TUS

Topic 4
Build a LAMP Server

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LAMP

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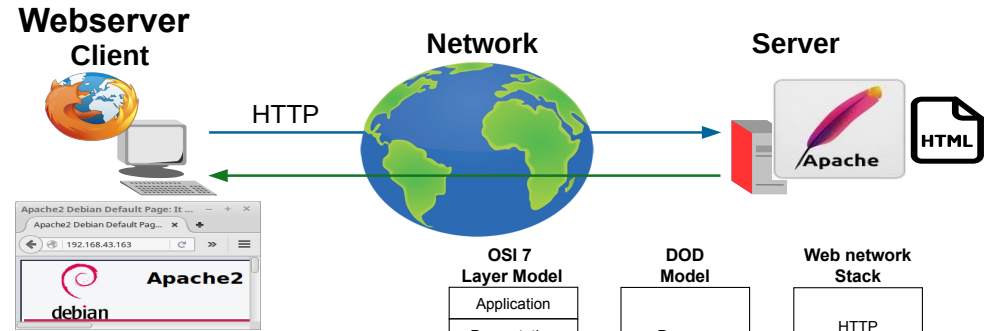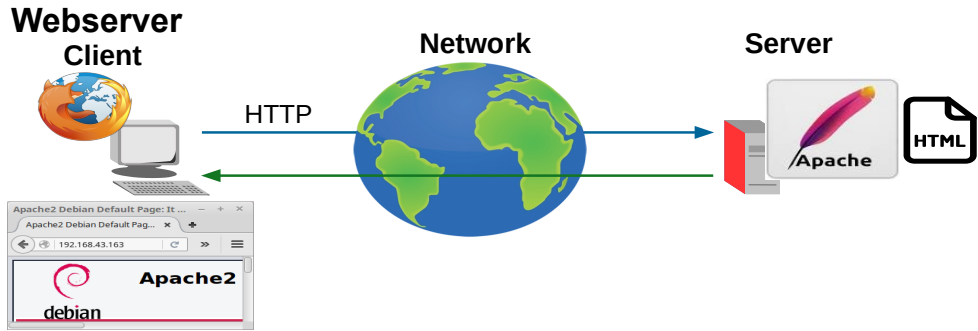

Learning Objectives

At the end of this topic the learner will be able to build a LAMP Server:

- Install and test Apache2 Webserver

- Install and test PHP

- Install and test MariaDB

- Install and test Perl
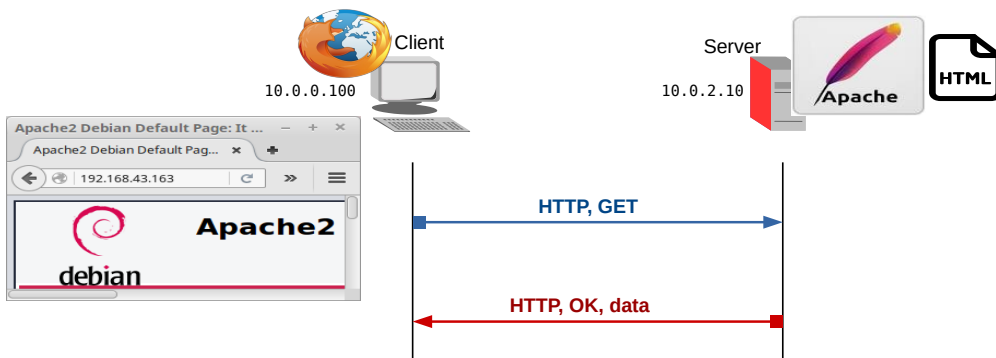
- Install and test Python

Webserver

Client
Network
Server

HTTP

Apache2 Debian Default Page: It ...
Apache2 Debian Default Pag... ×
192.168.43.163

Apache2
debian

TUS 5

Webserver

Client
Network
Server

HTTP

Apache2 Debian Default Page: It ...
Apache2 Debian Default Pag... ×
192.168.43.163

