COMP30670
Software Engineering (Conversion)

15 - Project & DB
27/03/2017

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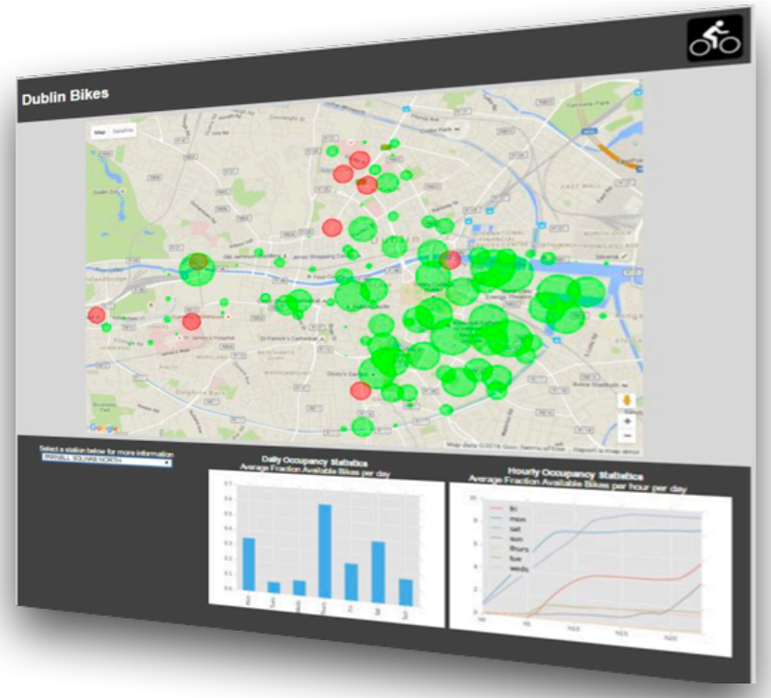
Timetables

Lecture	Monday	11.00	50mins	B003 (CSI)
Lecture	Friday	10.00	50mins	B003 (CSI)
Practical	Monday	13.00	110mins	B003
Practical	Friday	11.00	110mins	B003

Project Overview

Project Overview

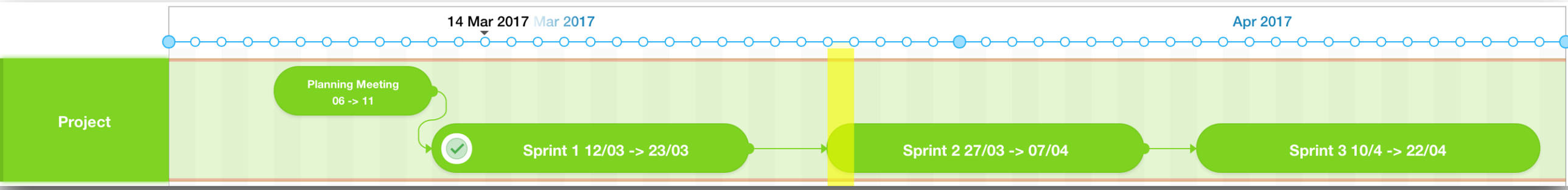
Product Backlog
select station
display weather
heat map of occupancy/ availability
...



scraping from API
setup

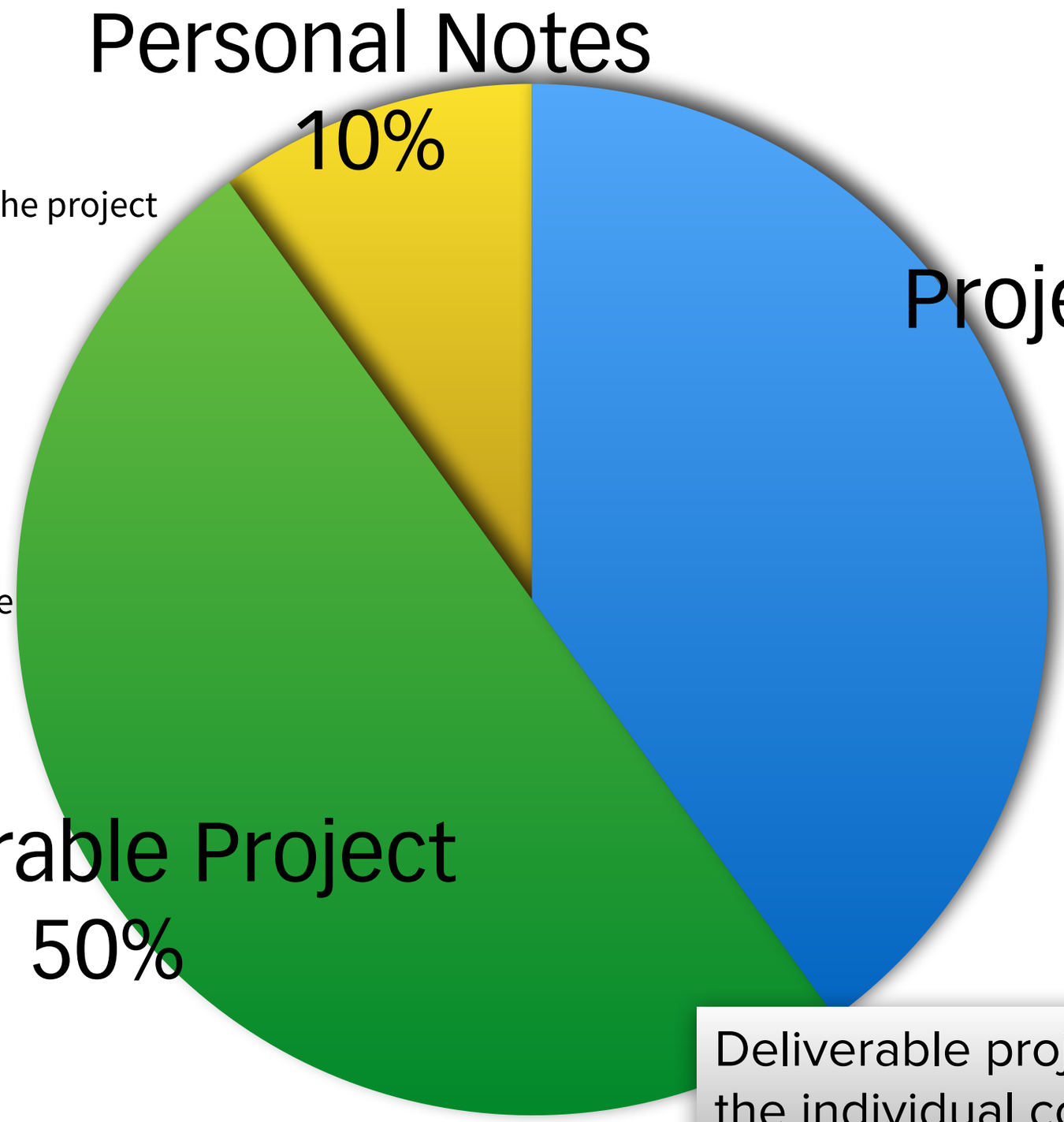
flask
web app
html/js

better analytics
interaction with web app
design...



Group Assessment

Marking



- learning journal
- your own review of the project

- data collection
- data management/storage
- display on map
- occupancy calculation
- weather
- interactivity

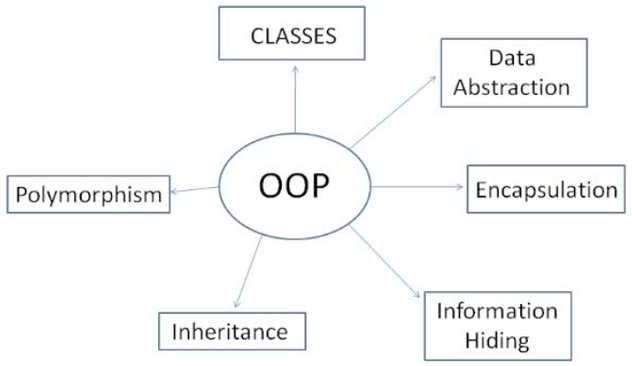
- project management
- meetings
- feature selection/ product backlog
- burndown charts
- managing deliverables

Deliverable project is weighted by the individual contribution

Outline

27 Mar 2017	29	Mon	11:00	50mins	1	24919	LEC
	29	Mon	13:00	110mins	1	24919	PRA
	29	Fri	10:00	50mins	1	24919	LEC
	29	Fri	11:00	110mins	1	24919	PRA
03 Apr 2017	30	Mon	11:00	50mins	1	24919	LEC
	30	Mon	13:00	110mins	1	24919	PRA
	30	Fri	10:00	50mins	1	24919	LEC
	30	Fri	11:00	110mins	1	24919	PRA
10 Apr 2017	31	Mon	11:00	50mins	1	24919	LEC
	31	Mon	13:00	110mins	1	24919	PRA
	31	Fri	10:00	50mins	1	24919	LEC
	31	Fri	11:00	110mins	1	24919	PRA
17 Apr 2017	32	Mon	11:00	50mins	1	24919	LEC
	32	Mon	13:00	110mins	1	24919	PRA
	32	Fri	10:00	50mins	1	24919	LEC
	32	Fri	11:00	110mins	1	24919	PRA
24 Apr 2017	33	Mon	11:00	50mins	1	24919	LEC
	33	Mon	13:00	110mins	1	24919	PRA
	33	Fri	10:00	50mins	1	24919	LEC
	33	Fri	11:00	110mins	1	24919	PRA

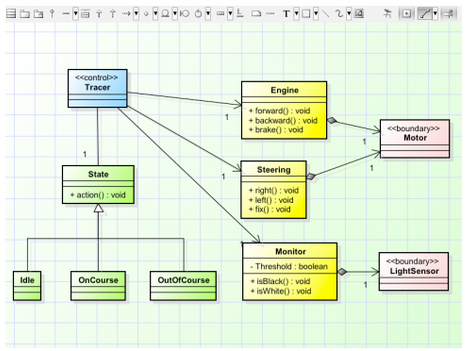
Future Areas to Cover



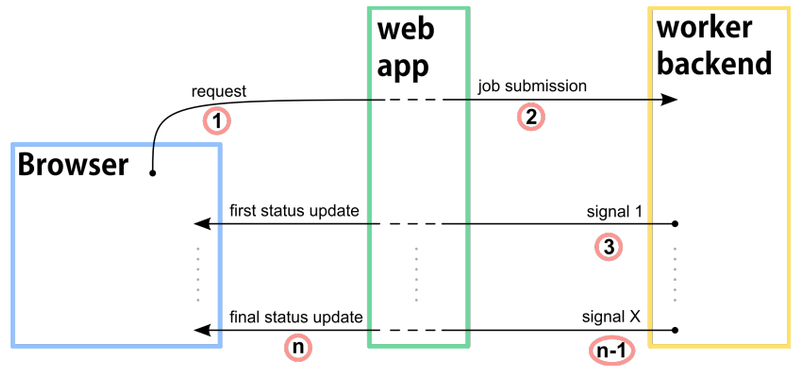
Object Oriented Python

- Software Architecture
- Software Design
- Web Apps/Flask

Databases/Storage



Object Oriented Python



client/server backend

Workflow

Workflow

- There are many possible ways to work with the server
- Here is one possible workflow

