Introduction to UNIX

Where there is a shell, there is a way.

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Outline

Introduction to UNIX
- What is UNIX?
- (Short) history of UNIX

Login to Lisa
- With username and password
- With a key pair

Hands on – Let’s Play!
- Install UNIX tool on your laptop
- Create key pair
- Login to Lisa
- First step on a UNIX, or rather Linux, system
About SURFsara

• SURFsara offers an integrated ICT research infrastructure and provides services in the areas of computing, data storage, visualization, networking, cloud and e-Science.

• In 1971, SARA was founded as an Amsterdam computing center by the two Amsterdam universities (UvA and VU) and the current CWI

• Independent as of 1995

• Founded Vancis in 2008 offering ICT services and ICT products to enterprises, universities, and educational and healthcare institutions

• As from 1 January 2013, SARA – from then on SURFsara – forms part of the SURF Foundation

• First supercomputer in The Netherlands in 1984 (Control Data Cyber 205). Hosting the national supercomputer(s) ever since.
About SURFsara

**Compute and Data are subdivided in six groups:**

- Supercomputing
- Clustercomputing
- Grid computing
- HPC Cloud
- Visualization
- Data services

About 90 people – System Programmers / Consultants (BSc – MSc – PhD)
What is UNIX?

• Operating System
  • Program that controls all other parts of a computer system
  • Allocates computer’s resources and schedules tasks
  • Allows the user to use the facilities provided by the system
  • Essential to all computer systems

• Multi-User, Multi-Tasking
  • Multiple users have multiple tasks running simultaneously

• Designed to be machine independent

• Setup as a software development environment
Developed by AT&T Bell Labs, starting 1969

- Ken Thompson (sitting) and Dennis Ritchie – on a PDP-11

https://www.youtube.com/watch?v=JoVQTPbD6UY
Remote Login (SSH) to SURFsara

Authentication on (some) SURFsara systems

*Lisa & Cartesius*
- username/password
- key pair

*HPC Cloud*
- key pair (only!)

*Grid*
- username/password (local clusters)
- Grid certificate (for other national and international clusters)

NB Grid certificates (X.509) will not be discussed here
Login to Lisa – with username (1)
Login to Lisa – with username (2)
Welcome to Lisa

This is a private computer facility. Access for any reason must be specifically authorized by the owner. Unless you are so authorized, your continued access and any other use may expose you to criminal and/or civil proceedings.

Information: http://www.surfsara.nl/systems/lisa/news

zhengm@lisa.surfsara.nl's password: 🟢
Login to Lisa – with username (4)

Information at: http://www.surfsara.nl/systems/lisa

Ganglia (host/job) monitoring at: http://ganglia.surfsara.nl/

- Please use /scratch as scratch (output) space for jobs
- Processes on the login nodes that consume more than 15 minutes cputime or 1GB resident memory will be automatically killed. Certain system and login programs are excluded from this, such as ssh and scp.

Questions?
* Call or email your advisor, or contact our helpdesk: helpdesk@surfsara.nl.

Due to maintenance the archive filesystems will not be available on November 8th from 9:00 until 14:00.

Filesystem Quota Used Avail Use% Server
/home/zhengm 200.0 GB 3.71 GB 196.29 GB 1% fs12

zhengm@login2:~$
Asymmetric Encryption – key pair (1)
Asymmetric Encryption – key pair (2)
Generate key pair (1)

```bash
[mnt0093:~ zhengm$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/Users/zhengm/.ssh/id_rsa): 
```
Generate key pair (2)

```bash
[mlt0093:~ zhengm]$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/Users/zhengm/.ssh/id_rsa):
Created directory '/Users/zhengm/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /Users/zhengm/.ssh/id_rsa.
Your public key has been saved in /Users/zhengm/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:QfqGqIExsSSCGSzBLfJGcpfJ2TCmCcTMnst5E0hN8 zhengmlt0093.wp.surfsara.nl
The key's randomart image is:

```
+---[RSA 2048]-----+
| ^&%6oo  
| @Ao%. o   
| !oX *....  
| o.B.E o.  
| ..+ . S   
| ...       

+---[SHA256]-----+
```
```
View public key

[Image of a Terminal window displaying the process of viewing a public key]

Introduction to UNIX
Install UNIX tool on your laptop

**Windows**
- MobaXterm ([http://mobaxterm.mobatek.net](http://mobaxterm.mobatek.net))

**Mac OSX**
- Terminal (pre-installed in /Applications/Utilities)
- XQuartz ([http://www.xquartz.org](http://www.xquartz.org))

**Linux**
- You are already well equipped!
Go to the following page:
https://github.com/sara-nl/clustercomputing/blob/master/unixcommands.md

Hands-on: Introduction to UNIX

Login to LISA with your sdemo account and password

```
ssh sdemoXXX@lisa.surfsara.nl
```

Replace `XXX` with your sdemo account number. You should be able to login to LISA without being asked for a password, because you've already uploaded your public key onto the SURFsara Portal. Type `logout` or `Ctrl+d` to logout from LISA.

