The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific and
Cultural Organization

IAEA
International Atomic Energy Agency

1967-4

Advanced School in High Performance and GRID Computing

3 - 14 November 2008

Tools for LINUX workstations

DI MEO Riccardo and COZZINI Stefano
S.I.S.S.A.
International School for Advanced Studies
Via Beirut 2-4
34014 Trieste
ITALY

Advanced School in
High Performance
and GRID Computing

Tools for Linux workstations

Riccardo di Meo/ Stefano Cozzini

ICTP EU-IndiaGrid project / CNR-INFM DEMOCRITOS, Trieste

Useful tool you should be aware of

- Today's list:
  - ssh / scp
  - gnuplot
  - gzip / bzip2/ tar
  - wget
  - rpm/yum
- Check-out the wiki for more:

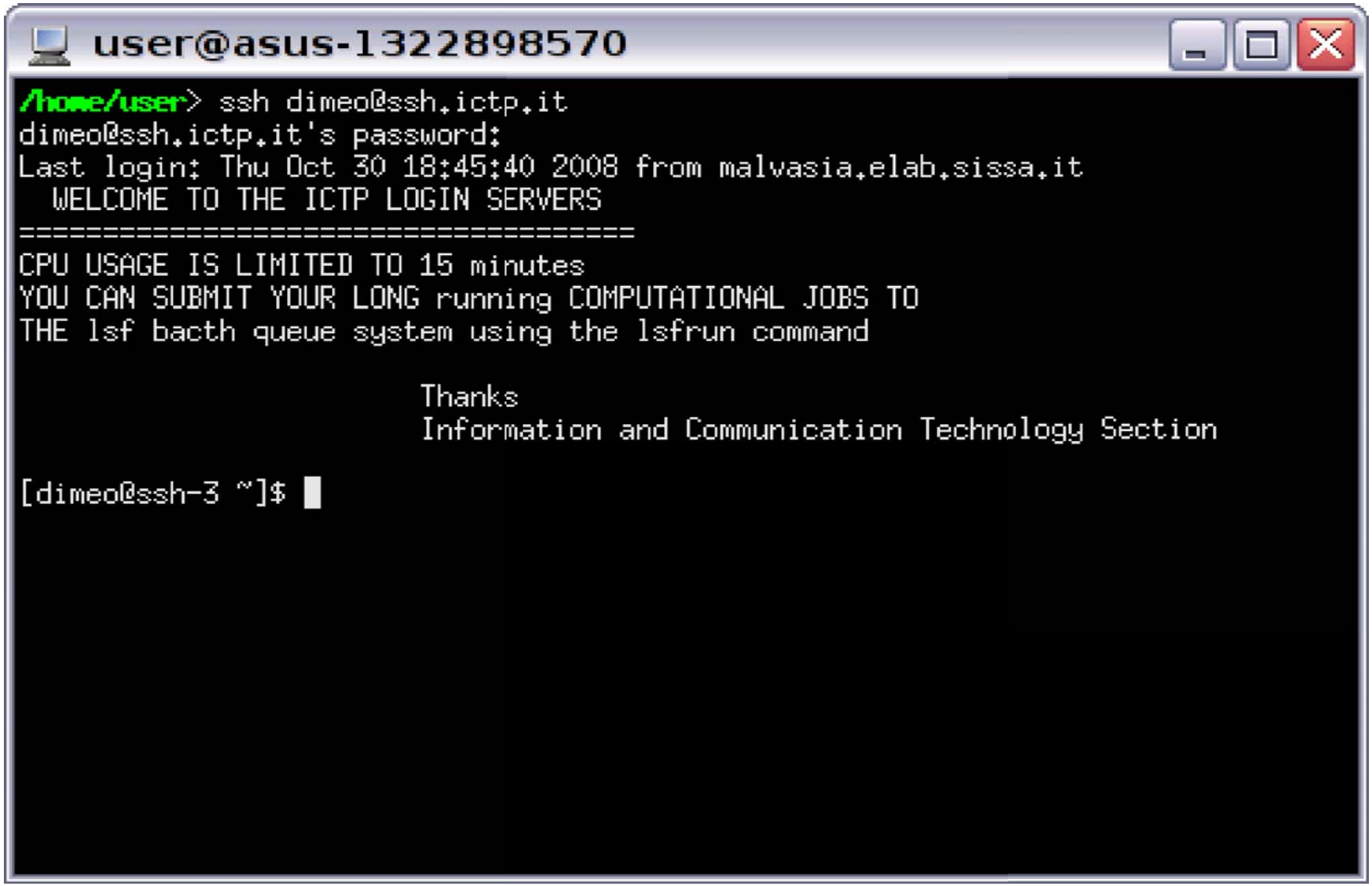
  http://www.democritos.it/hpc-wiki/index.php/Main/ToolsYouShouldBeAwareOf

All commands have electronic manual pages: just type “man” followed by the name of the command in a terminal, to access them

ssh

- Secure Shell: provide a secure way (i.e. an encrypted channel) way to connect on a remote computer
- You need an account on the remote computer
- man ssh for options and other uses
- ssh remoteuser@remote.host.eu
  - log into the computer remote.host.eu where you have an account as remoteuser
- ssh remote.host.eu
  - as before but it assumes that username is the same on local and remote computer
- ssh allows passwordless login: to be discussed in day 4

ssh session


user@asus-1322898570
/home/user> ssh dimeo@ssh.ictp.it
dimeo@ssh.ictp.it's password:
Last login: Thu Oct 30 18:45:40 2008 from malvasia.elab.sissa.it
WELCOME TO THE ICTP LOGIN SERVERS
CPU USAGE IS LIMITED TO 15 minutes
YOU CAN SUBMIT YOUR LONG running COMPUTATIONAL JOBS TO
THE lsf bacth queue system using the lsfrun command
Thanks
Information and Communication Technology Section
[dimeo@ssh-3 ~]$