- Use your own machine to develop your code
- This includes writing the code and testing
- Push the code to your git repo (github.com)
- SSH to server
- Run a ‘git clone’/‘git pull’ on the server to update the code
- Execute the code on the server

push to the git repo when the code is tested and running

pull the code from the repo to the server

Develop your code locally on your own laptop

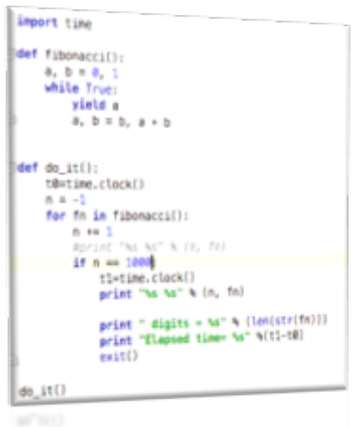
`git push`

git

`git pull`

git

‘ssh’ to the server (perhaps using putty)

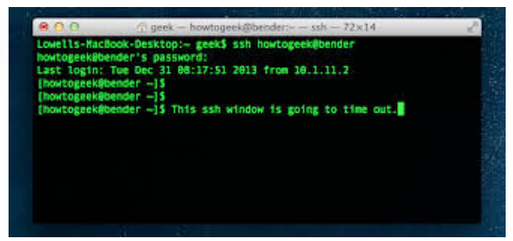


eclipse

python

MySQL

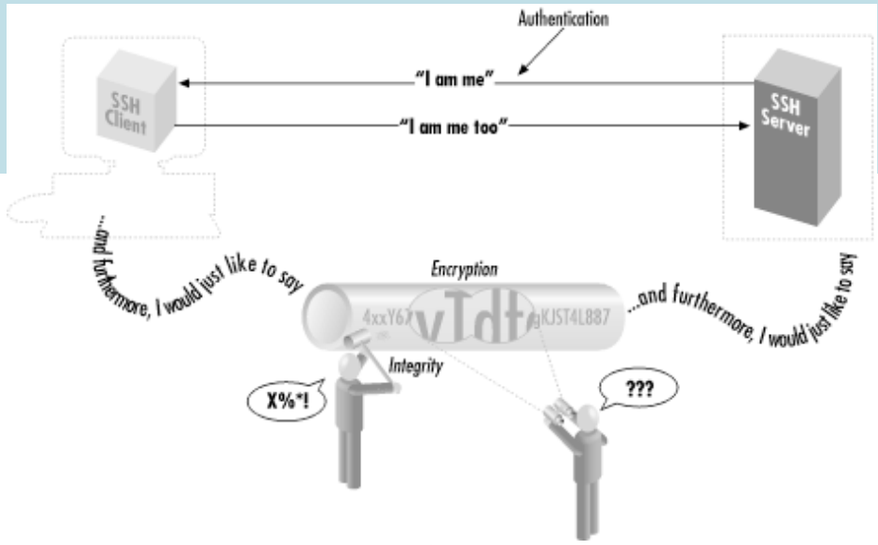
SSH



Amazon EC2

execute the code on the server

Server access

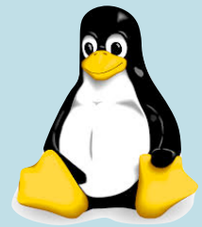


- **SSH**
- ssh is a protocol which specifies how to conduct secure communication over a network
- **Authentication**
  - Reliably determines someone's identity. If you try to log into an account on a remote computer, SSH asks for digital proof of your identity. If you pass the test, you may log in; otherwise SSH rejects the connection.
- **Encryption**
  - Scrambles data so it is unintelligible except to the intended recipients. This protects your data as it passes over the network.
- **Integrity**
- Guarantees the data traveling over the network arrives unaltered. If a third party captures and modifies your data in transit, SSH detects this fact.

SSH terms

Local computer (local host, local machine)	A computer on which you are logged in and, typically, running an SSH client.
Remote computer (remote host, remote machine)	A second computer you contact from your local computer. Typically, the remote computer is running an SSH server and is contacted via an SSH client. As a degenerate case, the local and remote computers can be the same machine.
Local user	A user logged into a local computer.
Remote user	A user logged into a remote computer.
Server	An SSH server program.
Server machine	A computer running an SSH server program. We will sometimes simply write "server" for the server machine when the context makes clear (or irrelevant) the distinction between the running SSH server program and its host machine.
Client	An SSH client program.
Client Machine	A computer running an SSH client. As with the server terminology, we will simply write "client" when the context makes the meaning clear.
~ or $HOME	A user's home directory on a Unix machine, particularly when used in a file path such as ~/filename. Most shells recognize ~ as a user's home directory, with the notable exception of Bourne shell. $HOME is recognized by all shells.

OSX Terminal



- OSX comes with a command line ssh client program
- open /Applications/Terminal.app
- the ssh command takes lots of options, but you will not need most of them- type

```
man ssh
```

for more information

aonghus — less ◂ man ssh — 98×17

NAME

ssh -- OpenSSH SSH client (remote login program)

SYNOPSIS

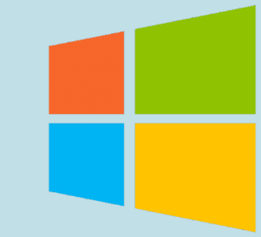
ssh [**-1246AaCfGgKkMNnqsTtVvXxYy**] [**-b** bind_address] [**-c** cipher_spec]
[**-D** [bind_address:]port] [**-E** log_file] [**-e** escape_char] [**-F** configfile]
[**-I** pkcs11] [**-i** identity_file] [**-L** address] [**-l** login_name] [**-m** mac_spec]
[**-O** ctl_cmd] [**-o** option] [**-p** port] [**-Q** query_option] [**-R** address] [**-S** ctl_path]
[**-W** host:port] [**-w** local_tun[:remote_tun]] [user@]hostname [command]

DESCRIPTION

ssh (SSH client) is a program for logging into a remote machine and for executing commands on a remote machine. It is intended to provide secure encrypted communications between two untrusted hosts over an insecure network. X11 connections, arbitrary TCP ports and UNIX-domain sockets can also be forwarded over the secure

:

SSH Windows



- Windows does not come with an ssh client by default

- Putty is a good open source ssh client
- There are many other options too, but putty will do the job

Command line (linux)

- Check out LinuxCommand
- Basic Shell Commands
- Intro to Shell Commands

Navigation

Linux Command	DOS Command	Description
`pwd`	`cd`	“Print Working Directory”. Shows the current location in the directory tree.
`cd`	`cd, chdir`	“Change Directory”. When typed all by itself, it returns you to your home directory.
`cd directory`	`cd directory`	Change into the specified directory name. Example: `cd /tmp`
`cd ~`		“~” is an alias for your home directory. It can be used as a shortcut to your “home”, or other directories relative to your home.
`cd ..`	`cd ..`	Move up one directory. For example, if you are in `/home/vic` and you type “`cd ..`”, you will end up in `/home`.
`cd -`		Return to previous directory. An easy way to get back to your previous location!
`ls`	`dir /w`	List all files in the current directory, in column format.
`ls directory`	`dir directory`	List the files in the specified directory. Example: `ls /var/log`
`ls -l`	`dir`	List files in “long” format, one file per line. This also shows you additional info about the file, such as ownership, permissions, date, and size.
`ls ./data/*.txt`	`dir data/*.txt`	List all files whose names begin with the letter “d” in the `/usr/bin` directory.

Files & Directories

Linux Command	DOS Command	Description
`file`		Find out what kind of file it is. For example, "`file /bin/ls`" tells us that it is a Linux executable file.
`cat`	`type`	Display the contents of a text file on the screen. For example: `cat readme.txt` would display the file.
`head`		Display the first few lines of a text file. Example: `head /etc/services`
`tail`		Display the last few lines of a text file. Example: `tail /etc/services`
`tail -f`		Display the last few lines of a text file, and then output appended data as the file grows (very useful for following log files!). Example: tail -f /var/log/messages
`cp`	`copy`	Copies a file from one location to another. Example: `cp mp3files.txt /tmp` (copies the mp3files.txt file to the /tmp directory)
`mv`	`rename, res, move`	Moves a file to a new location, or renames it. For example: `mv mp3files.txt /tmp` (copy the file to /tmp, and delete it from the original location)
`rm`	`del`	Delete a file. Example: `rm /tmp/mp3files.txt`
`mkdir`	`md`	Make Directory. Example: `mkdir /tmp/myfiles/`
`rmdir`	`rd, rmdir`	Remove Directory. Example: `rmdir /tmp/myfiles/`

Linux Commands

File Commands

ls – directory listing
ls -al – formatted listing with hidden files
cd *dir* - change directory to *dir*
cd – change to home
pwd – show current directory
mkdir *dir* – create a directory *dir*
rm *file* – delete *file*
rm -r *dir* – delete directory *dir*
rm -f *file* – force remove *file*
rm -rf *dir* – force remove directory *dir* *
cp *file1 file2* – copy *file1* to *file2*
cp -r *dir1 dir2* – copy *dir1* to *dir2*; create *dir2* if it doesn't exist
mv *file1 file2* – rename or move *file1* to *file2*
if *file2* is an existing directory, moves *file1* into directory *file2*
ln -s *file link* – create symbolic link *link* to *file*
touch *file* – create or update *file*
cat > *file* – places standard input into *file*
more *file* – output the contents of *file*
head *file* – output the first 10 lines of *file*
tail *file* – output the last 10 lines of *file*
tail -f *file* – output the contents of *file* as it grows, starting with the last 10 lines

Process Management

ps – display your currently active processes
top – display all running processes
kill *pid* – kill process id *pid*
killall *proc* – kill all processes named *proc* *
bg – lists stopped or background jobs; resume a stopped job in the background
fg – brings the most recent job to foreground
fg *n* – brings job *n* to the foreground

System Info

date – show the current date and time
cal – show this month's calendar
uptime – show current uptime
w – display who is online
whoami – who you are logged in as
finger *user* – display information about *user*
uname -a – show kernel information
cat /proc/cpuinfo – cpu information
cat /proc/meminfo – memory information
man *command* – show the manual for *command*
df – show disk usage
du – show directory space usage
free – show memory and swap usage
whereis *app* – show possible locations of *app*
which *app* – show which *app* will be run by default

Searching

grep *pattern files* – search for *pattern* in *files*
grep -r *pattern dir* – search recursively for *pattern* in *dir*
command* | grep *pattern – search for *pattern* in the output of *command*
locate *file* – find all instances of *file*

Compression

tar cf *file.tar files* – create a tar named *file.tar* containing *files*
tar xf *file.tar* – extract the files from *file.tar*
tar czf *file.tar.gz files* – create a tar with Gzip compression
tar xzf *file.tar.gz* – extract a tar using Gzip
tar cjf *file.tar.bz2* – create a tar with Bzip2 compression
tar xjf *file.tar.bz2* – extract a tar using Bzip2
gzip *file* – compresses *file* and renames it to *file.gz*
gzip -d *file.gz* – decompresses *file.gz* back to *file*

INSTALL GIT

GitHub provides desktop clients that include a graphical user interface for the most common repository actions and an automatically updating command line edition of Git for advanced scenarios.

