

# Beyond the Mouse – A Short Course on Programming

## 7. Unix Tools II

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YOU'LL NEVER FIND A  
PROGRAMMING LANGUAGE  
THAT FREES YOU FROM  
THE BURDEN OF  
CLARIFYING  
YOUR IDEAS.



BUT I KNOW  
WHAT I MEAN!

"The Uncomfortable Truths Well",  
<http://xkcd.com/568> (April 13, 2009)

# Today's schedule ...

- 1 Introduction
- 2 Remote access: ssh
- 3 Backup Strategies
- 4 Makefiles
- 5 Version control (with subversion)
- 6 Putting it all together ...

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## Goal for today:

- introduce a couple tools: ssh, rsync, make, svn
- explain how they work by themselves
- show how you can orchestrate them into a decent project management suite

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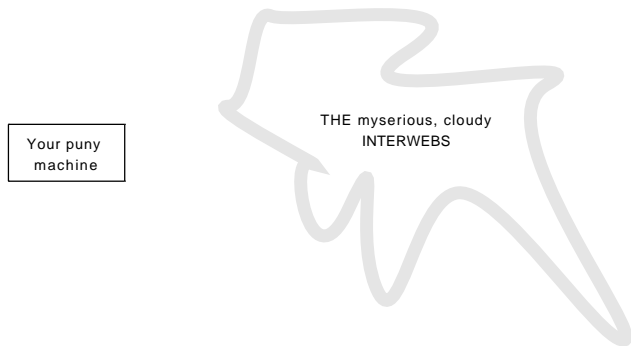
# Remote access: ssh

`ssh` (secure shell): log into and execute commands on remote machine

Your puny  
machine

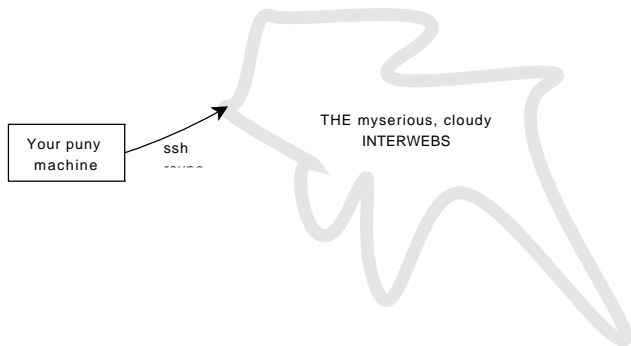
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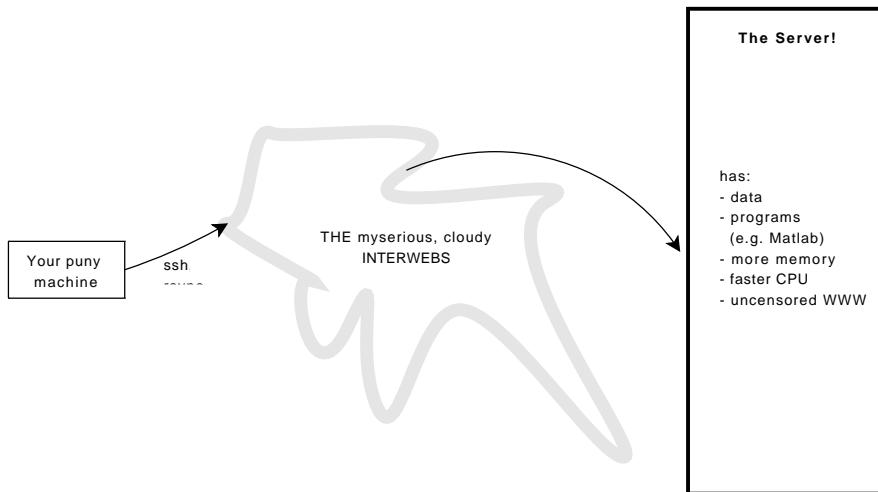
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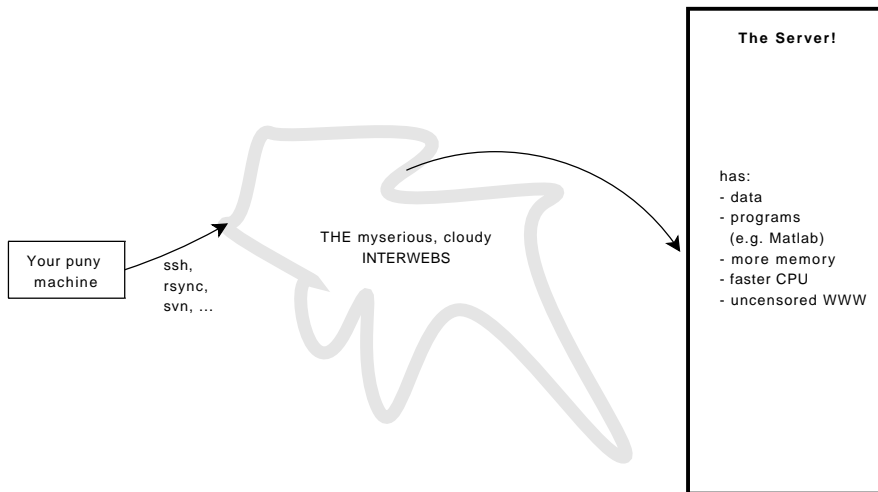
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Command line syntax (see man page!)

