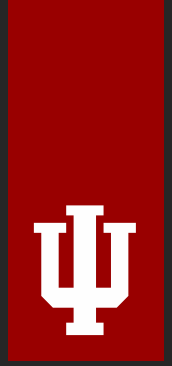


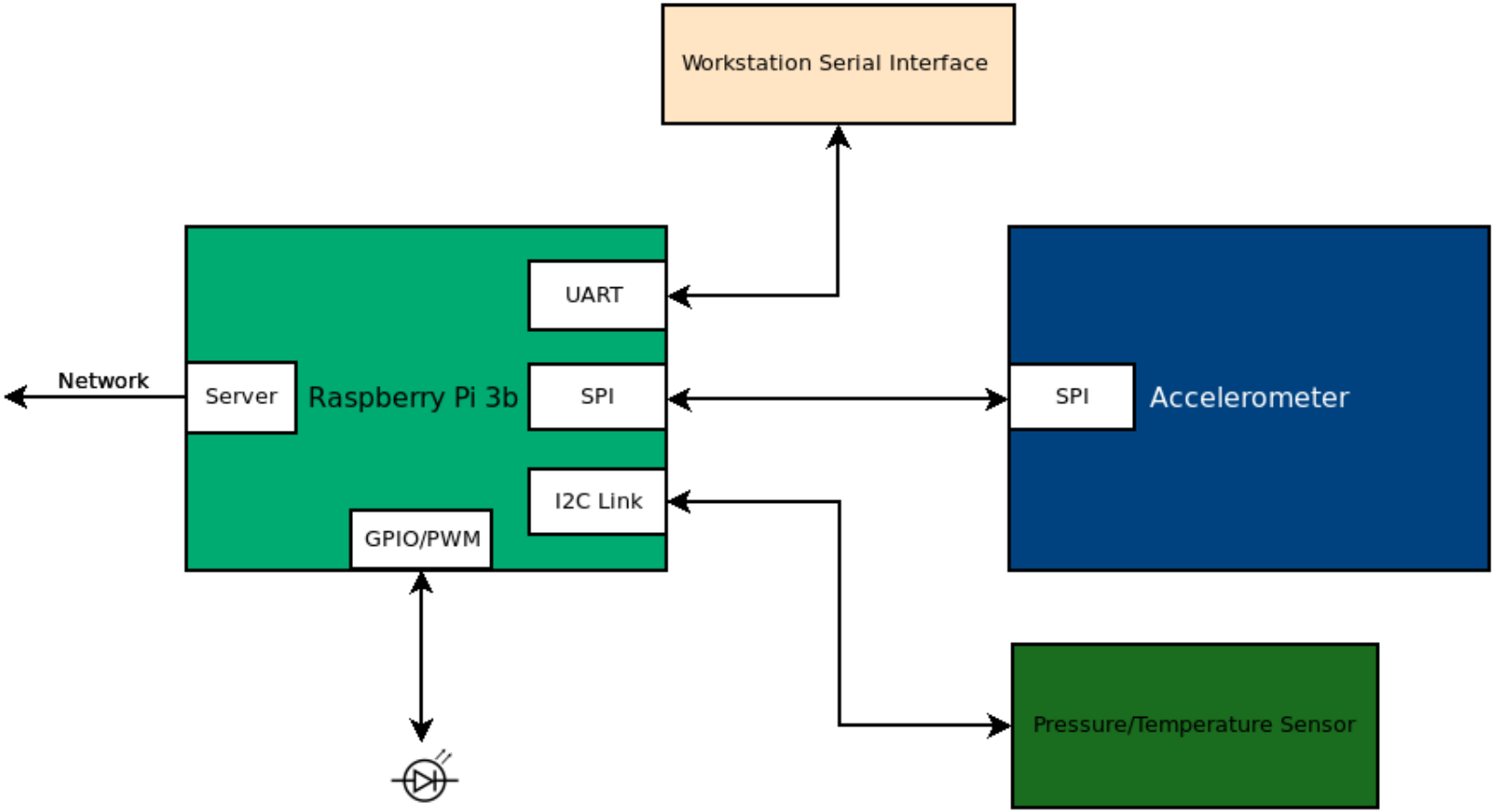
E210 Engineering Cyber-Physical Systems

Flask

Bryce Himebaugh

Weekly Focus	Reading	Monday	Wed	Lab
CPS Intro/UART		**1/10:** CPS Introduction	**1/12:** Pi Intro/UART Bus	**Project 0 Raspberry PI Setup**
I2C Bus		**1/17:** MLK Day	**1/19:** I2C Bus Overview	**Project 1 I2C Pressure/Temperature Sensor**
I2C and SPI Bus		**1/24:** Pressure Sensor	**1/26:** SPI Bus Overview	**Project 2 SPI Accelerometer**
SPI/Networking		**1/31:** Accelerometer	**2/2:** MQTT	**Project 3 MQTT Sensor Data Server**
Networking		**2/7:** GPIO/LED	**2/9:** Flask	**Project 4 Sensor LED Output**
Web Server		**2/14:** No Class	**2/16:** CPS Wrapup, Exam Review	**P5 Demultiplexer**
Evaluation		**2/21:** Exam 1	**2/23:** CE Intro/ Logic	**P6 ALU**