GitHub for Windows
https://windows.github.com

GitHub for Mac
https://mac.github.com

Git distributions for Linux and POSIX systems are available on the official Git SCM web site.

Git for All Platforms
http://git-scm.com

CONFIGURE TOOLING

Configure user information for all local repositories

```
$ git config --global user.name "[name]"
```
Sets the name you want attached to your commit transactions

```
$ git config --global user.email "[email address]"
```
Sets the email you want attached to your commit transactions

```
$ git config --global color.ui auto
```
Enables helpful colorization of command line output

CREATE REPOSITORIES

Start a new repository or obtain one from an existing URL

```
$ git init [project-name]
```
Creates a new local repository with the specified name

```
$ git clone [url]
```
Downloads a project and its entire version history

MAKE CHANGES

Review edits and craft a commit transaction

```
$ git status
```
Lists all new or modified files to be committed

```
$ git diff
```
Shows file differences not yet staged

```
$ git add [file]
```
Snapshots the file in preparation for versioning

```
$ git diff --staged
```
Shows file differences between staging and the last file version

```
$ git reset [file]
```
Unstages the file, but preserve its contents

```
$ git commit -m "[descriptive message]"
```
Records file snapshots permanently in version history

GROUP CHANGES

Name a series of commits and combine completed efforts

```
$ git branch
```
Lists all local branches in the current repository

```
$ git branch [branch-name]
```
Creates a new branch

```
$ git checkout [branch-name]
```
Switches to the specified branch and updates the working directory

```
$ git merge [branch]
```
Combines the specified branch's history into the current branch

```
$ git branch -d [branch-name]
```
Deletes the specified branch

REFACTOR FILENAMES
Relocate and remove versioned files

```
$ git rm [file]
```
Deletes the file from the working directory and stages the deletion

```
$ git rm --cached [file]
```
Removes the file from version control but preserves the file locally

```
$ git mv [file-original] [file-renamed]
```
Changes the file name and prepares it for commit

SUPPRESS TRACKING
Exclude temporary files and paths

```
*.log
build/
temp-*
```
A text file named `.gitignore` suppresses accidental versioning of files and paths matching the specified patterns

```
$ git ls-files --other --ignored --exclude-standard
```
Lists all ignored files in this project

SAVE FRAGMENTS
Shelve and restore incomplete changes

```
$ git stash
```
Temporarily stores all modified tracked files

```
$ git stash pop
```
Restores the most recently stashed files

```
$ git stash list
```
Lists all stashed changesets

```
$ git stash drop
```
Discards the most recently stashed changeset

REVIEW HISTORY
Browse and inspect the evolution of project files

```
$ git log
```
Lists version history for the current branch

```
$ git log --follow [file]
```
Lists version history for a file, including renames

```
$ git diff [first-branch]...[second-branch]
```
Shows content differences between two branches

```
$ git show [commit]
```
Outputs metadata and content changes of the specified commit

REDO COMMITS
Erase mistakes and craft replacement history

```
$ git reset [commit]
```
Undoes all commits after `[commit]`, preserving changes locally

```
$ git reset --hard [commit]
```
Discards all history and changes back to the specified commit

SYNCHRONIZE CHANGES
Register a repository bookmark and exchange version history

```
$ git fetch [bookmark]
```
Downloads all history from the repository bookmark

```
$ git merge [bookmark]/[branch]
```
Combines bookmark's branch into current local branch

```
$ git push [alias] [branch]
```
Uploads all local branch commits to GitHub

```
$ git pull
```
Downloads bookmark history and incorporates changes

Screen

Screen

Sometimes you are connected to your server with SSH and in the middle of some long-running task, and suddenly your connection drops for some reason, and you lose your work. A small utility called *screen* allows you to reattach to a previous session so that you can finish your task. Tutorial here

```
$ screen -S work
```

Creates a new screen session called work. Looks exactly like your existing console.

```
$ screen -ls
```

get a list of open screen sessions

```
alawlor@buzzer$ screen -ls
There is a screen on:
        16015.work      (10/03/16 00:01:38)     (Attached)
1 Socket in /var/run/screen/S-alawlor.
```

```
$ screen -r
```

when you log in the next time, run 'screen -r' to resume the screen session. You should see the console just where you left it

detach a screen session

```
"Ctrl-a" "d"
```

```
alawlor@buzzer$
[detached from 16015.work]
```

re-attach a screen session

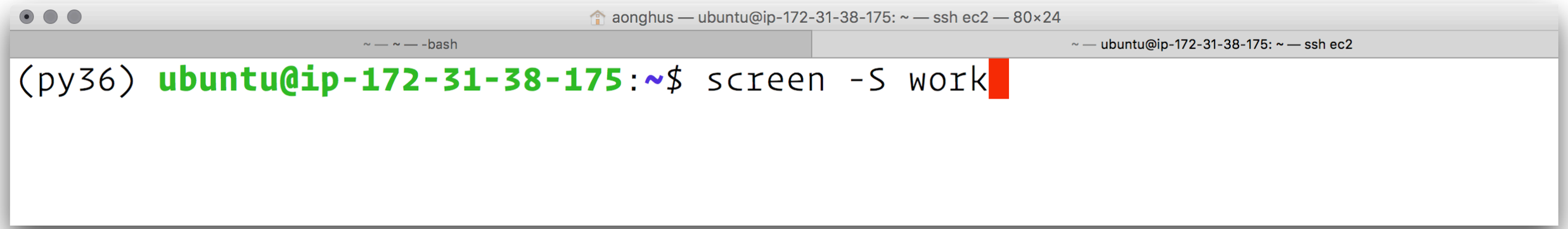
```
$ screen -r 16015.work
```

Using Multiple Screens

When you need more than 1 screen to do your job, is it possible? Yes it is. You can run multiple screen window at the same time. There are 2 (two) ways to do it. First, you can detach the first screen and the run another screen on the real terminal. Second, you do nested screen.

Switching between screens

When you use nested screens, you can switch between screens using command "Ctrl-A" and "n". This will move to the next screen. When you need to go to the previous screen, just press "Ctrl-A" and "p". To create a new screen window, just press "Ctrl-A" and "c".


aonghus — ubuntu@ip-172-31-38-175: ~ — ssh ec2 — 80×24
~ — ~ — -bash
~ — ubuntu@ip-172-31-38-175: ~ — ssh ec2
(py36) ubuntu@ip-172-31-38-175:~$ screen -S work

aonghus — ubuntu@ip-172-31-38-175: ~ — ssh ec2 — 80×24

~ — ~ — -bash | ~ — ubuntu@ip-172-31-38-175: ~ — ssh ec2

```
ubuntu@ip-172-31-38-175:~$ screen -ls
There is a screen on:
        21058.work      (03/25/2017 07:37:01 PM)        (Attached)
1 Socket in /var/run/screen/S-ubuntu.
ubuntu@ip-172-31-38-175:~$
```

aonghus — ubuntu@ip-172-31-38-175: ~ — ssh ec2 — 80×24

~ — ~ — -bash | ~ — ubuntu@ip-172-31-38-175: ~ — ssh ec2

```
(py36) ubuntu@ip-172-31-38-175:~$ screen -S work
[detached from 21058.work]
(py36) ubuntu@ip-172-31-38-175:~$
```

aonghus — ubuntu@ip-172-31-38-175: ~ — ssh ec2 — 80×24

~ — ~ — -bash | ~ — ubuntu@ip-172-31-38-175: ~ — ssh ec2

```
top - 19:38:18 up 62 days,  3:20,  1 user,  load average: 0.02, 0.11, 0.13
Tasks: 125 total,   1 running, 123 sleeping,   1 stopped,   0 zombie
%Cpu(s):  0.0 us,  0.0 sy,  0.0 ni,100.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :  1014452 total,   269616 free,    67312 used,   677524 buff/cache
KiB Swap:        0 total,        0 free,        0 used.   896572 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S %CPU %MEM     TIME+ COMMAND
21077 ubuntu    20   0   40500   3748   3168 R  0.5  0.4   0:00.03 top
    1 root      20   0   37656   4848   3128 S  0.0  0.5   0:19.82 systemd
    2 root      20   0       0      0      0 S  0.0  0.0   0:00.00 kthreadd
    3 root      20   0       0      0      0 S  0.0  0.0   0:02.13 ksoftirqd/0
    5 root       0 -20       0      0      0 S  0.0  0.0   0:00.00 kworker/0:0H
    7 root      20   0       0      0      0 S  0.0  0.0   0:04.23 rcu_sched
    8 root      20   0       0      0      0 S  0.0  0.0   0:00.00 rcu_bh
    9 root      rt   0       0      0      0 S  0.0  0.0   0:00.00 migration/0
   10 root      rt   0       0      0      0 S  0.0  0.0   0:24.73 watchdog/0
   11 root      20   0       0      0      0 S  0.0  0.0   0:00.00 kdevtmpfs
   12 root       0 -20       0      0      0 S  0.0  0.0   0:00.00 netns
   13 root       0 -20       0      0      0 S  0.0  0.0   0:00.00 perf
   14 root      20   0       0      0      0 S  0.0  0.0   0:00.00 xenwatch
   15 root      20   0       0      0      0 S  0.0  0.0   0:00.00 xenbus
   17 root      20   0       0      0      0 S  0.0  0.0   0:01.15 khungtaskd
   18 root       0 -20       0      0      0 S  0.0  0.0   0:00.00 writeback
   19 root      25   5       0      0      0 S  0.0  0.0   0:00.00 ksmd
```

aonghus — ubuntu@ip-172-31-38-175: ~ — ssh ec2 — 80×24

~ — ~ — -bash | ~ — ubuntu@ip-172-31-38-175: ~ — ssh ec2

```
(py36) ubuntu@ip-172-31-38-175:~$ screen -S work
[detached from 21058.work]
(py36) ubuntu@ip-172-31-38-175:~$ screen -ls
There is a screen on:
        21058.work      (03/25/2017 07:37:01 PM)        (Detached)
1 Socket in /var/run/screen/S-ubuntu.
(py36) ubuntu@ip-172-31-38-175:~$ screen -r 21058.work
[detached from 21058.work]
(py36) ubuntu@ip-172-31-38-175:~$ screen -r 21058.work
[detached from 21058.work]
(py36) ubuntu@ip-172-31-38-175:~$
```

