

# Introduction.

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October 13, 2017

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# Module Structure

- Module consists of lectures, seminars and homeworks (5 ECTS credits  $\sim$  150 hours per semester).
- Web page

<https://edux.fit.cvut.cz/courses/BI-PS1/en/start>

- Seminars
  - Discussion about described examples.
  - Solving task.
- Classification
  - Tests.
  - Graded assessment.
- You can subscribe auxiliary e-learning module BI-ULI (Introduction to Linux, 2 credits). Send email to department of study.

# Local UNIX System

- Not visible from the Internet (private IP address).
- CPU architecture is Intel.
- Operating system is GNU Linux.
- Home directories `/home/classroom/USER` are shared among local lab computers.
- How to login to this system?
  - Use the CTU password.
- How to change CTU password?
  - Go to the page <https://usermap.cvut.cz>.
- How to run applications?
  - From GUI.
  - From CLI (Terminal).
- Try to run the application Firefox from GUI.
- Try to run the application Firefox from CLI.

```
firefox &
```

# Remote UNIX Servers fray1 and fray3

- Visible from the Internet (public IP address).
- Fully qualified domain names are `fray1.fit.cvut.cz` and `fray3.fit.cvut.cz`.
- CPU architecture is Sparc.
- Operating system is Solaris.
- Home directories `/home/stud/USER` are shared between `fray1` and `fray3`.
- How to login to these systems?
  - Use the initial system password.
- What is your initial system password?
  - Go to the page <https://profile.fit.cvut.cz/en>.
- How to change this password only on these servers?
  - Use command `passwd`.
- You can connect to these servers by Secure Shell Protocol (SSH).
  - Use command `ssh` for remote connection.
  - Use command `scp` for data transfer.

- SHELL = command line interpreter.
- There are different shells (programs):
  - Bourne Shell – sh,
  - Korn Shell – ksh,
  - C Shell – csh,
  - Bourne Again Shell – bash.
- What shell is running in the terminal?

```
ps
```

```
echo $0
```

- Parts of command are separated by one or more spaces/TABs.

```
ls -la /usr
```

- Commands can be separated by semicolon, ampersand, pipe, or by new line.

```
date -u ; who am i
```

- UNIX is case sensitive!!!

# Shell syntax

- *Command name* defines which command will be executed (what).
- *Options* modify behaviour of command (how).
- *Arguments* specify data (with).
- Example

```
ls -l -R /usr/bin /tmp
```

- list (*ls*)
  - long (*-l*) and recursively (*-R*)
  - directories */usr/bin* and */tmp*
- Some (typically GNU) commands allow you to mix options and arguments.

```
ls /usr/bin -lR /tmp
```

- The word *--* means the end of options, then everything else is considered like arguments.

```
ls -- -l # list the file/directory -l
```

# Shell syntax – command name

- The first word in the command line.
  - Without path.

```
date
```

- With the path.

```
/usr/bin/date  
../script.sh  
./program
```

- If the shell can not find the command, shell returns  
Command not found.
- If the user has not permission to run the command, the shell returns  
Permission denied.
- The command type indicates how each name would be interpreted by the shell if used as a command name.

```
type date
```

```
type echo
```



# Shell syntax – options and arguments

- There can be no, one or more options or arguments.

```
ls  
ls -a  
ls -a -l /etc /home /tmp
```

- *Short options*

- They start with character "-" and contain just one character.
- They can be written separately or together

```
ls -a -l /etc  
ls -la /etc
```

- *Long options*

- They start with characters "--" and contain the whole words (or more words).
- They are written separately. The option and its argument can be separated by "=".

```
ls --color=never
```

# Basic commands

- Run the application *Terminal*.
- What information contains the prompt?
- Who is working in the terminal?

```
echo $USER  
whoami
```

- What is the name of the system where the terminal is running?

```
hostname
```

- How to get information about the system?

```
uname -a  
cat /etc/*release*      # in Solaris and Linux
```

- How to print string to the standard output?

```
echo "Hello word."  
printf "Hello word."  
printf "%s = %5d\n" "sum" "11"
```

# Basic commands

- Where is my home directory?

```
echo $HOME
```

- What is the current working directory?

```
echo $PWD
```

```
pwd
```

- How to change the current working directory to the directory /etc?

```
cd /etc
```

- How to list the contents of the current working directory?

```
ls
```

- How to list the contents of the directory /usr/bin?

```
ls /usr/bin
```

```
cd /usr/bin
```

```
ls
```