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## Example – Logging into GPS webserver

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> ssh -2Y ronni@fairweather.gps.alaska.edu
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Opens a new session on host `fairweather.gps.alaska.edu` for user `ronni` using protocol SSH 2 with trusted X11 forwarding.

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## Why/when would you need that?

- Whenever you don't want to walk to the machine.
- Can't access data locally.
- You are actually, physically, and really on that machine (isn't the Internet great?)
- Many tools (svn, rsync, ...) offer to use ssh tunnels (they do their job after an SSH session has been established).

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# What is a *backup*?

## Backup, backup!

- Creating a copy of something that must never get lost.
- data, results, settings, figures, writing (YOUR THESIS), ...
- ... because hard drives sometimes die, laptops get lost, fires burn down houses, you get the idea.



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## General strategies

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- We'll concentrate on `rsync`
- Whatever method you choose, every now and then make sure the files can indeed be recovered!

# rsync: a fast, versatile, remote (and local) file-copying tool

## Command line syntax (see man page!)

Local: `rsync [OPTION...] SRC... [DEST]`

Access via remote shell:

Pull: `rsync [OPTION...] [USER@]HOST:SRC... [DEST]`

Push: `rsync [OPTION...] SRC... [USER@]HOST:DEST`

Access via rsync daemon:

Pull: `rsync [OPTION...] [USER@]HOST::SRC... [DEST]`

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- If any of the files already exist on the remote system then `rsync` sends only the differences.
- `-avz` transfer in “archive” mode: ensures that symbolic links, permissions, etc. are preserved. Compression is used to reduce the size of data portions.

# rsync: example

```
#!/bin/csh
# takes folder in ~/www that's to be updated on fairweather as
# argument

if ($#argv < 1) then
    echo "Usage: $0 <folder in ~/www>"
    exit
endif

rsync -avz --delete ~/www/$1 ronni@fairweather.gps.alaska.edu:/export/ftpweb/htdocs
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```
#!/bin/csh

#pulling selected data for a project from a server
rsync -avz --include="*/" --include="BEZ*" --include="BZ*" --exclude="*" \
    ronni@fairweather.gps.alaska.edu:/gps/data/NEAsia2.5_timeseries/ ./data
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# make my day!

- `make` is a program that (usually) lives in `/usr/bin`
- determines which parts of a project need to be updated depending on those that changed
- `make` does that according to rules defined in a `Makefile`
- has its roots in the programming world, but can be used for anything (link coffee machine to USB port, write rules, `make coffee`)

## Make Rules