https://engr210.github.io/

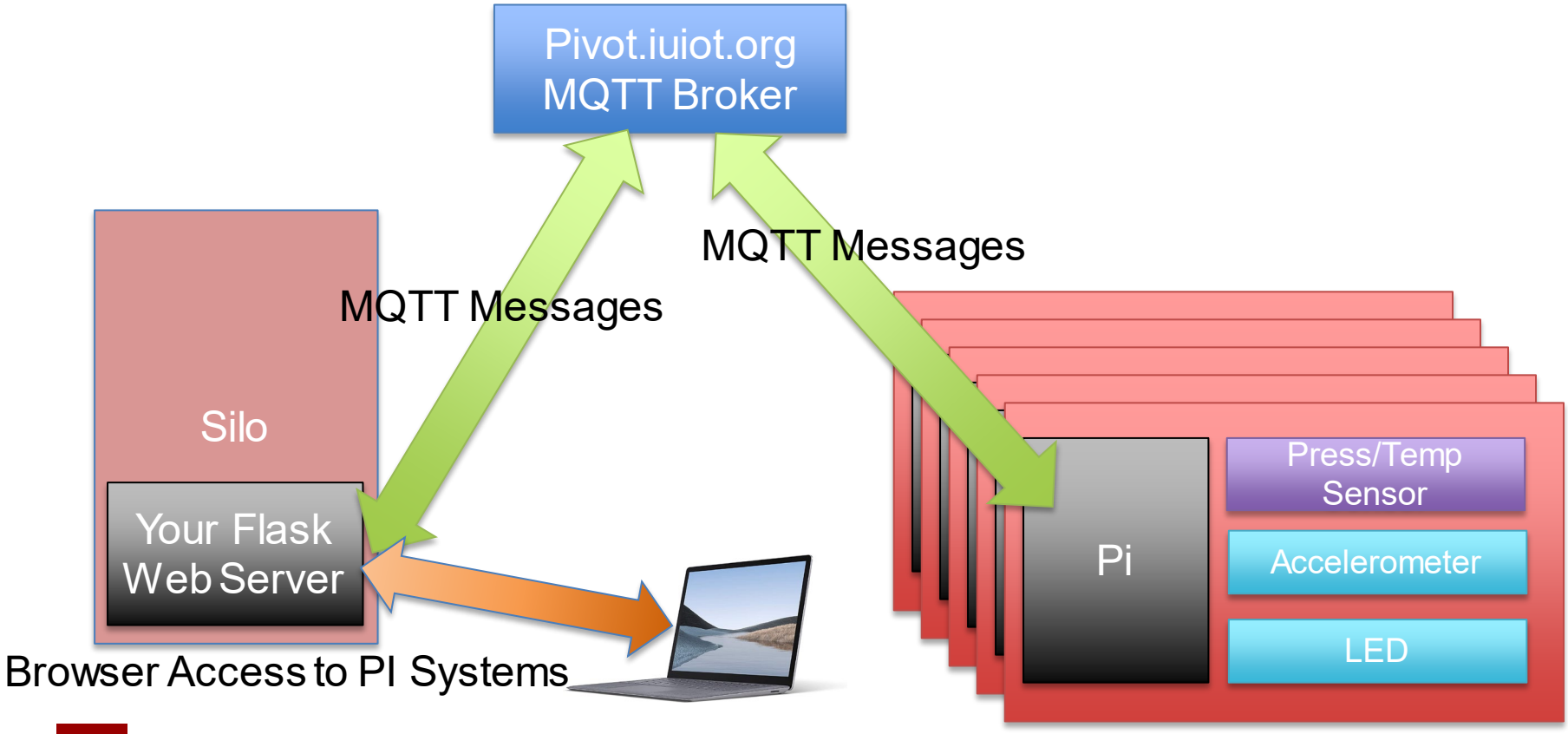

Workstation Serial Interface
UART
Network
Server
Raspberry Pi 3b
SPI
SPI
Accelerometer
I2C Link
GPIO/PWM
Pressure/Temperature Sensor

Flask Overview

Flask

1. Python Micro Web Framework
   - Minimalist compared to Django Framework
2. First Release in 2010
3. Hammer vs toolbox
4. Used in projects as the API …