scp

- Secure CoPy: secure copy files or directories from one host to another
- As for ssh, you need an account on the remote computer
- man scp for options
- The form of the command is:
  - scp -r <source> <destination>
  - One of the operands must be a local file or directory
  - The -r flag is required only when the recursive copy of a directory is required (otherwise it can be omitted)

scp examples

- scp localfile ruser@remotehost.it/tmp
  - Copy the file localfile to the host remotehost.it, logging in as ruser
  - The destination directory will be /tmp
- scp -r localdir ruser@rhost:
  - Recursively copy a directory into the home directory of ruser at the computer rhost
  - : is a shorthand for the remote $HOME of the user
- scp ruser@rhost:work/somefile .
  - Copy the file somefile in the $HOME/work directory of ruser in the rhost machine to the local directory

gnuplot

- Standard plotting package
  - Offers 2D and 3D plotting with a wide variety of options
- It has a pretty good online “help” feature: RTFM!
- Other sources of information are:
  - The gnuplot homepage: http://www.gnuplot.info/
  - The demo gallery: http://gnuplot.sourceforge.net/demo/
- Available almost on all Linux boxes

my first plot

Script:

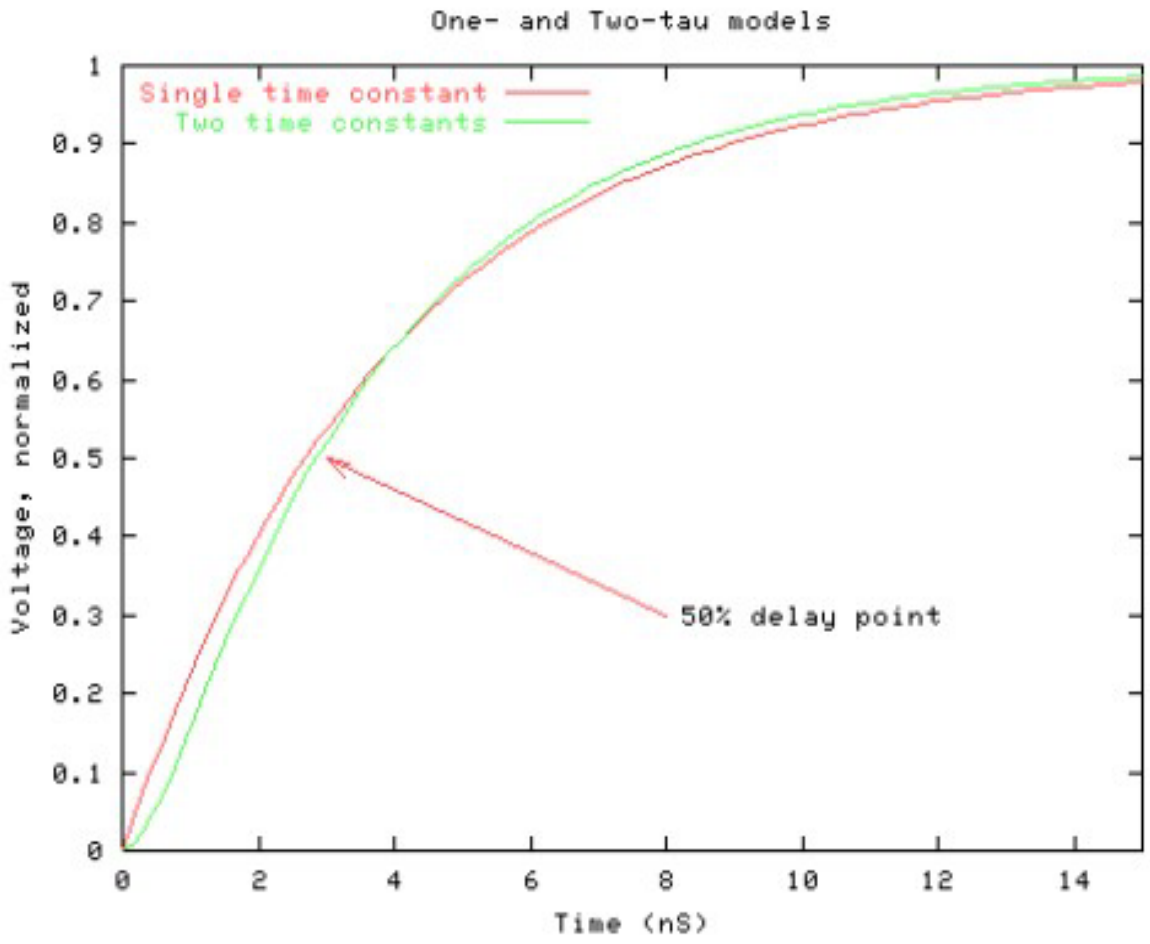
```
➢plot 1-exp(-x/3.8825)
➢pause -1
➢set xrange [0:15]; replot
➢plot 1-exp(-x/3.8825) title "Single
time constant"
➢set xlabel "Time (nS)"; replot
➢set ylabel "Voltage, normalized"
➢set key top left
➢replot 1-(3.44*exp(-x/3.44)-0.44*exp(-
x/0.44))/3.0 title "Two time constants"
➢set title "One- and Two-tau models"
➢set arrow 1 from 8,0.3 to 3.0,0.5 head
➢set label 1 "50% delay point" at
8.2,0.3 left
```

Each step is followed by a "replot"

