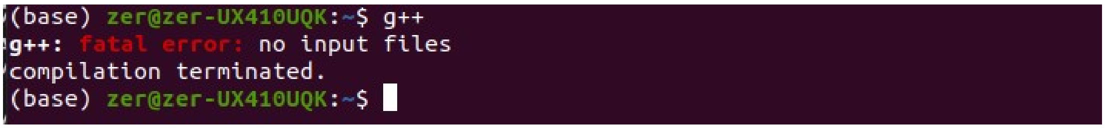
ITU Computer Engineering Department
BLG 223E Data Structures, Fall 2021-2022
Development Environment Setup – Linux (Ubuntu)

1. Make sure that GNU compiler collection is installed in your system. Run g++ from terminal window to test.



```
(base) zer@zer-UX410UQK:~$ g++
g++: fatal error: no input files
compilation terminated.
(base) zer@zer-UX410UQK:~$ 
```

In our system it was installed. But if it is not installed in your system, you can install it by running the following command as root or user with sudo privileges;

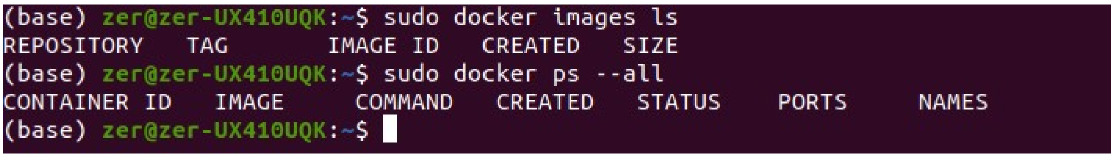
sudo apt update
sudo apt install build-essential

In here '**sudo apt update**', command is used to download package information from all configured sources in order to get info on an updated version of packages or their dependencies. '**sudo apt install build-essential**' command installs "build-essential" meta-package that includes the GNU compiler collection, GNU debugger, and other development libraries and tools required for compiling software.

2. Make sure that docker is installed and running in your system. If docker is not installed in your system, you can install it following command;

sudo apt install docker.io

It may take a bit time according to the your download speed. To test docker installation, get a list of docker images and containers.



```
(base) zer@zer-UX410UQK:~$ sudo docker images ls
REPOSITORY   TAG       IMAGE ID   CREATED   SIZE
(base) zer@zer-UX410UQK:~$ sudo docker ps --all
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
(base) zer@zer-UX410UQK:~$ 
```

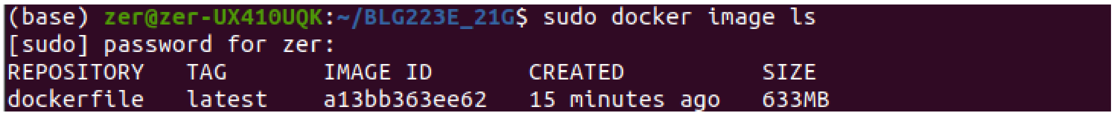
3. Create a directory and put dockerfile, distributed over ninova there. Open up a terminal and navigate to the directory where dockerfile remains.

4. Run the following command to build the docker image.

docker build -t <image_name> .

- Pay attention to the dot at the end of the command
- It should take a while to build the image
- If you get, following warnings messages,it is safe to ignore them;
  - WARNING: apt does not have a stable CLI interface. Use with caution in scripts.
  - debconf: delaying package configuration, since apt-utils is not installed

5. Check if the image has been built getting list of docker images.



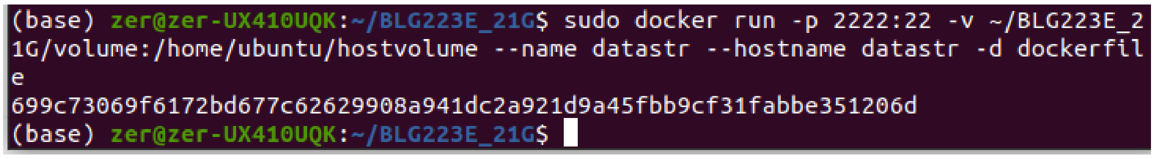
```
(base) zer@zer-UX410UQK:~/BLG223E_21G$ sudo docker image ls
[sudo] password for zer:
REPOSITORY   TAG       IMAGE ID       CREATED          SIZE
dockerfile   latest    a13bb363ee62   15 minutes ago   633MB
```

6. Generate a directory to put the files that would be visible to your container. Let’s call this directory’s path as <dev_path>

7. Run the following command to boot a container instance from the image you have just built.

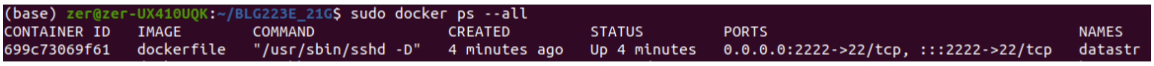
   docker run -p <local_port>:22 -v <dev_path>:<container_path>
   --name <container_name> --hostname <container_host_name>
   -d <image_name>