Apache2
debian

OSI 7 Layer Model	DOD Model	Web network Stack
Application		HTTP HTTPS
Presentation	Process	
Session		
Transport	Host to host	TCP (80, 443)
Network	Internet	IP / IPv6
Data Link	Network Access	Ethernet
Physical		

TUS 6

Hyper Text Transfer Protocol (HTTP)

Client
10.0.0.100

Server
10.0.2.10

Apache2 Debian Default Page: It ...
Apache2 Debian Default Pag... ×
192.168.43.163

Apache2
debian

HTTP, GET

HTTP, OK, data

TUS 7

HTTP GET

```
Internet Protocol Version 4, Src: 10.0.0.20, Dst: 10.0.2.10
Transmission Control Protocol,
   Src Port: 54117, Dst Port: 80, Seq: 1, Ack: 1, Len: 253
Hypertext Transfer Protocol
   GET / HTTP/1.0\r\n
   Host: 10.0.2.10\r\n
   Accept: text/html, text/plain, text/sgml, text/css, app/xhtml+xml, */*;q=0.01\r\n
   Accept-Encoding: gzip, compress, bzip2\r\n
   Accept-Language: en\r\n
   User-Agent: Lynx/2.8.9dev.1 libwww-FM/2.14 SSL-MM/1.4.1 GNUTLS/3.3.8\r\n   \r\n
```
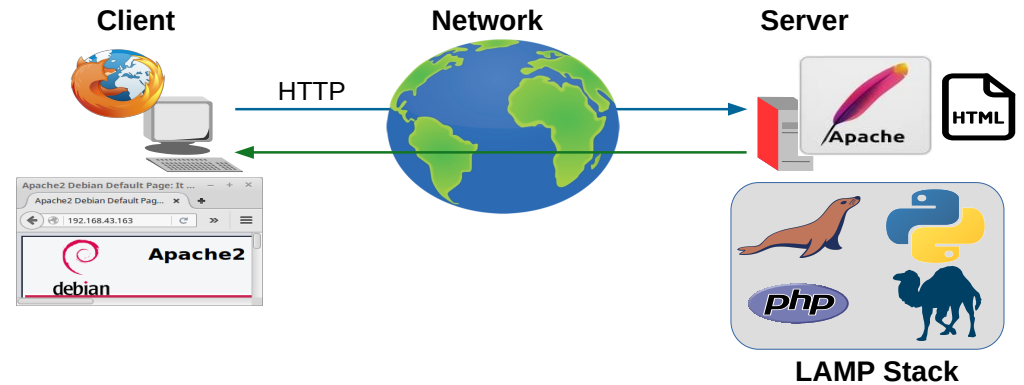
TUS 8