Related commands:

```
➢set key x,y
➢set [no]log (x|y)
➢set autoscale (x|y)
```

➢ Note: Screen shots are low-quality to keep the file size down. High-quality .eps plots discussed later.



slides taken from: http://mos.stanford.edu/papers/Plotting.pdf

plotting from data files

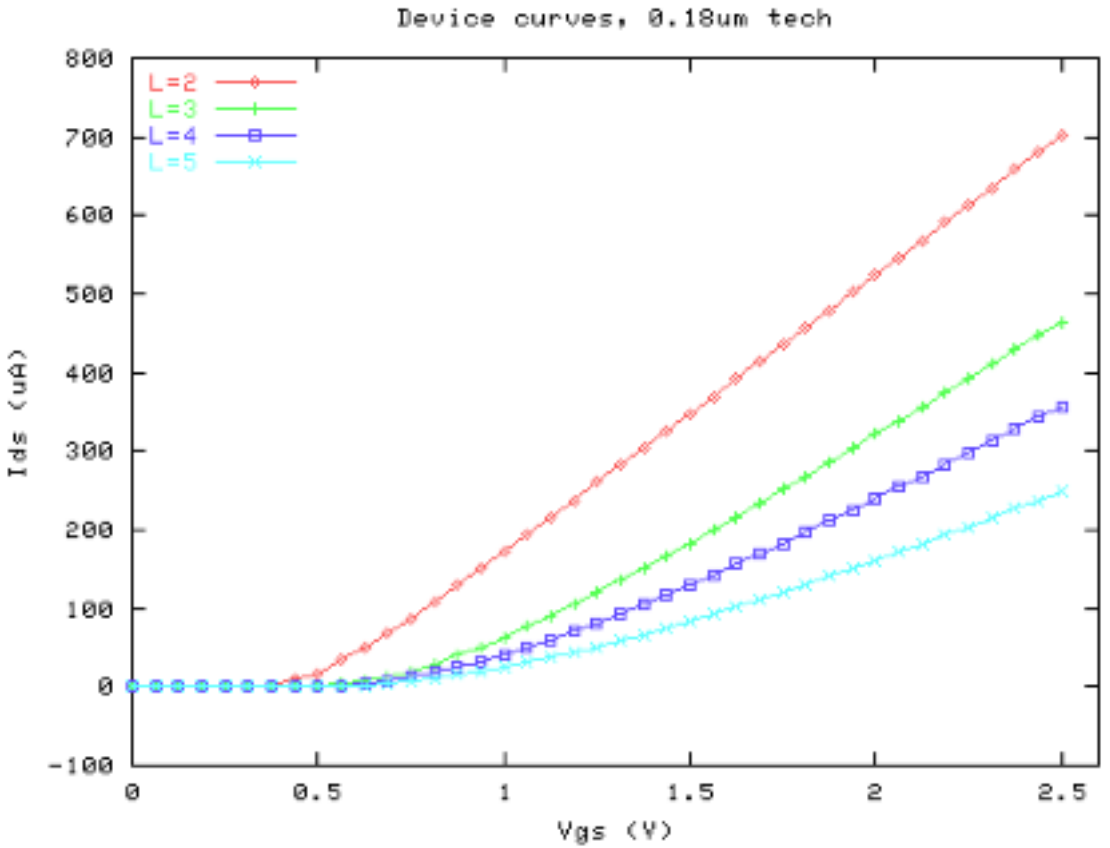
Script:

```
➢set xlabel; set ylabel; set title
➢set key top left
➢plot "plot5.dat" title "IV curves"
➢plot "plot5.dat" using ($1*2.5/2e-
9):($2*-1e6) title "IV curves"
➢set xlabel "Vgs (V)"; set ylabel "…"
➢set xrange [0:2.6]
➢plot "plot5.dat" index 2 using
($1*2.5/2e-9):($2*-1e6) title "L=4"
➢replot "plot5.dat" index 3 using
($1*2.5/2e-9):($2*-1e6) title "L=5"
with lines
➢set data style linespoints
➢plot "plot5.dat2" u ($1*2.5/2e9):($3*-
1e6) title "L=3"
➢plot "plot5.dat3" u ($1*2.5/2e9):($2*-
1e6) '%lf,%lf,%lf,%lf,%lf' title "L=2"
```