   - **-p <local_port>:<container_port>** : Maps port 22 of the container to one of your pc ports. This is required to be able to ssh into your container
   - **-v <dev_path>:<container_path>** : Maps your local files to a directory inside the container
   - The rest is self explanatory.
   - It should almost instantly boot the container, a screen similar to below should appear



```
(base) zer@zer-UX410UQK:~/BLG223E_21G$ sudo docker run -p 2222:22 -v ~/BLG223E_2
1G/volume:/home/ubuntu/hostvolume --name datastr --hostname datastr -d dockerfil
e
699c73069f6172bd677c62629908a941dc2a921d9a45fbb9cf31fabbe351206d
(base) zer@zer-UX410UQK:~/BLG223E_21G$ 
```

   - You may perform an additional check as by running “**docker ps --all**”

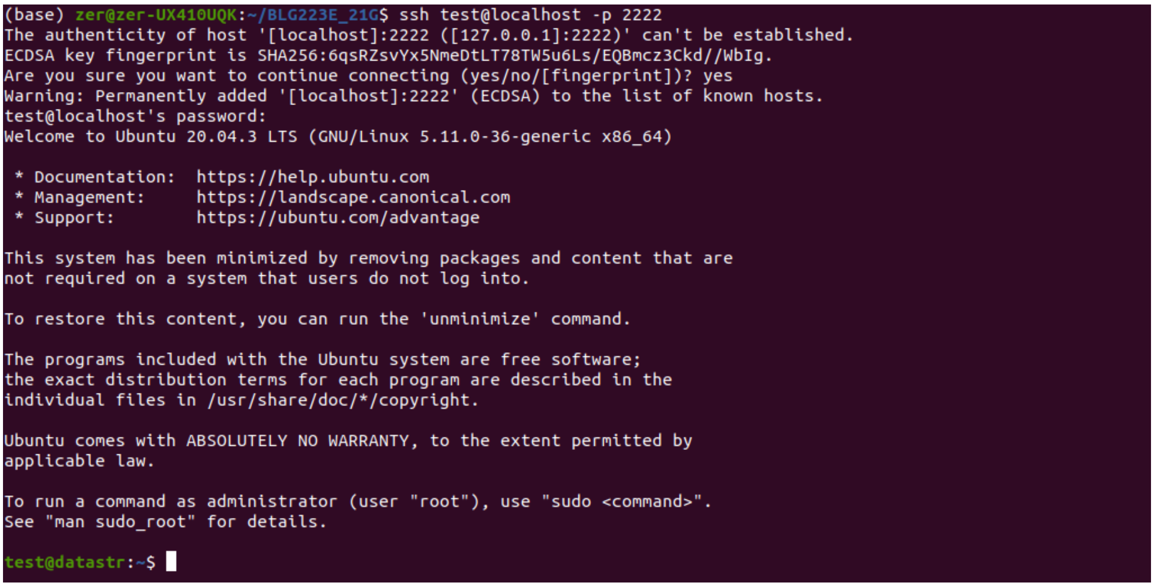


```
(base) zer@zer-UX410UQK:~/BLG223E_21G$ sudo docker ps --all
CONTAINER ID   IMAGE        COMMAND               CREATED         STATUS         PORTS                                   NAMES
699c73069f61   dockerfile   "/usr/sbin/sshd -D"   4 minutes ago   Up 4 minutes   0.0.0.0:2222->22/tcp, :::2222->22/tcp   datastr
```