System Architecture



Minimal Example

```
from flask import Flask
app = Flask(__name__)
@app.route('/')
def index():
    return 'Hello world'
if __name__ == '__main__':
    app.run(debug=True, port=55346, host='0.0.0.0')
```

```python
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```

Python Function Decorators

Functions

Python >>>

```
>>> def add_one(number):
...     return number + 1

>>> add_one(2)
3
```

https://realpython.com/primer-on-python-decorators/#functions

Functions can be Passed as Arguments

Python

```
def say_hello(name):
    return f"Hello {name}"

def be_awesome(name):
    return f"Yo {name}, together we are the awesomest!"

def greet_bob(greeter_func):
    return greeter_func("Bob")
```

Python >>>

```
>>> greet_bob(say_hello)
'Hello Bob'

>>> greet_bob(be_awesome)
'Yo Bob, together we are the awesomest!'
```

https://realpython.com/primer-on-python-decorators/#functions

Functions within Functions (Inner Functions)

Python

```
def parent():
    print("Printing from the parent() function")

    def first_child():
        print("Printing from the first_child() function")

    def second_child():
        print("Printing from the second_child() function")

    second_child()
    first_child()
```

Python Traceback

```
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'first_child' is not defined
```

first_child and second_child only exist inside of parent

Python >>>

```
>>> parent()
Printing from the parent() function
Printing from the second_child() function
Printing from the first_child() function
```

https://realpython.com/primer-on-python-decorators/#functions

Returning Functions

Python

```
def parent(num):
    def first_child():
        return "Hi, I am Emma"

    def second_child():
        return "Call me Liam"

    if num == 1:
        return first_child
    else:
        return second_child
```

Python

```
>>> first()
'Hi, I am Emma'

>>> second()
'Call me Liam'
```

Can call these functions like any other function

Python

```
>>> first = parent(1)
>>> second = parent(2)

>>> first
<function parent.<locals>.first_child at 0x7f599f1e2e18>

>>> second
<function parent.<locals>.second_child at 0x7f599dad5268>
```

Function Reference Returned

https://realpython.com/primer-on-python-decorators/#functions

Decorators

Python

```
def my_decorator(func):
    def wrapper():
        print("Something is happening before the function is called.")
        func()
        print("Something is happening after the function is called.")
    return wrapper

def say_whee():
    print("Whee!")

say_whee = my_decorator(say_whee)
```

Python

```
>>> say_whee()
Something is happening before the function is called.
Whee!
Something is happening after the function is called.
```

Decorators wrap the original function

https://realpython.com/primer-on-python-decorators/#functions

Dynamic Behavior

Python

```
from datetime import datetime

def not_during_the_night(func):
    def wrapper():
        if 7 <= datetime.now().hour < 22:
            func()
        else:
            pass  # Hush, the neighbors are asleep
    return wrapper

def say_whee():
    print("Whee!")

say_whee = not_during_the_night(say_whee)
```

When called after bedtime …

Python

```
>>> say_whee()
>>>
```

https://realpython.com/primer-on-python-decorators/#functions

@ symbol

Python

```
def my_decorator(func):
    def wrapper():
        print("Something is happening before the function is called.")
        func()
        print("Something is happening after the function is called.")
    return wrapper

