

Лабораторная работа №5

Сделал: Дулис К.С студент АДЭУ-221

Проверил: Босенко Т.М.

## 1.1 Sudo update

```
to check for new updates run: sudo apt update
Last login: Wed Sep 18 10:30:11 2024 from 10.193.19.171
devops@devopsvm:~$ sudo apt-get update
[sudo] password for devops:
Hit:1 http://ru.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://ru.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:3 http://ru.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:4 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:5 https://dl.google.com/linux/chrome/deb stable InRelease [1,825 B]
Get:6 http://ru.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [611 kB]
Get:7 http://ru.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [148 kB]
Get:8 http://ru.archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [114 kB]
Get:9 http://ru.archive.ubuntu.com/ubuntu noble-updates/main Icons (48x48) [30.1 kB]
Get:10 http://ru.archive.ubuntu.com/ubuntu noble-updates/main Icons (64x64) [43.9 kB]
Get:11 http://ru.archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [10.4 kB]
Get:12 http://ru.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Packages [405 kB]
Get:13 http://ru.archive.ubuntu.com/ubuntu noble-updates/restricted Translation-en [77.1 kB]
Get:14 http://ru.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
Get:15 http://ru.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 c-n-f Metadata [424 B]
Get:16 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [710 kB]
Get:17 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [211 kB]
Get:18 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [305 kB]
Get:19 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe Icons (48x48) [167 kB]
Get:20 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe Icons (64x64) [266 kB]
Get:21 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [19.9 kB]
Get:22 http://ru.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Packages [15.0 kB]
Get:23 http://ru.archive.ubuntu.com/ubuntu noble-updates/multiverse Translation-en [3,820 B]
Get:24 http://ru.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [940 B]
Get:25 http://ru.archive.ubuntu.com/ubuntu noble-updates/multiverse Icons (48x48) [1,867 B]
```

## 1.2 Установите Python 3 и необходимые библиотеки: sudo apt-get install -y python3 python3-pip sudo apt-get install -y python3-flask python3-cryptography

```
Get:49 http://security.ubuntu.com/ubuntu noble-security/universe Translation-en
Get:50 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Component
Get:51 http://security.ubuntu.com/ubuntu noble-security/universe Icons (48x48) [
Get:52 http://security.ubuntu.com/ubuntu noble-security/universe Icons (64x64) [
Get:53 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Met
B]
Get:54 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Package
Get:55 http://security.ubuntu.com/ubuntu noble-security/multiverse Translation-e
Get:56 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Compone
Get:57 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 c-n-f M
B]
Fetched 5,539 kB in 11s (498 kB/s)

sudo apt-get install -y python3 python3-pip
^C
devops@devopsvm:~$ sudo apt-get install -y python3 python3-pip
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
python3 is already the newest version (3.12.3-0ubuntu2).
The following packages will be upgraded:
  python3-pip python3-pip-whl
2 upgraded, 0 newly installed, 0 to remove and 274 not upgraded.
Need to get 3,020 kB of archives.
After this operation, 0 B of additional disk space will be used.
Get:1 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe amd64 python3-p
ip all 24.0+dfsg-1ubuntu1.1 [1,317 kB]
Get:2 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe amd64 python3-p
ip-whl all 24.0+dfsg-1ubuntu1.1 [1,703 kB]
Fetched 3,020 kB in 1s (2,467 kB/s)
[Reading database ... 75%
```

```
2. 172.20.10.9 (devops) x 3. 172.20.10.9 (devops) x +
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
python3 is already the newest version (3.12.3-0ubuntu2).
The following packages will be upgraded:
  python3-pip python3-pip-whl
2 upgraded, 0 newly installed, 0 to remove and 274 not upgraded.
Need to get 3,020 kB of archives.
After this operation, 0 B of additional disk space will be used.
Get:1 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe amd64 python3-pip all 24.0+dfsg-1ubuntu1.1 [1,317 kB]
Get:2 http://ru.archive.ubuntu.com/ubuntu noble-updates/universe amd64 python3-pip-whl all 24.0+dfsg-1ubuntu1.1 [1,703 kB]
Fetched 3,020 kB in 1s (2,467 kB/s)
(Reading database ... 194549 files and directories currently installed.)
Preparing to unpack .../python3-pip_24.0+dfsg-1ubuntu1.1_all.deb ...
Unpacking python3-pip (24.0+dfsg-1ubuntu1.1) over (24.0+dfsg-1ubuntu1) ...
Preparing to unpack .../python3-pip-whl_24.0+dfsg-1ubuntu1.1_all.deb ...
Unpacking python3-pip-whl (24.0+dfsg-1ubuntu1.1) over (24.0+dfsg-1ubuntu1) ...
Setting up python3-pip-whl (24.0+dfsg-1ubuntu1.1) ...
Setting up python3-pip (24.0+dfsg-1ubuntu1.1) ...
Processing triggers for man-db (2.12.0-4build2) ...
devops@devopsvm:~$ sudo apt-get install -y python3-flask python3-cryptography
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
python3-flask is already the newest version (3.0.2-1ubuntu1).
python3-cryptography is already the newest version (41.0.7-4ubuntu0.1).
python3-cryptography set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 274 not upgraded.
devops@devopsvm:~$
```

