Guide to installing the Debian 11 system on a virtual machine

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Contents

Step 1: INSTALL ISO IMAGE

An ISO image is a computer file that contains an exact copy of a storage medium, such as a CD, DVD, or Blu-ray disc. The ISO image contains all the data and structure of the original media, including files, folders, and file systems.

Here the ISO image of the latest Debian version is Debian 11 nicknamed "bullseye"

you can install the ISO image at this URL:
https://www.debian.org/download

Step 2: CREATE THE VIRTUAL MACHINE

The first thing to do is to install "Qemu" Qemu is a free virtual machine software, which can emulate a processor and, more generally, a different architecture if necessary. It will be the software that will support your virtual machine. You can install it at this address.
https://www.qemu.org/download/

Secondly you have to create the disk image on Qemu, launch a terminal and execute this command:

qemu-img create « $image » nG
$image = name of your image file (e.g. disk)
n = allocated disk space (e.g. 5)

Modify these 2 parameters as you want finally to launch the virtual machine just run this command and modify the parameters as you wish.

Finally third, to be able to launch the virtual machine run this long command:

lance_qemu="qemu-system-x86_64 -machine q35 -cpu host -m 4G -enable-kvm -device VGA,xres=1024,yres=768 -display gtk,zoom-to-fit=off -drive $drive -device e1000,netdev=net0 -netdev user,id=net0,hostfwd=tcp::2222-:22,hostfwd=tcp::4443-:443,hostfwd=tcp::8080-:80,hostfwd=tcp::5432-:5432"

Here's what each parameter in this command is all about:

- **qemu-system-x86_64:** This is the main QEMU binary used to emulate a x86_64 system.
- **-machine q35:** Specifies the Q35 virtual machine template. Q35 is a modern virtual machine architecture with advanced features.
- **-cpu host**: Uses the CPU host for emulation, which means that QEMU will use the features and performance of the host machine's processor.

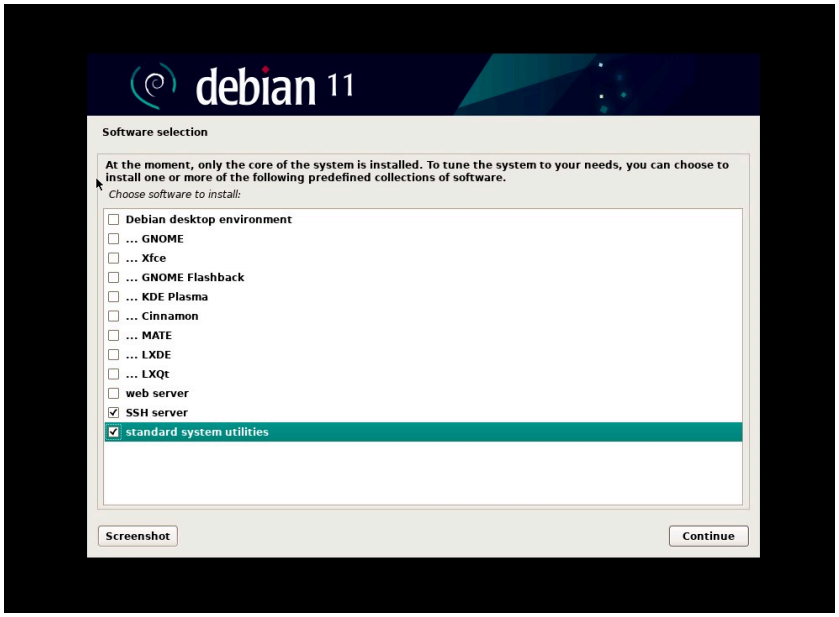
- **-m 4G**: Allocates 4 GB of memory to the virtual machine. This specifies the amount of RAM available to the virtual system.
- **-enable-kvm**: Enables hardware virtualization (KVM) support. This allows QEMU to use CPU virtualization extensions to improve performance.
- **-device VGA,xres=1024,yres=768**: Adds a VGA display device to the virtual machine with a resolution of 1024x768 pixels. This will display a graphical interface in the QEMU emulator window.
- **-display gtk,zoom-to-fit=off**: Uses the GTK GUI to display the graphical output of the virtual machine. The zoom-to-fit=off option disables automatic zoom in the GUI, allowing the specified resolution to be displayed without automatic adjustment.
- **-drive $drive**: Specifies the path to the disk image used by the virtual machine. The $drive variable must be replaced with the actual path of the disk image.
- **-device e1000,netdev=net0**: Adds an e1000 virtual network adapter to the virtual machine and attaches it to the net0 network appliance.
- **-netdev user,id=net0,hostfwd=tcp::2222-:22,hostfwd=tcp::4443-:443,hostfwd=tcp::8080-:80,hostfwd=tcp::5432-:5432**: Creates a virtual network appliance of type "user" with the identifier net0. This device allows the virtual machine to access the Internet through the host's network connection. The "hostfwd" options define the redirection of TCP ports from the host to the virtual machine. In this example, ports 2222, 4443, 8080, and 5432 on the host are redirected to ports 22, 443, 80, and 5432 on the virtual machine, respectively.