Generate SSH key on your laptop and upload the public key to portal.surfsara.nl

```
$ cd
$ ssh-keygen
$ cat .ssh/id_rsa.pub
```

# change directory to home directory
# generate SSH key pair
# view contents of public key

Login to LISA with your sdemo account and your key pair. You don't need to type in the password now if you didn't use a password to generate your key pair.

```
ssh sdemoXXX@lisa.surfsara.nl
```
Hands on – Upload public key (1)

- Go to portal.surfsara.nl
- Login with your sdemo account and password

Manage your SSH keys

Here you can manage your public ssh keys. Please note that these keys are not used by the git server.

<table>
<thead>
<tr>
<th>Title</th>
<th>Fingerprint</th>
</tr>
</thead>
</table>

Add key
Hands on – Upload public key (2)

Manage your SSH keys

SSH key

ssh-rsa
AAAAB3NzaC1yc2EAAAADAQABAAABgQDcp5S+6qCgK0I4G+jJa36Sxm4HA40rUjv929pTvSszULaLi69ZeSc0flqg+407ZQ9ovdXvGlq0IXVv+3DKH9ULTnaMKJk2woah8M1aWkux+yGF0goYWMVFRsri94KXrmmB7C37um4cEj6UPJ6gsbywc7xuhFVzvlyvik9EShj4+WquHcT09L5v866NbVnnVwHSjw4NkqH1dSUBGx05QUckZzkMsIFgXSHgSO/QPSyiD937hTwT3rcCgkomDzJ03rohxTNruOGTSwx5s+Zc/hmgdBGOU8cjBnh5i5e2d9yWYTJG3NjlvzhxHOxPUIKJFYBQgEjIXQ0h0EBEnJZzhengm@mtt0053.wp.surf.sara.nl

CUA password

.............

Add sshkey

Introduction to UNIX
Hands on – Upload public key (3)

Welcome, you are currently logged in as Zheng Meyer-Zhao (uid: zhengm)

Manage your SSH keys

Here you can manage your public ssh keys. Please note that these keys are not used by the git server.

Key has been stored successfully

<table>
<thead>
<tr>
<th>Title</th>
<th>Fingerprint</th>
</tr>
</thead>
</table>

Add key

Delete key
Hands on – My first commands

My first commands

$ date # print or set system date and time
$ w # who logged in
$ whoami # who am I?
$ abc # an unknown command
$ uname # name of the system
$ man bc # manual of command ‘bc’
$ bc # calculator, type ‘quit’ to quit ‘bc’
$ logout # logout of the system

Login to LISA and download the examples we prepared for you and we will look at some more commands

$ svn export https://subtrac.surfsara.nl/userdoc/examples/lisatutorial
$ ls # list contents of directory
$ ls -l # what is the difference?
Hands on – Permission bits explained

```
drwxrwxrwx
```

- **Type**
- **User**
- **Group**
- **Other**
Hands on – Permission bits

Permission bits

```sh
$ ls -l
# notice the permission bits
# drwx------
# ‘d’ directory = folder
# ‘r’ read, ‘w’ write, ‘x’ execute

$ cd lisatutorial
# notice the change in prompt
# ~ home directory
# / separates directory names

$ ls -l
$ chmod -x jobs
# remove x-bit from jobs
$ ls -ld jobs
# -d flag shows properties of directory, not contents
$ cd jobs
# will fail
$ chmod 700 jobs
# same as chmod +x jobs
# ‘r’ read = 4
# ‘w’ write = 2
# ‘x’ execute = 1
# ‘rw’ 4+2 = 6
# ‘rwx’ 4+2+1 = 7

$ cd jobs
# now you can access jobs
```
Hands on – Standard input, output & error

**Standard input, output, and error**

Every program has three predefined input/output files associated:

- Standard input (stdin): normally your keyboard
- Standard output (stdout): normally your screen
- Standard error (stderr): normally your screen
- stderr is for error messages (in general)

```
$ cd
$ cd lisatutorial/simple
$ cat bcin # show contents of file ‘bcin’
$ bc < bcin # ‘bc’ takes stdin from file ‘bcin’
$ bc < bcin > bcout # write output to ‘bcout’
$ cat bcout
$ cat bcin | bc # | ‘pipe’: output of ‘cat’ goes to # input of ‘bc’
```
Hands on – More commands

Create simple text files

$ nano # text editor, use ^X (Ctrl + X) to quit

Environment variables

$ echo $HOME # home directory
$ echo $PATH # directories in which shell will search for programs
$ export PATH=$HOME/bin:$PATH # extend the PATH variable to search
# also for programs in $HOME/bin

Some more commands

$ touch one # create an empty file
$ cp one two # copy
$ less bcou # view file
$ mv two three # rename file
$ pwd # where am I
$ mkdir mydir # create directory
$ rmdir mydir # delete directory
$ rm three # delete file
Hands on – My first script

My first script

Type in `nano` the following and save the script as `myscript`

```bash
#!/bin/bash
echo "Hello World!"
echo "$1 + $2 is "
echo "$1 + $2" | bc
$ chmod +x myscript      # make the script executable
$ ./myscript 3 4         # run the script
```

$1 and $2 are the command line arguments given to the program.
Hands on – Exercises

• More exercises are available on the hands-on page
• If you have any questions, please contact us at helpdesk@surfsara.nl
• Solutions to the exercises can be found at the bottom of the hands-on page

THANK YOU