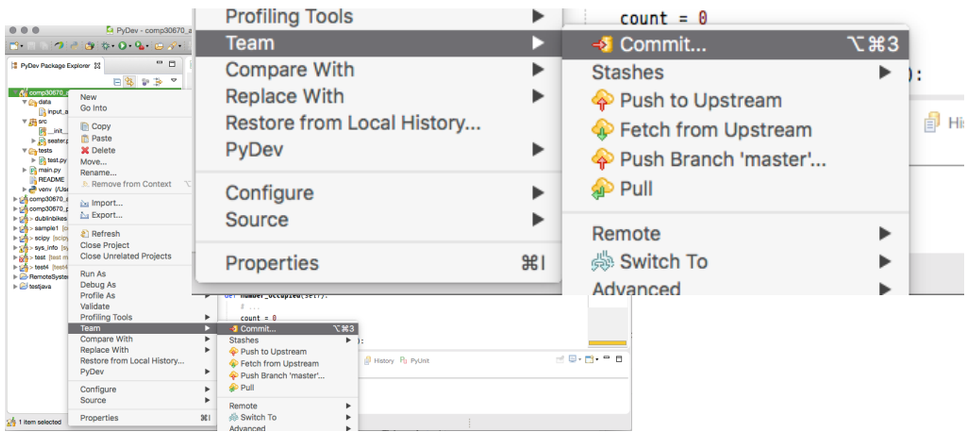
aonghus — ubuntu@ip-172-31-38-175: ~ — ssh ec2 — 80×24

~ — ~ — -bash | ~ — ubuntu@ip-172-31-38-175: ~ — ssh ec2

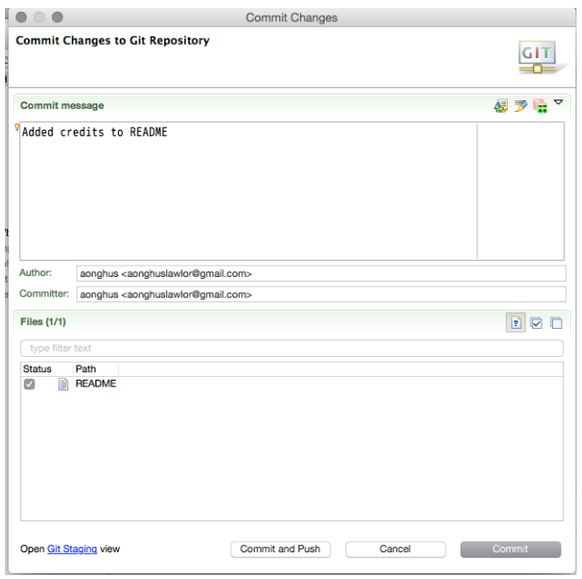
```
top - 19:38:38 up 62 days,  3:20,  1 user,  load average: 0.02, 0.11, 0.12
Tasks: 125 total,   1 running, 123 sleeping,   1 stopped,   0 zombie
%Cpu(s):  0.0 us,  0.0 sy,  0.0 ni,100.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :  1014452 total,   269616 free,    67312 used,   677524 buff/cache
KiB Swap:        0 total,        0 free,        0 used.   896572 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S %CPU %MEM     TIME+ COMMAND
 1198 root      10 -10    5724   3516   2424 S  0.5  0.3  10:45.12 iscsid
21077 ubuntu    20   0   40500   3748   3168 R  0.5  0.4   0:00.05 top
    1 root      20   0   37656   4848   3128 S  0.0  0.5   0:19.82 systemd
    2 root      20   0       0      0      0 S  0.0  0.0   0:00.00 kthreadd
    3 root      20   0       0      0      0 S  0.0  0.0   0:02.13 ksoftirqd/0
    5 root       0 -20       0      0      0 S  0.0  0.0   0:00.00 kworker/0:0H
    7 root      20   0       0      0      0 S  0.0  0.0   0:04.23 rcu_sched
    8 root      20   0       0      0      0 S  0.0  0.0   0:00.00 rcu_bh
    9 root      rt   0       0      0      0 S  0.0  0.0   0:00.00 migration/0
   10 root      rt   0       0      0      0 S  0.0  0.0   0:24.73 watchdog/0
   11 root      20   0       0      0      0 S  0.0  0.0   0:00.00 kdevtmpfs
   12 root       0 -20       0      0      0 S  0.0  0.0   0:00.00 netns
   13 root       0 -20       0      0      0 S  0.0  0.0   0:00.00 perf
   14 root      20   0       0      0      0 S  0.0  0.0   0:00.00 xenwatch
   15 root      20   0       0      0      0 S  0.0  0.0   0:00.00 xenbus
   17 root      20   0       0      0      0 S  0.0  0.0   0:01.15 khungtaskd
   18 root       0 -20       0      0      0 S  0.0  0.0   0:00.00 writeback
```

Git

on your local machine:

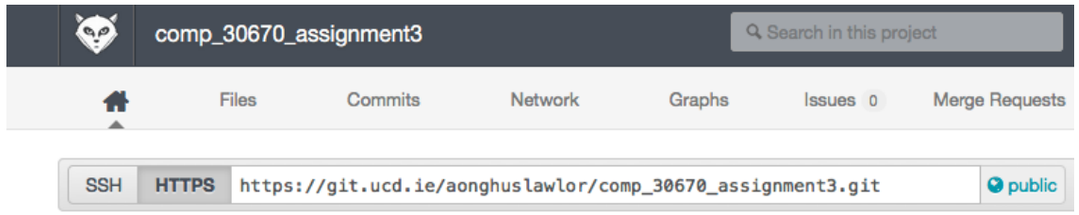


in Eclipse, do “commit and push”



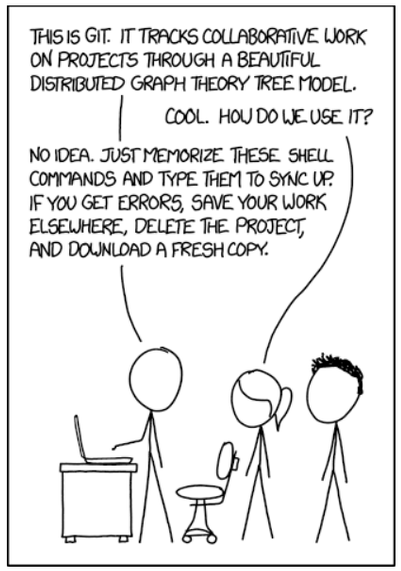
on the server:

github.com

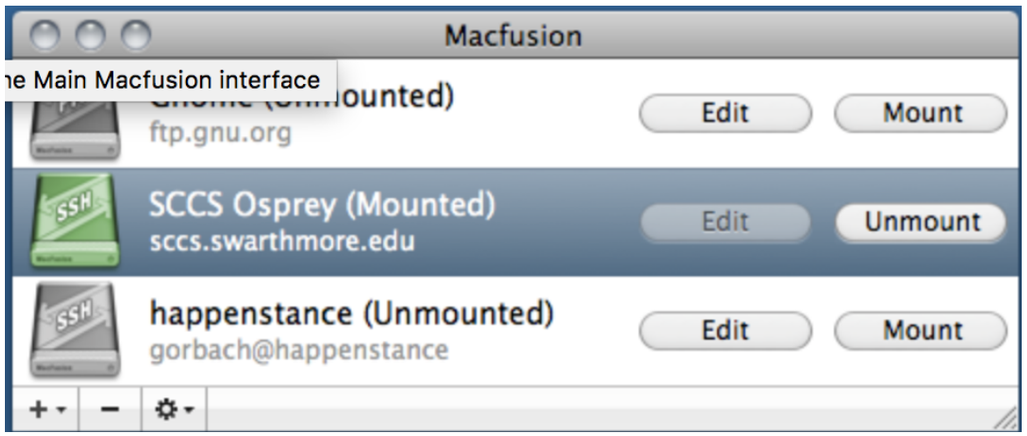



```
git clone https://github.com/aonghuslawlor/comp_30670_assignment3.git
```

```
aonghus — ssh alawlor@buzzer.ucd.ie — 98×17
(venv)~
[alawlor@buzzer$ git clone https://git.ucd.ie/aonghuslawlor/comp_30670_assignment3.git
Cloning into 'comp_30670_assignment3'...
remote: Counting objects: 22, done.
remote: Compressing objects: 100% (16/16), done.
remote: Total 22 (delta 3), reused 0 (delta 0)
Unpacking objects: 100% (22/22), done.
Checking connectivity... done.
(venv)~
alawlor@buzzer$
```