HTTP OK

```
Internet Protocol Version 4, Src: 10.0.2.10, Dst: 10.0.0.20
Transmission Control Protocol, Src Port: 80, Dst Port: 54117, Seq: 1, Ack: 254, Len: 500
Hypertext Transfer Protocol
    HTTP/1.1 200 OK\r\n
    Date: Fri, 26 Feb 2016 18:33:12 GMT\r\n
    Server: Apache/2.4.10 (Debian)\r\n
    Last-Modified: Fri, 26 Feb 2016 18:32:10 GMT\r\n
    ETag: "115-52cb08464d460"\r\n
    Accept-Ranges: bytes\r\n
    Content-Length: 277\r\n
    Connection: close\r\n
    \r\n
    Data (277 bytes)

0000  3c 68 74 6d 6c 3e 3c 62 6f 64 79 3e 3c 21 2d 2d   <html><body><!--
0010  20 67 65 6e 65 72 61 74 65 64 20 62 79 20 75 74    generated by ut
0020  69 6c 69 74 79 2e 70 79 3a 48 74 74 70 53 65 72   ility.py:HttpSer
0030  76 69 63 65 20 2d 2d 3e 0a 3c 68 31 3e 73 76 72   vice -->.<h1>svr
0040  31 20 77 65 62 20 73 65 72 76 65 72 3c 2f 68 31   1 web server</h1
0050  3e 0a 3c 70 3e 54 68 69 73 20 69 73 20 74 68 65   >.<p>This is the
0060  20 64 65 66 61 75 6c 74 20 77 65 62 20 70 61 67    default web pag
0070  65 20 66 6f 72 20 74 68 69 73 20 73 65 72 76 65   e for this serve
0080  72 2e 3c 2f 70 3e 0a 3c 70 3e 54 68 65 20 77 65   r.</p>.<p>The we
0090  62 20 73 65 72 76 65 72 20 73 6f 66 74 77 61 72   b server softwar
00a0  65 20 69 73 20 72 75 6e 6e 69 6e 67 20 62 75 74   e is running but
00b0  20 6e 6f 20 63 6f 6e 74 65 6e 74 20 68 61 73 20    no content has
00c0  62 65 65 6e 20 61 64 64 65 64 2c 20 79 65 74 2e   been added, yet.
00d0  3c 2f 70 3e 0a 3c 6c 69 3e 65 74 68 30 20 2d 20   </p>.<li>eth0 -
00e0  5b 27 31 30 2e 30 2e 32 2e 31 30 2f 32 34 27 2c   ['10.0.2.10/24',
00f0  20 27 32 30 30 31 3a 32 3a 3a 31 30 2f 36 34 27    '2001:2::10/64'
0100  5d 3c 2f 6c 69 3e 0a 3c 2f 62 6f 64 79 3e 3c 2f   ]</li>.</body></
0110  68 74 6d 6c 3e                                     html>
```
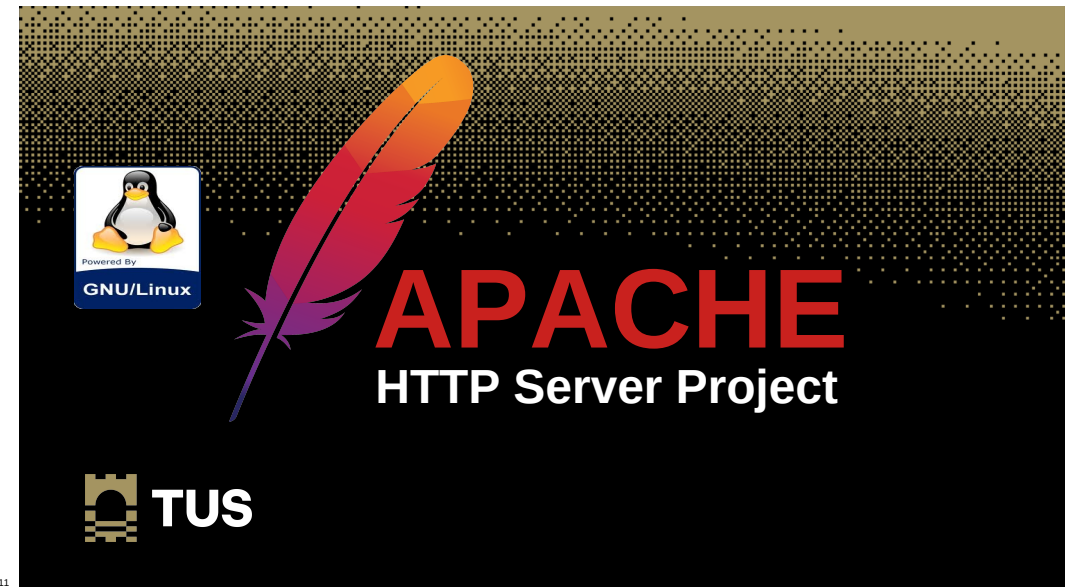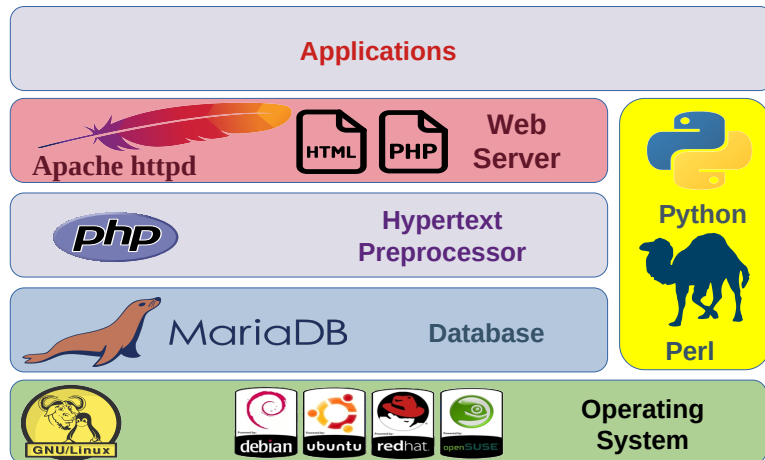