Step 3: INSTALLING THE DEBIAN 11 SYSTEM

The system will ask you a lot of different settings to install your DEBIAN 11 system. Adjust the settings as you see fit according to what suits you best, for me here are the settings I modified.

Language : English
Locales : United States, en_US.UTF-8
Location : other/Europe/France
Keyboard : French
Hostname : server-tivollij
Root Password : « root »
User Account - Full Name : Jarod Tivollier
User Name : tivollij
User Password : « etu »
Partition disks : Guided - use entire disk
Partition disks : All files in one partition
Partition disks : Yes
Software Selection : check that "Debian desktop" is not checked and that "ssh server" is checked and “Standard System Utilities”
Install GRUB : Yes
Device for boot loader : /dev/sda

For Software Selection:



For Hostname of your machine:

You can check your "Partition disks" settings in more detail with this command:

cat /etc/fstab

You will normally arrive on this file:

```
tivollij@server-tivollij:~$ cat /etc/fstab
# /etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name devices
# that works even if disks are added and removed. See fstab(5).
#
# systemd generates mount units based on this file, see systemd.mount(5).
# Please run 'systemctl daemon-reload' after making changes here.
#
# <file system> <mount point>   <type>  <options>       <dump>  <pass>
# / was on /dev/sda1 during installation
UUID=8b607967-3a69-4d38-a988-13ee2c5fe01a /               ext4    errors=remount-ro 0       1
# swap was on /dev/sda5 during installation
UUID=7b020c2a-4f89-4f3b-af6f-18952b5de218 none            swap    sw              0       0
/dev/sr0        /media/cdrom0   udf,iso9660 user,noauto     0       0
tivollij@server-tivollij:~$ _
```

Step 4: APACHE INSTALLATION

Apache allows you to create a localhost hosting server to allow you to host your HTML site that works only for Unix operating systems (which is DEBIAN 11).

Log in to your Root account with the command:

sudo -i

And enter your root password mine being "root", then, run this command:

apt-get update && apt-get upgrade

This command brings your packages up to date. It is very important otherwise the different installation in this tutorial will not work. To install Apache run this command:

apt install apache2

Then this command:

service apache2 start

After that your Apache2 software will then be operational to verify it run this command:

systemctl status apache2 (by being on the Root account)

```
root@server-tivollij:~# systemctl status apache2
● apache2.service - The Apache HTTP Server
     Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset: enabled)
     Active: active (running) since Fri 2023-05-05 09:22:50 EDT; 4min 24s ago
       Docs: https://httpd.apache.org/docs/2.4/
    Process: 383 ExecStart=/usr/sbin/apachectl start (code=exited, status=0/SUCCESS)
   Main PID: 445 (apache2)
      Tasks: 55 (limit: 4676)
     Memory: 11.7M
        CPU: 69ms
     CGroup: /system.slice/apache2.service
             ├─445 /usr/sbin/apache2 -k start
             ├─446 /usr/sbin/apache2 -k start
             └─447 /usr/sbin/apache2 -k start

May 05 09:22:50 server-tivollij systemd[1]: Starting The Apache HTTP Server...
May 05 09:22:50 server-tivollij apachectl[428]: AH00557: apache2: apr_sockaddr_info_get() failed
```

If everything works then the console shows you this (image above)

The line that will allow you to check this is the line with the green word "active (running)
If it doesn't work use this command:

systemctl restart apache

This restarts the Apache service.