```
target ... : prerequisites ...  
<TAB> command 1  
<TAB> command 2  
...  
<TAB> command N
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- **target:** name of a file to be created or an action to be carried out (e.g. update)
- **prerequisite:** a file/target necessary to create the target, often there are many prerequisites, is optional.
- **command:** action that make carries out. **Tabulator, tab, <TAB>, whatever this one character** MUST be at the beginning of each command line

## Make Example

```
# simple Makefile that shows which files in
# directory tree have changed since they've
# last been displayed
# call: make -f Makefile-delta <rule>

# 1st rule: target 'changes' depends on all the files
# that contain a dot in the current directory
#
# 1. command: display all the prerequisites that changed since
# last display, internal variable $? contains this list,
# display each on separate line using BASH-shell for-loop
# 2. command: touch (i.e. update) empty file 'changes', so that make
# knows about the last time this rule has been carried
# out
# the '@' says that the command should not be echoed in the shell

changes: *.*
    @for i in $?; do echo $$i; done
    @touch changes

# 2nd rule: remove file 'changes', Implicit understanding of this rule:
# Reset everything to the state before make was executed the first time
# no '@' - see the difference
clean:
    rm changes
```

# make my day even better!

## Make can do variables (and a lot more), too:

```
# simple Makefile demonstrating the use of variables
# call: make -f Makefile-vars <rule>

# Defining a variable
FILELIST := $(shell find ./ -type f)

# Accessing a variable ... as a list and then entry by entry
all:
    @echo
    @echo files:
    @echo $(FILELIST)
    @echo
    @echo files:
    @for i in $(FILELIST); do echo $$i; done
```

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# Version control (with subversion)

## What is 'version control'?

“Version control is the art of managing changes to information.”  
(svnbook)

- a fileserver that remembers every change ever written to it.
- traditionally used by programmers: change little bits of code on one day only to undo it the next day.
- well, that's just what we do with papers, theses, ...

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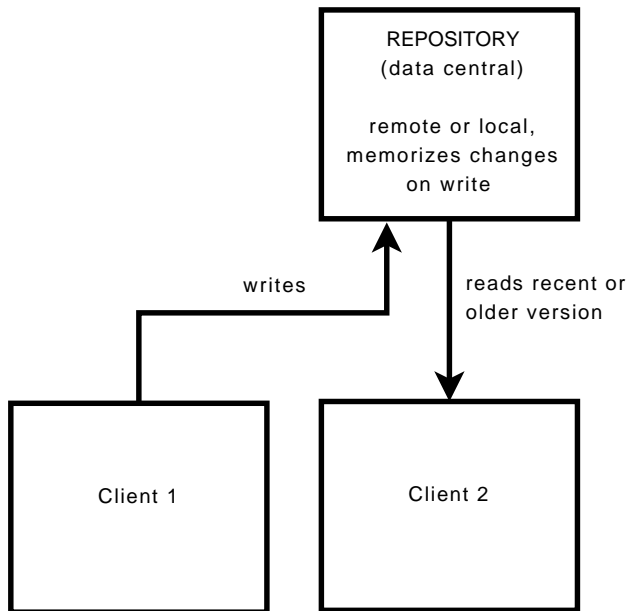
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## What can be under version control?

Depends on tool: CVS – only text files, subversion – text and binary files

# How it works



**\$> svnadmin**

**\$> svn**

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## Putting it all together . . . (assuming we're the only ones working on a project)

- setting up a repository (locally, server, anywhere) (pick the right filesystem!)
- setting up a project, -first commit -commit-update cycle
- create a new project: `new_project.csh <project-name>`
- what is version control, why should we use it? - don't mistake that with backup! (creates additional value: the history, logs, etc, you wanna back up your versioning system from time to time)
- what can be controlled (depends on tool: svn: pretty much everything)
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