Webserver

- Supporting services and applications

Client   **Network**   **Server**

HTTP

LAMP Stack

The LAMP Solution Stack

Applications

Apache httpd HTML PHP **Web Server**

Python

php **Hypertext Preprocessor**

MariaDB **Database**

Perl

GNU/Linux debian ubuntu redhat openSUSE **Operating System**

APACHE
HTTP Server Project

Powered By GNU/Linux

Install Apache

- The Apache HTTP Server is a free and open-source cross-platform web server software.
- The vast majority of Apache HTTP Server instances run on a GNU/Linux distribution and Apache is the world's most popular webserver as well as the first webserver to serve more than 100 million websites.
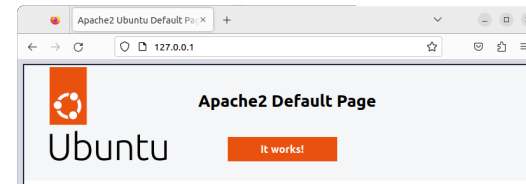

Install Apache

- Install Apache and check

```
~$ sudo apt install -y apache2

~$ cd /var/www/html

/var/www/html$ ls
index.html
```

- Browse from another device

Install Apache

- Create HTML index page to test

```
/var/www/html$ mv index.html index.html.old

/var/www/html$ sudo vi index.html
<HTML>
  <HEAD>
    <TITLE>Hello World</TITLE>
  </HEAD>
  <BODY>
    Hello World, Apache2 HTML here
  </BODY>
</HTML>
:wq!
```
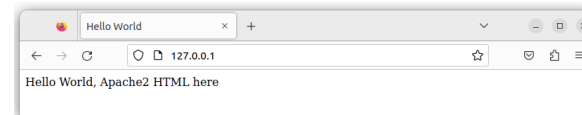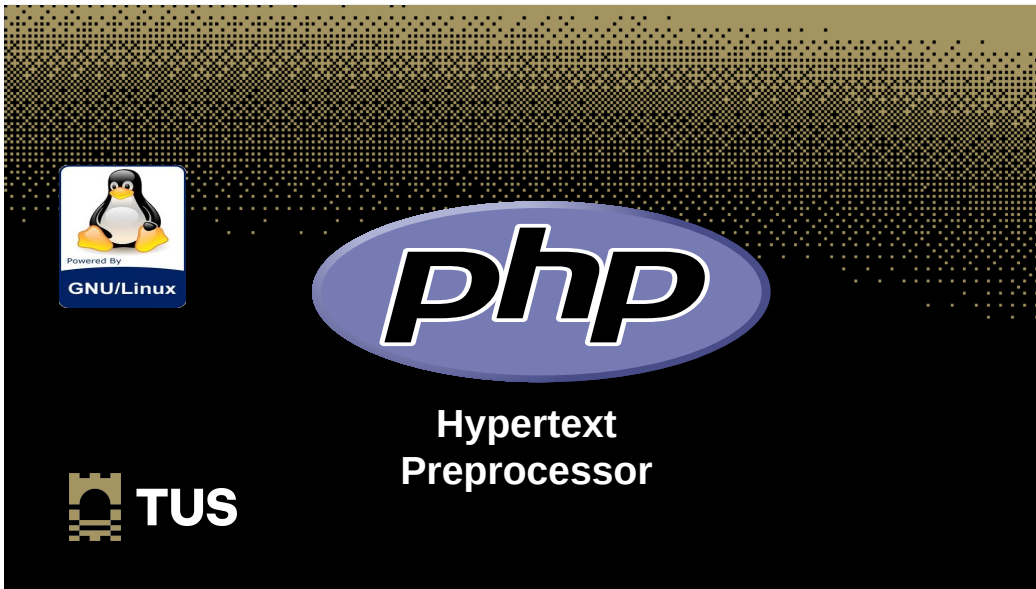