SCP/SSHFS

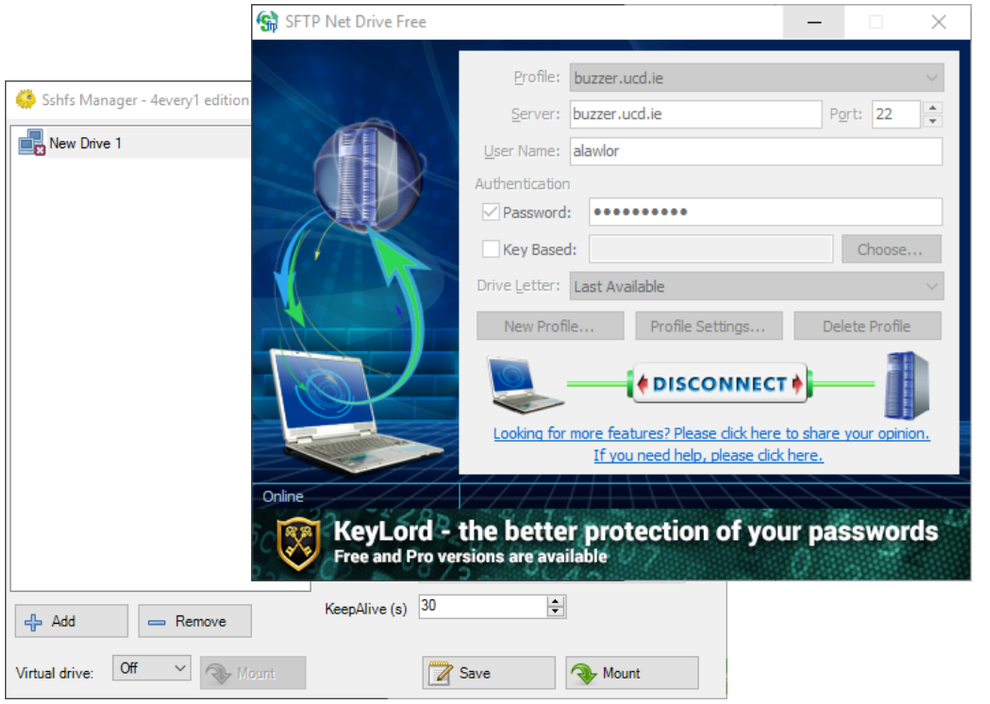


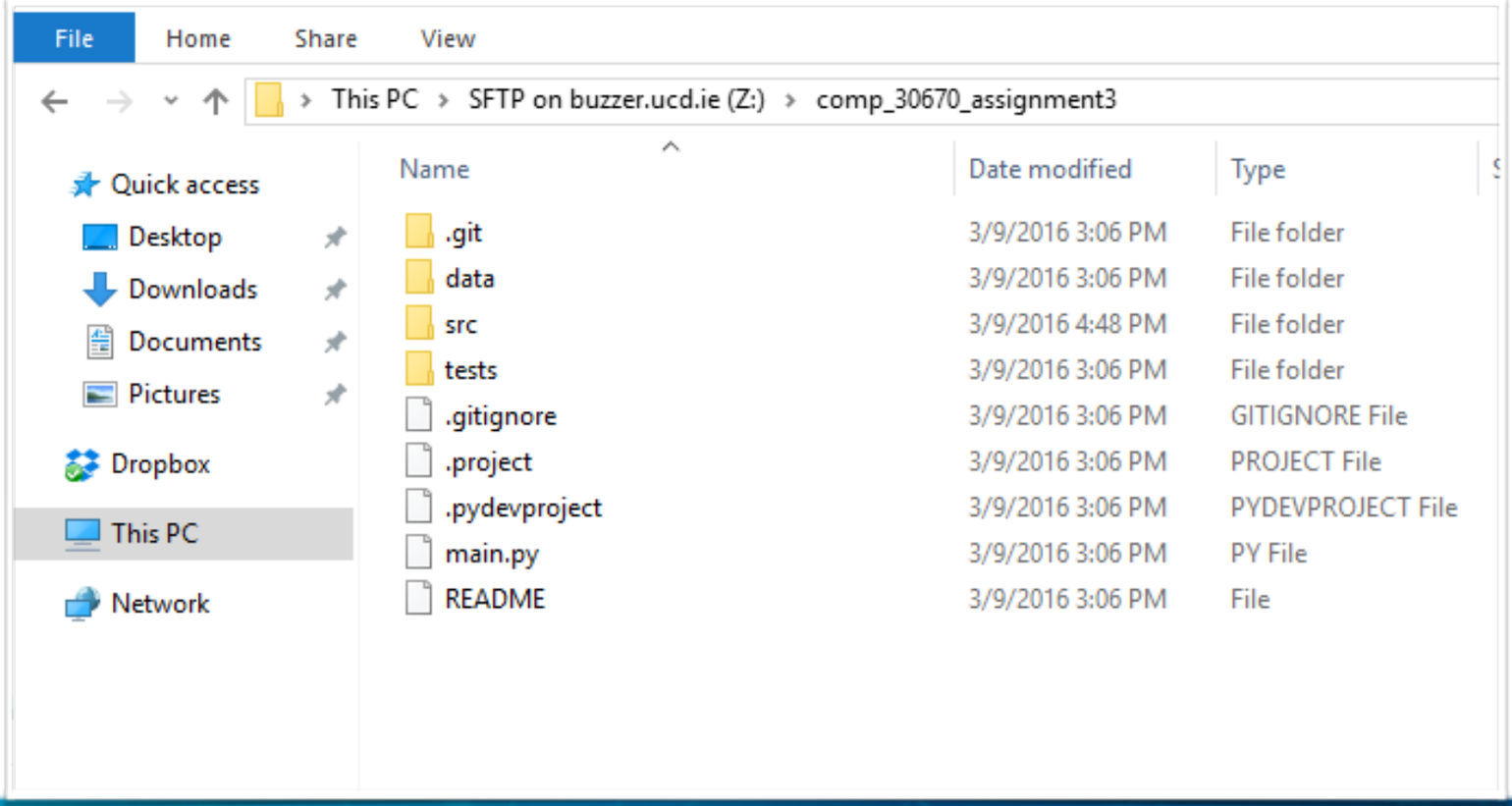
You can use scp (file copy over ssh) to transfer files to the server

Alternatively, you can use ssh to create a virtual mounted drive

win-sshfs, sftp net-drive

macfusion





Workflow

clone the repository

```
(py36) ubuntu@ip-172-31-38-175:~$ git clone https://github.com/aonghus/dublinbikesproject.git
Cloning into 'dublinbikesproject'...
remote: Counting objects: 3, done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), done.
Checking connectivity... done.
(py36) ubuntu@ip-172-31-38-175:~$
```

```
(py36) ubuntu@ip-172-31-38-175:~/dublinbikesproject$ git pull
Already up-to-date.
```

check which virtualenv you are using (activate if necessary)

```
ubuntu@ip-172-31-38-175:~$ source activate py36
(py36) ubuntu@ip-172-31-38-175:~$
```

change into the source directory

```
(py36) ubuntu@ip-172-31-38-175:~/dublinbikesproject$ ls
data  main.py  README.md  setup.py  src  tests
```

run your program...

if you want the program to continue running after you log out, then put '**nohup**' before the command and '**&**' after.

```
(py36) ubuntu@ip-172-31-38-175:~/dublinbikesproject$ nohup python ./main.py &
```

Workflow

- There are numerous posts and tutorials about the perfect workflow (none are!)
- Do some experimentation and find what works for you

The Perfect Workflow, with Git, GitHub, and SSH

Cloning Python Virtual Environment

Using pip

On your local machine, use pip to get a list of the installed packages in your virtual environment:

local machine

```
$ conda env export > environment.yml
```

file hostname path

```
$ scp environment.yml ec2:
```

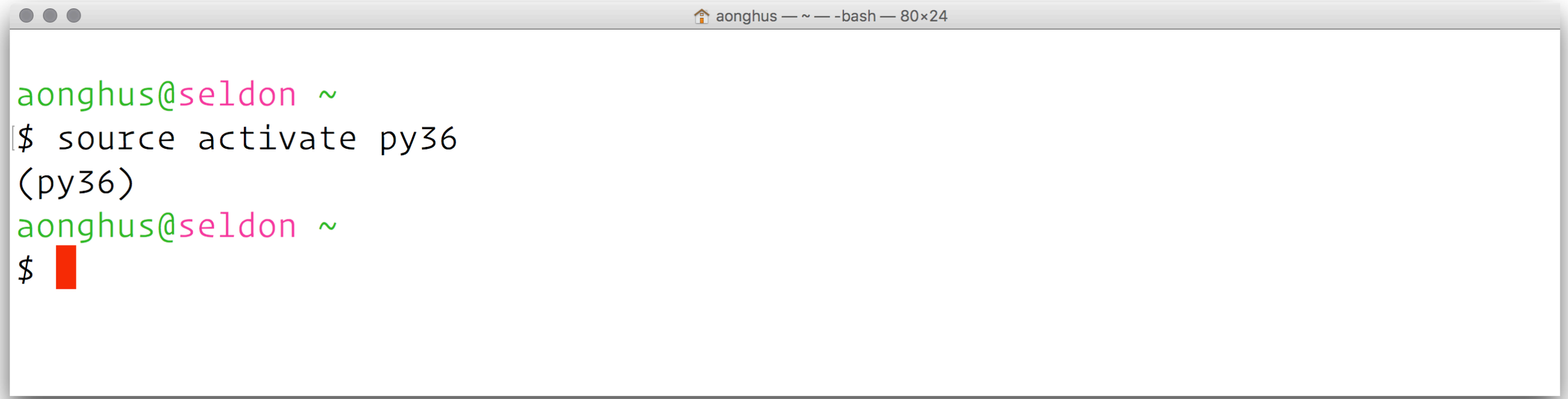
server

```
$ conda env update -f environment.yml
```

environment.yml
"package name"==version

```
beautifulsoup4==4.4.1
blosc==1.2.8
bokeh==0.11.1
boto==2.39.0
brewer2mpl==1.4.1
bz2file==0.98
cffi==1.5.2
chardet==2.3.0
...
```

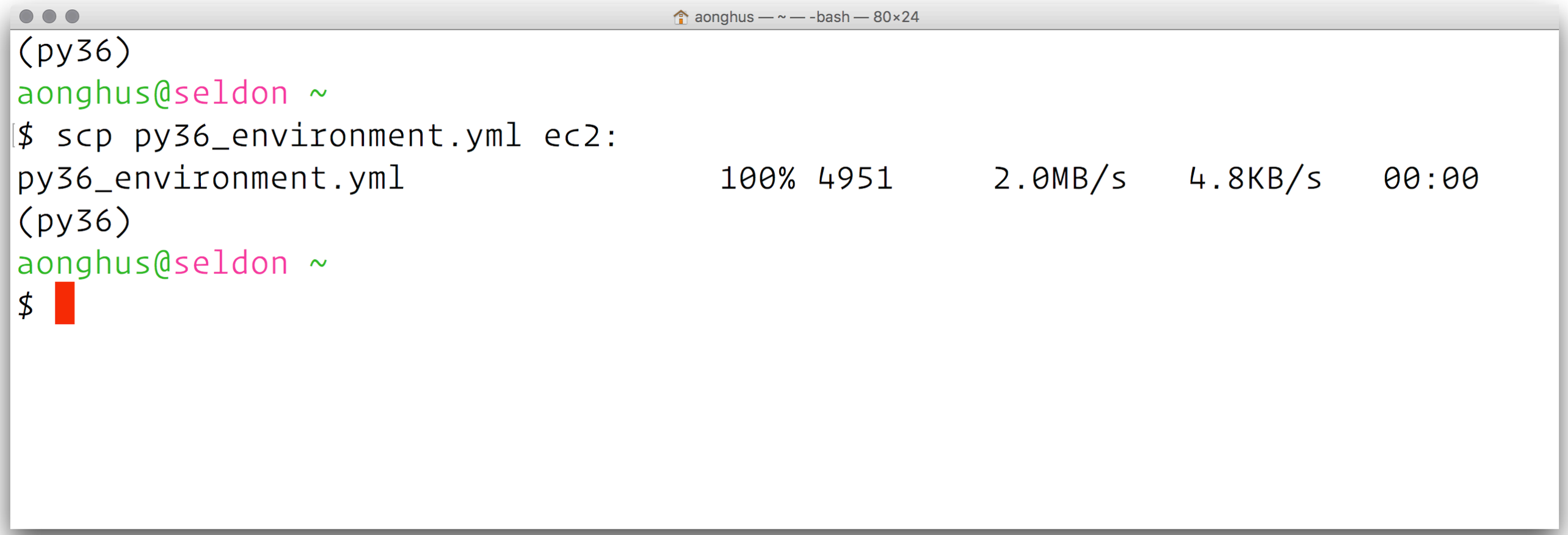
- You can now easily wipe the virtual environment on the server, re-create it and then install all the packages from scratch
- This is how you ensure you have the identical setup on all working machines