### 1.3 Установите OpenSSL: sudo apt-get install -y openssl

```
2. 172.20.10.9 (devops) x 3. 172.20.10.9 (devops) x +
Reading state information... Done
python3-flask is already the newest version (3.0.2-1ubuntu1).
python3-cryptography is already the newest version (41.0.7-4ubuntu0.1).
python3-cryptography set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 274 not upgraded.
devops@devopsvm:~$ sudo apt-get install -y openssl
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libssl3t64
The following packages will be upgraded:
  libssl3t64 openssl
2 upgraded, 0 newly installed, 0 to remove and 272 not upgraded.
Need to get 2,943 kB of archives.
After this operation, 0 B of additional disk space will be used.
Get:1 http://ru.archive.ubuntu.com/ubuntu noble-updates/main amd64 libssl3t64 amd64 3.0.13-0ubuntu3.4 [1,940 kB]
Get:2 http://ru.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssl amd64 3.0.13-0ubuntu3.4 [1,003 kB]
Fetched 2,943 kB in 1s (2,515 kB/s)
(Reading database ... 194549 files and directories currently installed.)
Preparing to unpack .../libssl3t64_3.0.13-0ubuntu3.4_amd64.deb ...
Unpacking libssl3t64:amd64 (3.0.13-0ubuntu3.4) over (3.0.13-0ubuntu3.2) ...
Setting up libssl3t64:amd64 (3.0.13-0ubuntu3.4) ...
(Reading database ... 194549 files and directories currently installed.)
Preparing to unpack .../openssl_3.0.13-0ubuntu3.4_amd64.deb ...
Unpacking openssl (3.0.13-0ubuntu3.4) over (3.0.13-0ubuntu3.2) ...
Setting up openssl (3.0.13-0ubuntu3.4) ...
Processing triggers for man-db (2.12.0-4build2) ...
```

## Шаг 2. Создание сертификатов X.509 для аутентификации

### 2.1. Сгенерируйте корневой сертификат центра сертификации (CA):

```
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:RU
State or Province Name (full name) [Some-State]:Moscow Oblast
Locality Name (eg, city) []:Moscow
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Interfax
Organizational Unit Name (eg, section) []:Analyst
Common Name (e.g. server FQDN or YOUR name) []:kirill
Email Address []:kirilld@xnix.ru
devops@devopsvm:~$
```