Install Apache

- Change ownership and mode

```
/var/www/html$ sudo chown ada:www-data index.html

/var/www/html$ sudo chmod 770 index.html

/var/www/html$ ls -la
drwxr-xr-x 2 root      root      4096 Aug 25 14:12 .
drwxr-xr-x 2 root      root      4096 Aug 25 00:04 ..
-rwxr-xr-x 2 ada       www-data    90 Aug 25 13:53 index.html
```


Hello World, Apache2 HTML here

Hypertext Preprocessor (PHP)

- A general-purpose scripting language geared towards web development.

- PHP code is usually processed on a web server by a PHP interpreter implemented as a module, a daemon or as a Common Gateway Interface (CGI) executable.

- On a web server, the result of the interpreted and executed PHP code – which may be any type of data, such as generated HTML or binary image data – would form the whole or part of an HTTP response. Various web template systems, web content management systems, and web frameworks exist which can be employed to orchestrate or facilitate the generation of that response.

Install PHP

- Install PHP and check

```
~$ sudo apt install -y php

~$ cd /var/www/html

/var/www/html$ sudo rm index.html

/var/www/html$ sudo vi index.php
<?php
echo "hello world";
phpinfo( );
?>
:wq!

/var/www/html$ sudo systemctl restart apache2
```

Install PHP

PHP Simple Example

- This is a simple calculator that demonstrates the interaction between HTML and PHP
- Copy the files to the Apache root

```
~$ ls /var/www/html
images  calculator.php

~$ ls /var/www/html/images
tus_logo.png


~$ sudo chown -R ada:www-data /var/www/html

~$ sudo chmod -R 770 /var/www/html
```

PHP Simple Example

- HTML part of the file

```
/var/www/html$ cat calculator.php

<TITLE>My Simple Calculator</TITLE>
<HEAD></HEAD>

<BODY style="background-color:white;font-family:arial;color:black;">
<IMG SRC="images/tus_logo.png" alt="TUS logo">
<BR>
<H2>My Simple Calculator</H2>

<FORM action="" method="post">
<LABEL>Enter Num1:</LABEL>
<INPUT type="text" name="num1" /><BR>
<LABEL>Enter Num2:</LABEL>
<INPUT type="text" name="num2" /><BR><BR>
<INPUT  type="submit" name="btn_submit" value="ADD">
</FORM>
```

PHP Simple Example

- This part of the file is the PHP piece.
- The program is waiting for the user to press the button.
- When this event happens the numbers are extracted from the HTML form, added and the total printed.

```php
<?php

    if(isset($_POST['btn_submit'])){ // is variable set & not NULL //
        $num1 = $_POST['num1'];      // assign box 1 value to $num1 //
        $num2 = $_POST['num2'];      // assign box 2 value to $num2 //
        $total =  $num1 + $num2;     // add and assign to $total //
        print ("<P><B>The total value is: " . $total . "</B></P>");
    }

?>

</BODY>
</HTML>
```

PHP Simple Example

- Run the program
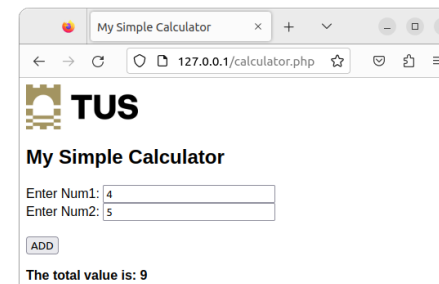
Relational Database Management System

- An RDBMS is a database that support the organisation of data.