Notes:

```
➢plot <FILE> index n …
```

requires \n\n between datasets



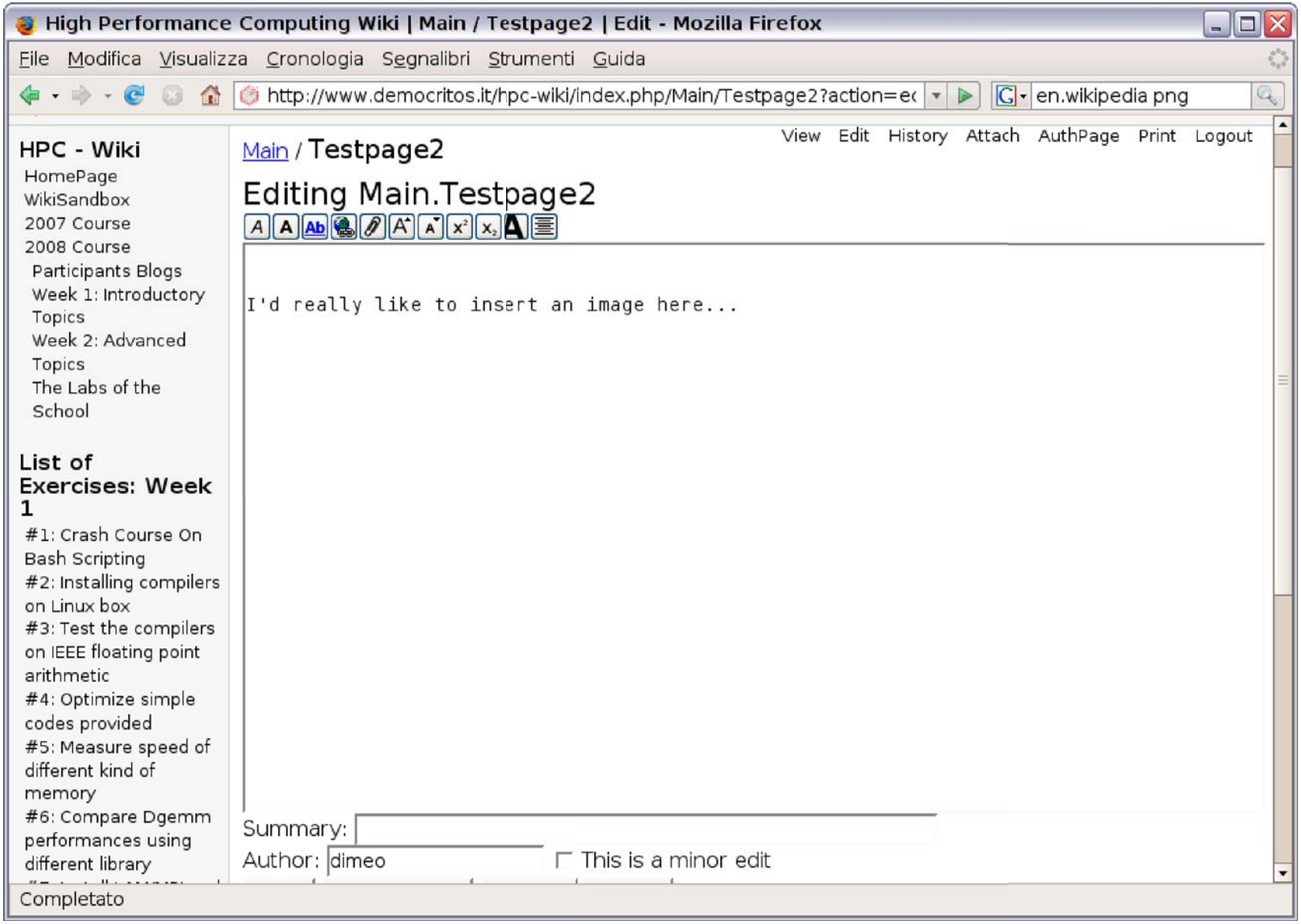
Saving the Output to a file

- Prepare your graph
- set term png small
  - PNG stands for Portable Network Graphis: a graphic file format
- set output “output_file.png”
  - Where output_file.png is the file that will contain your plot
- replot
  - Actually write the data on the file
- set term x11;set out
  - Re-direct the output to the screen again

Uploading a file to the wiki

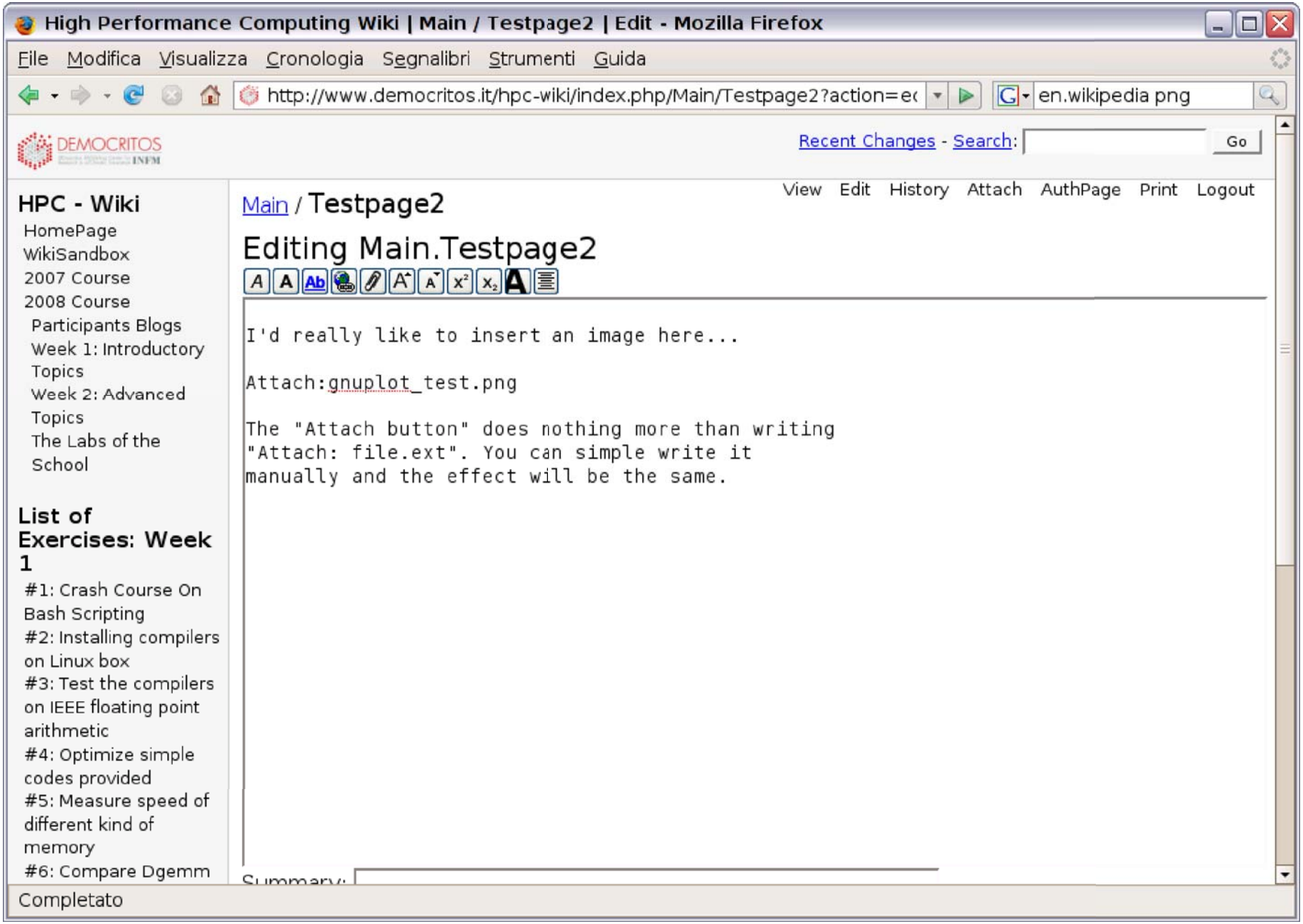
- Occasionally you will be required to create a graph and save it on the wiki
- First, create the image file and keep track where you saved it
- To double-check that the file with your image is what you want, run:
  - display <name of the image file>
  - Press “q” to exit the display program
  - If the graph doesn't appear, and a small window is opened, click on cancel and close “display” with “q”