@my_decorator
def say_whee():
    print("Whee!")
```

Same as say_whee = my_decorator(say_whee)

https://realpython.com/primer-on-python-decorators/#functions

Back to the Example …

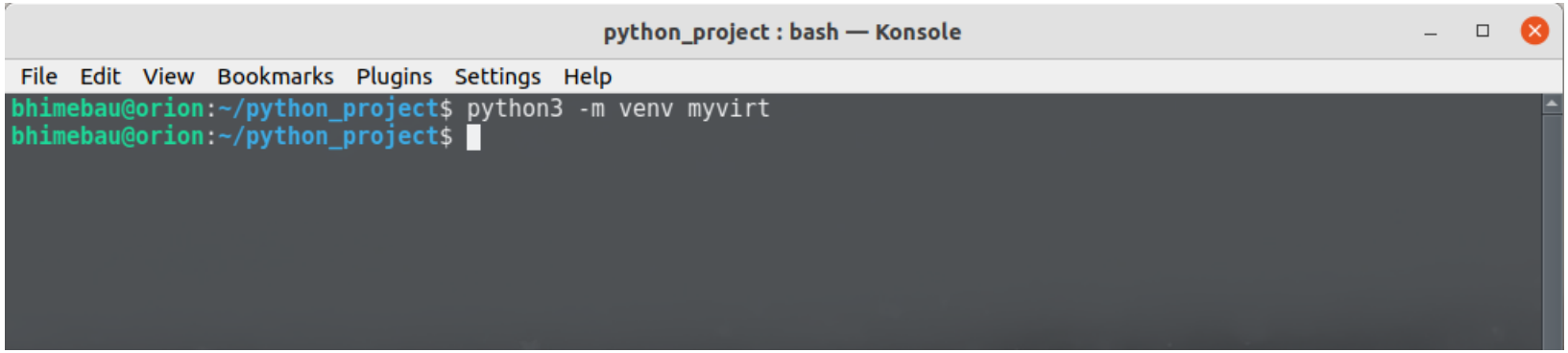
```python
from flask import Flask
app = Flask(__name__)
@app.route('/')
def index():
    return 'Hello world'
if __name__ == '__main__':
    app.run(debug=True, port=55346, host='0.0.0.0')
```

Python Virtual Environment

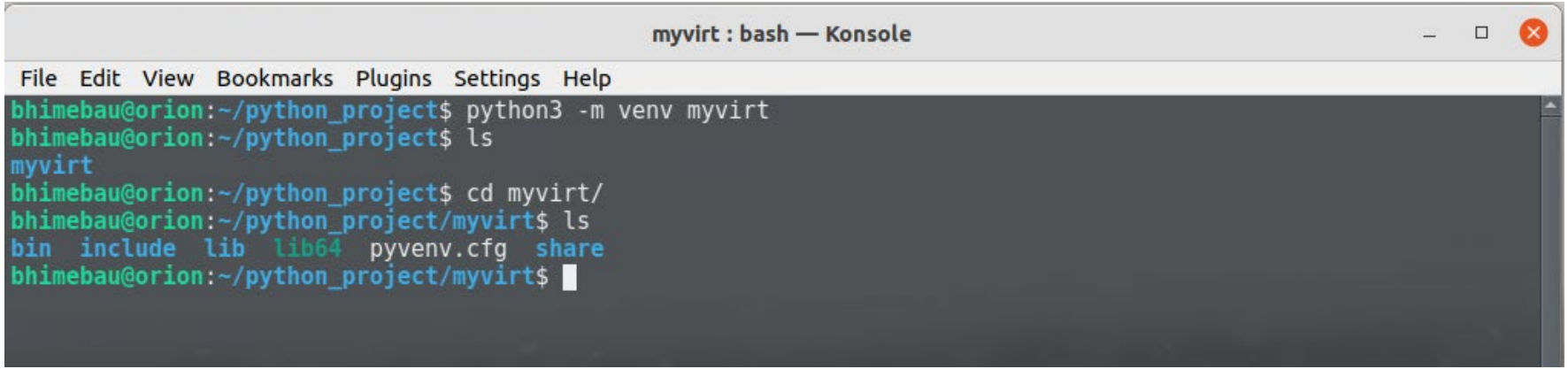
Python Virtual Environment

1. Used to isolate packages from the larger system
2. Python packages are installed for a given project rather than locally.
3. Uses pip3 to install packages

Example


python_project : bash — Konsole
File Edit View Bookmarks Plugins Settings Help