Optional Step 1: APACHE TEST

To test the proper functioning of Apache you can simply go to the default page of Apache to do this to run on your virtual machine console the command

telnet localhost 80 (on your normal account not root)

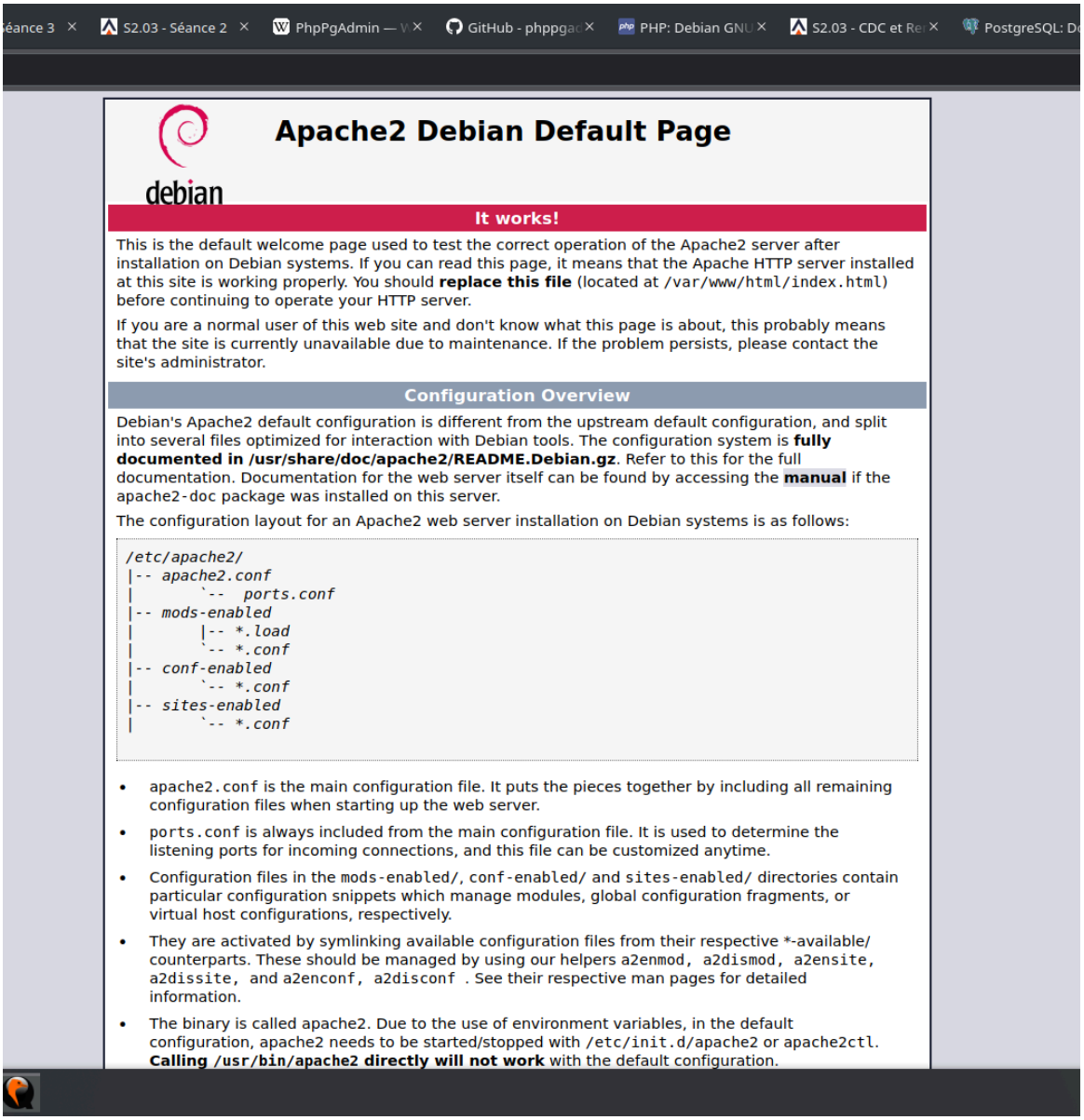
This will show you this:

$ telnet localhost 80
Trying ::1...
Connected to localhost.
Escape character is '^]'.