### 2.2 Создайте сертификаты для клиентских и серверных узлов:

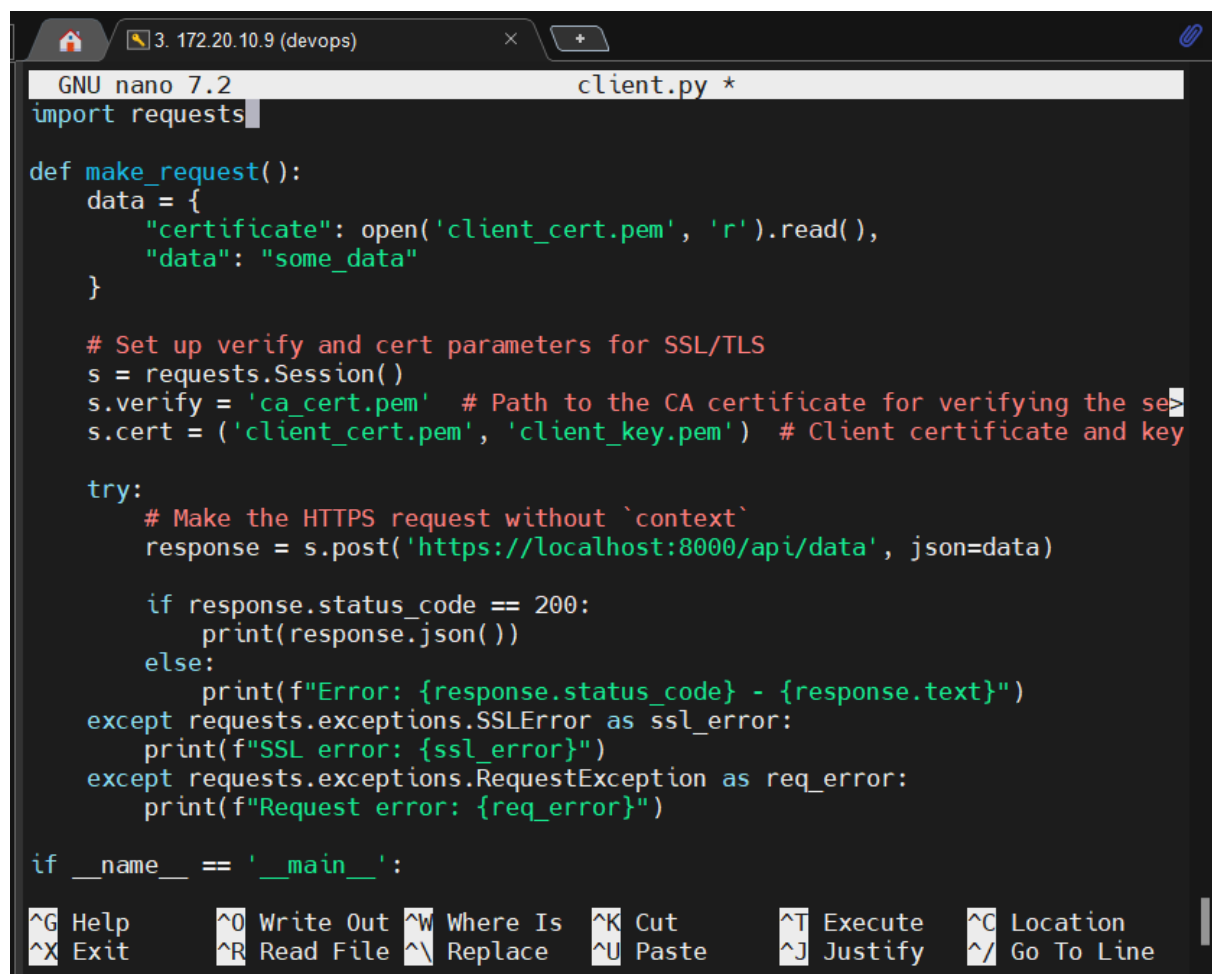
```
Country Name (2 letter code) [AU]:RU
State or Province Name (full name) [Some-State]:Moscow Oblast
Locality Name (eg, city) []:Moscow
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Interfax
Organizational Unit Name (eg, section) []:Analyst
Common Name (e.g. server FQDN or YOUR name) []:kirill
Email Address []:kirilld@xnix.ru
```

```
Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:1
String too short, must be at least 4 bytes long
A challenge password []:1234
An optional company name []:interfax
devops@devopsvm:~$
```

```
An optional company name []:interfax
devops@devopsvm:~$ openssl x509 -req -in server_req.pem -CA ca_cert.pem -CAkey c
a_key.pem -CAcreateserial -out server_cert.pem -days 365
x509: Use -help for summary.
devops@devopsvm:~$
```