- One of the original RSBMS is MySQL which uses the Structured Query Language to query the database.

- MariaDB is an improved fork of MySQL that offers data processing capabilities for both small and enterprise tasks with numerous inbuilt powerful features, security and performance improvements over MySQL.

Install `MariaDB`

- Install MariaDB

```
~$ sudo apt install -y mariadb-server mariadb-client php-mysql

~$ sudo systemctl restart apache2

~$ sudo mysql_secure_installation

Enter current password for root (Enter for none): <Enter>
Set root password? [Y/n] Y
New Password: rootpass           # Remember this password
Re-enter new Password: rootpass
Remove anonymous users? [Y/n] Y
Disallow root login remotely? [Y/n] Y
Remove test database and access to it? [Y/n] Y
Reload privilege tables now? [Y/n] Y

Thanks for using MariaDB!
```

Install `MariaDB`

- Check the MariaDB installation

```
~$ mysql --user=root --password
Enter password: rootpass
MariaDB [(none)]>

> CREATE USER admin@localhost IDENTIFIED BY 'admpass';
Query OK, 0 rows affected (0.002 sec)
> GRANT ALL PRIVILEGES ON *.* TO admin@localhost;
Query OK, 0 rows affected (0.002 sec)

> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0.002 sec)

> EXIT;
```

Database Administration

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phpMyAdmin

- A free and open source administration tool for MariaDB and MySQL.
- It is a portable web application written primarily in PHP.
- One of the most popular MariaDB/MySQL administration tools, especially for web hosting services.

Install `phpMyAdmin`

- Install phpMyAdmin

```
~$ sudo apt install -y phpmyadmin

[*] Apache2
[ ] lighttpd      <ok>
```

```
Configure database for phpmyadmin with dbconfig-common?

    <Yes>        <No>

MySQL application password for phpmyadmin: myadmpass
Password confirmation: myadmpass
```

Enable MySQL Improved Extension

- Enable the PHP `MySQLi` extension
- Soft link from `phpmyadmin`
- Change ownership and permissions
- Restart `apache2` to effect changes

```
~$ sudo phpenmod mysqli

~$ sudo ln -s /usr/share/phpmyadmin /var/www/html

~$ sudo chown -R ada:www-data /var/www/html

~$ sudo chmod -R 770 /var/www/html

~$ sudo systemctl restart apache2
```

Check `phpMyAdmin`

- From browser on Raspberry Pi

`http://127.0.0.1/phpmyadmin`
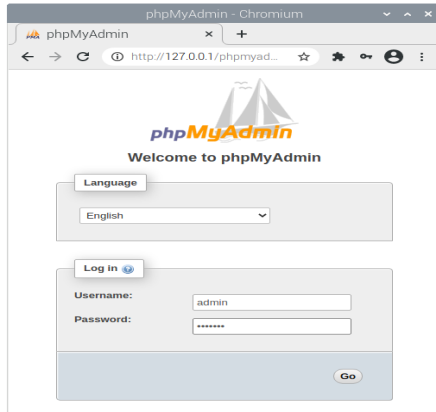
`admin`
`admpass`

Check `phpMyAdmin`

- From browser on Raspberry Pi
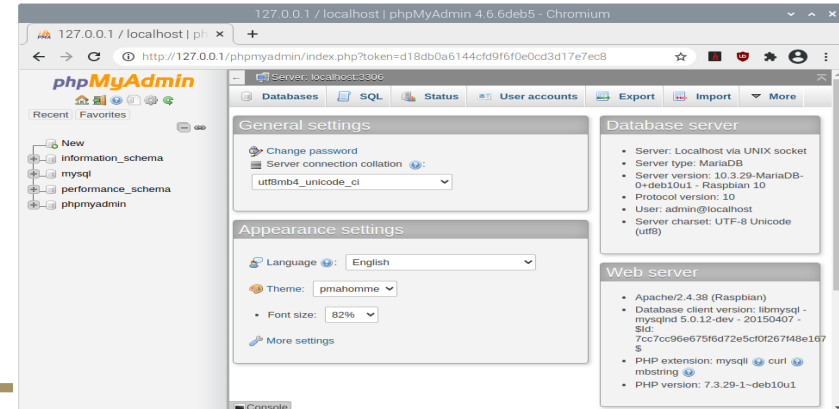
Perl and Python