8. Check if you can ssh into your container as follows.

   ssh test@localhost -p <local_port>

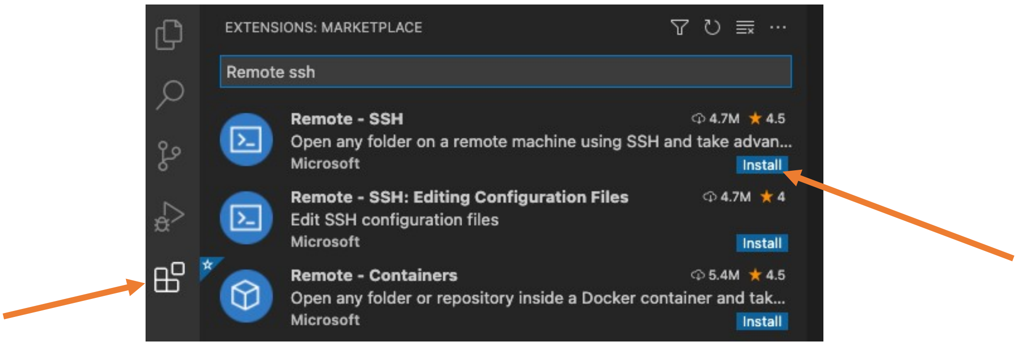
   - Your container’s username password both are set as ‘test’. You may change it by editing the dockerfile and rebuilding the image and re-running the container.
   - Don’t forget to exit from the ssh session.



```
(base) zer@zer-UX410UQK:~/BLG223E_21G$ ssh test@localhost -p 2222
The authenticity of host '[localhost]:2222 ([127.0.0.1]:2222)' can't be established.
ECDSA key fingerprint is SHA256:6qsRZsvYx5NmeDtLT78TW5u6Ls/EQBmcz3Ckd//WbIg.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '[localhost]:2222' (ECDSA) to the list of known hosts.
test@localhost's password:
Welcome to Ubuntu 20.04.3 LTS (GNU/Linux 5.11.0-36-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

test@datastr:~$ 
```

9. Install Visual Studio Code in your system. (!!!Be careful: Visual Studio and Visual Studio Code are different.)

10. Run Visual Studio Code and Install the extension named “Remote SSH”



EXTENSIONS: MARKETPLACE

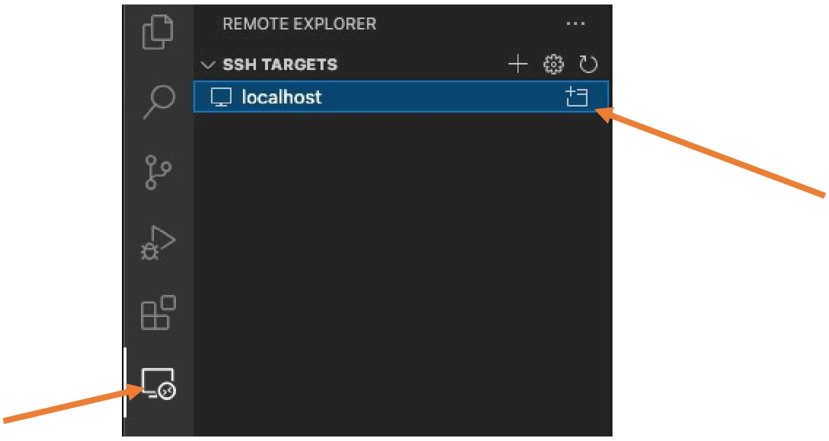
Remote ssh

Remote - SSH — 4.7M ★ 4.5
Open any folder on a remote machine using SSH and take advan...
Microsoft — Install

Remote - SSH: Editing Configuration Files — 4.7M ★ 4
Edit SSH configuration files
Microsoft — Install

Remote - Containers — 5.4M ★ 4.5
Open any folder or repository inside a Docker container and tak...
Microsoft — Install

11. Click on the newly added “Remote Eplorer” button and make a connection with localhost, If threre is no ssh target you have to add new.