Шаг 4. Создайте client.py для шифрования данных:



The screenshot shows a terminal window with a browser tab at 3. 172.20.10.9 (devops). The GNU nano 7.2 editor is open, editing a file named client.py. The code defines a function make\_request() that uses the requests library to send a POST request to https://localhost:8000/api/data with a JSON body containing a certificate and some data. It also sets up SSL/TLS parameters and includes error handling for SSL and request exceptions. The main block is also visible.

```
GNU nano 7.2 client.py *
import requests

def make_request():
    data = {
        "certificate": open('client_cert.pem', 'r').read(),
        "data": "some_data"
    }

    # Set up verify and cert parameters for SSL/TLS
    s = requests.Session()
    s.verify = 'ca_cert.pem' # Path to the CA certificate for verifying the se
    s.cert = ('client_cert.pem', 'client_key.pem') # Client certificate and key

    try:
        # Make the HTTPS request without `context`
        response = s.post('https://localhost:8000/api/data', json=data)

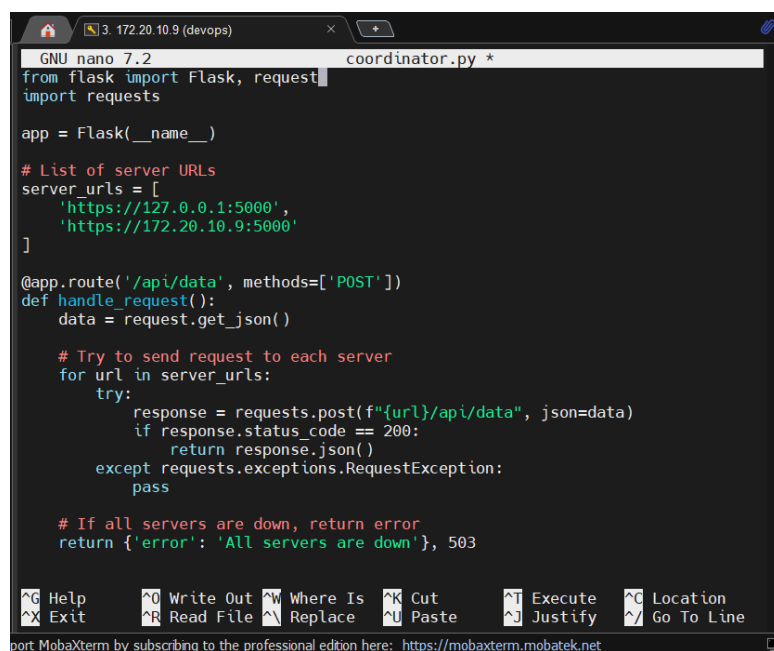
        if response.status_code == 200:
            print(response.json())
        else:
            print(f"Error: {response.status_code} - {response.text}")
    except requests.exceptions.SSLError as ssl_error:
        print(f"SSL error: {ssl_error}")
    except requests.exceptions.RequestException as req_error:
        print(f"Request error: {req_error}")

if __name__ == '__main__':

^G Help      ^O Write Out ^W Where Is  ^K Cut       ^T Execute  ^C Location
^X Exit      ^R Read File ^\ Replace   ^U Paste     ^J Justify  ^_ Go To Line
```