Perl and Python

- Practical Extraction and Reporting Language (Perl)
  - Perl is a high-level, general-purpose, interpreted, dynamic programming language.
- Python
  - Python is also an interpreted high-level general-purpose programming language.

Perl

```
~$ sudo apt install perl

~$ perl --version

This is perl 5, version 28, subversion 1 (v5.28.1) built for arm-linux-
gnueabihf-thread-multi-64int (with 61 registered patches, see perl -V for more
detail)

Copyright 1987-2018, Larry Wall

Perl may be copied only under the terms of either the Artistic License or the
GNU General Public License, which may be found in the Perl 5 source kit.

Complete documentation for Perl, including FAQ lists, should be found on this
system using "man perl" or "perldoc perl".  If you have access to the
Internet, point your browser at http://www.perl.org/, the Perl Home Page.
```

Python3

```
~$ sudo apt install python3 python3-pip idle3 python3.10-venv

~$ python3 --version
Python 3.7.3

~$ python3 -m pip --version
pip 18.1 from /usr/lib/python3/dist-packages/pip (python 3.7)

~$ python3 -m pip install --upgrade pip
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting pip
  Downloading  100% |████████████████████████████████| 1.6MB 112kB/s
Installing collected packages: pip
Successfully installed pip-21.2.4

~$ sudo apt install -y libmariadb3 libmariadb-dev
```
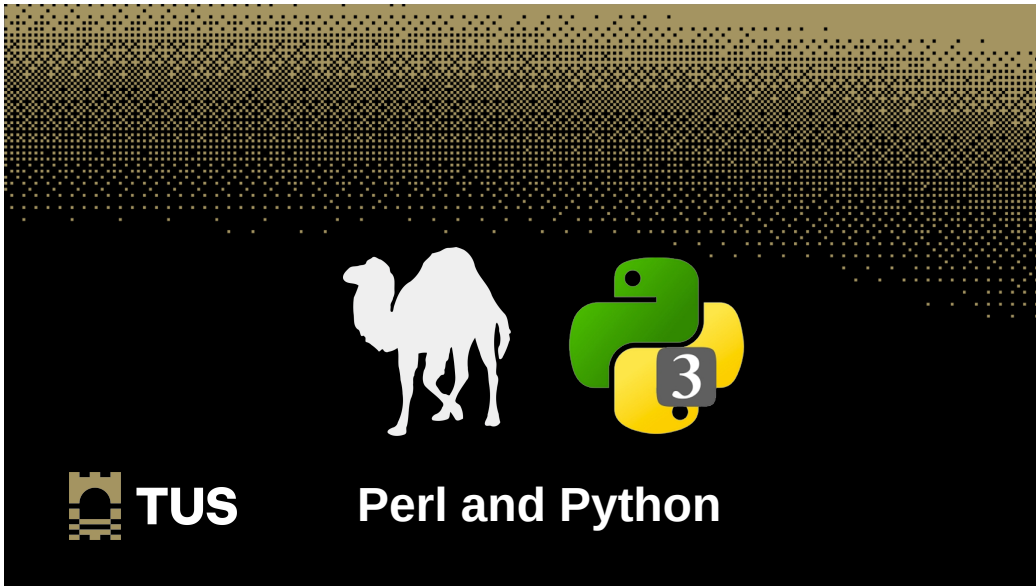
Python3

```
~$ python3 -m venv ~/.venv

~$ source ~/.venv/bin/activate

(.venv)~$ python3 -m pip install flask

(.venv)~$ python3 -m pip install mariadb

(.venv)~$ python3 -m pip install pyyaml
```