1 – edit your wiki page



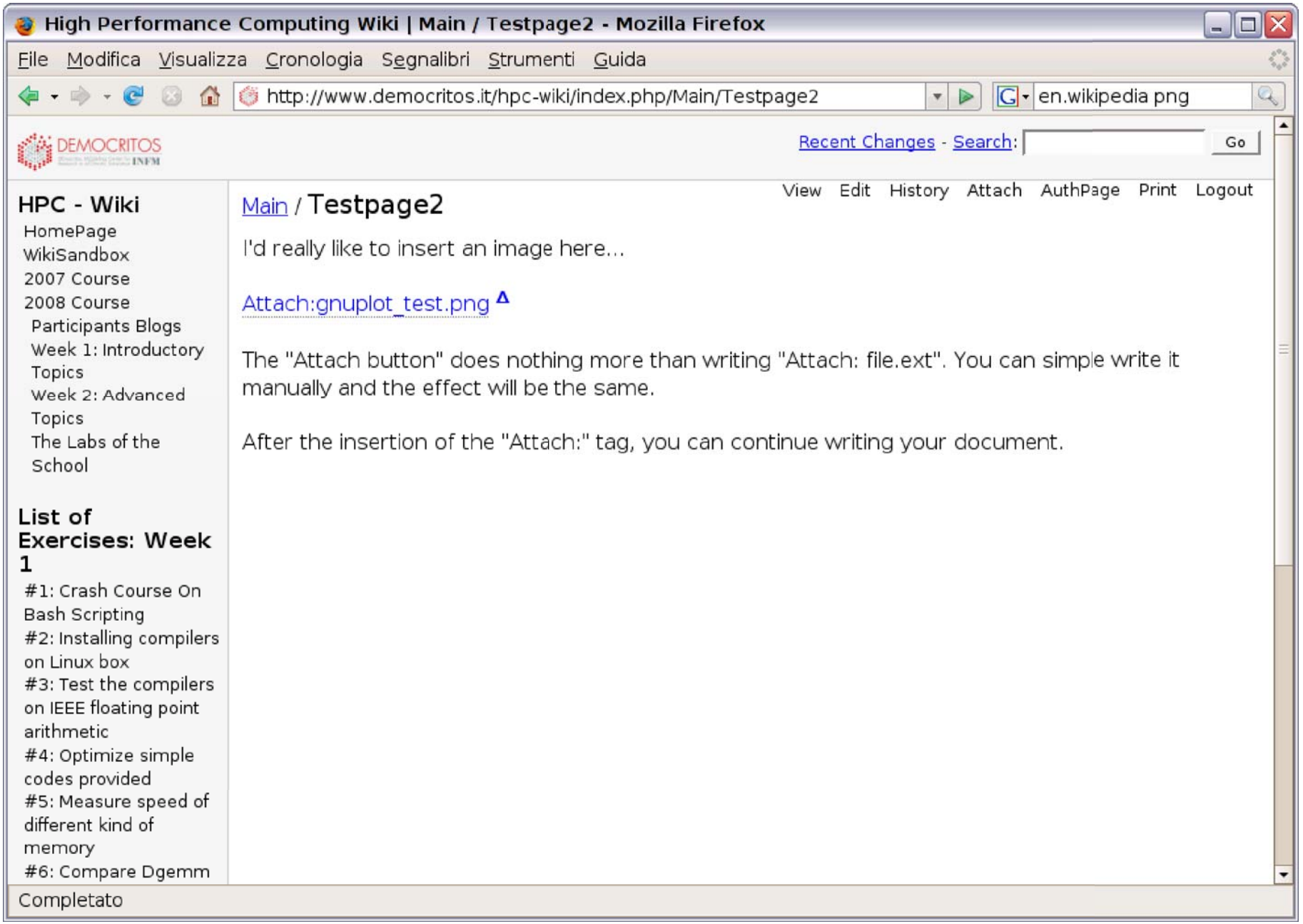
2 – add the link

- Move your prompt to the place where you would like the image
- Click on the paper clip icon on the top of the editing area (5th icon from the left)
  - The text “Attach:file.ext” will appear
- Replace “file.ext” with a more suitable name (e.g. “graph.png”
  - Don't put spaces between the filename and the :
- Continue to edit your page