Шаг 5. Настройка отказоустойчивости

5.1. Создайте файл coordinator.py для реализации координатора распределенной



The screenshot shows a terminal window with a browser tab at 3. 172.20.10.9 (devops). The GNU nano 7.2 editor is open, editing a file named coordinator.py. The code uses Flask to create a web application with a single POST endpoint /api/data. It implements a distributed coordinator by sending the request to a list of server URLs. If all servers are down, it returns a 503 status code.

```
GNU nano 7.2 coordinator.py *
from flask import Flask, request
import requests

app = Flask(__name__)

# List of server URLs
server_urls = [
    'https://127.0.0.1:5000',
    'https://172.20.10.9:5000'
]

@app.route('/api/data', methods=['POST'])
def handle_request():
    data = request.get_json()

    # Try to send request to each server
    for url in server_urls:
        try:
            response = requests.post(f"{url}/api/data", json=data)
            if response.status_code == 200:
                return response.json()
        except requests.exceptions.RequestException:
            pass

    # If all servers are down, return error
    return {'error': 'All servers are down'}, 503

^G Help      ^O Write Out ^W Where Is  ^K Cut       ^T Execute  ^C Location
^X Exit      ^R Read File ^\ Replace   ^U Paste     ^J Justify  ^_ Go To Line
```

port MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>



Откройте терминал и перейдите туда-то

```
bash: syntax error near unexpected token `host=0.0.0.0';
devops@devopsvm:~$ nano server.py
devops@devopsvm:~$ nano server.py
devops@devopsvm:~$ nano server.py
devops@devopsvm:~$ nano client.py
devops@devopsvm:~$ nano client.py
devops@devopsvm:~$ nano coordinator.py
devops@devopsvm:~$ mkdir /home/devops/Downloads/lw_05
devops@devopsvm:~$ cd /home/devops/Downloads/lw_05
devops@devopsvm:~/Downloads/lw_05$
```

port MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>

Сгенерируйте приватный ключ для сервера:

Эта команда создаст файл server\_key.pem с приватным ключом длиной 2048 бит.

```
devops@devopsvm:~/Downloads/lw_05$ nano coordinator.py
devops@devopsvm:~/Downloads/lw_05$ openssl genrsa -out server_key.pem 2048
devops@devopsvm:~/Downloads/lw_05$
```

port MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>

Создайте сертификат X.509 для сервера, используя сгенерированный ключ:

```
devops@devopsvm:~/Downloads/lw_05$ openssl req -new -x509 -key server_key.pem -o
ut server_cert.pem -days 365
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:
```

port MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>

В директории появилось два файла:

```
devops@devopsvm:~/Downloads/lw_05$ ls -a
.  ..  coordinator.py  server_cert.pem  server_key.pem
devops@devopsvm:~/Downloads/lw_05$
```

Создадим ключ длиной 2048 бит, а так же, создадим само-подписанный сертификат центра сертификации

```
devops@devopsvm:~/Downloads/lw_05$ openssl genrsa -out ca_key.pem 2048
devops@devopsvm:~/Downloads/lw_05$ openssl req -new -x509 -key ca_key.pem -out c
a_cert.pem -days 3650 -subj "/C=US/ST=State/L=City/O=Organization/OU=Unit/CN=Com
monName"
devops@devopsvm:~/Downloads/lw_05$
```

5.2 Запустить server.py на нескольких машинах (или на одном при тестировании) для обеспечения отказоустойчивости.

```
devops@devopsvm:~/Downloads/lw_05$ python3 server.py
* Serving Flask app 'server'
* Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Running on all addresses (0.0.0.0)
* Running on https://127.0.0.1:5000
* Running on https://172.20.10.9:5000
Press CTRL+C to quit
```

Теперь server\_urls содержит адреса ваших реальных серверов, запущенных на 127.0.0.1:5000 и 172.20.10.9:5000. Ваш прокси-сервер будет пытаться отправить запросы на эти адреса, пока не получит успешный ответ.

Запуск coordinator

```
* Debugger PIN: 348-538-240
devops@devopsvm:~/Downloads/lw_05$ python3 coordinator.py
* Serving Flask app 'coordinator'
* Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
* Running on all addresses (0.0.0.0)
* Running on http://127.0.0.1:8000
* Running on http://172.20.10.9:8000
Press CTRL+C to quit
```

port MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>

Выдает ошибку

```
devops@devopsvm:~/Downloads/lw_05$ curl http://localhost:8000/api/data
curl: (7) Failed to connect to localhost port 8000 after 23 ms: Couldn't connect to server
devops@devopsvm:~/Downloads/lw_05$
```

port MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>

Я не понимаю, почему оно выдает ошибку, постараюсь за выходные переработать