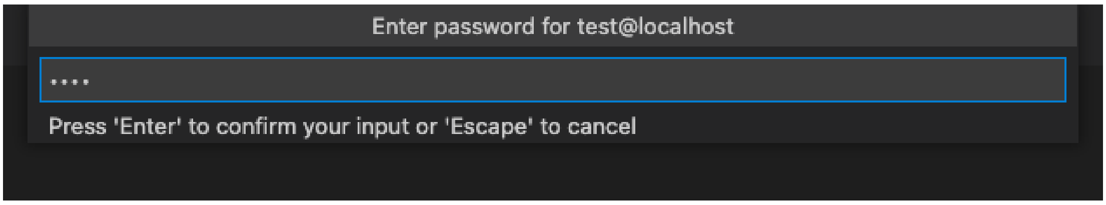


REMOTE EXPLORER

SSH TARGETS

localhost

12. A new window should open and ask for password. If you didn’t change anything, your default should be ‘test’

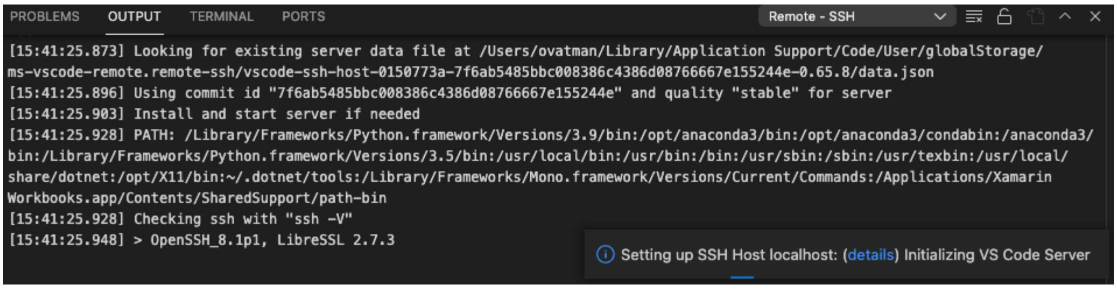


Enter password for test@localhost

••••

Press 'Enter' to confirm your input or 'Escape' to cancel

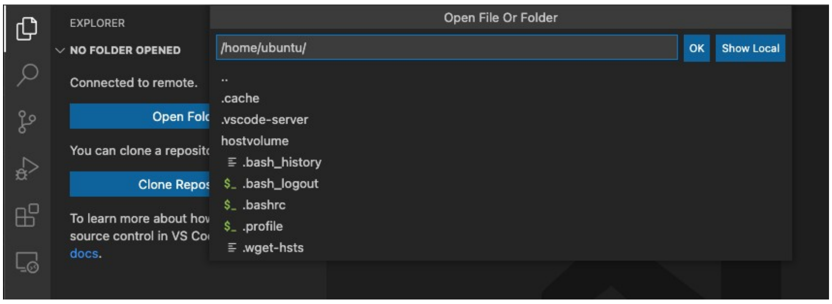
13. Down below, you can track VS related installation to be done in container



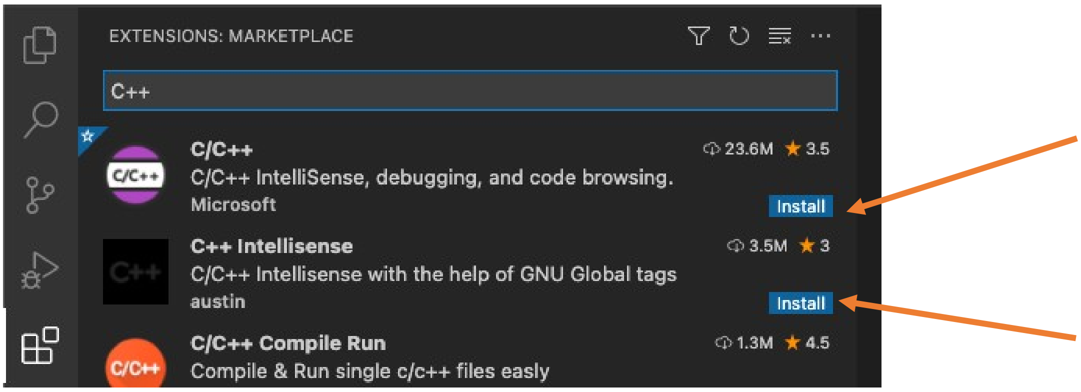
```
[15:41:25.873] Looking for existing server data file at /Users/ovatman/Library/Application Support/Code/User/globalStorage/
ms-vscode-remote.remote-ssh/vscode-ssh-host-0150773a-7f6ab5485bbc008386c4386d08766667e155244e-0.65.8/data.json
[15:41:25.896] Using commit id "7f6ab5485bbc008386c4386d08766667e155244e" and quality "stable" for server
[15:41:25.903] Install and start server if needed
[15:41:25.928] PATH: /Library/Frameworks/Python.framework/Versions/3.9/bin:/opt/anaconda3/bin:/opt/anaconda3/condabin:/anaconda3/
bin:/Library/Frameworks/Python.framework/Versions/3.5/bin:/usr/local/bin:/usr/bin:/bin:/usr/sbin:/sbin:/usr/texbin:/usr/local/
share/dotnet:/opt/X11/bin:~/.dotnet/tools:/Library/Frameworks/Mono.framework/Versions/Current/Commands:/Applications/Xamarin
Workbooks.app/Contents/SharedSupport/path-bin
[15:41:25.928] Checking ssh with "ssh -V"
[15:41:25.948] > OpenSSH_8.1p1, LibreSSL 2.7.3
```

Setting up SSH Host localhost: (details) Initializing VS Code Server

14. When ready, check if you can open up your local folder from the container as follows



15. In the new window, we should install a few more extensions for c++ development. Search for C++ among the extensions and install "C/C++" and "C++ Intellisense"



EXTENSIONS: MARKETPLACE
C++
C/C++
C/C++ IntelliSense, debugging, and code browsing.
Microsoft
23.6M ★ 3.5
Install
C++ Intellisense
C/C++ Intellisense with the help of GNU Global tags
austin
3.5M ★ 3
Install
C/C++ Compile Run
Compile & Run single c/c++ files easly
1.3M ★ 4.5

16. Afterwards you can copy your development files in your local <dev_path> and continue developing.

17. If you encounter with permission error about files when using hostvolume on VS Code, you have to change ownership of the folder using following command;

chown -R test /home/ubuntu/hostvolume