After that type this command:

HEAD / HTTP/1.0

After that the console will answer you by HTTP/1.1 200 OK and much more. But the most interesting line and this one allows us to know the link between the server and the page. Finally, you can access your page on your non-virtual machine from the URL "http://localhost:8080".



Then you arrive on this page if everything works.

Step 5: POSTGRESQL INSTALLATION

PostgreSQL is a database management and creation software that is very useful if you want to store for example login and password of your website.

To install PostgreSQL run this command (being on root account):

apt install postgresql

To verify that PostgreSQL is installed, either you run the command that is the same for Apache:

systemctl status postgresql

Where you will get this:

```
tivollij@server-tivollij:~$ systemctl status postgresql
● postgresql.service - PostgreSQL RDBMS
     Loaded: loaded (/lib/systemd/system/postgresql.service; enabled; vendor preset: enabled)
     Active: active (exited) since Fri 2023-05-05 10:37:25 EDT; 22min ago
    Process: 9408 ExecStart=/bin/true (code=exited, status=0/SUCCESS)
   Main PID: 9408 (code=exited, status=0/SUCCESS)
        CPU: 795us
```

Same as for Apache if it is not "active" to execute the command:

systemctl restart postgresql

Or to check if it is indeed install run this command:

su - postgres

The result of this command is to log in to the postgres account and this only works if PostgreSQL is installed. Run the exit command if you want to go back to your account.

Optional Step 2: POSTGRESQL TEST

Part I: CREATING A ROLE AND DATABASE

To test POSTGRESQL first log in to the PostgreSQL admin account to do so type this command:

su - postgres

This will connect you to the postgres account and you can use this command that will allow you to have the list of default databases on PostgreSQL

psql -l

And it will show you this:

```
postgres@server-tivollij:~$ psql -l
                                  List of databases
      Name        |  Owner   | Encoding |   Collate   |    Ctype    |   Access privileges
------------------+----------+----------+-------------+-------------+-----------------------
 jarod_tivollier  | tivollij | UTF8     | en_US.UTF-8 | en_US.UTF-8 |
 postgres         | postgres | UTF8     | en_US.UTF-8 | en_US.UTF-8 |
 template0        | postgres | UTF8     | en_US.UTF-8 | en_US.UTF-8 | =c/postgres          +
                  |          |          |             |             | postgres=CTc/postgres
 template1        | postgres | UTF8     | en_US.UTF-8 | en_US.UTF-8 | =c/postgres          +
                  |          |          |             |             | postgres=CTc/postgres
(4 rows)
```

Normally you will not have the database called "jarod_tivollier" ; it will be created later in this tutorial.

Start by connecting to the postgre database to do this Run this command

psql -U -d postgres

Then create a role with the command CREATE ROLE with your username here "tivollij"

CREATE ROLE username WITH LOGIN PASSWORD”your password”;

Then add the rights that will allow you to create modify databases

ALTER ROLE username SUPERUSER;
ALTER ROLE username CREATEDB;

ALTER ROLE username CREATEROLE;

You can check the creation of the role and the addition of rights with this command:

/du

```
postgres=# \du
                                   List of roles
 Role name |                         Attributes                         | Member of
-----------+------------------------------------------------------------+-----------
 postgres  | Superuser, Create role, Create DB, Replication, Bypass RLS | {}
 tivollij  | Superuser, Create role, Create DB                          | {}
```

"Tivollij" here will be replaced by your username.