PyCalculator

```
PyCalculator
├── init.py
├── static
│   └── images
│       └── tus.png
└── templates
    ├── answer.html
    ├── calculator.html
    └── layout.html

3 directories, 5 files
```

```python
~$ cat init.py
from flask import Flask, render_template, request

# // Flask app //
app = Flask(__name__)

@app.route("/")
def index():
    """The calculator index page"""
    return render_template("calculator.html")


@app.route("/answer", methods=["GET", "POST"])
def answer():
    """The calculator answer page"""
    post_data = dict(request.form)
    num1, num2 = int(post_data["num1"]), int(post_data["num2"])
    num3 = num1 + num2
    data = (num1, num2, num3)
    return render_template("answer.html", data=data)

if __name__ == "__main__":
    app.run(debug=True)
```

PyCalculator

```
~$ cat layout.html
<TITLE>My Simple Calculator</TITLE>
<HEAD></HEAD>
<BODY style="background-color:white;font-family:arial;color:black;">
 <IMG SRC="{{ url_for('static', filename='images/tus.png') }}" alt="TUS">
 <BR>
 {% block content %}
 {% endblock %}
 </BODY>
</HTML>
```

```
~$ cat answer.html
{% extends "layout.html" %}
{% block content %}
<H1>My Simple Calculator</H1>
<H3>{{ data[0] }} + {{ data[1] }} = {{ data[2] }}</H3>
{% endblock %}
```

```
~$ cat calculator.html
{% extends "layout.html" %}
{% block content %}
<H1>My Simple Calculator</H1>
    <FORM action="/answer" method="POST" enctype="multipart/form-data">
    <P>Enter Num1: </td><td><input type = "text" name = "num1"></P>
    <P>Enter Num2: </td><td><input type = "text" name = "num2"></P>
    <P><INPUT type = "submit" value = "ADD" /></P>
    </FORM>
{% endblock %}
```


PyCalculator

```
~$ python3 PyCalculator/init.py
 * Serving Flask app 'init'
 * Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
 * Restarting with stat
 * Debugger is active!
 * Debugger PIN: 764-273-319

127.0.0.1 - - [16/Oct/2022 01:58:26] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [16/Oct/2022 01:58:26] "GET /static/images/tus_logo.jpg HTTP/1.1" 304 -
127.0.0.1 - - [16/Oct/2022 01:58:34] "POST /answer HTTP/1.1" 200 -
127.0.0.1 - - [16/Oct/2022 01:58:34] "GET /static/images/tus_logo.jpg HTTP/1.1" 304 -
```

PyCalculator
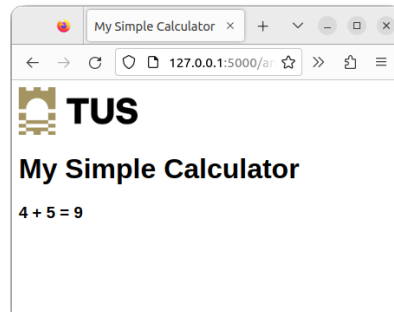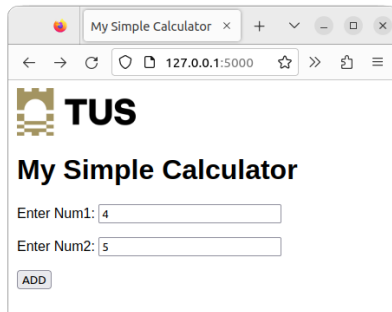
Laboratory #1

Build a LAMP Server

Laboratory – Install a LAMP Server

- Using either a Raspberry Pi or a GNU/Linux image from an Internet Cloud Provider build a full stack LAMP Server, include:
  - **Maria DB** Database
  - **Apache** Webserver
  - PHP
  - Perl
  - Python
- Install **phpMyAdmin** to administrate the database
- Build a simple database

Learning Objectives

- Install and test Apache2 Webserver ✓
- Install and test PHP ✓
- Install and test MariaDB ✓
- Install and test Perl ✓
- Install and test Python ✓

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Thank you

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