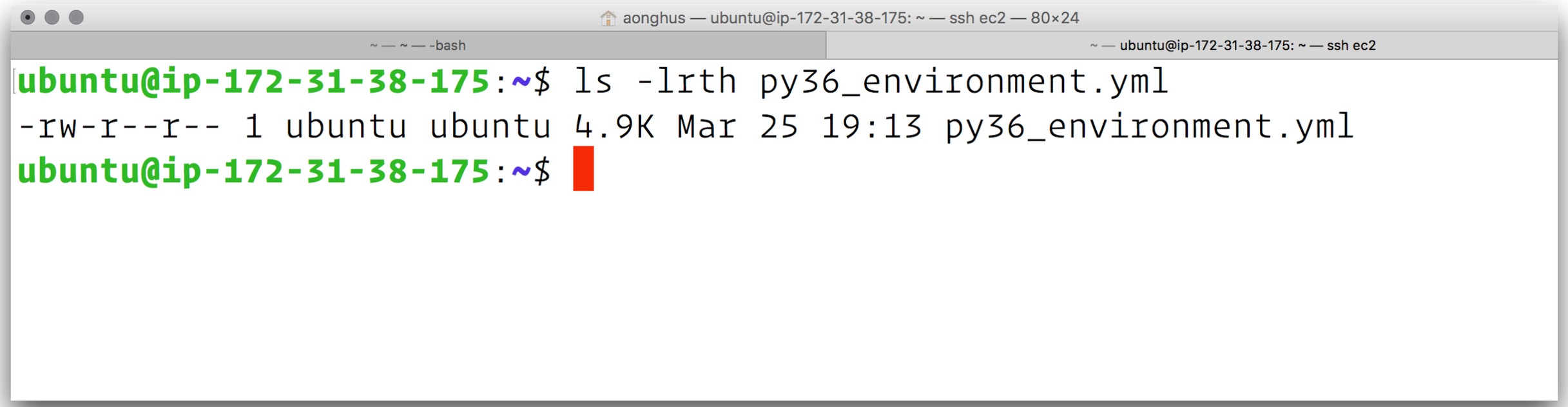

aonghus — ~ — -bash — 80×24
aonghus@seldon ~
$ source activate py36
(py36)
aonghus@seldon ~
$

aonghus — ~ — -bash — 80×24

```
(py36)
aonghus@seldon ~
$ conda env export > py36_environment.yml
DEPRECATION: The default format will switch to columns in the future. You can us
e --format=(legacy|columns) (or define a format=(legacy|columns) in your pip.con
f under the [list] section) to disable this warning.
(py36)
aonghus@seldon ~
$
```

```
name: py36
channels: !!python/tuple
- conda-forge
- defaults
dependencies:
- boto=2.46.1=py36_0
- bz2file=0.98=py36_0
- conda-forge::appnope=0.1.0=py36_0
- conda-forge::blas=1.1=openblas
- conda-forge::bleach=1.5.0=py36_0
- conda-forge::ca-certificates=2017.1.23=0
- conda-forge::cairo=1.14.6=4
- conda-forge::cairocffi=0.7.2=py36_1
- conda-forge::certifi=2017.1.23=py36_0
- conda-forge::cffi=1.7.0=py36_0
- conda-forge::click=6.7=py36_0
- conda-forge::cycler=0.10.0=py36_0
- conda-forge::decorator=4.0.11=py36_0
- conda-forge::elasticsearch=5.2.0=py36_0
- conda-forge::entrypoints=0.2.2=py36_1
- conda-forge::flask=0.12=py36_0
- conda-forge::fontconfig=2.12.1=4
- conda-forge::freetype=2.7=1
py36_environment.yml
```


aonghus — ~ — -bash — 80×24
(py36)
aonghus@seldon ~
$ scp py36_environment.yml ec2:
py36_environment.yml 100% 4951 2.0MB/s 4.8KB/s 00:00
(py36)
aonghus@seldon ~
$


aonghus — ubuntu@ip-172-31-38-175: ~ — ssh ec2 — 80×24
~ — ~ — -bash
~ — ubuntu@ip-172-31-38-175: ~ — ssh ec2
ubuntu@ip-172-31-38-175:~$ ls -lrth py36_environment.yml
-rw-r--r-- 1 ubuntu ubuntu 4.9K Mar 25 19:13 py36_environment.yml
ubuntu@ip-172-31-38-175:~$

```
ubuntu@ip-172-31-38-175:~$ conda create -n py36 python=3.6
Fetching package metadata .........
Solving package specifications: .

Package plan for installation in environment /home/ubuntu/anaconda3/envs/py36:

The following NEW packages will be INSTALLED:

    openssl:    1.0.2k-1
    pip:        9.0.1-py36_1
    python:     3.6.1-0
    readline:   6.2-2
    setuptools: 27.2.0-py36_0
    sqlite:     3.13.0-0
    tk:         8.5.18-0
    wheel:      0.29.0-py36_0
    xz:         5.2.2-1
    zlib:       1.2.8-3

Proceed ([y]/n)?
```

aonghus — ubuntu@ip-172-31-38-175: ~ — ssh ec2 — 80×24

~ — ~ — -bash | ~ — ubuntu@ip-172-31-38-175: ~ — ssh ec2

```
(py36) ubuntu@ip-172-31-38-175:~$ conda env update -f=py36_environment.yml
```

Databases/MySQL

Data Storage Zoo

Document Stores
SimpleDB, CouchDB, MongoDB, Terrastore

Relational
MySQL, Postgres, SQLite, ...

Key-Value Stores
Voldemort, Riak, Redis, Scalaris, Tokyo
Cabinet, Memcached/Membrain/Membase

Extensible Record Stores:
HBase, HyperTable, Cassandra, PNUT, BigTable


MySQL®

MySQL Workbench

Connect to Database

Stored Connection: dbikes — Select from saved connection settings

Connection Method: Standard (TCP/IP) — Method to use to connect to the RDBMS

Parameters | SSL | Advanced

Hostname: dbikes.ci1fi4edpsps.eu-west-1.rds.amazonaws.com Port: 3306 — Name or IP address of the IP port.

Username: aonghus — Name of the user to conn

Password: Store in Keychain ... Clear — The user's password. Will not set.

Default Schema: — The schema to use as def to select it later.

Cancel OK

Column Types

- **INT** integer
- **FLOAT** Small floating-point number
- **DOUBLE** Double-precision floating-point number
- **CHAR(N)** Text N characters long (N=1..255)
- **VARCHAR(N)** Variable length text up to N characters long
- **TEXT** Text up to 65535 characters long
- **LONGTEXT** Text up to 4294967295 characters long

A table consists of several columns each of which has a specific data type (e.g. integer, text).

It is useful to define columns correctly because it has implications for sorting the data (numeric versus text), and for the size of the data allowed in a column

Create Table

```
DROP TABLE IF EXISTS gene_map;
CREATE TABLE gene_map (
gene VARCHAR(255) NOT NULL,
chromosome INT NOT NULL,
cM_position FLOAT NOT NULL,
id INT NOT NULL AUTO_INCREMENT,
);
```

Create Table

```
DROP TABLE IF EXISTS gene_map;
CREATE TABLE gene_map (
gene VARCHAR(255) NOT NULL,
chromosome INT NOT NULL,
cM_position FLOAT NOT NULL,
id INT NOT NULL AUTO_INCREMENT,
PRIMARY KEY (id),
INDEX i_g (gene),
INDEX i_c (chromosome),
INDEX i_cp (cM_position)
);
```

Insert

```
CREATE TABLE gene_map (
gene VARCHAR(255) NOT NULL,
chromosome INT NOT NULL,
cM_position FLOAT NOT NULL,
id INT NOT NULL AUTO_INCREMENT,
);
```

Note that if you specify a value for every column in order it is not necessary to declare the column names in the statement (e.g. (a)).If you only want to add data to some columns, or to add them in a different order, then you must declare the column names after the table name in the statement (e.g., (b)). In this case columns with no value specified will be “NULL” or will get the default value (“0” for numeric columns, “” for text columns, and the next integer for auto increment columns) if “NOT NULL” was specified during table definition.

```
(a) INSERT INTO gene_map VALUES('agrc259','1','233.3','NULL');
(b) INSERT INTO gene_map (gene, chromosome) VALUES('adp0', '10');
```

Cheat Sheet

A Quick Guide To MySQL Tables & Queries

This is a Quick reference Guide for MySQL 5.x. MySQL is a relational database management system (RDBMS) based on SQL (Structured Query Language). MySQL is available under GNU public license and through subscription to MySQL Network for business applications. It runs on Unix, iMac, and Windows and provides rich API for many programming languages including C, C++, Java, Perl, Python, Ruby and PHP.

Database Queries:

List all databases
```
>SHOW databases;
```

Select the database
>USE <database name>
```
>USE university;
```

Create a database
>CREATE DATABASE <database name>
```
>CREATE DATABASE university;
```

Delete a database
>DROP DATABASE <database name>
```
>DROP DATABASE university;
```

Rename a database
>ALTER DATABASE <database name> RENAME <new database name>
```
>ALTER DATABASE university RENAME faculty
```

Table Queries:

Create a table
>CREATE TABLE <table name> (<field name> <field type> (<field size>), ...)
```
>CREATE TABLE teachers (name varchar(20), age INT(10));
```

List all tables in the database
```
>SHOW tables;
```

Show table format with column names and data types
>DESCRIBE <table name>
```
>DESCRIBE teachers;
```

Modify the structure of table
```
>ALTER TABLE <table name> <alter specifications>
>ALTER TABLE teachers DROP COLUMN salary;
>ALTER TABLE teachers ADD COLUMN salary INT(5);
>ALTER TABLE teachers CHANGE firstName name VARCHAR(20);
```

Delete the table
>DROP TABLE <table name>
```
>DROP TABLE teachers;
```

Retrieving Data:

>SELECT <columns> FROM <tables> WHERE <conditions>

Retrieve from all columns
*>SELECT * FROM <tables>*
```
>SELECT * FROM teachers;
```

Retrieve from selected columns
>SELECT <column 1>, <column 2> FROM <tables>
```
>SELECT id, name FROM teachers;
```

Retrieve from selected tables
>SELECT <columns> FROM <table 1>, <table 2>
```
>SELECT teachers.name, students.name FROM teachers, students;
```

Retrieve unique values
>SELECT DISTINCT <column name> FROM <table>
```
>SELECT DISTINCT name FROM teachers;
```

Retrieve data satisfying a given condition
>SELECT <columns> FROM <tables> WHERE <condition>
```
>SELECT name FROM teachers WHERE age > 35;
```

Retrieve data satisfying multiple conditions
>SELECT <columns> FROM <tables> WHERE <condition> AND <condition>
```
>SELECT name FROM teachers WHERE age > 35 AND gender = 'female';
```

Inserting Data:

> INSERT INTO <table> (<columns>) VALUES (<data>)
```
> INSERT INTO teachers (id, name, age) VALUES (NULL, 'John', '12');
```

Loading Data from Files:

>LOAD DATA LOCAL INFILE '<filename>' INTO TABLE <table>
```
>LOAD DATA LOCAL INFILE 'file.sql' INTO TABLE teachers;
```

This is very convenient to load data directly from files when you have thousands of entries.

Modifying Data:

>UPDATE <table> SET <field1> = <value1> AND <field2> = <value2> WHERE <conditions>
```
>UPDATE teachers SET status = 'enrolled' WHERE fees = 'paid';
```

Deleting Data:

>DELETE FROM <table> WHERE <condition>
```
>DELETE FROM teachers WHERE fees = 'paid';
```

Pattern Matching Examples:

```
>SELECT * FROM teachers WHERE name LIKE 'j%';
```
Wildcard % selects joe, john, jones, etc.

```
> SELECT * FROM teachers WHERE name LIKE '_ _ _';
```
Selects 3 character values.

```
> SELECT * FROM teachers WHERE name REGEXP '^A';
```
Selects all entries beginning with A.

```
> SELECT * FROM teachers WHERE name REGEXP 'p$';
```
Selects all entries ending with p.