We will then your database for this disconnect from postgres with the exit command and then connect to your role that you have just created with the command

su - username

Then to create your database type command taking into account that it does not need space or add "_" to separate 2 words as I did on the first image of this part and not to capitalize:

CREATE DATABASE name_of_your_DB;

Following this you have more than to connect to your database with the command quote a little higher but changing 1 parameter

psql -U -d name_of_your_DB

Part II: CREATING A TABLE AND ADDING ATTRIBUTES

To create a table make sure you are in your database or you want to create tables to create a table you must use the CREATE TABLE command and add as a parameter the attribute and its type here is the command:

CREATE TABLE name_of_your_table(name_of_attribute type_of_attribute);

Example for using this command:"CREATE TABLE number (int digit)" int here is the type to define an integer so you can only add integers in this attribute.

To add elements in your attributes that you have created run this command:

INSERT INTO name_of_your_table VALUES (the_number_of_what_your_want);

Then to see this modification/addition type this command:

SELECT * FROM name_of_your_table;

And you will get a result similar to this:

```
jarod_tivollier=# SELECT * FROM simple;
 un
----
  2
(1 row)
```

Here my table is called "simple" and my attribute "un".

Part III: ACCESSING DATABASES ON THE HOST MACHINE

We come to the complicated part of the postgreSQL test, access your database stored on your virtual machine, on your host machine for this you will have to modify 2 files of the PostgreSQL software which are the file "postgresql.conf" and "pg_hba.conf" start with the changes on the file "postgresql.conf". Use this command to open the file on your virtual machine:

nano /etc/postgresql/13/main/postgresql.conf

Modify the line where it is "listen_adresses" delete the "#" then replace "localhost" by "*" then find the line where it is "passeword_encryption" delete the "#" then modify if necessary "MD5" by "SCRAM-SHA-256".

Then we will modify the file "pg_hba.conf" using this command to access it:

nano /etc/postgresql/13/main/pg_hab.conf

Find the line where this is located "IPv4 remote connections" then add this "host all 0.0.0.0/0 scram-sha-256" then all places where there is "md5" replace with "scram-sha-256". "Scram-SHA-256" is a type of encryption for passwords.

Finally on your host machine connect to your database with this command:

psql -h localhost name_of_your_DB

I will ask you for your password and then you can check with /d that it is your database here is what it should look like:

```
tivollij@pc-dg-035-07:~$ psql -h localhost jarod_tivollier
Password for user tivollij:
psql (13.11 (Debian 13.11-0+deb11u1), server 13.9 (Debian 13.9-0+deb11u1))
SSL connection (protocol: TLSv1.3, cipher: TLS_AES_256_GCM_SHA384, bits: 256, compression: off)
Type "help" for help.

tivollij@jarod_tivollier=> \d
         List of relations
 Schema |  Name  | Type  |  Owner
--------+--------+-------+----------
 public | simple | table | tivollij
(1 row)

tivollij@jarod_tivollier=> SELECT * FROM simple;
 un
----
  2
  5
(2 rows)
```

And if you want you can see how your password is encrypted by displaying a hidden table of PostgreSQL by typing this command:

SELECT * FROM pg_shadow;

And you will get this:

```
jarod_tivollier=# SELECT * FROM pg_shadow;
 usename  | usesysid | usecreatedb | usesuper | userepl | usebypassrls |
        passwd                                                        | valuntil | useconfig
----------+----------+-------------+----------+---------+--------------+-------------------------------------------------------
-----------------------------------------------------------------------------------+----------+-----------
 postgres |       10 | t           | t        | t       | t            |
                                                                                   |          |
 tivollij |    16389 | t           | t        | f       | f            | SCRAM-SHA-256$4096:3P72PX9LOkj31m2VboWZDw==$xpdfP9C3PzJ
PWBvRC5bfTKfBydPjDf6IxxRM7hufFMs=:/SVJGFxHLyOj93dJHBpHek54NVPHDE2SJWq+Li2ChcY= |          |
(2 rows)
```

Step 6: PHP INSTALLATION

PHP is an "extension" for HTML that allows you to write scripts to execute specific things on a website.