bhimebau@orion:~/python_project$ python3 -m venv myvirt
bhimebau@orion:~/python_project$

Adds python related infrastructure



Initiating the virtual environment

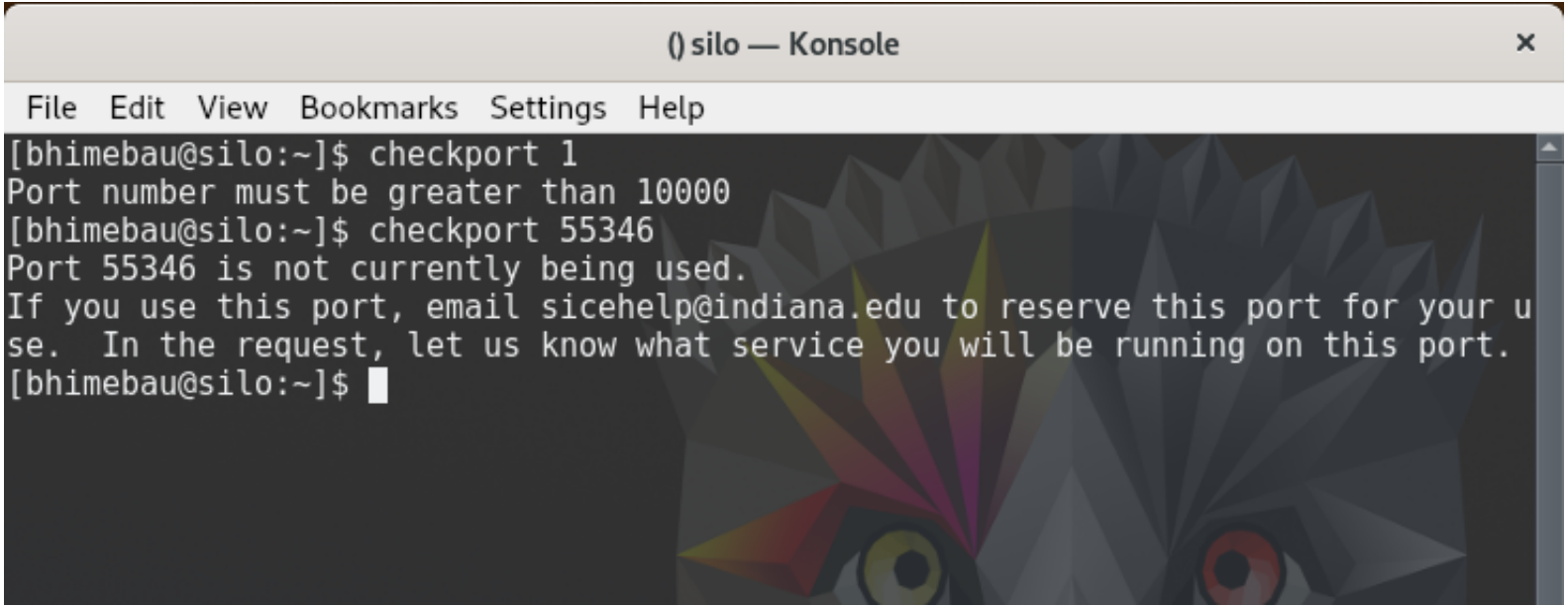
```
bhimebau@orion:~/python-venv$ ls
myvenv
bhimebau@orion:~/python-venv$ cd myvenv/
bhimebau@orion:~/python-venv/myvenv$ ls
bin  include  lib  lib64  pyvenv.cfg  share
bhimebau@orion:~/python-venv/myvenv$ cd bin/
bhimebau@orion:~/python-venv/myvenv/bin$ ls
activate      activate.fish  easy_install      pip   pip3.9  python3
activate.csh  Activate.ps1   easy_install-3.9  pip3  python  python3.9
bhimebau@orion:~/python-venv/myvenv/bin$ source activate
(myvenv) bhimebau@orion:~/python-venv/myvenv/bin$
```

Installing Packages