High Performance Computing Wiki | Main / Testpage2 | Edit - Mozilla Firefox
File Modifica Visualizza Cronologia Segnalibri Strumenti Guida
http://www.democritos.it/hpc-wiki/index.php/Main/Testpage2?action=e
en.wikipedia png
DEMOCRITOS
Recent Changes - Search:
Go
View Edit History Attach AuthPage Print Logout
HPC - Wiki
HomePage
WikiSandbox
2007 Course
2008 Course
Participants Blogs
Week 1: Introductory Topics
Week 2: Advanced Topics
The Labs of the School
List of Exercises: Week 1
#1: Crash Course On Bash Scripting
#2: Installing compilers on Linux box
#3: Test the compilers on IEEE floating point arithmetic
#4: Optimize simple codes provided
#5: Measure speed of different kind of memory
#6: Compare Dgemm
Main / Testpage2
Editing Main.Testpage2
I'd really like to insert an image here...
Attach:gnuplot_test.png
The "Attach button" does nothing more than writing
"Attach: file.ext". You can simple write it
manually and the effect will be the same.
Summary:
Completato

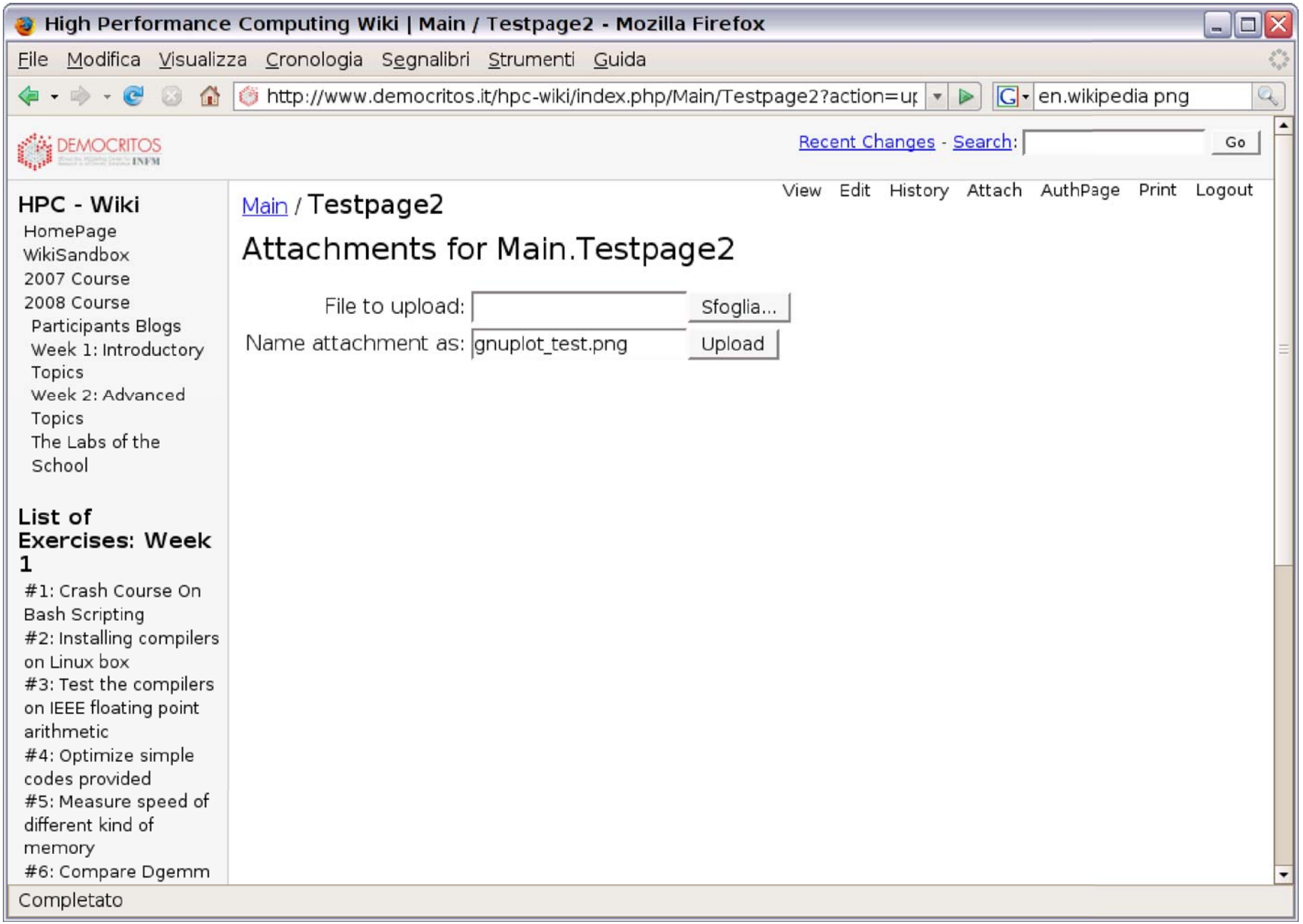
3 – Save the page

- The “Attach:...” line will be highlighted in blue


High Performance Computing Wiki | Main / Testpage2 - Mozilla Firefox
File Modifica Visualizza Cronologia Segnalibri Strumenti Guida
http://www.democritos.it/hpc-wiki/index.php/Main/Testpage2
en.wikipedia png
Recent Changes - Search: Go
View Edit History Attach AuthPage Print Logout
HPC - Wiki
HomePage
WikiSandbox
2007 Course
2008 Course
Participants Blogs
Week 1: Introductory Topics
Week 2: Advanced Topics
The Labs of the School
List of Exercises: Week 1
#1: Crash Course On Bash Scripting
#2: Installing compilers on Linux box
#3: Test the compilers on IEEE floating point arithmetic
#4: Optimize simple codes provided
#5: Measure speed of different kind of memory
#6: Compare Dgemm
Main / Testpage2
I'd really like to insert an image here...
Attach:gnuplot_test.png
The "Attach button" does nothing more than writing "Attach: file.ext". You can simple write it manually and the effect will be the same.
After the insertion of the "Attach:" tag, you can continue writing your document.
Completato