To install PHP run this command:

apt-get install php (by being on the root account)

Always to know if it is well installed run this command:

systemctl status php

Optional Step 3: PHP TEST

To know if PHP is installed we will create a file in .php for that, type this command:

cat > info.php (create your "info.php name file")

Then:

nano info.php (allows you to edit this file)

And finally write these lines in your file:

```
<?php
phpinfo();19
phpinfo(INFO_MODULES);
?>
```

Then move this file to the folder where all your pages stored on your Apache server localhost /var/www/html/ are located using this command:

mv info.php /var/www/html/

Which will now allow access through this URL on your non-virtual machine
http://localhost:8080/info.php
it will open the default PHP page.

Step 7: SECURITY CHECK

To be able to do security checks it is enough to execute 2 commands which are:

apt upgrade
apt update

"apt upgrade" checks if updates are needed and "apt update" updates are found by "apt
upgrade".

```
root@server-tivollij:~# apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
root@server-tivollij:~# apt update
Get:1 http://deb.debian.org/debian bullseye InRelease [116 kB]
Get:2 http://security.debian.org/debian-security bullseye-security InRelease [48.4 kB]
Get:3 http://deb.debian.org/debian bullseye-updates InRelease [44.1 kB]
Get:4 http://security.debian.org/debian-security bullseye-security/main Sources [201 kB]
Get:5 http://deb.debian.org/debian bullseye/main Sources [8,637 kB]
Get:6 http://security.debian.org/debian-security bullseye-security/main amd64 Packages [245 kB]
Get:7 http://security.debian.org/debian-security bullseye-security/main Translation-en [161 kB]
Get:8 http://deb.debian.org/debian bullseye-updates/main Sources.diff/Index [18.5 kB]
Get:9 http://deb.debian.org/debian bullseye-updates/main amd64 Packages.diff/Index [18.5 kB]
Get:10 http://deb.debian.org/debian bullseye-updates/main Translation-en.diff/Index [7,239 B]
Get:11 http://deb.debian.org/debian bullseye-updates/main Sources T-2023-05-24-2006.01-F-2023-05-24-2006.01.pdiff [547 B]
Get:11 http://deb.debian.org/debian bullseye-updates/main Sources T-2023-05-24-2006.01-F-2023-05-24-2006.01.pdiff [547 B]
Get:12 http://deb.debian.org/debian bullseye-updates/main amd64 Packages T-2023-05-24-2006.01-F-2023-05-24-2006.01.pdiff [362 B]
Get:12 http://deb.debian.org/debian bullseye-updates/main amd64 Packages T-2023-05-24-2006.01-F-2023-05-24-2006.01.pdiff [362 B]
Get:13 http://deb.debian.org/debian bullseye-updates/main Translation-en T-2023-05-24-2006.01-F-2023-05-24-2006.01.pdiff [355 B]
Get:13 http://deb.debian.org/debian bullseye-updates/main Translation-en T-2023-05-24-2006.01-F-2023-05-24-2006.01.pdiff [355 B]
Get:14 http://deb.debian.org/debian bullseye/main amd64 Packages [8,183 kB]
Get:15 http://deb.debian.org/debian bullseye/main Translation-en [6,240 kB]
Fetched 23.9 MB in 4s (6,257 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
35 packages can be upgraded. Run 'apt list --upgradable' to see them.
N: Repository 'http://deb.debian.org/debian bullseye InRelease' changed its 'Version' value from '11.6' to '11.7'
```

Optional Step 4: STORAGE

To see how many spaces are left for your virtual machine you can run this command:

df -k

And you will get this:

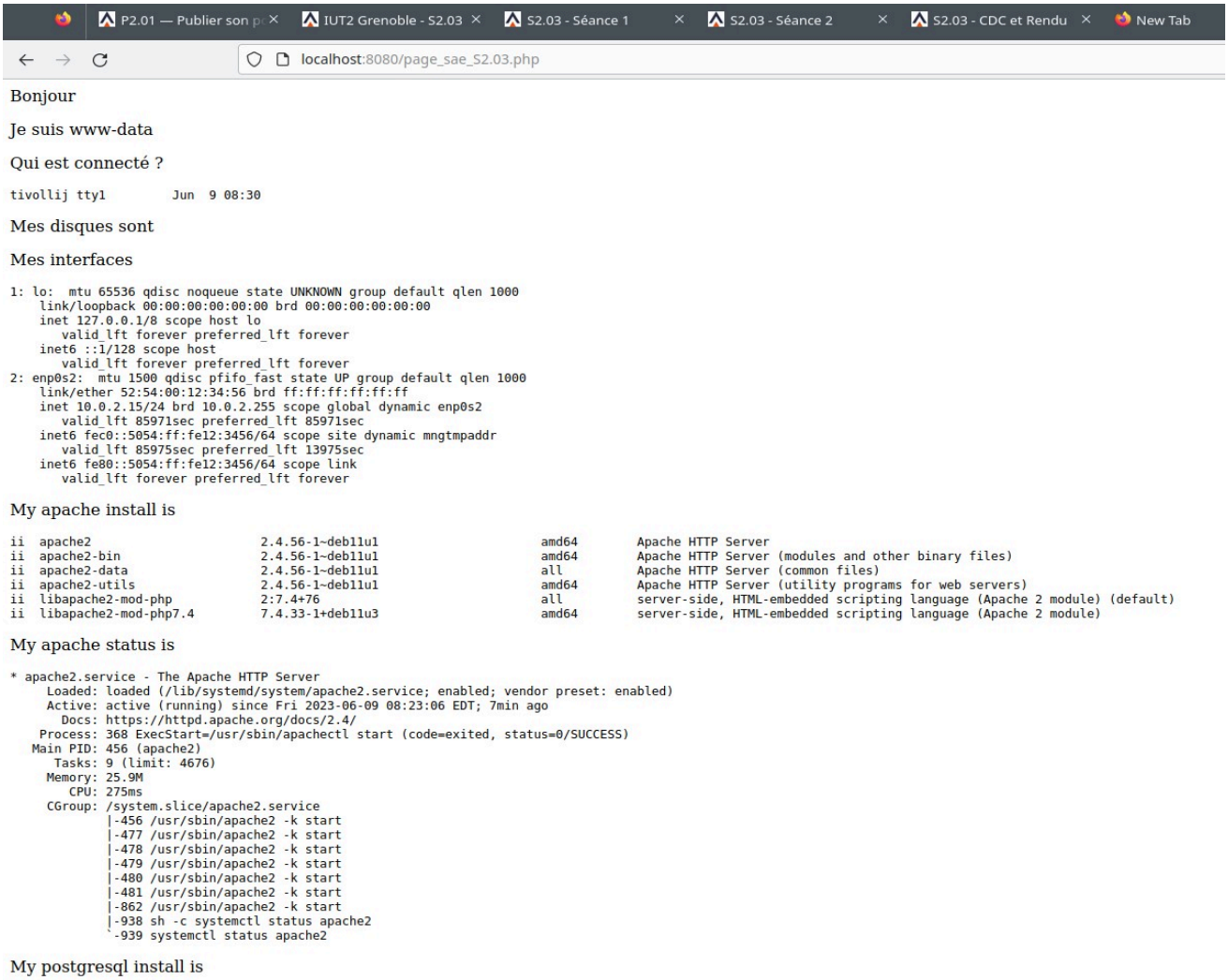
```
tivollij@server-tivollij:~$ df -k
Filesystem     1K-blocks    Used Available Use% Mounted on
udev             1995196       0   1995196   0% /dev
tmpfs             402612     488    402124   1% /run
/dev/sda1        3067812 1726328   1165460  60% /
tmpfs            2013040      16   2013024   1% /dev/shm
tmpfs               5120       0      5120   0% /run/lock
tmpfs             402608       0    402608   0% /run/user/1000
```

With the remaining space of all your disks partitions.

Optional Step 5: ALL SERVER INFORMATION

If you want to access all your server information whether php, PostgreSQL, SSH and well you can thanks to php for this you will have to create a PHP file and copy it to **/var/www/html/**

For my part I had a file that did this so here's what it's supposed to show you:



THE END