```
(myvenv) bhimebau@orion:~/python-venv$ pip3 install flask
Collecting flask
  Downloading Flask-2.0.2-py3-none-any.whl (95 kB)
     |████████████████████████████████| 95 kB 3.8 MB/s
Collecting itsdangerous>=2.0
  Downloading itsdangerous-2.0.1-py3-none-any.whl (18 kB)
Collecting Werkzeug>=2.0
  Downloading Werkzeug-2.0.3-py3-none-any.whl (289 kB)
     |████████████████████████████████| 289 kB 14.4 MB/s
Collecting click>=7.1.2
  Downloading click-8.0.3-py3-none-any.whl (97 kB)
     |████████████████████████████████| 97 kB 12.0 MB/s
Collecting Jinja2>=3.0
  Downloading Jinja2-3.0.3-py3-none-any.whl (133 kB)
     |████████████████████████████████| 133 kB 14.6 MB/s
Collecting MarkupSafe>=2.0
  Downloading MarkupSafe-2.0.1-cp39-cp39-manylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_12_x86_64.manylinu
x2010_x86_64.whl (30 kB)
Installing collected packages: MarkupSafe, Werkzeug, Jinja2, itsdangerous, click, flask
Successfully installed Jinja2-3.0.3 MarkupSafe-2.0.1 Werkzeug-2.0.3 click-8.0.3 flask-2.0.2 itsdangerous-2.0.1
(myvenv) bhimebau@orion:~/python-venv$
```

Running the Code on Silo

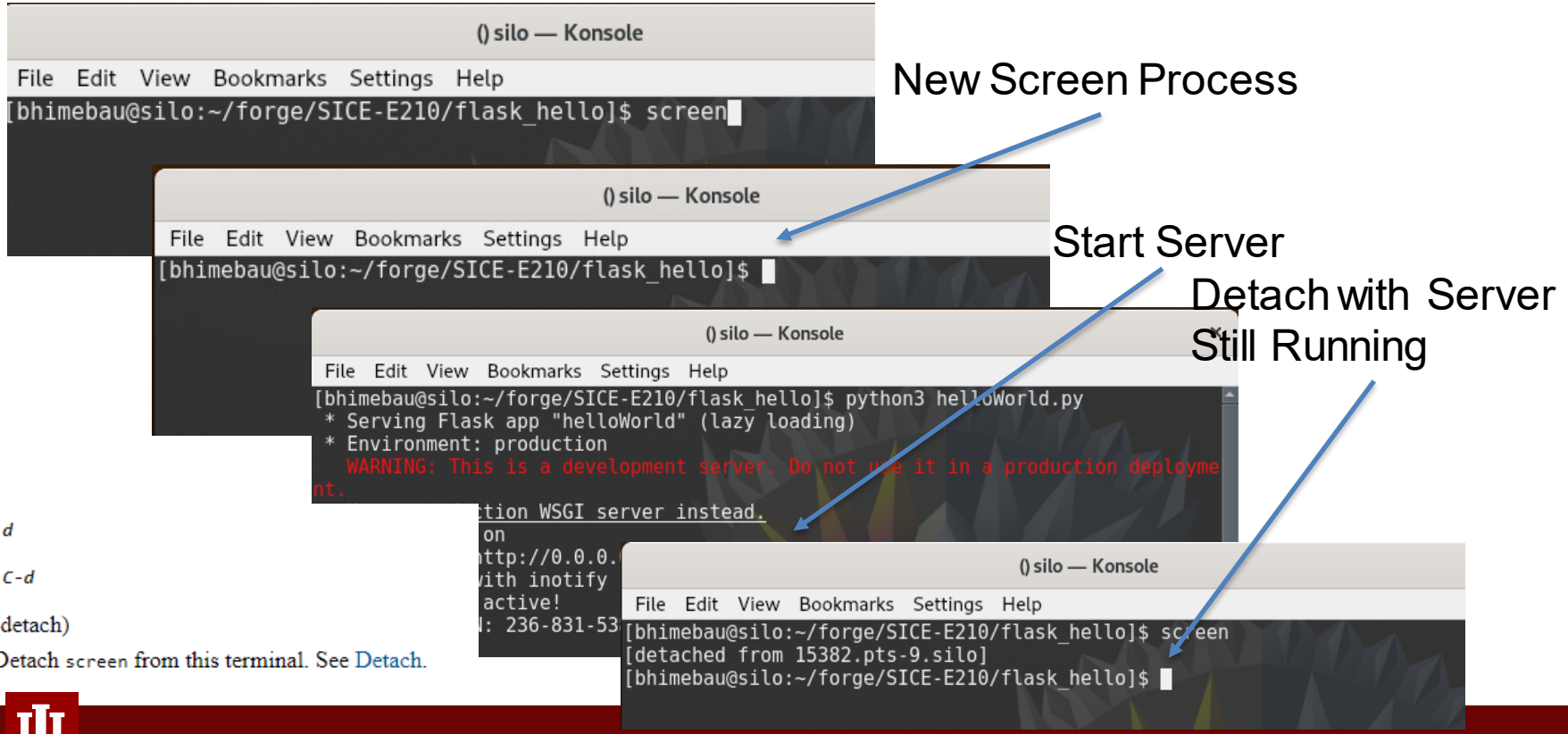
Find an Open Port

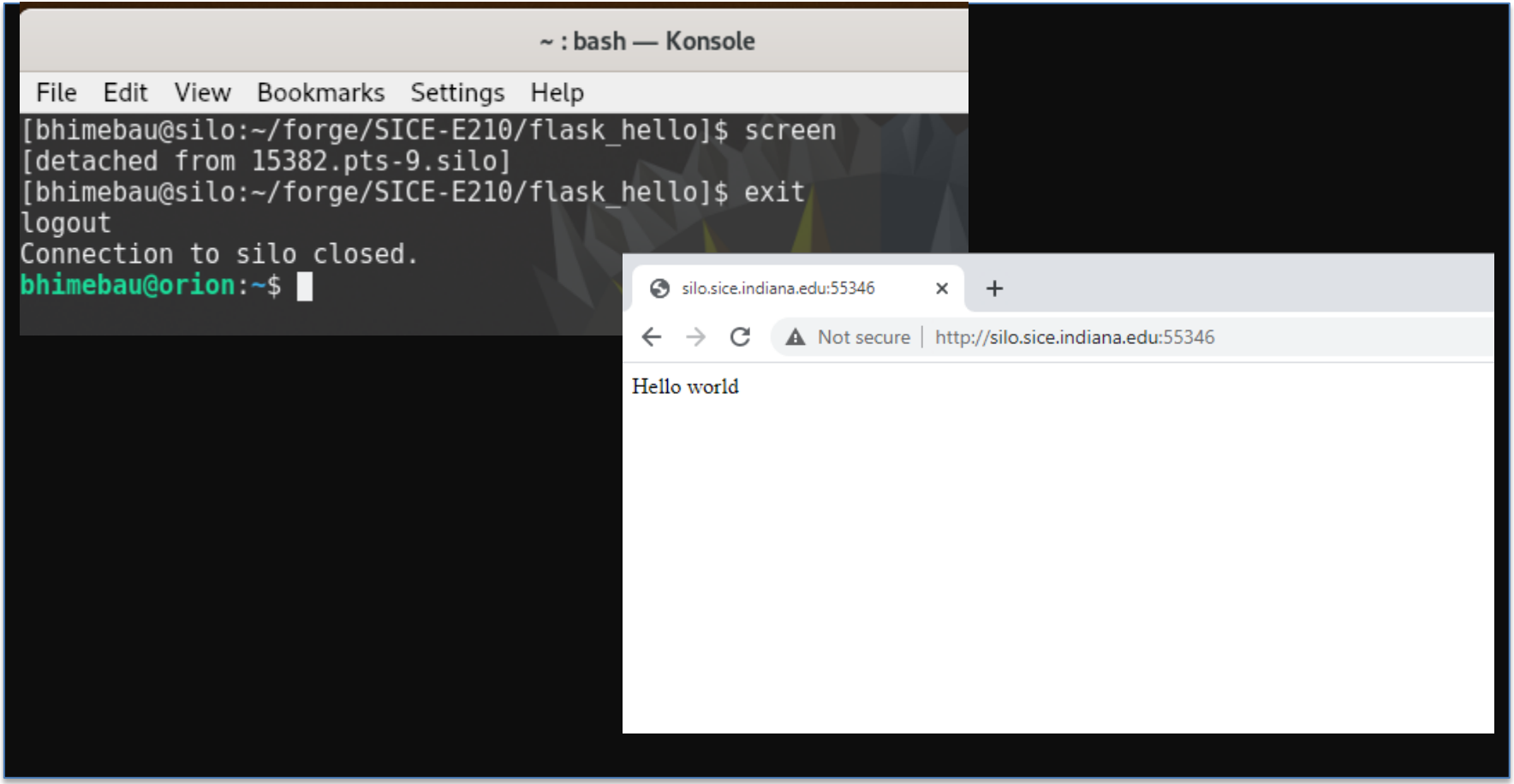


Screen Command

1. Versatile Linux Utility
2. Allows User Processes to Continue to Run after Terminal Closes