[abc]	match a, b, or c
[^abc]	match all expect a, b, or c
[A-Z]	match uppercase
[a-z]	match lowercase
[0-9]	match any digit

Create DB

In [120]:
```
import sqlalchemy as sqla
from sqlalchemy import create_engine
import traceback
import glob
import os
from pprint import pprint
import simplejson as json
import requests
import time
from IPython.display import display
```

In [17]:
```
URI="dbikes.ci1fi4edpsps.eu-west-1.rds.amazonaws.com"
PORT="3306"
DB = "dbikes"
USER = "aonghus"
```

In [18]:
```
engine = create_engine("mysql+mysqldb://{}:{}@{}:{}/{}".format(USER, PASSWORD,
URI, PORT, DB), echo=True)
```

In [16]:
```
sql = """
CREATE DATABASE IF NOT EXISTS dbikes;
"""
engine.execute(sql)
```

```
2017-03-26 17:05:24,152 INFO sqlalchemy.engine.base.Engine
CREATE DATABASE IF NOT EXISTS dbikes;

2017-03-26 17:05:24,154 INFO sqlalchemy.engine.base.Engine ()
2017-03-26 17:05:24,159 INFO sqlalchemy.engine.base.Engine COMMIT
```

Out[16]:
```
<sqlalchemy.engine.result.ResultProxy at 0x10787bda0>
```

MySQL Workbench

dbikes

SCHEMAS

Filter objects

- innodb
- sys
- tmp

Object Info | Session

Connection:
Name: *dbikes*
Host: *dbikes.ci1fi4edpsps.eu-west-1.rds.amazonaws.com*
Port: *3306*
Server: *MySQL Community Server (GPL)*
Version: *5.6.27-log*
Connector: *C++ 1.1.8*
Login User: *aonghus*
Current User: *aonghus@%*
SSL: *Using AES256-SHA*

Query 1

Don't Limit

1

100% 1:1

Action Output

	Time	Action	Response	Duration / Fetch Time

Context Help | Snippets

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

Connection cancelled

In [11]:
```
for res in engine.execute("SHOW VARIABLES;"):
    print(res)
```

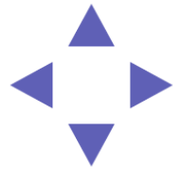
```
('auto_increment_increment', '1')
('auto_increment_offset', '1')
('autocommit', 'OFF')
('automatic_sp_privileges', 'ON')
('avoid_temporal_upgrade', 'OFF')
('back_log', '63')
('basedir', '/rdsdbbin/mysql/')
('big_tables', 'OFF')
('bind_address', '*')
('binlog_cache_size', '32768')
('binlog_checksum', 'CRC32')
('binlog_direct_non_transactional_updates', 'OFF')
('binlog_error_action', 'IGNORE_ERROR')
('binlog_format', 'MIXED')
('binlog_gtid_simple_recovery', 'OFF')
('binlog_max_flush_queue_time', '0')
('binlog_order_commits', 'ON')
('binlog_row_image', 'FULL')
('binlog_rows_query_log_events', 'OFF')
('binlog_stmt_cache_size', '32768')
('binlogging_impossible_mode', 'IGNORE_ERROR')
('block_encryption_mode', 'aes-128-ecb')
('bulk_insert_buffer_size', '8388608')
('character_set_client', 'utf8')
('character_set_connection', 'utf8')
('character_set_database', 'latin1')
('character_set_filesystem', 'binary')
('character_set_results', 'utf8')
('character_set_server', 'latin1')
('character_set_system', 'utf8')
('character_sets_dir', '/rdsdbbin/mysql-5.6.27.R1/share/charsets/')
```

Create Tables

In [100]:

```
sql = """
CREATE TABLE IF NOT EXISTS station (
address VARCHAR(256),
banking INTEGER,
bike_stands INTEGER,
bonus INTEGER,
contract_name VARCHAR(256),
name VARCHAR(256),
number INTEGER,
position_lat REAL,
position_lng REAL,
status VARCHAR(256)
)
"""
try:
    res = engine.execute("DROP TABLE IF EXISTS station")
    res = engine.execute(sql)
    print(res.fetchall())
except Exception as e:
    print(e)
```

```
2017-03-26 18:29:43,944 INFO sqlalchemy.engine.base.Engine DROP TABLE IF EXIST
S station
2017-03-26 18:29:43,947 INFO sqlalchemy.engine.base.Engine ()
2017-03-26 18:29:43,955 INFO sqlalchemy.engine.base.Engine COMMIT
2017-03-26 18:29:43,990 INFO sqlalchemy.engine.base.Engine
CREATE TABLE IF NOT EXISTS station (
address VARCHAR(256),
banking INTEGER,
bike_stands INTEGER,
bonus INTEGER,
contract_name VARCHAR(256),
name VARCHAR(256),
number INTEGER,
```



In [29]:

```
sql = """
CREATE TABLE IF NOT EXISTS availability (
number INTEGER,
available_bikes INTEGER,
available_bike_stands INTEGER,
last_update INTEGER
)
"""
try:
    res = engine.execute(sql)
    print(res.fetchall())
except Exception as e:
    print(e)#, traceback.format_exc())
```

```
2017-03-26 17:16:06,540 INFO sqlalchemy.engine.base.Engine
CREATE TABLE IF NOT EXISTS availability (
number INTEGER,
available_bikes INTEGER,
available_bike_stands INTEGER,
last_update INTEGER
)

2017-03-26 17:16:06,542 INFO sqlalchemy.engine.base.Engine ()
2017-03-26 17:16:06,562 INFO sqlalchemy.engine.base.Engine COMMIT
This result object does not return rows. It has been closed automatically.
```

MySQL Workbench

dbikes

SCHEMAS

Filter objects

- dbikes
  - Tables
    - stations
      - Columns
        - address
        - banking
        - bike_stands
        - bonus
        - contract_name
        - name
        - number
        - position_lat
        - position_lng
        - status
      - Indexes
      - Foreign Keys
      - Triggers

Object Info | Session

Connection:
Name: *dbikes*
Host: *dbikes.ci1fi4edpsps.eu-west-1.rds.amazonaws.com*
Port: *3306*
Server: *MySQL Community Server (GPL)*
Version: *5.6.27-log*
Connector: *C++ 1.1.8*
Login User: *aonghus*
Current User: *aonghus@%*
SSL: *Using AES256-SHA*

Query 1 | new_schema - Schema

Don't Limit

1

100% 1:1

Action Output

	Time	Action	Response	Duration / Fetch Time
1	16:55:28	Appl...		

Context Help | Snippets

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

Connection reopened.

Web/API Crawling

```
#!/usr/bin/env python
import requests
import traceback
import datetime
import time
APIKEY="908234203984"
NAME="Dublin"
STATIONS="https://api.jcdecaux.com/vls/v1/stations"

def write_to_file(text):
    with open("data/bikes_{}".format(now).replace(" ", "_"), "w") as f:
        f.write(r.text)

def write_to_db(text):

def main():
    while True:
        try:
            now = datetime.datetime.now()
            r = requests.get(STATIONS, params={"apiKey": APIKEY, "contract":
NAME})
            print(r, now)
            write_to_file(r.text)
            write_to_db(r.text)
            time.sleep(5*60)
        except:
            print(traceback.format_exc())
            if engine is None:

    return
```

Insert row into table (SQL)

In [101]:
```
def stations_to_db(text):
    stations = json.loads(text)
    print(type(stations), len(stations))
    for station in stations:
        print(station)
        vals = (station.get('address'), int(station.get('banking')),
station.get('bike_stands'), int(station.get('bonus')),
                        station.get('contract_name'), station.get('name'),
station.get('number'),
                        station.get('position').get('lat'),
station.get('position').get('lng'), station.get('status')
                        )
        engine.execute("insert into station
values(%s,%s,%s,%s,%s,%s,%s,%s,%s,%s)",
                        vals)
        break
    return
stations_to_db(r.text)
```

```
<class 'list'> 101
{'number': 42, 'name': 'SMITHFIELD NORTH', 'address': 'Smithfield North', 'pos
ition': {'lat': 53.349562, 'lng': -6.278198}, 'banking': True, 'bonus': False,
'status': 'OPEN', 'contract_name': 'Dublin', 'bike_stands': 30, 'available_bik
e_stands': 22, 'available_bikes': 8, 'last_update': 1490545430000}
2017-03-26 18:30:25,565 INFO sqlalchemy.engine.base.Engine insert into station
values(%s,%s,%s,%s,%s,%s,%s,%s,%s,%s)
2017-03-26 18:30:25,709 INFO sqlalchemy.engine.base.Engine ('Smithfield Nort
h', 1, 30, 0, 'Dublin', 'SMITHFIELD NORTH', 42, 53.349562, -6.278198, 'OPEN')
2017-03-26 18:30:25,712 INFO sqlalchemy.engine.base.Engine COMMIT
```

MySQL Workbench

dbikes

SCHEMAS

Filter objects

- dbikes
  - Tables
    - availability
    - station
      - Columns
        - address
        - banking
        - bike_stands
        - bonus
        - contract_name
        - name
        - number
        - position_lat
        - position_lng
        - status
      - Indexes
      - Foreign Keys

Object Info | Session

Schema: dbikes

Query 1 | dbikes.station

Don't Limit

```
1  select * from station;
```

100% 23:1

Result Grid | Filter Rows: Search | Export:

address	banking	bike_stands	bonus	contract_name	name	number	position_lat	position_lng	status
Smithfield North	1	30	0	Dublin	SMITHFIELD NORTH	42	53.349562	-6.278198	OPEN

station 3

Read Only

Context Help | Snippets

My Snippets

Result Grid | Form Editor | Field Types | Query Stats | Execution Plan

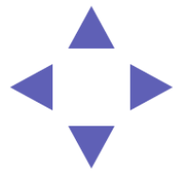
Query Completed

Create Table (sqlalchemy)

In [114]:

```
metadata = sqla.MetaData()
station = sqla.Table("station", metadata,
    sqla.Column('address', sqla.String(256), nullable=False),
    sqla.Column('banking', sqla.Integer),
    sqla.Column('bike_stands', sqla.Integer),
    sqla.Column('bonus', sqla.Integer),
    sqla.Column('contract_name', sqla.String(256)),
    sqla.Column('name', sqla.String(256)),
    sqla.Column('number', sqla.Integer),
    sqla.Column('position_lat', sqla.REAL),
    sqla.Column('position_lng', sqla.REAL),
    sqla.Column('status', sqla.String(256))
)

availability = sqla.Table("availability", metadata,
    sqla.Column('available_bikes', sqla.Integer),
    sqla.Column('available_bike_stands', sqla.Integer),
    sqla.Column('number', sqla.Integer),
    sqla.Column('last_update', sqla.BigInteger)
)

try:
    station.drop(engine)
    availability.drop(engine)
except:
    pass

metadata.create_all(engine)
```

```
2017-03-26 18:48:08,219 INFO sqlalchemy.engine.base.Engine
DROP TABLE station
2017-03-26 18:48:08,221 INFO sqlalchemy.engine.base.Engine ()
2017-03-26 18:48:08,237 INFO sqlalchemy.engine.base.Engine COMMIT
2017-03-26 18:48:08,245 INFO sqlalchemy.engine.base.Engine
```



In [ ]:

```
# use this code to load the Tables if you have already created them
# metadata = sqla.MetaData(bind=engine)
# print(metadata)
# station = sqla.Table('station', metadata, autoload=True)
# print(station)
```

Insert row (sqlalchemy)