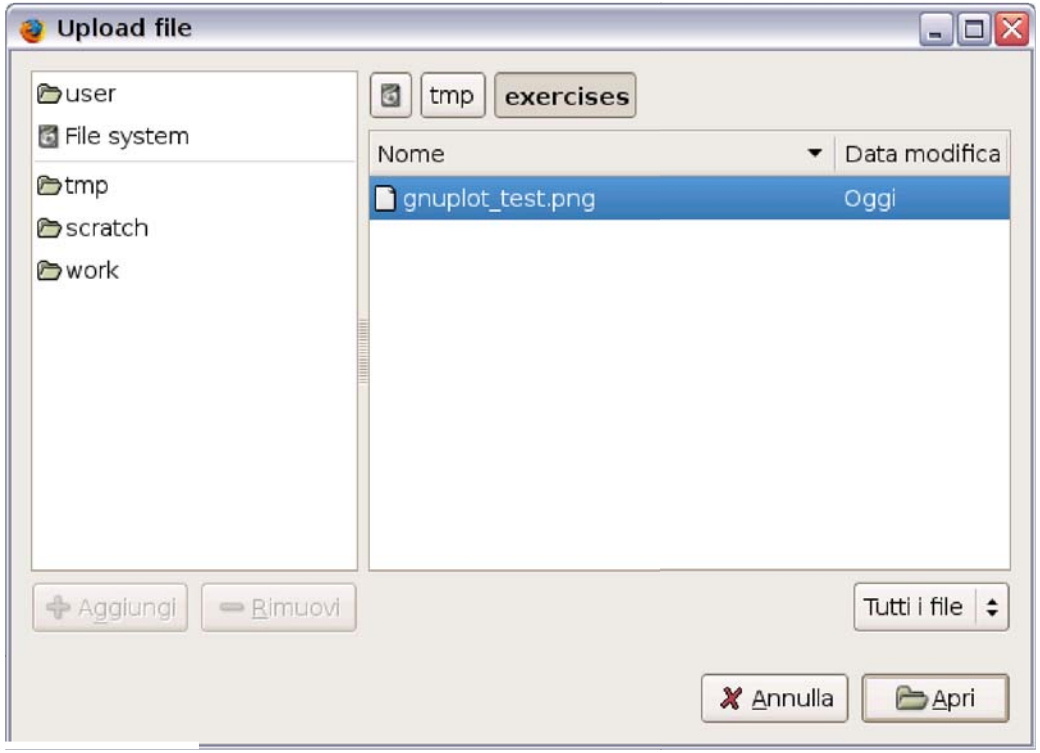
4 – Upload the image on the wiki

- Click on the blue link
- A new page will appear, with two fields, with a button on the right side
  - The 2th field is already filled: leave it as it is
  - The 1th one is empty
- Click on the button to the right of the first field (“Browse” or “Sfoglia”, depending on your browser)


High Performance Computing Wiki | Main / Testpage2 - Mozilla Firefox
File Modifica Visualizza Cronologia Segnalibri Strumenti Guida
http://www.democritos.it/hpc-wiki/index.php/Main/Testpage2?action=up
en.wikipedia png
Recent Changes - Search: Go
View Edit History Attach AuthPage Print Logout
HPC - Wiki
HomePage
WikiSandbox
2007 Course
2008 Course
Participants Blogs
Week 1: Introductory Topics
Week 2: Advanced Topics
The Labs of the School
List of Exercises: Week 1
#1: Crash Course On Bash Scripting
#2: Installing compilers on Linux box
#3: Test the compilers on IEEE floating point arithmetic
#4: Optimize simple codes provided
#5: Measure speed of different kind of memory
#6: Compare Dgemm
Main / Testpage2
Attachments for Main.Testpage2
File to upload: Sfoglia...
Name attachment as: gnuplot_test.png Upload
Completato

4b – Upload the image on the wiki

- A small window will appear which will allow to browse your filesystem
- Search for the image you want to upload, click on it and press the “Open” button (“Apri” in the image)



- The 1th field is now filled with the name of the image file: click on the Upload button to save the file on the wiki
- Click on “View” to enjoy the result