   - Detach and Reattach
3. Key Bindings: https://www.gnu.org/software/screen/manual/html_node/Default-Key-Bindings.html

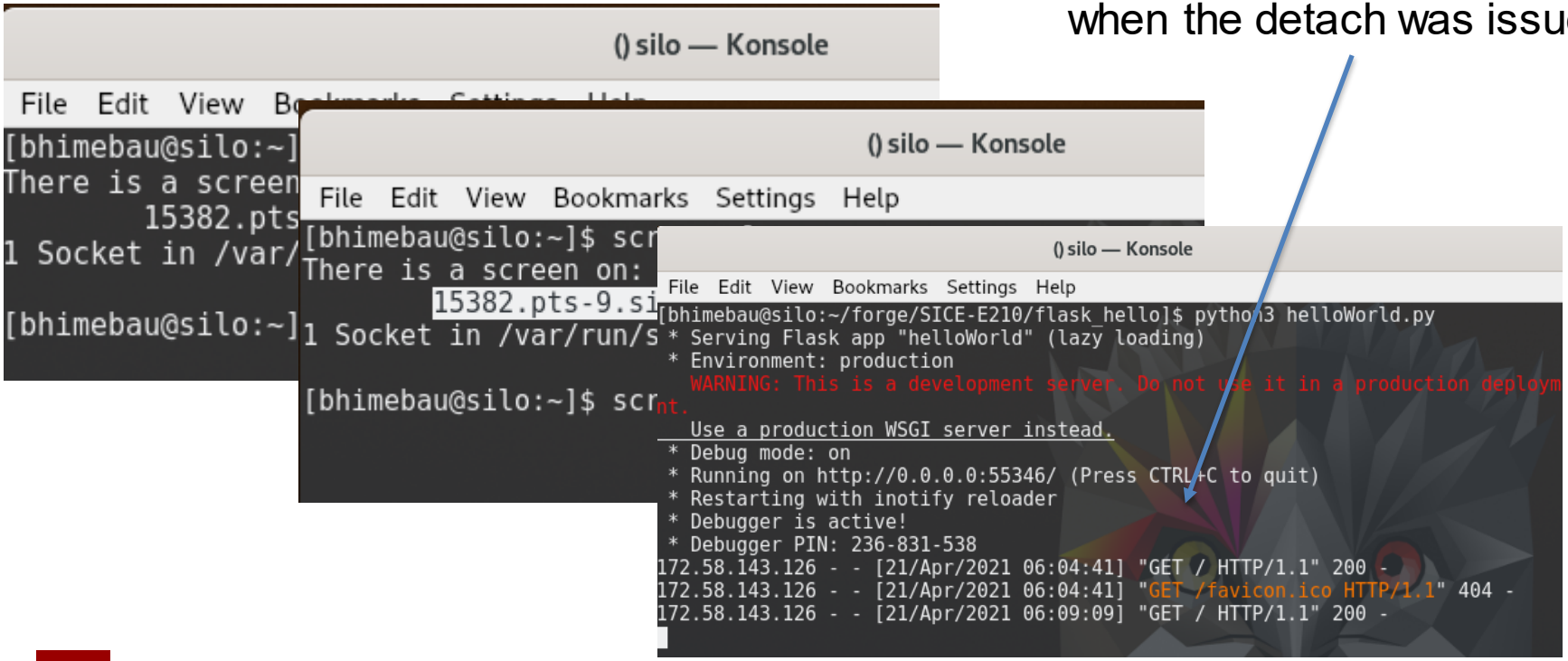
Running Screen



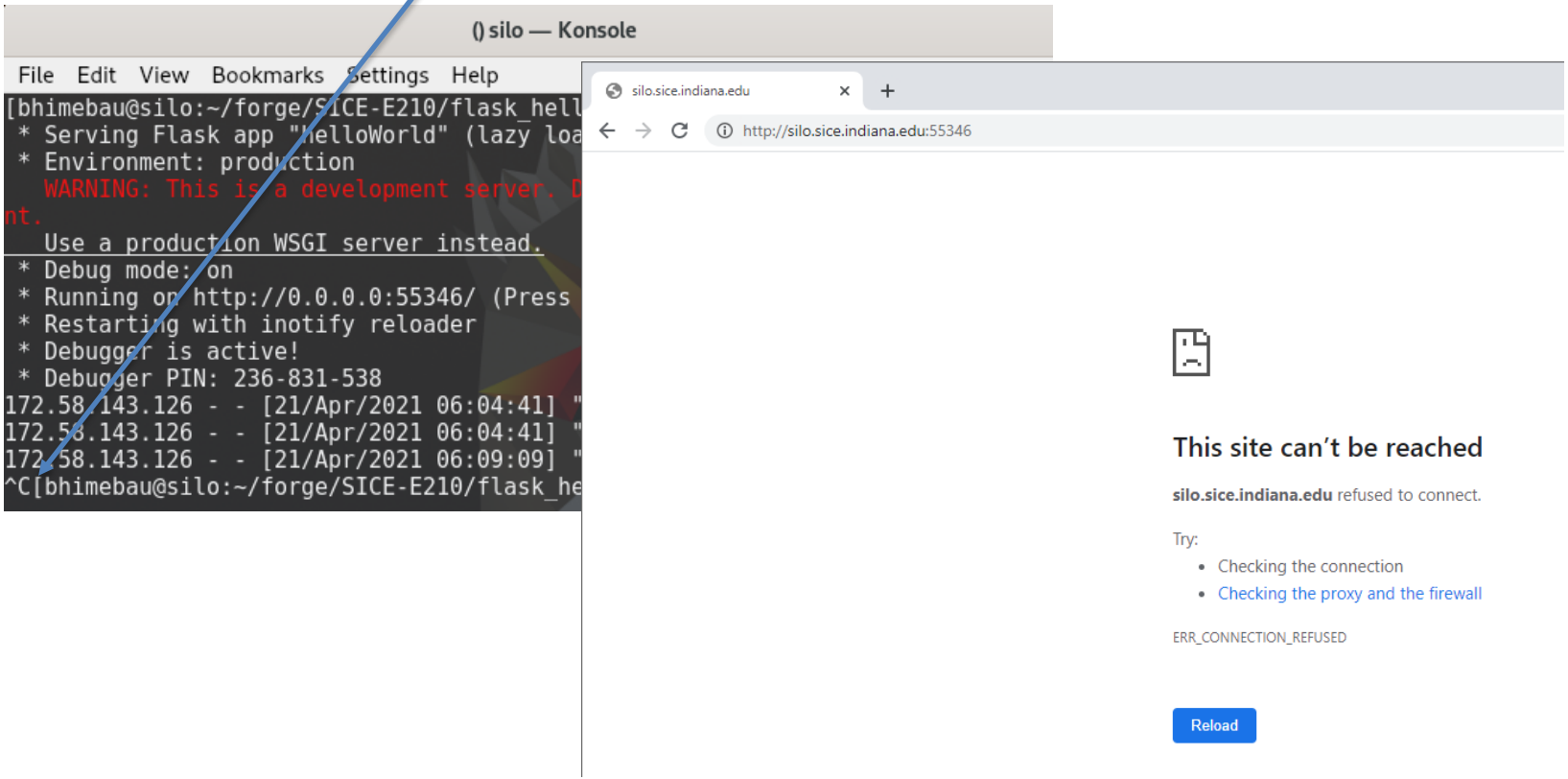

~ : bash — Konsole
File Edit View Bookmarks Settings Help
[bhimebau@silo:~/forge/SICE-E210/flask_hello]$ screen
[detached from 15382.pts-9.silo]
[bhimebau@silo:~/forge/SICE-E210/flask_hello]$ exit
logout
Connection to silo closed.
bhimebau@orion:~$
silo.sice.indiana.edu:55346
Not secure
http://silo.sice.indiana.edu:55346
Hello world

Reattaching

Right back where we left off when the detach was issued



CTRL-C to stop



System Architecture