In [122]:
```
# need to make sure the right keys are in the rows being inserted into the db
def stations_fix_keys(station):
    station['position_lat'] = station['position']['lat']
    station['position_lng'] = station['position']['lng']
    return station

stations = json.loads(open('stations.json', 'r').read())

engine.execute(station.insert(), *map(stations_fix_keys, stations))
```

```
2017-03-26 19:24:37,977 INFO sqlalchemy.engine.base.Engine INSERT INTO station
(address, banking, bike_stands, bonus, contract_name, name, number, position_l
at, position_lng, status) VALUES (%s, %s, %s, %s, %s, %s, %s, %s, %s, %s)
2017-03-26 19:24:37,991 INFO sqlalchemy.engine.base.Engine (('Smithfield Nort
h', True, 30, False, 'Dublin', 'SMITHFIELD NORTH', 42, 53.349562, -6.278198,
 'OPEN'), ('Parnell Square North', True, 20, False, 'Dublin', 'PARNELL SQUARE
 NORTH', 30, 53.353462, -6.265305, 'OPEN'), ('Pearse Street', True, 30, False,
'Dublin', 'PEARSE STREET', 32, 53.344304, -6.250427, 'OPEN'), ('Excise Walk',
 False, 40, False, 'Dublin', 'EXCISE WALK', 48, 53.347777, -6.244239, 'OPEN'),
('Fitzwilliam Square West', False, 30, False, 'Dublin', 'FITZWILLIAM SQUARE WE
ST', 13, 53.336074, -6.252825, 'OPEN'), ('St. James Hospital (Central)', Fals
e, 40, False, 'Dublin', 'ST. JAMES HOSPITAL (CENTRAL)', 81, 53.339983, -6.2955
94, 'OPEN'), ('Hanover Quay', True, 40, False, 'Dublin', 'HANOVER QUAY', 68, 5
3.344115, -6.237153, 'OPEN'), ('Oliver Bond Street', False, 30, False, 'Dubli
n', 'OLIVER BOND STREET', 74, 53.343893, -6.280531, 'OPEN')  ... displaying 10
of 101 total bound parameter sets ...  ('Heuston Bridge (North)', False, 40, F
alse, 'Dublin', 'HEUSTON BRIDGE (NORTH)', 92, 53.347802, -6.292432, 'OPEN'),
 ('Blackhall Place', False, 30, False, 'Dublin', 'BLACKHALL PLACE', 88, 53.348
8, -6.281637, 'OPEN'))
2017-03-26 19:24:38,016 INFO sqlalchemy.engine.base.Engine COMMIT
```

Out[122]: <sqlalchemy.engine.result.ResultProxy at 0x1074f3e48>

MySQL Workbench

dbikes

SCHEMAS

Filter objects

- dbikes
  - Tables
    - availability
    - station
  - Views
  - Stored Procedures
  - Functions
- innodb
- sys
- tmp

Object Info | Session

No object selected

Query 1 | dbikes.station

Don't Limit

```
1  select * from station;
```

100% 23:1

Result Grid | Filter Rows: Search | Export:

address	banking	bike_stands	bonus	contract_name	name	number	position_lat
Smithfield North	1	30	0	Dublin	SMITHFIELD NORTH	42	NULL
Parnell Square North	1	20	0	Dublin	PARNELL SQUARE NORTH	30	NULL
Pearse Street	1	30	0	Dublin	PEARSE STREET	32	NULL
Excise Walk	0	40	0	Dublin	EXCISE WALK	48	NULL
Fitzwilliam Square West	0	30	0	Dublin	FITZWILLIAM SQUARE WEST	13	NULL
St. James Hospital (Central)	0	40	0	Dublin	ST. JAMES HOSPITAL (CENTRAL)	81	NULL
Hanover Quay	1	40	0	Dublin	HANOVER QUAY	68	NULL
Oliver Bond Street	0	30	0	Dublin	OLIVER BOND STREET	74	NULL
Collins Barracks Museum	1	38	0	Dublin	COLLINS BARRACKS MUSEUM	87	NULL
Brookfield Road	0	30	0	Dublin	BROOKFIELD ROAD	84	NULL
Clonmel Street	0	33	0	Dublin	CLONMEL STREET	54	NULL
James Street East	0	30	0	Dublin	JAMES STREET EAST	20	NULL
Mount Street Lower	0	40	0	Dublin	MOUNT STREET LOWER	56	NULL
Christchurch Place	0	20	0	Dublin	CHRISTCHURCH PLACE	6	NULL
Grantham Street	1	30	0	Dublin	GRANTHAM STREET	18	NULL
York Street East	0	32	0	Dublin	YORK STREET EAST	52	NULL
Portobello Road	1	30	0	Dublin	PORTOBELLO ROAD	43	NULL
Parnell Street	0	20	0	Dublin	PARNELL STREET	31	NULL
Frederick Street South	1	30	0	Dublin	FREDERICK STREET SOUTH	98	NULL
Fownes Street Upper	0	30	0	Dublin	FOWNES STREET UPPER	14	NULL
Chatham Street	0	29	0	Dublin	CHATHAM STREET	1	NULL

station 4

Read Only

Result Grid | Form Editor | Field Types | Query Stats | Execution Plan

Context Help | Snippets

My Snippets

Query Completed

MySQL Workbench

dbikes

SCHEMAS

Filter objects

- dbikes
  - Tables
    - availability
      - Columns
      - Indexes
      - Foreign Keys
      - Triggers
    - station
  - Views
  - Stored Procedures
  - Functions
- innodb
- sys
- tmp

Object Info | Session

Table: availability

Columns:

available_bikes	int(11)
available_bike_stands	int(11)
number	int(11)
last_update	bigint(20)

Query 1 | dbikes.station | SQL File 2* | dbikes.availability

Limit to 200 rows

```
1  select * from availability;
```

100% 28:1

Result Grid | Filter Rows: Search | Export: | Fetch rows:

available_bikes	available_bike_stands	number	last_update
22	8	42	1464735626000
0	20	30	1464735674000
0	30	32	1464735548000
1	39	48	1464735651000
8	22	13	1464735765000
40	0	81	1464735581000
7	33	68	1464735661000
25	5	74	1464735628000
31	7	87	1464735249000
30	0	84	1464735194000
4	29	54	1464735396000
0	30	20	1464735613000
7	33	56	1464735285000
1	19	6	1464735632000
16	14	18	1464735177000
0	32	52	1464735390000
29	1	43	1464735472000
0	20	31	1464735458000
0	29	98	1464735604000
0	30	14	1464735544000

availability 2

Read Only

Context Help | Snippets

My Snippets

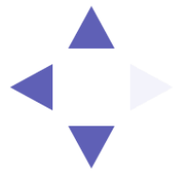
Result Grid | Form Editor | Field Types | Query Stats | Execution Plan

Query Completed

Reading DB with Pandas

In [124]:
```
import pandas as pd

df = pd.read_sql_table("station", engine)
```

```
2017-03-26 19:24:47,929 INFO sqlalchemy.engine.base.Engine SHOW FULL TABLES FR
OM `dbikes`
2017-03-26 19:24:47,932 INFO sqlalchemy.engine.base.Engine ()
2017-03-26 19:24:47,936 INFO sqlalchemy.engine.base.Engine SHOW FULL TABLES FR
OM `dbikes`
2017-03-26 19:24:47,938 INFO sqlalchemy.engine.base.Engine ()
2017-03-26 19:24:47,943 INFO sqlalchemy.engine.base.Engine SHOW CREATE TABLE `
station`
2017-03-26 19:24:47,945 INFO sqlalchemy.engine.base.Engine ()
2017-03-26 19:24:47,974 INFO sqlalchemy.engine.base.Engine SELECT station.addr
ess, station.banking, station.bike_stands, station.bonus, station.contract_nam
e, station.name, station.number, station.position_lat, station.position_lng, s
tation.status
FROM station
2017-03-26 19:24:47,976 INFO sqlalchemy.engine.base.Engine ()
```



In [126]:
```
display(df.head())
```

	address	banking	bike_stands	bonus	contract_name	name	n
0	Smithfield North	1	30	0	Dublin	SMITHFIELD NORTH	4
1	Parnell Square North	1	20	0	Dublin	PARNELL SQUARE NORTH	3
2	Pearse Street	1	30	0	Dublin	PEARSE STREET	3
3	Excise Walk	0	40	0	Dublin	EXCISE WALK	4
4	Fitzwilliam Square West	0	30	0	Dublin	FITZWILLIAM SQUARE WEST	1

Simple Queries

In [128]:
```
sql = "select count(*) from station;"
#for row in engine.execute(sql):
#    print(row)
print(engine.execute(sql).fetchall())
```

```
2017-03-26 20:17:24,678 INFO sqlalchemy.engine.base.Engine select count(*) fro
m station;
2017-03-26 20:17:24,683 INFO sqlalchemy.engine.base.Engine ()
[(101,)]
```

In [130]:
```
sql = "select name from station limit 10;"
for row in engine.execute(sql):
    print(row)
```

```
2017-03-26 20:18:02,341 INFO sqlalchemy.engine.base.Engine select name from st
ation limit 10;
2017-03-26 20:18:02,343 INFO sqlalchemy.engine.base.Engine ()
('SMITHFIELD NORTH',)
('PARNELL SQUARE NORTH',)
('PEARSE STREET',)
('EXCISE WALK',)
('FITZWILLIAM SQUARE WEST',)
('ST. JAMES HOSPITAL (CENTRAL)',)
('HANOVER QUAY',)
('OLIVER BOND STREET',)
('COLLINS BARRACKS MUSEUM',)
('BROOKFIELD ROAD',)
```

In [150]:

```
# JOIN
# (SELECT name, number from station)
# on AVAIL.number = station.number
sql = """
select * from
(select available_bike_stands, available_bikes, number from availability
    where available_bikes > 0
    # add in more conditions here (eg. date/time)
    GROUP BY number)
    a1
JOIN
(select name,number from station) a2
ON a1.number = a2.number limit 10;
"""
for row in engine.execute(sql):
    print(row)
```

```
2017-03-26 20:40:05,828 INFO sqlalchemy.engine.base.Engine
select * from
(select available_bike_stands, available_bikes, number from availability
    where available_bikes > 0
    # add in more conditions here (eg. date/time)
    GROUP BY number)
    a1
JOIN
(select name,number from station) a2
ON a1.number = a2.number limit 10;

2017-03-26 20:40:05,860 INFO sqlalchemy.engine.base.Engine ()
(8, 22, 42, 'SMITHFIELD NORTH', 42)
(19, 1, 30, 'PARNELL SQUARE NORTH', 30)
(29, 1, 32, 'PEARSE STREET', 32)
(39, 1, 48, 'EXCISE WALK', 48)
(22, 8, 13, 'FITZWILLIAM SQUARE WEST', 13)
```

Scrum Review

- During the first sprint planning meeting, pick the user stories for your initial sprint.
- Focus mainly on stories that will get your infrastructure and processes in place, but plan to have working software for the demo at the end of the sprint.
- Keep the coding simple for this first sprint.
- Coordinating the use of tools and processes and establishing high-quality practices from the start is important
- For the next sprint, focus on getting the skeleton/prototype of a working app up and running.
- We will discuss Flask in the lecture on Friday