# Key shortcuts in bash

- Key TAB ... command/filename/username/hostname completion.
- Key CTRL v TAB ... insert a tab character.
- Command history ... display the command history list.
- Keys ↑ and ↓ ... enable to go through the command history list.
- Keys CTRL r ... search backward in command history list.
- Keys CTRL c ... stop the last foreground process.
- Keys CTRL d ... EOF (End Of File).
- Keys CTRL a ... move to the start of the current line.
- Keys CTRL e ... move to the end of the current line.
- Keys CTRL l ... clear the screen.
- Keys CTRL d ... delete the character at point.
- Keys CTRL k ... kill the text from point to the end of the line.
- Keys CTRL u ... kill backward from point to the beginning of the line.

# Secure Shell

- Run the application *Terminal*.
- How to connect to the remote server `fray1.fit.cvut.cz` like user with login name `USER`?

```
ssh USER@fray1.fit.cvut.cz
```

- How to execute comand *hostname* on the remote server `fray1.fit.cvut.cz`?

```
ssh USER@fray1.fit.cvut.cz hostname
```

- Which users are working on the server
  - Solution 1

```
ssh USER@fray1.fit.cvut.cz finger
```

- Solution 2

```
ssh USER@fray1.fit.cvut.cz  
finger  
exit
```

- How to copy local file `/etc/group` to home directory on the server `fray1.fit.cvut.cz` like user with login name `USER`?

```
scp /etc/group USER@fray1.fit.cvut.cz:
```

- How to copy local file `/etc/group` to the directory `/tmp` on the server `fray1.fit.cvut.cz`?

```
scp /etc/group USER@fray1.fit.cvut.cz:/tmp
```

- How to copy the directory `/etc` on the server `fray1.fit.cvut.cz` to the local directory `/tmp`?

```
scp -r USER@fray1.fit.cvut.cz:/etc /tmp
```

- It consists of several sections.
- Search by keyword.
- Uniform manual page structure.
- Web documentation (system dependent)!
- Access to UNIX manual by command `man`.

```
man man
man ls                # press key H to get help
man printf
man -a printf
man -k printf
man 3 printf          # in Linux
man -s 3 intro        # in Solaris
man -s 3c printf      # in Solaris
```

- What pager (program) is used to display manual pages?

```
echo $PAGER
```

- How to change the pager temporarily?

```
export PAGER=less
```

- How to change the pager permanently?

```
# in Linux
echo "export PAGER=less" >> $HOME/.bash_profile

# in Solaris
echo "export PAGER=less" >> $HOME/.profile
```



# Information about builtin commands

- Builtin commands are implemented inside the shell.
- They are interpreted directly by the shell (no binary file/script is executed).
- How to get information about builtin commands?
  - See section "SHELL BUILTIN COMMANDS" in manual page of shell.

```
man bash      # and search for pattern "^SHELL B"
```

- Use command help.

```
help help
```

- What options can be used with the builtin command echo?

```
help echo
```

```
man bash      # and search for pattern "^ *echo"
```

# Setting the locale

- Keyboard layout and its switching.
- The locale define langue, date formats, alphabetic idiosyncrasies, and other locale-specific standards (see `locale(1)` and `locale(5)`).
- What is the current locale?

```
locale
```

- What locales are available in the system?

```
locale -a
```

- How to change the current locale?

```
export LANG=C  
export LC_ALL=C
```

# Homework

- Read info about [Secure Shell \(ssh\)](#) and [Public-key cryptography](#)
- Set SSH login without password

- 1 Create private and public keys.

```
ssh-keygen
```

- 2 Copy the public key to remote-host under user with the login name USER.

```
ssh-copy-id -i ~/.ssh/id_rsa.pub USER@fray1.fit.cvut.cz
```

- 3 Verify the login to remote-host without entering the password.

```
ssh USER@fray1.fit.cvut.cz
```

- Will the following command work now? Why yes or no?

```
ssh USER@fray3.fit.cvut.cz
```

- Connect to the server `fray1.fit.cvut.cz` and study structure of manual pages of the following commands
  - `man(1)`
  - `date(1)`
  - `ssh(1)`
- Use only one command `date` to print the current date and the current time on the standard output in the following format

```
Today is Thursday, 05.10.2017 (week 40).  
The time is 14:13:57 [CEST].
```

## Hint

- `man date`
- `export LC_ALL=C`