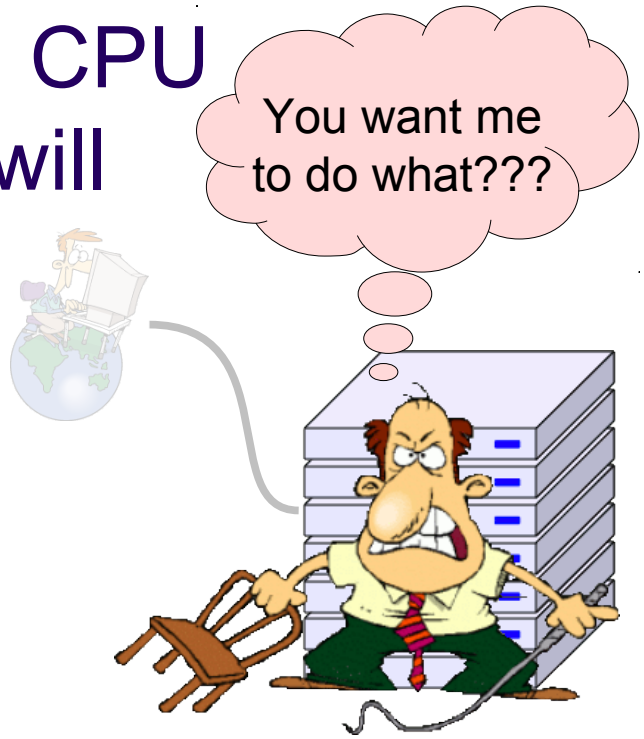

More on OSG this afternoon

# Beggars can't be choosers

- Remember, when you scout for free resources, you have very few rights
  - **You are effectively "a beggar"**
- You will have to adapt
  - Don't expect to get it your way
    - Even though some sysadmins may be willing to help
  - The more flexible you are, the more free resources you will be able to use

# Consider contributing back

- If you buy hardware, consider contributing back
  - i.e. give unused CPU cycles to others
- A modest amount of gifted CPU can buy you a lot of good will
  - For when you need to level your own spikes
  - Likely not a quid-pro-quo but don't underestimate good will

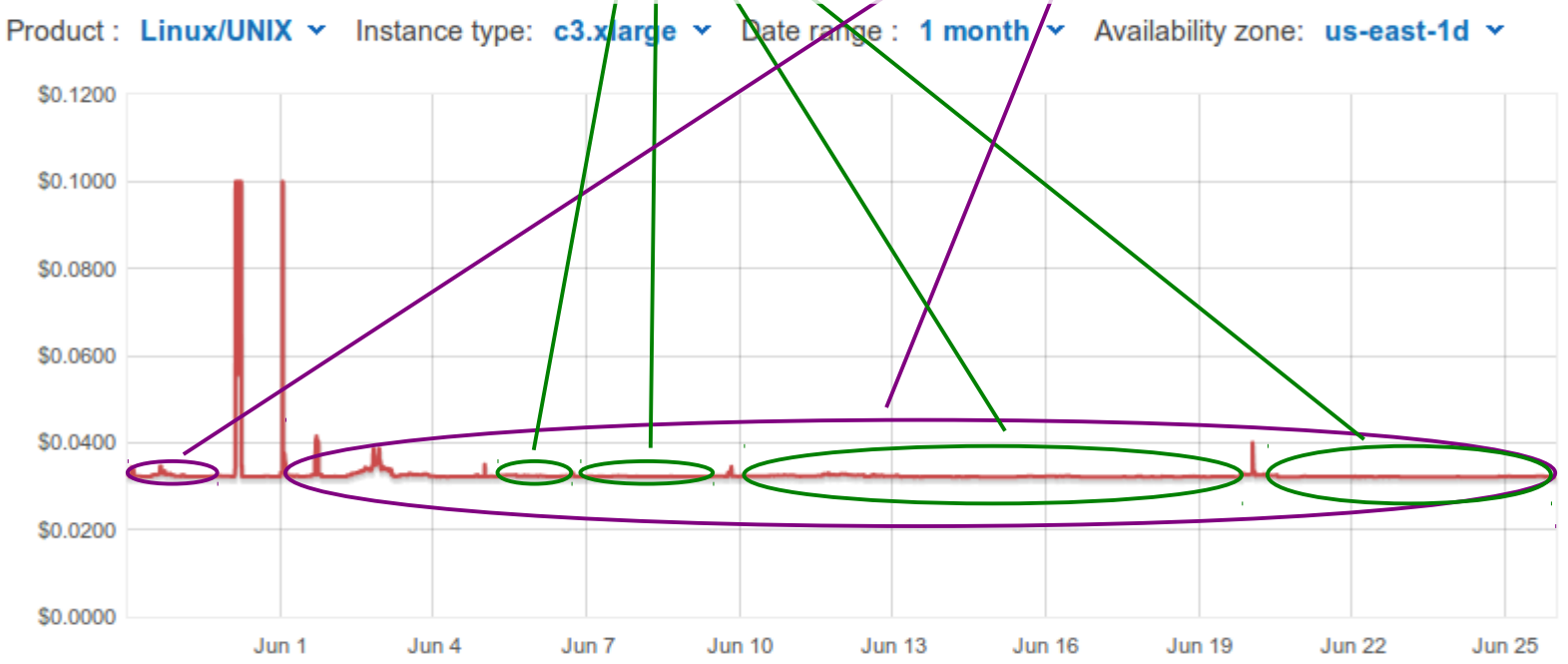


# Opportunistic Cloud Resources

- Here opportunistic means **cheap(er)**
  - Not free
- Basically one **bids**  (real money) for resources
  - The highest bidder gets the resources
  - Until someone else bids higher
    - At which point your jobs are killed!
  - e.g. Amazon EC2 Spot Instances
- Can get a lot for relatively little money
  - But not always

# Example

- For Amazon EC2 c3.xlarge (4 cores)
  - Full price: $0.21/hour (about $35/core/month)
  - Spot price: $0.03/hour - $0.04/hour (about $6/core/month)
    - Many periods when you could get those prices



# Putting everything together

- You will get most work done if you **mix** owned, leased and opportunistic resources
  - Spread over many location
  - i.e. DHTC
- Plan on using an overlay system early on
  - So you don't have to use N different tools to use N different resource types
  - Searching for/Learning about new tools when you are close to a deadline is no fun

# Questions?

- Questions? Comments?
  - Feel free to ask me questions later:

    Igor Sfiligoi <isfiligoi@ucsd.edu>
- Upcoming sessions
  - glideinWMS – the OSG overlay software
  - Hands-on exercises
  - Tour

# Automation to the rescue

Courtesy bancaynegocios.com

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