High Performance Computing Wiki | Main / Testpage2 - Mozilla Firefox

File Modifica Visualizza Cronologia Segnalibri Strumenti Guida

http://www.democritos.it/hpc-wiki/index.php/Main/Testpage2

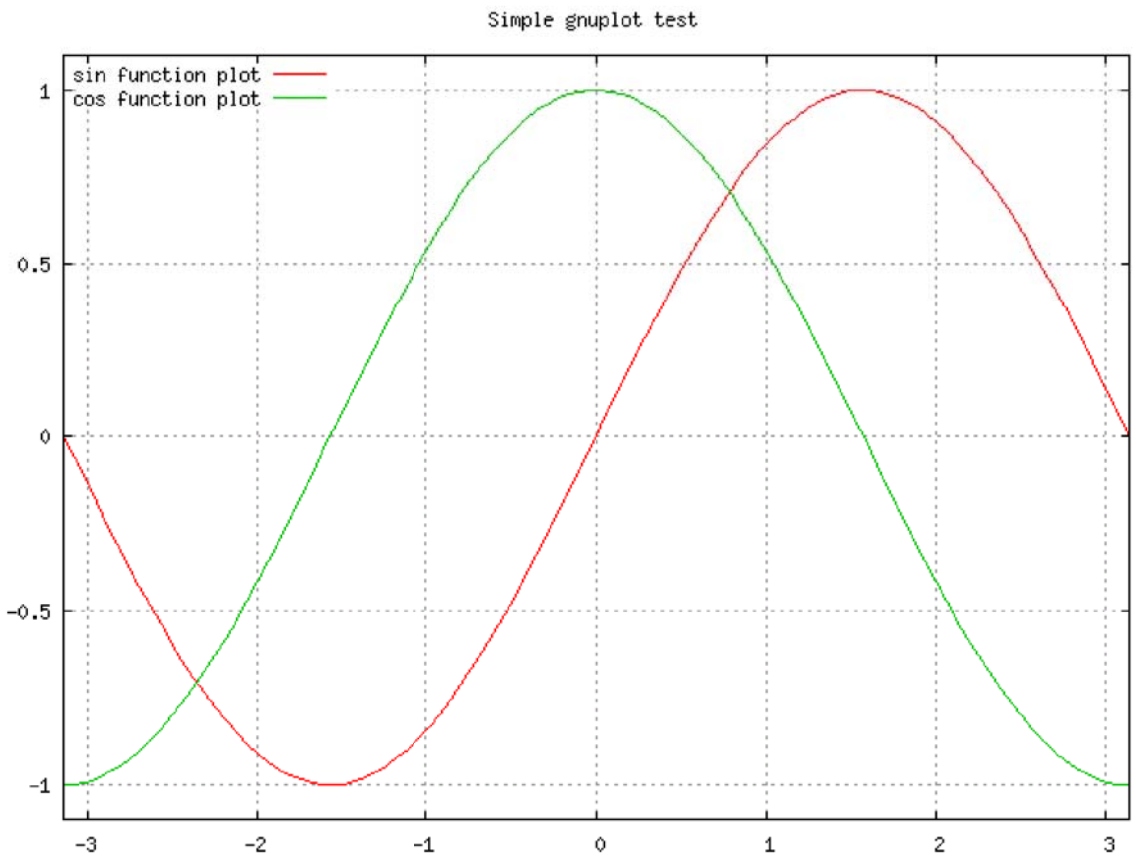
en.wikipedia png

WikiSandbox
2007 Course
2008 Course
Participants Blogs
Week 1: Introductory Topics
Week 2: Advanced Topics
The Labs of the School

List of Exercises: Week 1

#1: Crash Course On Bash Scripting
#2: Installing compilers on Linux box
#3: Test the compilers on IEEE floating point arithmetic
#4: Optimize simple codes provided
#5: Measure speed of different kind of memory
#6: Compare Dgemm performances using different library
#7: Install LAM/MPI and run your first MPI programs

I'd really like to insert an image here...



The "Attach button" does nothing more than writing "Attach: file.ext". You can simple write it manually and the effect will be the same.

Completato

gzip / bzip2

- Utilities to compress and decompress files
- Both commands are invoked in the same way
  - RTFM links: man gzip and man bzip2
- gzip somefile
  - Compress the file somefile, generating a file somefile.gz and then removes the original
- gzip -d somefile.gz
  - Decompress a file compressed with gzip: recreates somefile and removes somefile.gz
- Same recipes for bzip2
  - only difference, the extension added is .bz2

tar

- Utility to create and open archives
- Can produce compressed archives, relying on gzip and bzip2
- tar cvzf myarchive.tar.gz somedir
  - Create a gzip-compressed archive called myarchive.tar.gz with the content of the somedir directory
    - c = create
    - v = verbose (prints the names of the files archived)
    - z = compress with gzip
    - f file_name = save the data on file_name

More on “tar”

- tar xvzf myarchive.tar.gz
  - Decompress the gzip-compressed myarchive.tar.gz in the local directory (restoring the somedir directory and all its content)
    - x = eXtract
    - v = verbose (prints the names of the files extracted)
    - z = use gzip to de-compress
    - f file_name = load the data from file_name
- Replacing the z flag with a j, creates/opens a bzip2 compressed archives
  - Use .tar.bz for the file extension!
- No z or j flags to create/open uncompressed .tar files

wget

- Non interactive network downloader
- Very useful for long downloads on slow connections
  - interrupted downloads can be resumed
  - can be put in background (no need to keep a session open just to keep the download running)
  - sites can be mirrored incrementally
  - can limit the bandwidth consumed
  - works for both http and ftp urls
- RTFM link: man wget

```
wget -t0 http://www.tldp.org/LDP/Bash-Beginners-Guide/Bash-Beginners-Guide.pdf
```

  - download the Bash Guide for Beginners from TLDP

rpm

- rpm: Red Hat Package Manager
  - packaging systems to handle software on linux
- For CentOS and other distros. the software is provided as “rpm packages”
  - the package contains both the software and information about the content
- `rpm -qf /bin/ls`
  - show the source of /bin/ls
- `rpm -ql coreutils`
  - show the content of the installed package coreutils
- Mostly used to install third party software, now.

yum

- Command line package management utility
- Can be used both as user and administrator
  - works on top of rpm
  - uses external repositories to download new software
- yum search string
  - search for a package matching string in the repository
- yum info <package>
  - print information about the package
- WARNING: root privileges required!
- yum install <package>
  - download and install a package

Final remarks

- Read the documentation
  - all commands in this presentation provide functionalities far above the simple use shown here
  - all the info. you need are a couple of keystrokes away from you, man command_name!!!
- Be curious
  - if you see someone using an utility with unfamiliar options or in a strange way, ask or, better, read the documentation
- But never repeat commands you don't understand
  - **read the documentation** first
- Did I mentioned to read the documentation already?